SLEEP EXPERIENCES OF HOSPITALIZED ANTEPARTUM PATIENTS

by

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Dedication

This dissertation is dedicated to the hospitalized antepartum women who were willing to share their sleep experiences with a total stranger, all for science! Their openness adds to the body of literature related to this understudied population.

Acknowledgements

Most Acknowledgements begin with mention of the PhD program being a long journey that could not have been accomplished without help, love, and support. I do not mean to be cliché, but I have a long list of people to thank. When I could not find the energy to keep going, these individuals kept me in their prayers, encouraged me, and offered a shoulder to cry on. Words cannot express how much I appreciate my parents, Jim and Deb Erwin. They have been by my side throughout my every academic achievement. Thank you for adding me to the prayer list at church. The prayers worked! Quint, you spent the majority of your childhood watching me type away on the computer. It's time to take fencing and cupcake decorating classes. Ryan, your encouragement helped me keep going. Many thanks go out to my extended family, the Erwin's and the Reed's. They encouraged me and mentioned many times how proud they are of me.

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Abstract

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For many women, pregnancy can be a time of sleep disturbance. Physiological, hormonal, and emotional changes associated with pregnancy often lead to sleep disturbance. Women who develop antepartum complications frequently are prescribed bed rest and hospitalization. Both pregnancy and hospitalization can influence sleep. This study examined the sleep experience of hospitalized antepartum women. The purposes of this descriptive correlational study were to determine whether being in the hospital affects sleep in pregnant women, gestational age influences sleep while hospitalized, and patient's usual sleep patterns influence sleep during hospitalization. A conceptual model of impaired sleep for the childbearing family provided theoretical guidance.

A convenience sample of 24 pregnant women, 18-39 years of age, participated in the study. Most participants were unmarried minority women with annual incomes of less than $30,000. Difficulties in retaining participants to Day 4 were encountered; only 9 participants completed the study to Day 4.

Most participants had existing sleep disturbances, according to PSQI and GSDS scores on admission. Women self-reported both internal and external factors that interrupted their sleep during hospitalization. There was a moderate, inverse relationship between the weeks of gestation and how well the participants slept the previous night on Day 3. Perceptions of sleep depth and sleep quality increased significantly over time. Self-reported difficulty in falling asleep the previous night significantly decreased over time.

Recommendations for future research are modification of the design to include all women admitted and discharged prior to Day 4, larger sample size, and the use of objective and subjective measures in data collection.

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Chapter 1

Introduction

Background/Significance

Antepartum care emphasizes the detection and management of complications during the antepartum period of pregnancy. Regular antepartum visits to health care providers are useful for identifying women at risk, providing care to minimize that risk, and allowing for continuous health education concerning factors related to a positive pregnancy outcome (Richter, Parkes, & Chaw-Kant, 2007; Sable & Herman, 1997). A small percentage of women will develop antepartum complications despite receiving regular antepartum care (Richter et al., 2007). More than 1 million women in the United States experience complications of pregnancy annually, and up to 20% of them are prescribed bed rest for at least a day and sometimes much longer during pregnancy (Goldenberg et al., 1994; Williams et al., 2009).

Despite research studies failing to support the effectiveness of bed rest for antepartum complications, this treatment regimen is widely prescribed for antepartum complications, such as threatened preterm birth, vaginal bleeding, multiple gestation, gestational hypertension, and hyperemesis, and is used extensively at a high cost to the patients and the health care system (Cunningham, 2001; Goldenberg et al., 1994; Heaman & Gupton, 1998; Maloni & Kasper, 1991;

Maloni, Margevicius, & Damato, 2006; May, 2001; Richter et al., 2007; Sprague, 2004).

Bed rest is associated with adverse physical and psychological complications. Pregnant women find bed rest and restricted activity stressful and often experience feelings of depression, boredom, isolation, anxiety, and somatic complaints (Richter et al., 2007). They regularly report major concerns related to family responsibility (Maloni, 1998; May, 2001), such as adjustment to having someone else doing the housework, expressing feelings of guilt at being unable to perform their normal duties, a feeling of lack of control over their pregnancy, and fear for the viability of their infants (Heaman & Gupton, 1998; Mackey & Coster-Schulz, 1992; Maloni & Park, 2005; Richter et al., 2007; Schroeder, 1996). Physiological symptoms vary from increased somatic symptoms, fatigue, muscle atrophy, and ingestion to sleep disturbance (Maloni & Kutil, 2000; Richter et al., 2007).

Function of Sleep

Sleep is an essential physiological process. Although almost one third of life is spent sleeping (Humphries, 2008; Ohayon, Carskadon, Guilleminault, & Vitiello, 2004), researchers only started to understand the body's need for sleep in the last 50 years. The primary function of sleep remains unknown, but several theories have been postulated. Sleep has been theorized as having restorative, protective, energy conservation, ethological, and instinctive properties (Drucker-

Colín, 1995; Webb, 1974). The body oscillates between the stages of sleep, allowing for the body to reset itself based on the previous day's activity and to permit adequate functioning during waking hours (Druker-Colín, 1995). The amount of sleep a person needs is based on activity experienced throughout the previous day, which accounts for the variability in individual sleep patterns. To maintain behavioral and physiological homeostasis, adults require a minimum of seven hours of continuous sleep (Banks & Dinges, 2007; Humphries, 2008).

Sleep Physiology

No longer thought to be a passive and inactive state, sleep is currently viewed as an active process in which various metabolic processes, tissue restoration, memory consolidation, and homeostatic balance are maintained (Adam, 1980; Dement, 2011). Sleep consists of two physiological states, NREM sleep and REM sleep, which are defined using physiological measurements including brain activity via the electroencephalogram (EEG), muscle tone via the electromyogram (EMG), and eye movements via the electrooculogram (EOG) (Carskadon & Dement, 2010; Krueger & Majde, 1990, 2003; Stinton & McCarley, 2000).

NREM sleep

NREM sleep is subdivided into four stages (stages 1, 2, 3, and 4) that are defined by amplitude, frequency, and morphology of the EEG. The stages of NREM sleep are parallel to a depth of sleep continuum, with arousal thresholds

generally lowest in Stage 1 and highest in Stage 4 sleep (Carskadon & Dement, 2010). A transitional phase between wakefulness and true sleep, Stage 1 sleep is the initial step into sleep and may only last a few minutes (Stinton & McCarley, 2000). A person can be easily aroused in this stage. Stages 2, 3, and 4 of NREM sleep contain synchronous firing of large numbers of neurons. These patterns include sleep spindles, K-complexes, and high-voltage, delta frequency, slow waves (Carskadon & Dement, 2010).

Stage 1 is characterized by decreased alpha activity, with the EEG comprised mostly of low-voltage, mixed-frequency activity at a rate of 4-7 Hz. Rapid eye movements are absent, but slow-rolling eye movements appear. Muscle tonus is relatively high or relatively low (Åkerstedt, Hume, Minors, & Waterhouse, 1994; Åkerstedt & Nilsson, 2003; Stinton & McCarley, 2000).

Stage 1 is typically followed by stage 2 sleep, where bursts of distinctive, rhythmic 12-16 Hz waveforms called sleep spindles appear. Short-duration, high-amplitude K-complexes are interspersed with the sleep spindles (Carskadon & Dement, 2010; Stinton & McCarley, 2000). These waveforms appear on a background of 4-7 Hz activity (Åkerstedt et al., 1994; Åkerstedt & Nilsson, 2003). Stage 2 initially lasts about 10-25 minutes, with a gradual progression into Stage 3 sleep. Stages 3 and 4 comprise slow wave sleep (SWS), as indicated by a predominance of low-frequency (0.5-2 Hz), high-amplitude (> 75 μV) EEG waves referred to as delta waves (Carskadon & Dement, 2010; Stinton &

McCarley, 2000). The percentage of delta waves determines if Stage 3 or Stage 4 is present. Stage 3 sleep is the shorter duration cycle of the two stages. Stage 3 is scored if the epoch is 20-49% delta, while Stage 4 is scored at > 50% delta (Carskadon & Dement, 2010).

REM sleep

REM sleep is characterized by mixed high-frequency, low-amplitude EEG waves, along with bursts of rapid eye movements and diminished muscle tone (Stinton & McCarley, 2000). Humans exhibit a theta pattern similar to Stage 1 or Stage 2 sleep, without the sleep spindles or K-complexes (Rechtschaffen & Kales, 1968). The length of REM sleep is variable throughout the night. The first episode is often quite brief, lasting only a few moments, while the final REM period can often last longer than 20 minutes (Carskadon & Dement, 2010).

Costs of Sleep Loss

Chronic sleep loss or sleep disorders may affect as many as 70 million Americans, resulting in an annual cost of $16 billion in health care expenses and $50 billion in lost productivity (National Heart, Lung, and Blood, Institute, n.d.). As is the case with cardiovascular disease and mental dysfunction, sleep disorders are often the primary or secondary source of morbidity and mortality. Due to the bidirectional communication between the brain and the host defense system, sleep loss can exacerbate various disease states (Benca & Quintas, 1997). Sleep loss is linked with (a) increased risk of motor vehicle accidents, (b) increase in body

mass index, (c) increased risk of diabetes and cardiovascular disease, (d) increased risk for diminished immune function, (e) increased risk for psychiatric conditions including depression and substance abuse, and (f) decreased ability to consolidate memories, learn tasks, and make decisions (National Sleep Foundation, 2011a).

Restorative Function of Sleep during Pregnancy

Sleep is thought to promote physical and mental restoration (Adam, 1980; Adam & Oswald, 1977). Alterations in metabolism and arousal as a result of pregnancy are of important consideration (P. Richardson, 1996). With high metabolic effort, much of the maternal energy is directed toward the fetal-placental component in a time-dependent manner. Beginning with the mother and ending with the fetus, a physiological shift favoring anabolic activity occurs, which is timed to facilitate the appropriate growth and maturation of the fetus in a protective manner (P. Richardson, 1996). Suggesting an adaptive process to the increased wake-after-sleep onset observed during pregnancy, some studies show alterations in SWS and in Stage 1 at various points of gestation (Hertz et al., 1992; Schorr et al., 1998). As a result, the pregnant female experiences shorter, consolidated sleep periods which prepares her for the pending needs of her newborn.

Pregnancy and Alterations in Sleep

The sleep architecture of women during pregnancy is markedly different than that of nonpregnant women (Hertz et al., 1992; K. A. Lee, McEnany, & Zaffke, 2000; K. A. Lee, Zaffke, & McEnany, 2000; Mindell & Jacobson, 2000). Sleep disturbances are common during pregnancy as a result of physiological, hormonal, and anatomical/physical changes. Sleep characteristics in pregnancy differ depending on the trimester (Gallo & Lee, 2008). Several factors interfere with sleep throughout pregnancy including nausea, vomiting, backache, urinary frequency, fetal movements, heartburn, shortness of breath, leg cramps, itching, and nightmares (Baratte-Beebe & Lee, 1999; Driver & Shapiro, 1992; Mindell & Jacobson, 2000; Schwieger, 1972). Hormonal influences may contribute to sleep disturbance during pregnancy. As estrogen and progesterone are altered during pregnancy, they may contribute to the differences in sleep patterns observed during pregnancy.

Sleep quality and quantity vary by trimester. Fragmentation of sleep as well as decreases in total sleep time and sleep efficiency are typical occurrences during pregnancy (Hertz et al., 1992; K. A. Lee, McEnany, & Zaffke, 2000; K. A. Lee, Zaffke, & McEnany, 2000; Mindell & Jacobson, 2000). Characterized by increased arousals and awakenings, sleep disruption becomes more intense as the pregnancy progresses.

Sleep Disruption Throughout Pregnancy

Sleep patterns differ during each trimester. Women in the first trimester (Week 1 to the end of Week 12) typically complain of increased fatigue and take more naps, but they also experience a decrease in total sleep time, longer sleep latency, and reduced sleep efficiency during the nocturnal sleep period (Karacan & Williams, 1970; K. A. Lee, Zaffke, & McEnany, 2000; Manber, Colrain, & Lee, 2002; Mindell & Jacobson, 2000; Santiago, Nolledo, Kinzler, & Santiago, 2001). During the second trimester (Week 13 to the end of Week 26), sleep patterns are similar to patterns observed prior to pregnancy. As a result of improved sleep at night, many women report more daytime energy as compared to the first trimester (K. A. Lee & Zaffke, 1999). The majority of sleep disturbances occur during the third trimester (Week 27 to the end of the pregnancy) and include restless sleep and multiple nocturnal awakenings (Balserak & Lee, 2011).

Sleep in Hospitalized Patients

When pregnant patients are hospitalized for antepartal complications, sleep disturbances may increase due to the change in health status and environment. Sleep patterns are significantly disrupted in nonpregnant hospitalized patients, who often complain of sleep disturbances (Lauri, Lepistö, Käppeli, 1997; Raymond, Nielsen, Lavigne, Manzini, & Choinière, 2001). These disruptions may be caused by exogenous factors, such as environmental noise,

bright lightening, and timing of staff interventions, and/or endogenous factors, such as delirium, depression, anxiety, stress, pain, and discomfort (Ersser et al., 1999; Miller, Gardner, & Mlott, 1976; Raymond et al., 2001). Most of the research on patients' sleep patterns in the hospital setting has been conducted in intensive care settings (Webster & Thompson, 1986). Often characterized by high levels of noise, light, and frequent interruptions, these environments influence the quality and restorative nature of sleep (Pulling & Seaman, 1993; Topf, 1992; Topf & Davis, 1993). Although patients may appear to sleep in the hospital, the sleep may not be refreshing or restorative. Poor sleep can have serious, detrimental effects on health and recovery from illness. Only one study has focused on antepartum hospitalized women (Gallo & Lee, 2008).

Theoretical Framework

Sleep is a complex interaction of both physiologic and behavioral processes (Carskadon & Dement, 2010). In adults, chronic sleep loss resulting from either too little sleep or fragmented sleep that disrupts the stages of sleep can contribute to pathology, daytime dysfunction, fatigue, sleepiness, disease, injury, death, and poor quality of life. Several social, occupational, lifestyle, environmental, and disease-related factors contribute to sleep deprivation and altered circadian rhythms (Redeker & McEnany, 2011).

Model of Impaired Sleep for the Childbearing Family

K. A. Lee's (2011) conceptual model of impaired sleep for the childbearing family provided the theoretical guidance for this study (see Figure 2). Nursing as a discipline is concerned with human responses in wellness and illness at the individual, family, and community level. Sleep and circadian rhythms are biological processes that can influence wellness and illness. These processes can be altered by illness and adverse environments. Impaired sleep can be conceptualized as a health problem resulting from sleep deprivation or sleep restriction due to lifestyle factors, or from sleep disruption and fragmented sleep due to illness. The resulting sleep loss places an individual at risk for adverse health outcomes (K. A. Lee et al., 2004).

Risk factors for impaired sleep include all of the factors responsible for sleep deprivation and sleep disruption. K. A. Lee et al. (2004) proposed that sleep deprivation or sleep disruption lead to sleep loss, which then leads to adverse health outcomes. Sleep deprivation is described as an inadequate amount of sleep due to poor sleep hygiene, lack of consistent bedtime, care-giving, or developmental stages. Sleep deprivation can result from inadequate amount of sleep due to self-imposed sleep restriction, lifestyle, or work demands. Due to these factors, individuals obtain less than the recommended nightly seven to eight hours. Chronically restricted sleep patterns over time subsequently accumulate as "sleep debt," with potential health consequences.

Sleep loss can also result from disrupted sleep during the night (K. A. Lee et al., 2004). Sleep disruption is described as fragmentation of sleep related to health issues, environmental stimuli, or stress. Even the recommended seven to eight hours of sleep is inadequate when the stages of sleep are altered by fragmented sleep. An individual may or may not be aware of sleep disrupted by an actual or potential health problem. Disrupted sleep occurs when one's sleeping environment is suddenly altered, or disrupted sleep can be in response to stress in the person's environment.

K. A. Lee (2011) further conceptualized how sleep deprivation and sleep disruption can impact perinatal health outcomes in the childbearing family (see Figure 2). In the present study, both sleep deprivation and sleep disruption lead to sleep loss, resulting in potential adverse health outcomes. Women have a high risk for sleep deprivation and sleep disruption when they are pregnant. When pregnant patients are hospitalized for antepartal complications, they are at higher risk for sleep loss and potential adverse health outcomes due to the change in health status and environment.

Sleep parameters are the variables of interest in this study. Sleep parameters include total sleep time, sleep efficiency, and number of awakenings. Impaired sleep affects overall sleep quality, sleep latency, sleep quantity, sleep disturbances, use of sleep aids, and daytime functioning. Impaired sleep is either manifested as difficulty falling asleep, difficulty arousing upon rising, daytime

fatigue, daytime sleepiness, poor daytime performance, or misuse of sleep aids to manage it (K. A. Lee, 2003). The conceptual definitions of the sleep parameters are described in Table 1. Sleep disturbances can impact overall sleep quality. Sleep quality is a complex phenomenon that includes quantitative (i.e., sleep duration, sleep latency, number of arousals) and subjective (i.e., depth, restfulness) aspects of sleep, which varies between individuals (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

The present study explored sleep deprivation (inadequate amount of sleep) in hospitalized antepartum women due to such factors as developmental adaptations of pregnancy, delayed bedtime, early wake time, and poor sleep hygiene while hospitalized on an antepartum unit. This study explored sleep disruption (fragmented sleep) due to patients' antepartal complications, stress and anxiety of the high-risk pregnancy, pain or discomforts of pregnancy, or environmental noxious stimuli within the antepartum unit. Since sleep loss places an individual at risk for adverse health outcomes, this study focused on the consequences of sleep loss within the cognitive/behavioral/psychological domains (see Figure 1).

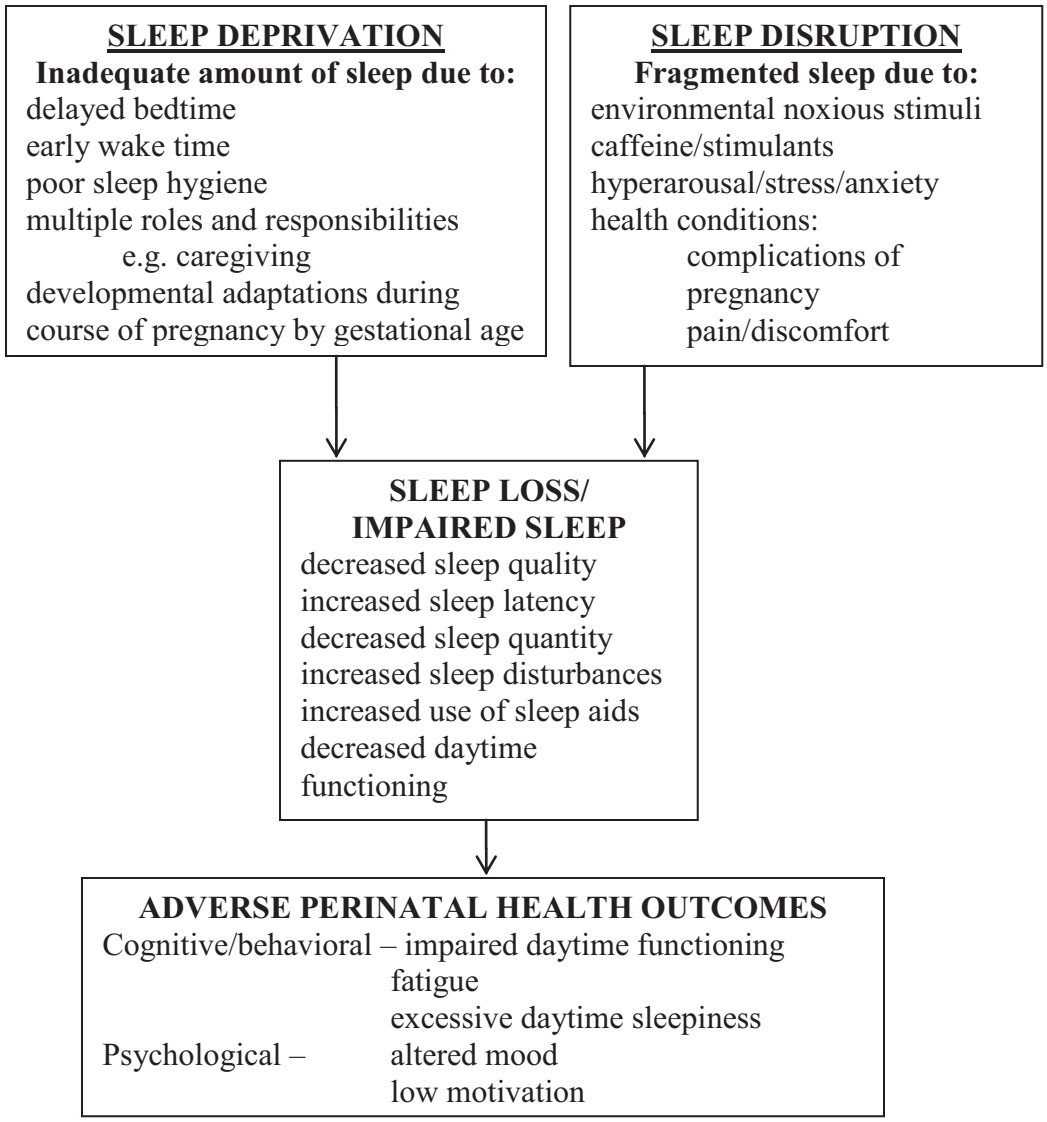


Figure 1 Conceptual Model of Study Showing Why the Hospitalized Pregnant is at Risk for and the Consequences of Sleep Loss/Impaired Sleep

Table 1 Conceptual definitions of study variables

Study variable	Conceptual definition
Sleep quality	A complex phenomenon that includes quantitative (i.e., sleep duration, sleep latency, number of arousals) and subjective (i.e., depth, restfulness) aspects of sleep, which varies between individuals (Buysse et al., 1989).
Sleep latency	The amount of time required to fall asleep after settling down for the night.
Sleep quantity	Refers to all aspects of the sleep period including duration and efficiency.
Sleep disturbances	Refers to any situation that interferes with sleep including sleep deprivation and sleep disruption (K. A. Lee, 2011; K. A. Lee et al., 2004).
Use of sleep aids	The use of a substance/medication to induce sleep.
Daytime functioning	The role of sleep on daily functioning.
Weeks of gestation	Calculated from the first day of the mother's last menstrual period (American Pregnancy Association, 2007).

Propositional Statements

From review of the literature and the conceptual framework (see Figure 1), the following propositional statements include:

1. Sleep is an essential restorative process.
2. Sleep deprivation and sleep disruption lead to sleep loss or impaired sleep.
3. Sleep loss places an individual at increased risk for adverse health outcomes.
4. Pregnant women are at high risk for sleep deprivation and sleep disruption by nature of the pregnancy itself.
5. When pregnant patients are hospitalized for antepartal complications, they are at higher risk for sleep loss and potential adverse health outcomes.

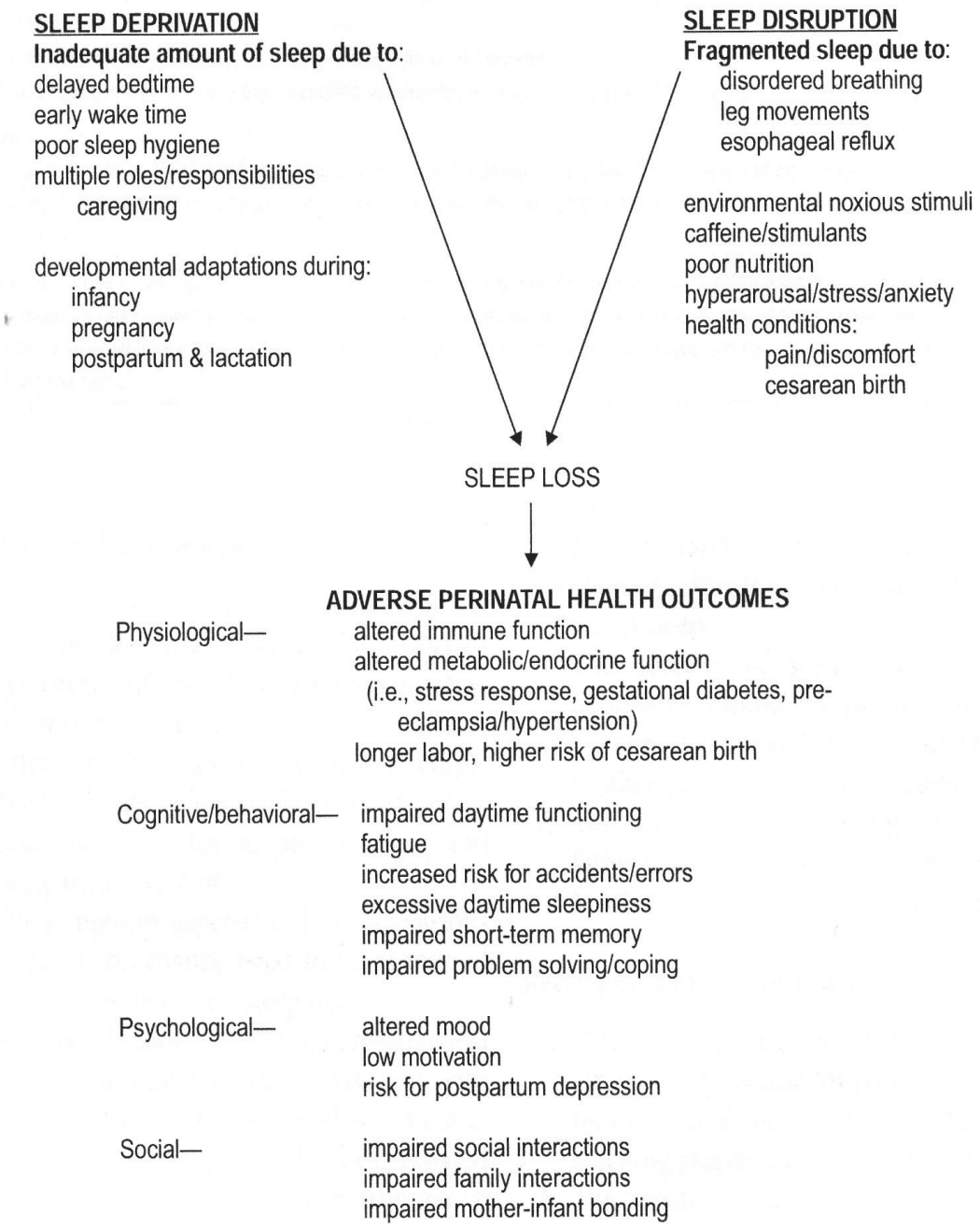


Figure 2 Conceptual model of impaired sleep for the childbearing family. Adapted from "Sleep Promotion in the Childbearing Family," by K. A. Lee, *Sleep Disorders and Sleep Promotion in Nursing Practice,* by N. Redeker & G. P. McEnany (Eds.), 2011, p. 54. Copyright 2004 by Elsevier. Reprinted with permission.

Purpose

Physiologic, hormonal, and emotional changes associated with pregnancy often lead to sleep disturbances. Sleep disturbances are common experiences of hospitalized patients. Only one study has focused on antepartum hospitalized women (Gallo & Lee, 2008). Both pregnancy and hospitalization can influence sleep. The present study examined the sleep experience of hospitalized antepartum women. The purposes of this descriptive correlational study were to determine whether (a) being in the hospital affects sleep in pregnant women, (b) gestational age influences sleep while hospitalized, and (c) patient's usual sleep patterns influence sleep during hospitalization.

Research Questions

This study addressed the following research questions:

1. What are the sleep experiences (total sleep time, number of arousals/awakenings, and daytime sleep time) in hospitalized antepartum patients?
2. What is the relationship between the weeks of gestation and a woman's sleep experience while hospitalized on an antepartum unit?
3. Is there a difference in a pregnant woman's sleep experience at one month before hospitalization, one week before hospitalization, and during hospitalization on an antepartum unit?

Assumptions

1. The physical environment within the hospital setting results in sleep disturbances.
2. Pregnancy affects a woman's sleep both physiologically and psychologically.
3. Subjects will honestly report their feelings and behaviors.
4. Data recorded on medical records are accurate.

Summary

The National Sleep Foundation (2011b) found that 78% of women report more disturbed sleep during pregnancy than at other times. Sleep represents a nightly, dramatic change in physiologic state, not simply a period of quiescence (Tranmer, Minard, Fox, & Rebelo, 2003). Pregnancy and the postpartum periods further complicate this complex phenomenon. For many women, pregnancy can be a time of serious sleep disturbance, even for women without prior sleep problems.

When pregnant patients are hospitalized for antepartal complications, sleep disturbances may be further impacted due to the change in health status and environment. Sleep deprivation in hospitalized patients may result in increased morbidity and mortality and reduced quality of life. Hospitalized patients often require more than the average amount of sleep but often experience an inadequate amount of sleep or experience poor sleep quality (Patel, Chipman, Carlin, &

Shade, 2008; Reynolds et al., 2010). Sleep deprivation impacts health and recovery from illness. Sleep deprivation in healthy subjects has been shown to have adverse effects on (a) immune responses; (b) on metabolic, endocrine, and cardiovascular function; and (c) normal circadian rhythms. Immune system dysfunction, impaired wound healing, and changes in behavior are all observed in patients who are sleep deprived, especially in the critical care setting. Anxiety, fear, pain, noise, light exposure, frequent awakenings, underlying illness, and medications can result in sleep deprivation and can affect a patient's ability to sleep efficiently. Hospitalized antepartum patients may be vulnerable to the negative effects of inadequate sleep. Sleep is essential for growth and restoration. A pregnant woman needs sleep for her own functioning as well for the growth and development of her fetus.

Chapter 2

Critical Review of Relevant Literature

Sleep problems are common during pregnancy. Hormonal changes, plus the discomforts of later pregnancy, can interrupt a pregnant woman's sleep cycle. Insomnia and night waking can occur during the first trimester (Week 1 to the end of Week 12). The second trimester (Week 13 to the end of Week 26) is often a period of improved daytime energy and less need for naps. During the third trimester (Week 27 to the end of the pregnancy), women often experience increasing insomnia and night waking. Most women awaken three to five times nightly, usually due to such discomforts as back pain, need to urinate, leg cramps, heartburn, and fetal movement. Strange dreams are also common in the last few weeks of pregnancy. The need for daily naps returns as the due date approaches (National Sleep Foundation, 2011a).

Although most pregnant women maintain healthy pregnancies, resulting in no complications, a certain number of women will develop antepartum complications. In a high-risk pregnancy, the mother and/or fetus/ neonate is at increased risk of morbidity or mortality before or after delivery. Despite research studies failing to support the effectiveness of bed rest for antepartum complications, this treatment regimen is widely prescribed for antepartum complications. Pregnant women may be exposed to multiple stressors if medical complications arise and hospitalization is required (Cunningham, 2001;

Goldenberg et al., 1994; Heaman & Gupton, 1998; Maloni & Kasper, 1991; Maloni et al., 2006; May, 2001; Richter et al., 2007; Sprague, 2004).

Sleep deprivation in hospitalized patients can result in increased morbidity and mortality, and can lower quality of life. Hospitalized patients require more than the average amount of sleep to aid in recovery, but often get an inadequate amount of sleep or experience poor sleep quality (Patel et al., 2008; Reynolds et al., 2010). When pregnant patients are hospitalized for antepartal complications, sleep disturbances may be further impacted due to the change in health status and environment. The review of the literature that follows outlines the physiology of sleep, sleep during pregnancy, measurement of sleep, sleep during hospitalization, and sleep studies during pregnancy.

Sleep Physiology and Definitions

Sleep medicine is a relatively new discipline, existing for only about four decades (Roehrs, 2011). According to Hobson (1989),

> more has been learned about sleep in the past 60 years than in the preceding 6,000. In this short period of time, researchers have discovered that sleep is a dynamic behavior. Not simply the absence of waking, sleep is a special activity of the brain, controlled by elaborate and precise mechanisms. (Hobson, 1989, p. 1)

Discoveries of electrical brain activity, the arousal systems, the circadian rhythm, and rapid eye movement sleep have paved the way for the understanding of the complexity of sleep and its disorders across the lifespan (Roehrs, 2011).

Sleep is defined as “a reversible behavioral state of perceptual disengagement from and unresponsiveness to the environment” (Carskadon & Dement, 2010, p. 16). Yet, sleep is a complex interaction of both physiologic and behavioral processes. Normal sleep in humans is composed of two states that alternate cyclically across a sleep episode: non-rapid eye movement (NREM) and rapid eye movement (REM) sleep. NREM sleep is defined as “a relatively inactive yet actively regulating brain in a movable body” and involves a variably synchronous cortical EEG associated with low muscle tones and minimal psychological activity (Carskadon & Dement, 2010, p. 16). Characteristic waveforms along the EEG include sleep spindles, K-complexes, and high-voltage slow waves. The four NREM stages (stages 1, 2, 3, and 4) parallel a depth of sleep continuum, with arousal thresholds generally lowest in Stage 1 and highest in Stage 4 sleep (Carskadon & Dement, 2010; see Figure 3).

REM sleep is defined as “an activated brain in a paralyzed body” (Carskadon & Dement, 2010, p. 16). In REM, the EEG is desynchronized, muscles are atonic, and dreaming is typical. Although not usually divided into stages, tonic and phasic types of REM sleep are often distinguished for certain research purposes. The tonic versus phasic phase is based on short-lived events such as eye movements that tend to occur in clusters, separated by episodes of relative inactivity (Carskadon & Dement, 2010). The most commonly used marker of REM sleep phasic activity in humans is the bursts of rapid eye

movements. Muscle twitches and cardiorespiratory irregularities often accompany the bursts of rapid eye movements. Inhibition of spinal motoneurons by brainstem mechanisms mediates suppression of postural motor tonus in REM sleep (Carskadon & Dement, 2010; see Figure 3).

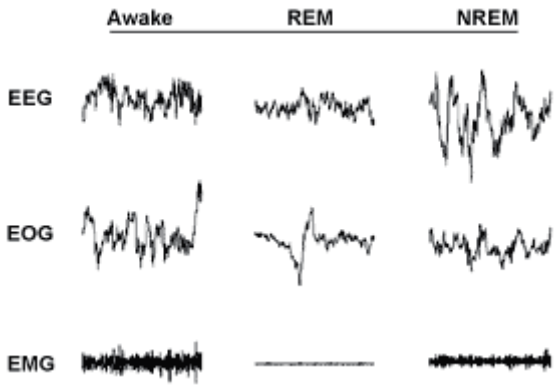


Figure 3 Patterns for wakefulness, REM sleep, and NREM sleep. Adapted from "Information About Sleep," by T. Roehrs, 1966, *Sleep, Sleep Disorders, and Biological Rhythms,* by National Heart, Lung, and Blood Institute, n.d., p. 22. Copyright 1966 by T. Roehrs. Reprinted with permission.

Sleep in the Healthy Young Adult

Several reliable characteristics of a nightly sleep pattern in healthy adults who sleep on a regular schedule include (a) sleep begins in NREM and progresses through deeper NREM stages (stages 2, 3, and 4) before the first episode of REM sleep approximately 80 to 90 minutes later (b) NREM sleep and REM sleep alternate with a period of approximately 90 minutes; (c) NREM stages 3 and 4 concentrate in the early NREM cycles; and (d) REM sleep episodes lengthen across the night (Carskadon & Dement, 2010). The onset of sleep under normal circumstances in healthy adult humans is through NREM sleep. Changes in

physiological measures, such as electromyogram (EMG), electrooculogram (EOG), and EEG readings, and an individual's perception of sleep do not always correlate (Agnew & Webb, 1972; Carskadon & Dement, 2010; see Figure 4).

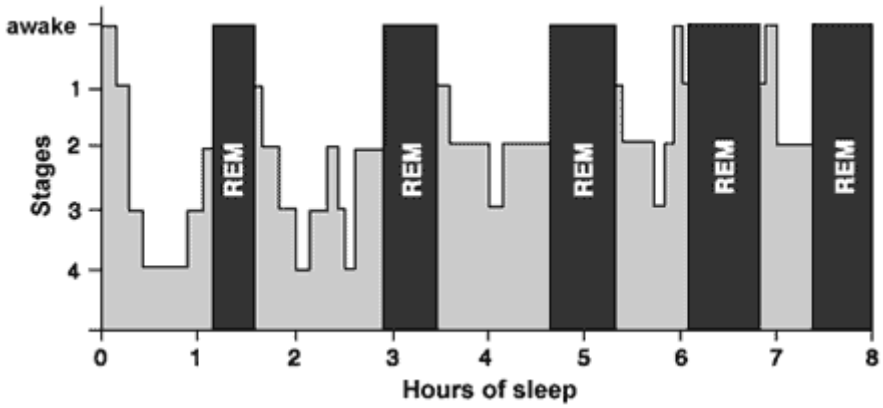


Figure 4 Repeated cycles of NREM and REM sleep over a night's sleep in a normal young adult. Adapted from *Sleep, Sleep Disorders, and Biological Rhythms*, by Biological Sciences Curriculum Study, 2003, p. 23. Copyright 2003 by Biological Sciences Curriculum Study. Reprinted with permission.

First sleep cycle

The first cycle of sleep in the healthy young adult begins with Stage 1 sleep, which usually persists for only one to seven minutes at the onset of sleep (Carskadon & Dement, 2010). Stage 1 sleep is associated with a low arousal threshold, plays a role in the initial wake-to-sleep transition, and occurs as a transitional stage throughout the night. Stage 2 NREM sleep, signaled by sleep spindles or K-complexes in the EEG, follows the brief episode of Stage 1 sleep and continues for 10 to 25 minutes (Carskadon & Dement, 2010). In this stage, a more intense stimulus is required to produce arousal. Usually lasting only a few

minutes, high-voltage slow wave activity occurs in Stage 3 NREM sleep and accounts for more than 20% but less than 50% of the EEG activity (Rechtschaffen & Kales, 1968). Stage 4 sleep usually lasts 20 to 40 minutes and is mostly high-voltage slow-wave activity. A more powerful stimulus is required to produce an arousal from Stage 3 or 4 sleep than from Stage 2 sleep. The combined stages of 3 and 4 sleep are frequently referred to as slow-wave sleep (SWS), delta sleep, or deep sleep. A series of body movements usually signals ascension to lighter NREM sleep stages: (a) one- to two-minute episode of Stage 3 sleep, followed by (b) five to 10 minutes of Stage 2 sleep interrupted by body movements (Carskadon & Dement, 2010). The initial REM episode in the first cycle of the night is usually short-lived at one to five minutes with a variable arousal threshold (Carskadon & Dement, 2010).

NREM-REM cycle across the night

NREM and REM sleep continue to alternate throughout the night in a cyclical manner (Carskadon & Dement, 2010). REM sleep episodes become progressively longer. As Stage 2 expands to occupy the NREM portion of the cycle, stages 3 and 4 sleep occupy less time in the second cycle and may disappear altogether from later cycles. The average period of the NREM-REM cycle is approximately 90 to 110 minutes (Carskadon & Dement, 2010). SWS occupies the NREM portion of the sleep cycle toward the first one third of the night in the young adult. REM sleep episodes are longest in the last one third of

the night, with brief episodes of wakefulness interrupting near REM sleep transitions (Carskadon & Dement, 2010). These brief episodes of wakefulness usually do not last long enough to be remembered in the morning. The distribution of REM sleep toward the latter part of the night may be linked to a circadian oscillator as it can be gauged by the oscillation of body temperature (Czeisler, Zimmerman, Ronda, Moore-Ede, & Weitzman, 1980; Zulley, 1980). The length of sleep is determined by processes associated with circadian rhythms, where, as sleep is extended, the amount of REM sleep increases because REM sleep depends on the persistence of sleep into the peak circadian time in order to occur. The distribution of SWS toward the beginning of a sleep episode is linked to the initiation of sleep, the length of prior wakefulness, and the time course of sleep (Carskadon & Dement, 2010; Weitzman, Czeisler, Zimmerman, & Ronda, 1980).

Factors Affecting Stages of Sleep

Several factors affect sleep stage distribution including temperature, drug ingestion, pathology, age, prior sleep history, and circadian rhythms (Carskadon & Dement, 2010). Temperature extremes in the sleep environment tend to disrupt sleep. REM sleep is generally more sensitive to temperature-related disruption than is NREM sleep. Mammals have only minimal ability to thermoregulate during REM sleep (Carskadon & Dement, 2010). Also, the distribution of sleep states and stages is affected by many common drugs, including those typically

prescribed in the treatment of sleep disorders as well as those not specifically related to the pharmacotherapy of sleep disorders (i.e., benzodiazepines, tricyclic antidepressants, monoamine oxidase inhibitors, and certain selective serotonin reuptake inhibitors) and those used socially or recreationally (i.e., alcohol and marijuana; Carskadon & Dement, 2010). In addition, sleep disorders, as well as other nonsleep problems, have an impact on the structure and distribution of sleep (Carskadon & Dement, 2010). These distinctions appear to be more important in diagnosis and in the consideration of treatments than for any implications about general health or illness resulting from specific sleep stage alterations. Common sleep-stage anomalies commonly associated with sleep disorders as well as with medical disorders involving physical pain or discomfort include narcolepsy, sleep apnea syndromes, fragmentation of sleep, and increased frequency of arousals (Carskadon & Dement, 2010).

Age

Age is the strongest and most consistent factor affecting the pattern of sleep stages across the night. The most striking age-related differences in sleep from the patterns described in the healthy young adult are found in newborn infants. For the first year of life, the transition from wake to sleep is often accomplished through REM sleep. This stage is known as active sleep during the newborn period. As compared with approximately 90 minutes in adults, the cyclical alteration of NREM-REM sleep is present from birth but has a period of

approximately 50 to 60 minutes in the newborn. Infants gradually acquire a consolidated nocturnal sleep cycle. The fully developed EEG patterns of the NREM stages emerge over the first two to six months of life. NREM stages 3 and 4 sleep become prominent when brain structure and function achieve a level that can support high-voltage slow-wave EEG activity (Carskadon & Dement, 2010).

SWS is maximal in young children and decreases markedly with age (Carskadon & Dement, 2010). The SWS of young children is both quantitatively and qualitatively different than that of older adults. It is nearly impossible to wake young children in the SWS of the first sleep cycle of the night. A similar, although less profound, qualitative difference distinguishes SWS occurring in the first and later cycles of the night. In adolescence, SWS decreases by nearly 40% during the second decade, even when the length of nocturnal sleep remain constant (Carskadon & Dement, 1987, 2010). According to Feinberg (1983), the age-related decline in nocturnal SWS may parallel loss of cortical synaptic density. By age 60 years, SWS may no longer be present, particularly in men. Women seem to maintain SWS later into life than men (Carskadon & Dement, 2010).

REM sleep as a percentage of total sleep is maintained well into healthy old age (Carskadon & Dement, 2010). The absolute amount of REM sleep at night has been correlated with intellectual functioning (Prinz, 1977) and declines markedly in the case of organic brain dysfunctions in the elderly (Prinz et al.,

1982). Arousals during sleep increase markedly with age. Extended wake episodes of which the individual is aware and can report, as well as brief and probably unremembered arousals, increase with aging (Carskadon, Brown, & Dement, 1982; Carskadon & Dement, 2010).

Prior Sleep History

After an episode of sleep loss, REM sleep tends to rebound on the second or subsequent recovery nights to make up for the loss. With total sleep loss, SWS has a tendency to be preferentially recovered compared with REM sleep, which tends to recover only after the recuperation of SWS. Chronic restriction of nocturnal sleep, an irregular sleep schedule, or frequent disturbance of nocturnal sleep can result in unusual distribution of sleep states, most notably premature REM sleep (Carskadon & Dement, 2010).

Circadian Rhythms

Lastly, the circadian phase at which sleep occurs affects the distribution of sleep stages (Carskadon & Dement, 2010). In particular, REM sleep occurs with a circadian distribution that peaks in the morning hours coincident with the trough of body temperature (Czeisler, Zimmerman, et al., 1980; Zulley, 1980). For example, REM sleep peaks in the early morning hours when body temperature is lowest. Studies of individuals sleeping in environments free of cues to time have demonstrated that the timing of sleep onset and the length of sleep occur as a function of circadian phase (Carskadon & Dement, 2010; Czeisler, Weitzman,

Moore-Ede, Zimmerman, & Knauer, 1980; Zulley, Wever, & Aschoff, 1981). With reference to the circadian body temperature phase position, sleep distribution shows that sleep onset is likeliest to occur on the falling limb of the temperature cycle. The offset of sleep occurs most often on the rising limb of the circadian body temperature curve (Carskadon & Dement, 2010).

Summary

Sleep in the healthy adult is composed of the two states of NREM and REM sleep. These states alternate in a well-defined cyclical pattern across a typical sleep episode. Several factors affect sleep stage distribution, including temperature, drug ingestion, pathology, age, prior sleep history, and circadian rhythms. Understanding sleep characteristics in the human adult provides a baseline on which to study clinical conditions that deviate from the expected norm (Carskadon & Dement, 2010).

Sleep During Pregnancy

Sleep patterns are greatly disturbed during pregnancy and the postpartum period (Balserak & Lee, 2011; Stremler & Wolfson, 2011). Hormonal changes in the first trimester (Week 1 to the end of Week 12), the large fetus, and anxiety about labor and delivery during the third trimester (Week 27 to the end of the pregnancy), and a newborn with unpredictable sleep patterns in the postpartum period contribute to poor sleep. Because of potential harm to the fetus or

newborn, complaints of excessive sleepiness and fatigue should be evaluated by health care providers (Balserak & Lee, 2011; Stremler & Wolfson, 2011).

Sleep disruption has been discussed among pregnant and postpartum women for centuries. Researchers only began in the late 1960s to describe specific alterations in sleep patterns during pregnancy and after birth. Although a challenge for researchers, sleep during pregnancy has been a focused area of research during the last decade (Balserak & Lee, 2011; Stremler & Wolfson, 2011). Karacan, Heine, Agnew, Webb, and Ross (1968) conducted one of the first clinical studies of sleep during pregnancy and compared seven women during the last month of pregnancy to age-matched nonpregnant women. The two groups spent about the same amount of time in bed trying to sleep, but the pregnant women had less total sleep. Only within the last decade have studies of sleep during pregnancy been more systematic and with larger sample sizes (Balserak & Lee, 2011).

Overall, both cross-sectional and longitudinal studies conclude that pregnant women have more awake time during the night as a result of the many symptoms and physical changes that occur over the 40 weeks of gestation, yet changes in sleep architecture seem to be minimal. REM sleep either remains unchanged or diminishes slightly from the first trimester to the third trimester. Changes in the amount of SWS remain inconclusive (K. A. Lee, 1998; Moline, Broch, Zak, & Gross, 2003; Santiago et al., 2001). However, more studies

document less SWS over the course of the pregnancy (Coble et al., 1994; K. A. Lee & Zaffke, 1999; Karacan et al., 1968; Karacan, Williams, Hursch, McCaulley, & Heine, 1969; K. A. Lee, Zaffke, & McEnany, 2000; Nishihara & Horiuchi, 1998). More frequent or longer wake episodes during the sleep period have little effect on REM sleep but result in less SWS and total sleep time (Brunner et al., 1994; Coble et al., 1994; Driver & Shapiro, 1992; Hertz et al., 1992; Karacan et al., 1969; K. A. Lee, McEnany, & Zaffke, 2000; K. A. Lee & Zaffke, 1999; Nishihara & Horiuchi, 1998; Petre-Quadens & De Lee, 1974; Schorr et al., 1998).

During pregnancy, a woman's sleep is affected both physiologically and psychologically (Dzaja et al., 2005). During the first trimester, sleep is interrupted by nausea, vomiting, backaches, and the increased need to urinate (Wolfson, Crowley, Anwer, & Bassett, 2003). The majority of women report increased fatigue, daytime sleepiness, and night awakenings during their first trimester (K. A. Lee & Zaffke, 1999). Although sleep is improved from the first trimester with more energy during the day, women may be awakened during the night by fetal movements and heartburn in the second trimester (Week 13 to the end of Week 26). Sleep is disrupted due to urinary frequency, backaches, shortness of breath, leg cramps, and disorganized uterine contractions during the third trimester (Baratte-Beebe & Lee, 1999; Wolfson et al., 2003).

Physiologic Changes During Pregnancy

Over the course of the pregnancy, increasing levels of placental hormones influence sleep both directly and indirectly (Balserak & Lee, 2011). During the first 12 weeks of pregnancy, many hormonal changes promote implantation and gestation. Dramatic increases in the secretion of placental estrogen, progesterone, and prolactin occur (Carsten, 1998; Sahota, Jain, & Dhand, 2003). The increased levels of progesterone may result in soporific effects. The sleep-inducing and sedating effects of progesterone potentiate any central nervous system depressant medication. The thermogenic effect of progesterone results in increased body temperature and the inhibitory effect on smooth muscle acts on the urinary tract, resulting in frequent urination. Changes in sleep may begin as early as the 10th week of gestation. In fact, feelings of sleepiness or fatigue may be the woman's first symptom of pregnancy (Balserak & Lee, 2011).

During the second trimester, many women report that sleep improves at night and that they have more energy during the daytime (K. A. Lee & Zaffke, 1999). Progesterone levels continue to rise, although more slowly. Many women no longer need to urinate as frequently as the growing fetus begins to move above the bladder. Approximately 30% of women report an onset of snoring that did not exist prior to pregnancy (Baratte-Beebe & Lee, 1999; Santiago et al., 2001; Wolfson et al., 2003). Resulting from the effects of estrogen on vascular tissue, snoring is an indication of increased congestion in the nasal passages. Pregnant

women who snore may be at risk of developing pregnancy-induced hypertension or sleep apnea syndrome. Further changes in SWS and REM sleep architecture during the second trimester may occur (Brunner et al., 1994; Coble et al., 1994; Driver & Shapiro, 1992; Karacan et al., 1968; Karacan et al., 1969; K. A. Lee, McEnany, & Zaffke, 2000; K. A. Lee & Zaffke, 1999; Nishihara & Horiuchi, 1998; Petre-Quadens & De Lee, 1974; Schorr et al., 1998).

Although first-trimester nausea and urinary frequency may influence sleep, it is when the growing uterus begins to press on the woman's bladder and her breasts enlarge and become tender that sleep becomes more fragmented. The quality of sleep in the last trimester is worse than during the first two trimesters as a result of sleep problems and feeling physically uncomfortable (Hedman, Pohjasvaara, Tolonen, Suhonen-Malm, & Myllylä, 2002; National Sleep Foundation, 2011b). Leg cramps increase from about 20% in the first trimester to 75% in the third trimester (Gupta, Schork, & Gay, 1992; K. A. Lee, Zaffke, & Baratte-Beebe, 2001). Many women describe longer sleep onset latencies, more awakenings, less total sleep, and increasing levels of morning sleepiness over the course of the third trimester (Baratte-Beebe & Lee, 1999; Santiago et al., 2001; Wolfson et al., 2003). Wolfson et al. (2003) found that women were particularly bothered by not being able to find a comfortable position for sleep (70%), by waking up frequently to use the bathroom (almost 85%), by feeling too hot or perspiring (almost 45%), and by their baby's movements (almost 40%). Carpal

tunnel pain due to edema involving the peripheral nerves, heartburn, and bad dreams also occur (Baratte-Beebe & Lee, 1999; Lowdermilk, 2012). Up to 20% of pregnant women develop restless legs syndrome during the third trimester (Goodman, Brodie, & Ayida, 1998; K. A. Lee, Zaffke, & Baratte-Beebe, 2001). Late in the third trimester, high levels of progesterone and an elevated diaphragm contribute to an increased rate of breathing and complaints of shortness of breath. The enlarged uterus pressing on the bladder reduces bladder capacity, resulting in increased urinary frequency. The intestines and esophageal sphincter are displaced as a result of the growing fetus, causing esophageal reflux and complaints of heartburn. Pregnant women also complain of frequent leg cramps (Balserak & Lee, 2011; see Table 2).

Polysomnographic studies indicate more wake-after-sleep onset as pregnancy progresses, resulting in lower sleep efficiency compared with nonpregnant women (Brunner et al., 1994; Coble et al., 1994; Driver & Shapiro, 1992; Hertz et al., 1992; Karacan et al., 1968; Karacan et al., 1969; K. A. Lee & Zaffke, 1999; Nishihara & Horiuchi, 1998). Although study results conflict due to small sample sizes, all agree that sleep architecture is altered during pregnancy. The amount of time spent in REM sleep either remains the same or decreases slightly as the pregnancy progresses, depending on whether REM sleep is reported as an absolute number of minutes or as a percentage of total sleep time (K. A. Lee, McEnany, & Zaffke, 2000; Nishihara & Horiuchi, 1998; Petre-

Quadens & De Lee, 1974; Schorr et al., 1998). Changes in amount of REM sleep, latency to the first REM sleep period, and amount of SWS are unclear (K. A. Lee, 1998; Moline et al., 2003; Santiago et al., 2001).

Growth hormone, prolactin, melatonin, cortisol, thyroid-stimulating hormone, progesterone, and estriol have a circadian rhythm that may change over the course of pregnancy and affect sleep architecture (Santiago et al., 2001). Estrogen and progesterone increase during the pregnancy and may be responsible for the increase in the basal levels of prolactin that rapidly increase between 25 weeks of gestation and term. Estrogen decreases REM sleep, although the placental form of estrogen (estriol) is significantly weaker than the ovarian source (Carsten, 1998). Progesterone has a sedating effect and appears to increase NREM sleep (Friess, Tagaya, Trachsel, Holsboer, & Rupprecht, 1997; Little, Matta, & Zahn, 1974). The circadian rhythms of both estrogen and progesterone have not been described in pregnant women. Although prolactin secretion associated with meals and sleep is similar in pregnant and in nonpregnant women, the basal level rapidly declines during active labor and peaks again for up to six hours after a vaginal delivery (Boyar, Finkelstein, Kapen, & Hellman, 1975; Quigley, Ishizuka, Ropert, & Yen, 1982; Rigg & Yen, 1997; Spiegel et al., 1995).

Cortisol concentrations continue to peak in the early morning hours. The half-life of cortisol is prolonged during pregnancy, and levels increase twofold in late pregnancy and fourfold during labor (Cousins et al., 1983). Because of a

lower early-morning cortisol peak and a higher concentration of melatonin, pregnant women who experience poor sleep during the third trimester may have lower cortisol-to-melatonin ratios than good sleepers (Suziki et al., 1993). Melatonin secretion does not seem to change over the course of pregnancy or during labor and delivery (Kivelä, Kauppila, Leppäluoto, & Vakkuri, 1989; Santiago et al., 2001). Uterine activity peaks at night, along with peaks in oxytocin, which may explain the increased incidence of labor and delivery during the evening and night (Cousins et al., 1983; Kivelä et al, 1989; Santiago et al., 2001; Serón-Ferré, Ducsay, & Valenzuela 1993; Suziki et al, 1993).

Table 2 Typical sleep changes during pregnancy

First trimester	Second trimester	Third trimester
High levels of progesterone from placenta (20–30 ng/ml)	Progesterone levels rise, but more slowly (50–100 ng/ml)	Progesterone levels peak (300–400 ng/ml)
More difficulty sleeping through the night due to increased urinary frequency	Sleep less disrupted by urinary frequency	Sleep disturbances due to leg cramps, heartburn, nasal congestion, and increased need to urinate

Table 2—*Continued*

First trimester	Second trimester	Third trimester
Daytime sleepiness	More daytime energy	Increased daytime sleepiness
Daytime fatigue	Snoring may begin; risk of sleep apnea; risk of hypertension	Increased fatigue Difficulty with sleeping positions
Morning or evening nausea		Discomfort due to irregular uterine contractions, shortness of breath, and breast tenderness
Tend to sleep more than prior to pregnancy	More wake time during the night	More wake time during the night Possible restless legs syndrome and periodic leg movements
Less SWS	Less SWS	Less SWS

Note. Adapted from "Pregnancy and the Postpartum Period," by A. R. Wolfson & K. A. Lee, 2005, *Principles and Practice of Sleep Medicine,* p. 1279, by J. H. Kryger, T. Roth, & W. C. Dement (Eds). Copyright by Elsevier Saunders.

Impact of Sleep Disturbances During Pregnancy

A correlation between sleep disturbances and serum cytokine levels has been shown. Increased cytokine levels have also been associated with inflammation. Persistent sleep disruption can increase and lead to long-lasting inflammation. In conjunction with other risk factors, sleep disturbances during pregnancy may affect inflammation and may possibly increase the risk of adverse pregnancy outcomes (Okun, Hall, & Coussons-Read, 2007; Okun, Roberts, Marsland, & Hall, 2009; Okun, Schetter, & Glynn, 2011; Strange, Parker, Moore, Strickland, & Bliwise, 2009).

As indicated by increased circulating concentrations of the proinflammatory cytokines, interleukin (IL)-6 and tumor necrosis factor (TNF)-α, and the acute phase protein, C-reactive protein (CPR), poor sleep quality and continuity, reduced sleep duration, and sleep disordered breathing are associated with augmentation of the inflammatory response (Irwin, Wang, Campomayor, Collado-Hidalgo, & Cole, 2006; McDade, Hawkley, & Cacioppo, 2006; Meier-Ewert et al., 2004; Redwine, Dang, Hall, & Irwin, 2003; Shamsuzzaman et al., 2002; Vgontzas et al., 2004; von Känel et al., 2006). Inflammation is considered a component of the development of adverse pregnancy outcomes (Bartha, Romero-Carmona, & Comino-Delgado, 2003; Freeman et al., 2004; Holcberg et al., 2001; Romero et al., 2006). IL-6, TNF-α, and CRP are increased in patients with preeclampsia, intrauterine growth restriction, and preterm labor/birth (Afshari et

al., 2005; Dekker & Sibai, 1999; Hayashi, Ueda, Ohkura, & Inaba, 2005; Hayashi, Ueda, Yamaguchi, & et al., 2005; Holst, Mattsby-Baltzer, Wennerholm, Hagberg, & Jacobsson, 2005; Laskowska, Leszczyńska-Gorzelak, Laskowska, & Oleszczuk, 2006; Menon, Merialdi, Lombardi, & Fortunato, 2006; Vogel, Thorsen, Curry, Sandager, & Uldbjerg, 2005).

In summary, sleep architecture during pregnancy and delivery is affected by physical and hormonal changes. As a result, women may experience sleep disturbances such as multiple awakenings and daytime fatigue. These disturbances may result in perinatal complications affecting both maternal and fetal outcomes.

Measures of Sleep

Objective measures

Polysomnography (PSG), assessment of human sleep stages using electrophysiologic techniques, is the accepted gold standard for sleep assessment (Keenan & Hirshkowitz, 2011; Natale, Plazzi, & Martoni, 2009). Although home-based PSG can be performed, this assessment is typically carried out in a sleep laboratory. The EEG, the EOG, and the surface EMG are the three core measures used to score sleep states and stages. These basic PSG measures stage sleep based on conventions established in the 1960s to define the two stages of sleep (NREM and REM sleep) and the four stages within NREM sleep. The three core measures are usually supplemented by other measures such as heart rate, breathing, and

limb movements. Sleep staging contributes to defining certain sleep disorders, establishing the severity of sleep disorders, and assessing the efficacy of therapeutic interventions (Keenan & Hirshkowitz, 2011).

PSG allows for the collection of detailed information including the stages of sleep, total sleep time, total wake time, and sleep onset latency. Yet, the PSG recording process may disturb a patient's sleep and is usually costly to record and to score. PSG only provides data about sleep episodes during the time of recording, resulting in limited information longitudinally or during the period of wakefulness (Stone & Ancoli-Israel, 2011).

The first night effect may produce results that are not representative of an individual's sleep pattern. Classified as the first night effect, sleep architecture is altered during the first night of sleep in a sleep laboratory. Although not fully understood, reduced total sleep, reduced REM sleep time, decreased sleep efficiency, increased intermittent wake time, and alterations in time spent in certain sleep stages have been reported. The most frequently reported characteristics of the first-night effect are prolonged sleep latency and difficulty in falling asleep. Individuals who have less of an ability to adapt to a new environment would potentially have more difficulty in transitioning from wakefulness to sleep when introduced to a different environment (Tamaki, Nittono, Hayashi, & Hori, 2005). The first-night effect may be caused by such

factors as the change in the sleeping environment, such as an inpatient admission, or reactions to a stressful environment (Natale et al., 2009; Tamaki et al., 2005).

Actigraphy is a method of assessment that infers wakefulness and sleep from the presence or absence of limb movement. Worn on a wrist or ankle, this watch-like device combines a movement detector and memory storage that records continuously day and night for long periods. Actigraphic and polysomnographic measures of sleep have been strongly correlated in those with and without sleep disorders. Although it does not assess sleep architecture, actigraphy yields such sleep-pattern measures such as latency to sleep, wake time after sleep onset, and total sleep time. Its objectivity, portability, and convenience account for its widespread use in measuring sleep. Actigraphy is much less expensive and less intrusive than PSG, is noninvasive, and records 24 hours of activity from which wake and sleep can be scored, making it more conducive to repeated measures. Although more sensitive than sleep diaries for documenting sleep fragmentation, the main challenge with actigraphy occurs when patients lie awake in bed motionless, which the actigraph scores as sleep (Ancoli-Israel et al., 2003; Gorny & Spiro, 2001; Lichstein et al., 2006; Sánchez-Ortuño, Edinger, Means, & Almirall, 2010; Stone & Ancoli-Israel, 2011).

Subjective measures

Individuals' sleep patterns may or may not be accurately reflected when recorded by PSG or actigraphy. Individuals who complain of impaired sleep may

not experience the issue when actually monitored by an objective measurement tool. Objective data may or may not correlate with subjective reports of difficulty falling asleep or staying asleep. Self-report tools either measure a history of impaired sleep or measure changes over time (K. A. Lee, 2003). Perceived impaired sleep may be as an important predictor of adverse health outcomes as are the objective criteria established by sleep experts.

Three subjective measures were used in this study. The psychometric properties of these tools are discussed in Chapter 3. These tools include: the Pittsburgh Sleep Quality Index (PSQI), General Sleep Disturbance Scale (GSDS), and St. Mary's Hospital (SMH) Sleep Questionnaire. The Pittsburgh Sleep Quality Index measures the frequency of sleep disturbances and subjective sleep quality over the past month. The General Sleep Disturbance Scale measures the frequency of perceived sleep quality and quantity during the previous week. The St. Mary's Hospital Sleep Questionnaire measures the duration and subjective quality of an individual's previous night's sleep.

PSQI Use in Pregnancy Studies

The Pittsburg Sleep Quality Index (PSQI) has been used frequently to study sleep during pregnancy. Naud et al. (2010) conducted a prospective cohort study of 260 low-risk pregnant women in a tertiary perinatal center and found that the mean overall PSQI scores showed evidence of deterioration in sleep quality from the second trimester (5.26 ± 3.16) to the third trimester (6.73 ± 4.02, $p <$

0.01). This deterioration was displayed in five of the seven sleep components ($p <$ 0.01). Scores in the "poor sleeper" range were recorded by 36% of women in the second trimester and by 56% of women in the third trimester. Poor sleep in trimesters two and three was associated with low or high weight gain ($p < 0.01$), annual family income < $40,000 ($p = 0.03$), and single motherhood ($p < 0.01$). Seasonal influence on sleep scores ($p = 0.08$) was also seen as a trend. Using multivariate analysis, single motherhood was the only predictor of poor sleep ($p <$ 0.01).

In a prospective, cohort study of 189 healthy, nulliparous women recruited between 6 and 20 weeks gestation, Facco et al. (2010) found that mean sleep duration was significantly shorter (7.4 ± 1.2 hours compared with 7.0 ± 1.3 hours, $p < .001$) between baseline and follow-up. Overall poor sleep quality became significantly more common as pregnancy progressed (39.0% compared with 53.5%, $p = .001$).

Bei, Milgrom, Ericksen, and Trinder (2010) investigated the relationship between disrupted sleep and postpartum mood disturbance the week following delivery in 44 healthy women at low risk for postpartum depression. Using a 2-stage longitudinal design, sleep and mood were measured during the third trimester and one week postpartum. After delivery, both objective (actigraphy) and subjective (PSQI) nighttime sleep significantly worsened with decreased total sleep time and sleep efficiency. Daytime napping behavior significantly

increased. Although 45.95% of the sample experienced mood deterioration, mood on average improved across all scales (Depression Anxiety Stress Scale, Hospital Anxiety Depression Scale, and Positive and Negative Affect Schedule) after delivery. Subjective nighttime sleep, sleep-related daytime dysfunction, and daytime napping behavior were significant predictors of postpartum mood rather than objective sleep quality and quantity.

Ko, Chang, & Chen (2010) explored (1) differences in sleep quality, depression, and stress among second- and third-trimester pregnant and nonpregnant women, and (2) relationships among depression, stress, and sleep quality of pregnant women in Taiwan. Data were collected from October 2006 to September 2007 using a demographic form, PSQI, Edinburgh Postnatal Depression Scale, and Perceived Stress Scale. Sleep quality during the previous month was measured by the PSQI. The prevalence of poor sleepers (PSQI score >5) was 60.0% for second- and third-trimester pregnant women and 48.0% for nonpregnant women. After controlling for significant covariates, pregnant women reported worse global sleep quality, habitual sleep efficiency, and sleep disturbances than nonpregnant women. Poorer sleep quality and sleep latency were most prevalent during their third trimester. A high prevalence of antenatal depression (27.3% to 36.0%) was found in pregnant women. Depressed women had worse sleep quality than nondepressed women in all groups. Stress affected sleep quality of pregnant women but not in nonpregnant women (Ko et al., 2010).

Although the psychometric properties of the PSQI were not thoroughly evaluated, the PSQI was used in the following study involving pregnant women. Okun, Hall, and Cussons-Read (2007) administered the PSQI at approximately 12, 24, and 36 weeks gestation. Although they found that PSQI scores did not differ significantly across time points during pregnancy, the mean global PSQI score was noticeably higher in the third trimester compared with the first and second trimesters.

Kamysheva, Skouteris, Wertheim, Paxton, and Milgrom (2008) administered the PSQI when investigating relationships among women's body attitudes, physical symptoms, self-esteem, depression, and sleep quality during pregnancy. In regressions, controlling for retrospective reports of body image, more frequent and intense physical symptoms were related to viewing the self as less strong/fit, and to poorer sleep quality and more depressive symptoms. In a multifactorial model, paths were found from sleep quality to depressive symptoms to self-esteem. Self-esteem was found to be a mediator associated with lower scores on feeling fat and salience of weight and shape, and on higher perceived attractiveness.

Jomeen and Martin (2008) administered the PSQI when investigating the impact of choice of maternity care on psychological health outcomes. No significant differences between groups were revealed on any of the scales or subscales measured. However, significant and corresponding differences were

identified within groups over time for Cambridge Worry Scale sociomedical worries, Multidimensional Health Locus of Control "powerful others", SF-36 bodily pain, vitality personal health and change in health, and global PSQI sleep. An interaction effect for the Culture Free Self-esteem Inventory general and social self-esteem was revealed between birth center and midwifery-led care/main unit women at 14 weeks postpartum.

Summary

The gold standard for measuring sleep, PSG is the most valid and reliable objective measure that assesses physiological processes during sleep periods. Actigraphy distinguishes between sleep and wakefulness using activity as a proxy measure of sleep. Subjective tools such as the Pittsburgh Sleep Quality Index (PSQI) and the General Sleep Disturbance Scale (GSDS) measure perceptual aspects of sleep. Although self-report measures are not considered as accurate as physiological measures such as PSG or actigraphy, they provide information about other attributes of sleep such as frequency of sleep disturbances or sleep quality. A combination of both objective and subjective measures would explore multiple attributes of the sleep experience. The measurement tools are chosen based on the setting, the specific population, and the clinical scenario being studied. The psychometric properties of the measurement tools chosen for this study are discussed further in Chapter 3.

Sleep Studies in Hospitalized Nonpregnant Patients

Sleep disturbances are common among adults during acute care hospitalization. Hospitalized patients often have difficulty initiating and maintaining sleep, or complain of early awakening and nonrestorative sleep (National Institutes of Health [NIH], 2005). Researchers have investigated this problem for nearly 30 years, yet little is known about sleep in acute care settings. In acutely ill patients, polysomnographic studies show (a) a predominance of Stage 1 sleep with a reduction of time spent in other sleep stages, including REM and SWS; (b) REM rebound following REM deprivation; (c) reduced total sleep time and sleep efficiency; (d) frequent sleep-stage transitions; (e) awakenings of unknown etiology; and (f) greater proportions of daytime sleep. Studies included patients with acute myocardial infarction, open-heart surgery, noncardiac surgery, neurological and respiratory disorders, and mixed groups of critically ill adults and surgical patients (Aaron et al., 1996; Aurell & Elmqvist, 1985; Broughton & Baron, 1978; Hilton, 1976; Johns, Large, Masterton, & Dudley, 1974; Knill, Moote, Skinner, & Rose, 1990; Orr & Stahl, 1977; Richards & Bairnsfather, 1988).

The etiology of sleep disruption is multifactorial and includes the patient's prehospitalization characteristics, underlying illness, medical treatments, and the hospital environment (Young, Bourgeois, Hilty, & Hardin, 2008). Sleep disturbance is a significant source of stress during acute illness (Aurell &

Elmqvist, 1985; Pérez de Ciriza, Otamendi, Ezenarro, & Asiain, 1996; Soehren, 1995; Wilson, 1987) and ranges from 22% to 61% on self-report measures (Beyerman, 1987; Closs, 1990, Jones, Hoggart, Withey, Donaghue, & Ellis, 1979; Southwell & Wistow, 1995; Yinnon, Ilan, Tadmor, Altarescu, & Hershko, 1992). Patients reported (a) increased awakenings, (b) difficulty falling asleep, (c) earlier awakening and bedtime, (d) shorter duration, (e) more napping, (f) perception of not feeling rested, (g) poor sleep quality, (h) less sleep than needed, and (i) the need for sleeping pills, compared with sleeping at home (Beyerman, 1987; Closs, 1990; Freedman, Kotzer, & Schwab, 1999; McFadden & Giblin, 1971; Pacini & Fitzpatrick, 1982; Southwell & Wistow, 1995; Yinnon & et al., 1992).

Factors Influencing Sleep

Both endogenous and exogenous factors influence sleep. When people are hospitalized, they bring with them their own habitual behaviors concerning rest and sleep, which are vulnerable to manipulation by the constraints of the hospital philosophy and routine (Webster & Thompson, 1986). Multiple factors such as demographic, clinical, and disease-related characteristics as well as pre-existing sleep disorders may contribute to poor sleep during acute care hospitalization and may complicate recovery (Redeker, Hedges, & Booker, 2011). In studies of medical patients with ischemic heart disease (Redeker, Tamburri, & Howland, 1998) and cardiac surgery patients (Redeker, Ruggiero, & Hedges, 2004a, 2004b), age, functional status, gender, and prehospitalization sleep patterns predicted

sleep during hospitalization. Isaia et al. (2010) found that comorbidity was the best predictor of insomnia during hospitalization (OR 7.9, SE 0.85, $p = .01$). The direct effects of medical disorders, illness, and injuries can impact sleep quality during acute care hospitalization.

As there are age-related changes in normal sleep, aging may potentially influence sleep during acute care hospitalization, Yet, sleep disturbance is probably more as a result of poor health in older adults, secondary to chronic illness or primary sleep disturbances. Gender differences in sleep and gender prevalence of certain sleep disorders should also be a point of consideration during acute care hospitalization and recovery (Redeker, Hedges, et al., 2011). Medications such as antidepressants, antiepileptics, and sedatives/hypnotics taken prior to and during hospitalization may negatively influence sleep, especially those with central nervous system effects (Redeker, Hedges, et al., 2011). Patients may experience acute withdrawal of substances taken prior to hospitalization, thereby, contributing to sleep disturbance. Some medications may worsen preexisting sleep disorders and many interfere with the restorative benefits of sleep (Redeker, Hedges, et al., 2011).

Researchers have studied the influence of the acute care environment on patients' sleep, focusing on noise, lighting, and interruptions of sleep to perform patient care activities (Redeker, Hedges, et al., 2011). Throughout U.S. hospitals, peak sound levels often exceed the recommended 35-45 dB (A; Christensen,

2005) and may reach 80 dB (A; Aaron et al., 1996; Christensen, 2005; Kahn et al., 1998; MacKensie & Galbrun, 2007), exceeding the federal regulations at which a worker must wear earplugs (Joseph & Ulrich, 2007).

Impact of Sleep Disturbance in Hospitalized Patients

The direct effects of sleep disturbance during acute care hospitalization are difficult to quantify because of the multiple factors that contribute to sleep and its outcomes (Redeker, Hedges, et al., 2011). Sleep disturbance has an impact on functional performance, and patients must be able to function sufficiently to perform self-management activities when discharged. Sleep disorders in the acute care setting may be tied to pathophysiological outcomes such as alterations in immune function and the hypothalamic-pituitary-adrenal (HPA)-axis, inflammatory processes, activation of the neuroendocrine system with elevated catecholamines, derangement of metabolic processes, and glucose and insulin regulation (Redeker, Hedges, et al., 2011; Sareli & Schwab, 2008).

Summary

Hospitalized patients often complain of sleep disturbances (Lauri et al., 1997; Raymond et al., 2001). These disturbances may be caused by exogenous factors such as unit environmental noise, bright lightening, and timing of staff interventions, and/or endogenous factors such as delirium, depression, anxiety, stress, pain, and discomfort (Ersser et al., 1999; Miller et al., 1976; Raymond et al., 2001). Although patients may appear to sleep in the hospital, the sleep may

not be refreshing or restorative. Poor sleep can have serious, detrimental effects on health and recovery from illness. The reasons can be categorized as environmental, physiological, and psychological (Raymond et al., 2001; Reid, 2001).

Sleep Studies in Hospitalized Antepartum Patients

Limited research has been conducted on hospitalized patients admitted to antepartum units. Women hospitalized during pregnancy are usually admitted for antepartum complications, such as threatened preterm birth, vaginal bleeding, multiple gestation, gestational hypertension, and hyperemesis. Maloni et al. (2006) studied women at varying gestational ages on bed rest precautions and found that complaints about sleep (over 80%) were as common as backache and dry lips. Using actigraphy to monitor sleep on an antepartum unit, Gallo and Lee (2008) found that 30%–40% of women reported that their sleep was very bad. The objective actigraphy validated their self-reports. Although the women were hospitalized for many different diagnoses, their awakenings ranged from 9 to 32 times nightly, with naps averaging approximately 2 hours daily.

Sleep Studies During Labor and Delivery

The quality of sleep at the end of the last trimester is worse than during the first two trimesters as a result of sleep problems and feeling physically uncomfortable (Evans, Dick, & Clark, 1995; Hedman et al., 2002; National Sleep Foundation, 2011b). Studies using wrist actigraphy found that pregnant women

experienced the most disrupted sleep during the five days prior to an expected delivery date. Their sleep was especially fragmented the night prior to their hospital admission both for those who experienced spontaneous labor and those admitted for a scheduled induction (Beebe & Lee, 2007). In Kennedy, Gardiner, Gay, and Lee's (2007) qualitative study, all 20 women described sleep difficulties once contractions began. Lee and Gay (2004) used wrist actigraphy to measure sleep in primigravidas about three weeks prior to delivery, and found that those who slept less than six hours per night had significantly longer labors (average of 12 hours) and were 4.5 times more likely to be delivered via Cesarean section, compared to women who slept more than seven hours.

Sleep Studies During Postpartum

Sleep disruption can persist not only over the course of the pregnancy but also into the postpartum period. Morrison Ludington-Hoe, and Anderson (2006) found that patients were interrupted an average of 54 times in 12 hours during the first day postpartum. Frequent interruptions can negatively affect sleep, breastfeeding, bonding, and transition from hospital schedule to home schedule. Hospitals that provide an afternoon parent-baby quiet time promote a restful atmosphere, which helps to decrease postpartum sleep deprivation (Hunter, Rychnovsky, & Yount, 2009). From birth to 6 months postpartum, lack of sleep, sleep deprivation, and fatigue are commonly expressed as women adapt to the new demands of motherhood (Dennis & Ross, 2005; Gay, Lee, & Yee, 2004;

Goyal, Gay, & Lee, 2007; Horiuchi & Nishihara, 1999; Hunter et al., 2009; Karacan et al., 1969; Kennedy et al., 2007; K. A. Lee, Zaffke, & McEnany, 2000; Matsumoto, Shinkoda, Kang, & Seo, 2003; Shinkoda, Matsumoto, & Park, 1999; Signal et al., 2007; Swain, O'Hara, Starr, & Gorman, 1997). Altered maternal sleep patterns, particularly in the early months, are associated with nighttime newborn feedings, care, and sleeping patterns (Dennis & Ross, 2005; Doan, Gardiner, Gay, & Lee, 2007; Horiuchi & Nishihara, 1999; Shinkoda et al., 1999; Thomas & Foreman, 2005). A decrease in total sleep efficiency, a decrease in total sleep time, and an increase in wake after sleep onset (WASO) are common characteristics for all mothers, especially in the first month postpartum, with primiparas and mothers who deliver via Cesarean section at greater risk for sleep disturbances (Hunter et al., 2009).

Findings from sleep research studies during the postpartum period are difficult to synthesize or compare, to translate into practice for healthcare providers, or to provide practical solutions for parents due to different methodologies, varied data collection methods, small sample sizes, variance in data collection timepoints, and failure to control for independent variables (Hunter et al., 2009). Karacan et al. (1969) examined postpartum maternal sleep awakenings and NREM-REM sleep characteristics in a hospital setting via EEG recordings. Compared with nonpregnant and pregnant controls, the study group of 10 postpartum women 3 to 4 days following delivery experienced more sleep

awakenings, an increase in Stage 0 sleep, a reduction in Stage 4 sleep, and a reduction in REM sleep. Compared with controls, Swain et al. (1997) found via sleep diaries that postpartum women experienced the most disturbed sleep patterns during the first week postpartum. Although sleep patterns improved by Week 3, they still did not equal the sleep patterns of the controls. Postpartum women experienced more nocturnal awakenings, stayed awake longer, slept later in the morning, and napped more frequently during the day than did the controls. In addition, sleep loss might affect new mothers' memory and psychomotor task performance.

Using sleep logs and actigraphy, Matsumoto et al. (2003) reported that women's total sleep time, sleep efficiency, and circadian amplitude decreased and that WASO increased in the early postpartum period. To compensate for nocturnal sleep deprivation, women increased their length of daytime naps. Although all variables improved over time, most had not returned to the level of the nonpregnant controls by 15 weeks postpartum. Because WASO and length of daytime naps slowly decreased, circadian amplitude was considered restored at Week 10.

Using actigraphy and self-report questionnaires to study 72 postpartum couples during the first month postpartum, Gay et al. (2004) found that women had increased sleep disruption compared with the last month of pregnancy, primarily due to less nocturnal sleep, more daytime napping, and more WASO

periods. Using small sample sizes, PSG (Horiuchi, 1994), and actigraphy with sleep logs (Kang, Matsumoto, Shinkoda, Mishima, & Seo, 2002; Shinkoda et al., 1999), authors found that total sleep time shortened, sleep efficiency decreased, and wakefulness after sleep onset during the postpartum period increased compared with late pregnancy. Using actigraphs to record sleep start and stop times as well as a sleep diary at 1 and 6 weeks postpartum, Signal et al. (2007) studied 19 women, finding that the most severe sleep disturbances occurred during the first week postpartum, with (a) 1.5 hours less sleep than during pregnancy, (b) 3 times more sleep episodes in 24 hours, (c) variability in day-to-day sleep, and (d) more daytime napping. Although not the same as their prepregnancy baseline, sleep variables were improved by 6 weeks postpartum.

Quillin (1997) reported that women slept an average of 7.53 total hours per day at one month postpartum, where 6.15 hours were during the night compared with the average of 8.43 total hours in nonpregnant women. Cottrell and Karraker (2002) reported women slept an average of 6.75 hours nightly at three to four months postpartum. Thomas and Foreman (2005) reported a mean total sleep time of 7.18 hours nightly at four to 10 weeks postpartum. Using sleep logs, Yamazaki, Lee, Kennedy, and Weiss (2005) reported that total sleep decreased from 7.56 hours in the third trimester to 6.34 hours four to five months postpartum in a convenience sample of 101 Japanese women.

Using a prospective, longitudinal, descriptive design, Rychnovsky and Hunter (2009) examined the relationship between sleep characteristics and postpartum fatigue in 109 women during the first six weeks after delivery. Across three measurement timepoints, fatigue had a positive correlation with sleep disturbance, indicating that higher levels of fatigue were associated with more disturbed sleep. Fatigue levels had a negative correlation with sleep effectiveness, indicating that the women were more fatigued if they perceived their sleep quality and adequacy to be poor or if they perceived the time spent sleeping to be short.

Summary

Sleep is a basic, dynamic, highly organized, and complex behavior that is essential for normal functioning and survival (Landis & Heitkemper, 2011). Theories suggest that sleep functions as a time of restoration and preparation for the next period of wakefulness. Behavioral and physiologic functions, including memory, mood, cognitive function, hormone secretion, glucose metabolism, immune function, body temperature, and renal function, are influenced by sleep. The benefits of sleep are often overlooked until a problem develops as a result of sleep disturbance.

Hospitalization is associated with decreases in total sleep time, sleep efficiency, and REM sleep. Preexisting sleep disorders, environmental sleep-disruptive factors, medications, and acute and chronic illness all contribute to poor sleep. Symptoms, such as pain, dyspnea, and nausea, in the acutely ill patient

can contribute to sleep loss. The hospital represents a new environment and normal cues linked to sleep may be absent.

Scant sleep research has been conducted on hospitalized antepartum patients. Much of what is known about sleep during pregnancy is based on research on healthy pregnant women. Pregnancy is a physiological state that is marked by disturbed sleep. Both self-reported and polysomnographically recorded sleep indicate that pregnant women experience diminished sleep quality, greater fragmentation, and often a decrease in sleep duration. Despite research studies failing to support the effectiveness of bed rest for antepartum complications, this treatment regimen is widely prescribed for antepartum complications Hospitalization also interferes with sleep. Admitting pregnant women to the hospital for an extended period of time could exacerbate their sleeping problems and be potentially harmful to their health. Only a single study has been conducted with a focus on antepartum-hospitalized women (Gallo & Lee, 2008). Therefore, this study examined sleep disturbances during pregnancy as a result of physiological, hormonal, and anatomical/physical changes and antepartal hospitalization.

Chapter 3

Methods and Procedures

Introduction

The present study examined the sleep experience of hospitalized antepartum women. This chapter describes the design, sample, setting, informed consent, protocol, data collection procedures, measurement methods, data analyses, and limitations of the study.

Research Design

The study was a descriptive correlational design to measure the relationship of total sleep time, number of arousals, and daytime sleep time to the gestational stage of hospitalized antepartum women. In addition, the study explored whether prehospitalization sleep patterns influence sleep during the inpatient hospitalization of antepartum women.

Sample

The original plan for this study was to recruit 50 participants. Admissions to the antepartum unit of the participating hospital were less than anticipated, resulting in a convenience sample of only 24 participants.

Difficulties in retaining the 24 participants until the end of the study were encountered. Nine of the 24 participants completed the study through Day 4, as per the research design (i.e., full protocol subgroup). Participants not completing

the study were either discharged or delivered their babies prior to Day 4 (end of study).

Only one study has been conducted with a focus on sleep patterns in antepartum-hospitalized women. Therefore, due to the lack of published effect sizes related to this population, it was not possible to conduct an a priori power analysis to establish the sample size prior to the beginning of the current study. The researcher consulted with a statistician for guidance regarding the target sample size. Based on Gallo and Lee's (2008) sample size of 39 antepartum women and the lack of published data on the population, a sample size of 50 antepartum women was considered feasible for the present study. G*Power was used to calculate a post hoc power analysis (Faul, Erdfelder, Land, & Buchner, 2007). The results of the post hoc power analysis are discussed in Chapter 4.

Potential participants met the following inclusion criteria: (a) pregnant woman 18 years or older with an initial admission to an antepartum unit, (b) hospitalized for > 3greater than three days, and (c) able to speak, read, and write English. Patients diagnosed with previous sleep disorders or who work night shifts or irregular work schedules were excluded due to the potential confounding effects on a pregnant woman's sleep experience (Gallo & Lee, 2008).

Setting

The research study was conducted at a 515-bed nonprofit hospital located just south of downtown Dallas, Texas. The hospital has an eight-bed antepartum

unit, 14 suites for labor, delivery, and recovery, a 50-bed Level III neonatal intensive care unit, and delivers approximately 3,600 babies annually (Methodist Health System, n.d.). The antepartum unit provides long-term obstetric care for women who are experiencing high-risk pregnancies or related pregnancy complications such as heart disease, hypertension, diabetes, multiple gestation, or preterm labor.

Measurement Methods

Sleep parameters are the variables of interest in this study. The conceptual and operational definitions of the sleep parameters are described in Table 3. The conceptual definitions were derived from subjective areas routinely assessed in clinical interviews of patients with sleep/wake complaints. The sleep parameters were operationalized with several self-report measurement tools. These tools include the Pittsburgh Sleep Quality Index (PSQI), General Sleep Disturbance Scale (GSDS), and St. Mary's Hospital Sleep Questionnaire (SMH). The PSQI measures the frequency of sleep disturbances and subjective sleep quality over the past month. The GSDS measures the frequency of perceived sleep quality and quantity during the previous week. The SMH Sleep Questionnaire measures the duration and subjective quality of an individual's previous night's sleep.

Table 3. Conceptual and operational definitions of study variables

Study variable	Conceptual definition	Operational definition
Sleep quality	Sleep quality, a complex phenomenon that includes quantitative (i.e., sleep duration, sleep latency, number of arousals) and subjective (i.e., depth, restfulness) aspects of sleep, which varies between individuals (Buysse et al., 1989).	PSQI: 1 item GSDS: 3 items SMH: 3 items
Sleep latency	Sleep latency is the amount of time required to fall asleep once settling down for the night.	PSQI: 2 items GSDS: 1 item SMH: 3 items
Sleep quantity	Sleep quantity refers to all aspects of the sleep period including duration and efficiency.	PSQI: 5 items GSDS: 2 items SMH: 4 items

The following sections describe the self-report measurement tools used in this study: the PSQI, GSDS, and SMH. The development of the tools and psychometric properties are discussed.

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) was developed to measure the complex multidimensional phenomenon of sleep quality (Buysse et al., 1989). The subscales of this self-report instrument measure the following dimensions: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. The PSQI is composed of 19 self-rated questions and five questions rated by a bed partner or roommate. Only the self-rated items are used in scoring the scale. The self-administered scale contains 15 multiple-choice items that inquire about frequency of sleep disturbances and subjective sleep quality, as well as four write-in items that inquire about typical bedtime, wake-up time, sleep latency, and sleep duration based on recalling the overall sleep experience of the previous month. Since the five questions answered by the bed partner are only used in clinical practice, they were not used in this study. The PSQI generates seven subscale scores that correspond to the previously listed dimensions. The score for each dimension ranges from 0 (*no difficulty*) to 3 (*severe difficulty*). The dimension scores are summed to produce a global score (range 0-21). A global PSQI score > 5 is

considered to be suggestive of significant sleep disturbance. Cutoff scores are not available for the dimension scales. Most respondents complete the PSQI in five to 10 minutes. No training is needed to administer the PSQI and scoring it takes less than five minutes (Buysse et al., 1989).

Psychometric Evaluation of the PSQI

The internal consistency of the PSQI was evaluated in a study with a sample of healthy control subjects (n = 52), patients with sleep disorders (n = 62), and depressed patients (n = 54; Buysse et al., 1989). Cronbach's alpha was 0.83 for the global score. Correlations between the subscale scores and the global score ranged from 0.35 to 0.76. Correlations of the individual multiple-choice items with the global score ranged from 0.20 to 0.66. Test-retest reliability (average interval of 28 days) with a subset of 91 of the patients in the study to determine the internal consistency of the scale was 0.85 for the global score and 0.65-0.84 for the subscales (Buysse et al., 1989).

Buysse et al. (1989) also found that subjects with sleep disorders (n = 62) or psychiatric disorders associated with sleep disturbances (e.g. depressive and anxiety disorders; n = 34) scored significantly higher than healthy control subjects (n = 52) on the subscales and the global scale. Subscale scores significantly differentiated diagnostic groups. A post hoc cutoff score of 5 on the PSQI produced a sensitivity of 89.6% and a specificity of 86.5% for patients versus control subjects. This cutoff score correctly identified 84% of patients with

disorders of initiating or maintaining sleep, 89% of patients with disorders of excessive sleepiness, and 97% of depressed patients. Group differences on the global PSQI scores between patients and control subjects were substantiated by comparable group differences in polysomnographic measures for sleep latency, sleep efficiency, sleep duration, and number of arousals. However, PSQI subscale scores were not significantly correlated with corresponding polysomnographic measures, with the exception of sleep latency (r = 0.33). The global PSQI score was significantly correlated with sleep latency (r = 0.20) but not with any other polysomnographic measures (Buysse et al., 1989).

Carpenter and Andrykowski (1998) examined the psychometric properties of the PSQI among four populations: bone marrow transplant patients (n = 155), renal transplant patients (n = 56), women with breast cancer (n = 102), and women with benign breast problems (n = 159). Results supported PSQI internal consistency reliability and construct validity. Cronbach's alphas were 0.80 across groups, and correlations between global and subscales scores were moderate to high. Global PSQI scores were moderately to highly correlated (r = .69–.77) with other measures of sleep quality (Sleep, Energy, and Appetite Scale) and sleep problems (Symptom Experience Report, Centers for Epidemiological Studies Depression Scale), and poorly correlated (r = .22–.65) with unrelated constructs, such as mood symptoms and depression. Individuals with sleep problems, poor

sleep quality, and sleep restlessness had significantly higher global PSQI scores in comparison to individuals without such problems.

Psychometric Evaluation of PSQI Use in Pregnancy Studies

Despite the complex and dynamic psychobiology of pregnancy, little work has been conducted to determine the most appropriate measure of sleep quality in this clinical group. The assessment of sleep quality in pregnancy would be facilitated by the availability of robust and reliable measure of sleep quality. Such a measure should capture the broad dimensions of sleep experience that may be expected to be impacted by the physiological changes and challenges that accompany pregnancy (Jomeen & Martin, 2007).

Jomeen and Martin (2007) evaluated the usefulness of the PSQI in early pregnancy and concluded that the relationship between sleep quality and depression was found to be statistically significant and clinically relevant during early pregnancy. The PSQI was found to be an appropriate measure to assess sleep quality during early pregnancy. The psychometric properties of the PSQI were evaluated in 148 women at 14 weeks gestation. To determine if women classified as depressed had significantly poorer sleep quality compare to those classified as not depressed, between-subjects *t* tests ($p < 0.01$) were calculated on PSQI subscales and PSQI global sleep quality scores as a function of depression classification. Participants classified as depressed had significantly higher scores on five of the seven PSQI subscales and significantly higher global PSQI sleep

quality scores compared to non-depressed participants. No significant difference between groups was observed on the PSQI sleep disturbance subscale. No *t* test was conducted on the PSQI sleep medication data due to a zero mean score and zero variance in the depressed group. Cronbach's alpha of all seven subscale scores of the PSQI was 0.73. Removal of the PSQI sleeping medications subscale score revealed that Cronbach's alpha would improve to 0.76 (Jomeen & Martin, 2007).

Pearson's correlation coefficients were calculated between PSQI subscale scores, the global PSQI sleep quality score, and Edinburgh Postnatal Depression Scale (EPDS) scores to determine convergent validity (Jomeen & Martin, 2007). Similarly, divergent validity was established between PSQI subscale scores, the global PSQI sleep quality score, and age. .

To extend Jomeen and Martin's (2007) study, Skouteris, Wertheim, Germano, Paxton, and Milgrom (2009) examined the psychometrics of the PSQI in pregnancy and whether sleep quality predicted increases in depressive symptoms, and compared PSQI scores across three or two levels of depressive symptoms. Each of the 252 participants completed the Beck Depression Inventory (short form) and the PSQI at mid- and late pregnancy. Global PSQI scores showed good internal consistency. Cronbach's alpha for the PSQI (items were the seven component subscale scores) was 0.70 and 0.76 at Time 1 (between 15 and 23 weeks gestation) and Time 2 (between 29 and 39 weeks gestation),

respectively. Removing the sleeping medications component (only seven women at Time 1 and 14 women at Time 2 had scores greater than zero) improved Cronbach's alpha to 0.72 and 0.78 for Time 1 and Time 2, respectively (Skouteris et al., 2009).

Other researchers studying sleep quality found that the PSQI had good internal consistency reliability in 285 Taiwanese postpartum women (Cronbach's alpha = 0.76) (Teng, See, Cheng, & Lee, 2007). Ko, Chang, and Chen (2010) found that the internal consistency of the PSQI was supported with a Cronbach's alpha of 0.73.

General Sleep Disturbance Scale

The GSDS was designed to assess perceived sleep quality and quantity in healthy adults during the previous week (K. A. Lee, 1992). The GSDS has 21 items that evaluate various aspects of sleep disturbance including subscales of sleep quality, sleep onset latency, sleep quantity, sleep maintenance, early awakening, use of medication to promote sleep, and excessive daytime sleepiness. Each item is rated on a 0 (*never*) to 7 (*every day*) numeric rating scale. The 21 items are summed to yield a total score that could range from 0 (*no disturbance*) to 147 (*extreme disturbance*) and subscale scores between 0 and 7. Total scores of 43 and higher and a mean of 3 on any one subscale indicate a clinically significant level of sleep disturbance (K. A. Lee, 1992). A mean score of 3 or more would indicate that sleep was perceived as disturbed on three or more nights during the

past week, corresponding to DSM-IV for primary insomnia (American Psychiatric Association, 1994).Validity and reliability have been tested in multiple studies of childbearing women (K. A. Lee & Gay, 2004) with a Cronbach's alpha coefficient of .82 for the three-item sleep quality subscale and alpha coefficient of .80 for the total scale.

St. Mary's Hospital Sleep Questionnaire

The SMH Sleep Questionnaire was designed to evaluate the subjective sleep of hospital patients from general surgical, medical, and psychiatric units (Ellis et al., 1981). Using check box format and categorical scales, it consists of 14 multiple-choice and short-answer questions evaluating sleep and wake times, daytime sleep, perceptions of and satisfaction with sleep, and early morning sleep behavior over the previous 24 hours. The questionnaire had good test-retest reliability and was used successfully to detect changes in the sleep of surgical patients during their hospital stay (Ellis et al.; Murphy, Bentley, Ellis & Dudley, 1977). A study of 93 healthy volunteers was conducted to test the tool's reliability and validity. The reliability of the items varied from 0.70 to 0.96. (Ellis et al., 1981; Murphy, Bentley, Ellis, & Dudley, 1977; Redeker, 2008; Richardson, Crow, Coghill, & Turnock, 2007). The results of a factor analysis of the SMH Sleep Questionnaire conducted in a study of 222 rheumatic patients identified that sleep latency and sleep quality correspond with the sleeping-state factors of ease of getting to sleep and quality of sleep, suggesting that the subjective perceptions

of sleep are the most important aspects of sleep to individuals (Leigh, Bird, Hindmarch, Constable, & Wright, 1988).

The St. Mary's Hospital Sleep Questionnaire has not been used in hospitalized pregnant patients; however, Rosen (2009) combined it with home polysomnography to compare how sleep architecture, sleep characteristics, and self-perception of sleep varied in 44 mothers. There were no significant differences in the study variables between the mothers who breast fed or formula fed their infants.

Procedure

.*Recruitment and Informed Consent*

Once approval had been granted by the Institutional Review Board, the researcher informed the antepartum unit nursing staff about the study during their staff meetings and through Institutional Review Board-approved flyers posted on the unit. Additional recruitment strategies will be described further as lessons learned in Chapter 4. Potential participants were screened upon admission to the antepartum unit. Once identified, potentials participants were approached during their first day of admission and asked to participate in the study. The informed consent process involved (1) disclosing to potential participants information needed to make an informed decision; (2) facilitating the understanding of what has been disclosed; and (3) promoting the voluntary decision about whether or not to participate in the research (U.S. Department of Health & Human Services,

n.d.). After informed consent was obtained, participants began the study procedures. The same researcher reviewed the informed consent (Appendix 1) with the participants and collected all data on all participants throughout the study. Once informed consent was obtained (see Appendix A), a demographic data was collected and included age, ethnicity, years of education, occupation, and marital status (see Appendix B). Medical information included such data as gravidity, parity, diagnosis, weeks of gestation, treatment orders (i.e., frequency of electronic fetal monitoring), activity (e.g., bed rest, bathroom privileges), and medications (see Appendix C). Medical information was collected via chart review by the researcher. The participants were asked to complete the PSQI (see Appendix D) and GSDS on admission (see Appendix E). Participants also completed the GSDS on Day 4 after admission (see Appendix F). The SMH Sleep Questionnaire (see Appendix G) and a questionnaire related to night interruptions (Appendix H) were used during days two, three, and four after admission. Table 4 presents the sequence of questionnaires.

Table 4 Administration of questionnaires

Tool	Admission	Day 2	Day 3	Day 4
Demographic Profile	X			
Medical/Medication History	X			
PSQI	X			
GSDS	X			X
SMH Sleep Questionnaire		X	X	X
Night Interruptions		X	X	X

Data Collection Process

Figure 5 outlines the flowchart for the data collection process for this research study.

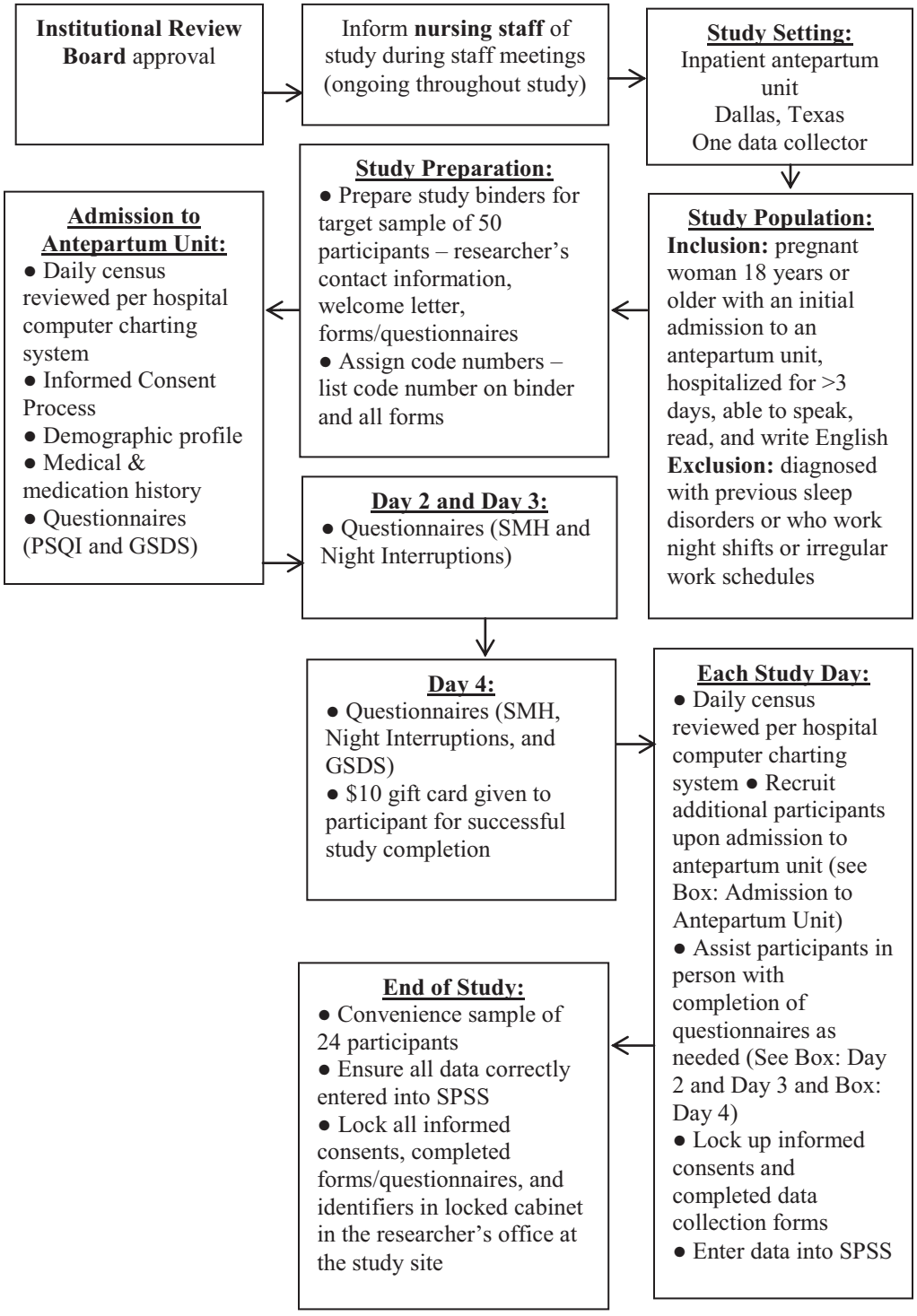


Figure 5 Flowchart for data collection process

Ethical Considerations

University of Texas at Arlington and Methodist Health System Institutional Review Board approval was obtained prior to data collection. The questionnaires used in this study of sleep in the hospitalized antepartum patient involved no specific risks or discomforts beyond those of a standard clinical questionnaire or interview situation. The research activities presented no more than minimal risk to human subjects. The participants may have felt upset at the review of the pregnancy and/or sleep experiences, or they may have felt boredom or fatigue.

Participant confidentiality was protected. During data collection, each participant was identified by a code number. All data were maintained in the researcher's office at Methodist Dallas Medical Center in a locked office and a locked file cabinet. The study enrollment log is password-protected and stored on the hospital server that is firewall-protected. The data will be stored for a period of three years and only then will the data collection tools be shredded and destroyed on-site.

Data Analysis

This section discusses the data analyses used to answer the research questions of this descriptive correlational study. Data analyses are organized by the respective research questions.

Research Question 1

Research Question 1 was, What are the sleep experiences (total sleep time, number of arousals/awakenings, and daytime sleep time) in hospitalized antepartum patients?

All data obtained from each participant's study binder was hand-entered into an SPSS file. Data obtained from the PSQI was hand-entered into the Access scoring database available from the University of Pittsburgh Sleep Medicine Institute (2013). Descriptive statistics including frequencies, percentages, means, standard deviations, and ranges for the demographic profile, medical/medication history, PSQI, and GSDS were analyzed for sleep experiences upon admission following informed consent. Following Day 2 and Day 3, descriptive statistics for the SMH and Night Interruptions questionnaire were analyzed via SPSS. Descriptive statistics for the GSDS, SMH, and Night Interruptions questionnaire were analyzed via SPSS following Day 4. All questionnaires used in this study underwent analyses for reliability.

Research Question 2

Research Question 2 was, What is the relationship between the weeks of gestation and woman's sleep experience while hospitalized on an antepartum unit?

To address Research Question 2, Pearson's product moment coefficients (r) were calculated to determine the relationship between the weeks of gestation

and the woman's sleep experience while hospitalized on an antepartum unit, as measured nightly by the SMH.

Research Question 3

Research Question 3 was, Is there a difference in a pregnant woman's sleep experience at one month before hospitalization, one week before hospitalization, and during hospitalization on an antepartum unit?

To address Research Question 3, repeated measures analysis of variance were calculated to determine if there was a difference in pregnant women's nightly sleep patterns during hospitalization as measured by the SMH. Due to the small sample size, only descriptive statistics were used to describe the sample's sleep experience at one month before hospitalization, as measured by the PSQI, and one week before hospitalization, as measured by the GSDS. Due to the constraints of a small sample size, no comparisons were made the between the one-month, one-week, and current hospitalization timepoints.

Limitations

Sleep is composed of dynamic, multidimensional processes that are important to the body's homeostasis and restoration. Sleep affects almost every physiological and psychological process and is associated with perceptual, physiological, behavioral, and temporal attributes. Due to the complexity of sleep, the study's focus on only perceptual attributes may have inadvertently overlooked other important factors that influenced the women's sleep.

The most reliable measure of sleep is polysomnography but is impractical outside the laboratory setting. Discomfort with wearing the probes could interfere with sleep. This study used questionnaires to collect data on only the perceptual aspects of sleep. A limitation of the questionnaires is the difficulty recalling one's sleep patterns, especially over the past week or month.

The study relied on the women's honesty when completing the questionnaires. Participants may have responded in a manner that reflects social norms or expectations. The small convenience sample was not representative of all trimesters and the study was poorly powered. Based on these limitations, the findings related to the sleep experiences of the participants in this study cannot be generalized to all patients hospitalized for antepartal complications.

Chapter 4

Findings

Introduction

Both pregnancy and hospitalization would be expected to influence sleep. This descriptive correlational study was conducted to answer the following research questions:

1. What are the sleep experiences (total sleep time, number of arousals/awakenings, and daytime sleep time) in hospitalized antepartum patients?
2. What is the relationship between the weeks of gestation and a woman's sleep experience while hospitalized on an antepartum unit?
3. Is there a difference in a pregnant woman's sleep experience at one month before hospitalization, one week before hospitalization, and during hospitalization on an antepartum unit?

The original plan for this study was to recruit 50 participants. Admissions to the antepartum unit of the participating hospital were less than anticipated, resulting in a convenience sample of 24 participants. Twenty-four women participated in this study between January and March 2013. Sample demographics and results of data analysis are presented in this chapter.

Description of Sample

Enrollment of 50 participants was not feasible during the study period. Participants were either discharged or delivered their babies prior to completion of this study. Fifty women hospitalized on the antepartum unit were screened upon admission to participate in the study. Table 5 provides detailed information regarding screen failures during the recruitment phase of the study.

Table 5 Screen failures

Screen failure	Number of patients ($N = 20$)
History of sleep disorder	1
Non-English-speaking	2
Admitted for treatment of substance abuse	2
< 18 years old	1
Admitted as 23-hour observation	2
Transferred to antepartum unit post-admission to intensive care unit	1
Received narcotic pain reliever prior to researcher's arrival	1
Admitted to the labor and delivery unit for magnesium sulfate therapy	6
Ineligible due to the time of their admission: researcher did not have 24 hour coverage	4

Of the 30 subjects who met eligibility criteria, 25 consented to participate and 5 refused. One woman signed the consent form and then chose not to participate. The attrition rates of the total sample across the study period are listed in Table 6. All attrition was due to discharge from the antepartum unit or delivery of the baby earlier than anticipated.

Table 6. Total sample across study period

Time point	Number of participants
Admission	24
Day 2	22 (8% attrition)
Day 3	15 (37% attrition)
Day 4	9 (62% attrition)

Table 7 illustrates the number of days each participant remained in the study.

Table 7 Number of days each participant remained in the study

Participant	Admission	Day 2	Day 3	Day 4
1	X	X		
2	X	X	X	
3	X	X	X	X
4	X	X	X	
5	X	X	X	
6	X	X	X	
7	X	X	X	X
8	X			
9	X	X	X	X
10*				
11	X	X		
12	X	X	X	X
13	X	X	X	
14	X			
15	X	X	X	X
16	X	X	X	X
17	X	X	X	X

Table 7—*Continued*

Participant	Admission	Day 2	Day 3	Day 4
18	X	X		
19	X	X	X	
20	X	X		
21	X	X	X	X
22	X	X	X	X
23	X	X		
24	X	X		
25	X	X		

Note. * Signed informed consent but chose to not participate.

Post Hoc Power Analysis

G*Power was used to calculate a post hoc power analysis (Faul, Erdfelder, Land, & Buchner, 2007). With a convenience sample of nine participants who completed the study through Day 4 as per the research design (i.e. full protocol subgroup), a probability of 0.05, and effect sizes ranging from .34-.51, power in the present study ranged from 0.16-.34. The study's descriptive correlational design would require a sample size of 25-63 to obtain an acceptable level of power for the effect sizes (.34-.51) obtained in the present study. Table 8 outlines the computed power for a convenience sample of nine participants, a probability

of 0.05, and a range of effect sizes. Table 8 demonstrates that as the degree of association increases the power increases.

Table 8 Post hoc power analysis

Computed power

η_p^2	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90
1-β	.06	.07	.08	.10	.13	.16	.21	.26	.32	.40	.49	.60	.71	.83	.93	.98	1.00

Demographic Data

Demographic data were collected on all 24 participants. The full protocol subgroup (n = 9) represents the sample that completed the entire study. The nine participants were similar in age, weeks of gestation, and income as compared to the total sample (N = 24), as shown in Table 9.

Table 9 Comparison of age, weeks of gestation, and income between the entire sample ($N = 24$) and those who completed the study ($n = 9$)

	Total Sample ($N = 24$)		Full Protocol Subgroup ($n = 9$)	
	Mean ± SD	Range	Mean ± SD	Range
Age	25.25 (6.02)	18-39	25.11 (6.77)	19-39
Weeks of Gestation	29.925 (5.18)	19.6-37.5	27.2 (4.10)	22.4-35.3
Income	*N* (%)		*n* (%)	
< $15,000	11 (45.8)		5 (55.6)	
$15,000–$29,000	5 (20.8)		2 (22.2)	
$30,000–$49,999	4 (16.7)		1 (11.1)	

Maternal Characteristics

The 24 women who agreed to be in the study had the following characteristics. They ranged in age from 18–39 years, 41.7% were primigravidas, and weeks of gestation ranged from 19.6 to 37.5 weeks. The majority of the participants were unmarried (75%). The ethnic background of the sample included 50% African American, 37.5% Hispanic, 8.4% Caucasian, and 4.2% Other. The majority of the participants had never taken any childbirth classes

(87.5%). Most stated they experienced troubled sleep one or more times a week during the past month (83.3%). Although 58.3% of the women were employed, 66.6% had a current income of less than $30,000 annually. Eight (33.3%) of the participants were admitted with a primary diagnosis of pregnancy-induced hypertension, four (16.7%) were admitted with a primary diagnosis of preterm labor, and three (12.5%) were admitted with a primary diagnosis of pyelonephritis. Other primary diagnoses included motor vehicle accidents, cervical incompetence, oligohydramnios/polyhydramnios, chest pain, migraines, and influenza. The majority of participants did not have a history of psychiatric illness. Table 10 provides a detailed description of the demographic variables.

Table 10 Sample demographic characteristics ($N = 24$)

Variable	*M (SD)*	Range
Age (years)	25.25 (6.02)	18–39
Pregnancies (#)	2.79 (2.17)	1–8
Live births (#)	1.13 (1.42)	0–4
Miscarriage/abortions (#)	.71(.91)	0–3
Weeks of gestation	29.925 (5.18)	19.6–37.5

Variable	*N* (%)
Pregnancies	
Primigravidas	10 (41.7)
Multigravidas	14 (58.3)
Live births	
1	7 (29.2)
2	1 (4.2)
3	2 (8.3)
4	3 (12.5)
Miscarriages/abortions	
None	13 (54.2)
1–3	11 (45.8)

Table 10—*Continued*

Variable	*N* (%)
Weeks gestation	
Second trimester (Week 13 to end of Week 26)	8 (33.3)
Third trimester (Week 27 to end of pregnancy)	16 (66.7)
Marital status	
Never married	18 (75.0)
Married	6 (25.0)
Ethnicity	
African American	12 (50.0)
Caucasian	2 (8.3)
Hispanic	9 (37.5)
Other	1 (4.2)
Childbirth classes	
No childbirth classes taken during current or previous pregnancy	21 (87.5)

Table 10—*Continued*

Variable	*N* (%)
Trouble sleeping during past month	
None	3 (12.5)
Less than once a week	1 (4.2)
Once or twice a week	5 (20.8)
3-4 times a week	9 (37.5)
5-6 times a week	1 (4.2)
Nightly	5 (20.8)
Employment	
Unemployed	10 (41.7)
Employed	14 (58.3)
Education	
Some high school or Less	2 (8.3)
High school graduate	10 (41.7)
Technical/trade school graduate	3 (12.5)
Some college	7 (29.2)
Undergraduate degree	2 (8.3)

Table 10—*Continued*

Variable	*N* (%)
Income	
< $15,000	11 (45.8)
$15,000–$29,999	5 (20.8)
$30,000–$49,999	4 (16.7)
$50,000–$69,999	0 (0.0)
$70,000 +	1 (4.2)
Unreported/unemployed	3 (12.5)
Primary admitting diagnosis	
Preterm labor	4 (16.7)
Pregnancy-induced hypertension	8 (33.3)
Urinary tract infection/pyelonephritis	3 (12.5)
Incompetent cervix	2 (8.3)
Motor vehicle accident	2 (8.3)
Oligohydramnios/polyhydramnios	2 (8.3)
Chest pain	1 (4.2)
Influenza	1 (4.2)
Migraines	1 (4.2)

Table 10—*Continued*

Variable	*N* (%)
Secondary admitting diagnosis	
None	17 (70.8)
Asthma	2 (8.3)
Diabetes mellitus	1 (4.2)
Hypothyroidism	1 (4.2)
Intrauterine growth restriction/small for gestational age	1 (4.2)
Multiple gestation	1 (4.2)
Psychiatric disorder	1 (4.2)
Tertiary admitting diagnosis	
None	22 (91.7)
Chronic hypertension	1 (4.2)
Diabetes mellitus	1 (4.2)
Frequency of electronic fetal monitoring	
Continuous	10 (45.5)
Twice a day	8 (36.4)
Once a day	3 (13.6)
Fetal heart tones every shift	1 (4.5)

Table 10—*Continued*

Variable	*N* (%)
Psychiatric History	
History of postpartum depression	1 (4.2)
History of psychiatric disorders	2 (8.3)
Positive suicide risk assessment	1 (4.2)

Only three (14.3%) of the participants were ordered strict bed rest. The remaining participants had activity orders that allowed them to move about the room. Ten (45.5%) of the participants were ordered continuous fetal monitoring.

Aside from orders for fetal monitoring, the majority of participants (65%) did not have additional treatment orders. Examples of other treatment orders included x-rays, sequential compression devices, computed tomography scans, finger-stick blood glucose monitoring, oxygen therapy, sonograms, magnetic resonance imaging, Doppler studies, electrocardiograms, respiratory treatments, 24-hour urine collection, and vital signs.

Subjects were prescribed a variety of medications including opioids (45.8%), tocolytic medications (e.g., calcium channel blocker) (29.2%), pharmacological sleep aids (i.e., hypnotic sedative) (45.8%), and steroids (29.2%). Of the total sample ($N = 24$), 66.7% received intravenous fluid medications such as antibiotics. The aforementioned medications were the most

likely to affect the sleep patterns of the enrolled participants. Opioid medications and sleep aids have sedative properties, which promote sleep. Tocolytic medications and steroidal medications have stimulant-like effects, which may impair sleep. Sleep may have been interrupted in those participants receiving intravenous fluid medications due to the medication administration schedule and the intravenous pump alarm. Other medications taken during the study are listed in Table 11.

Table 11 Medications taken during study

Variable (medications)	*N* (%)
Antihypertensives	5 (20.8)
Antidiabetics	2 (8.3)
Routine pregnancy	17 (70.8)
Opioids	11 (45.8)
Nonopioids	14 (58.3)
Tocolytics	7 (29.2)
IV fluids	16 (66.7)
Gastrointestinal	14 (58.3)
Antibiotics/antivirals/antifungals	12 (50.0)
Flu/flu symptoms	2 (8.3)

Table 11—*Continued*

Variable (medications)	*N* (%)
Sleep aids	11 (45.8)
Steroids	7 (29.2)
Respiratory	2 (8.3)
Allergy	3 (12.5)
Anticoagulants	1 (4.2)
Pyelonephritis	1 (4.2)
Thyroid	1 (4.2)

Other factors that could influence sleep during hospitalization were identified in the Night Interruptions questionnaire, as listed in Table 12. Figure 6 illustrates the frequency of sleep interruptions of the women during this hospitalization, as identified by the SMH and Night Interruptions questionnaires. The women self-reported both internal and external factors that interrupted their sleep during hospitalization. The most frequently reported internal factor was pain. The most frequently reported external factor was alarms.

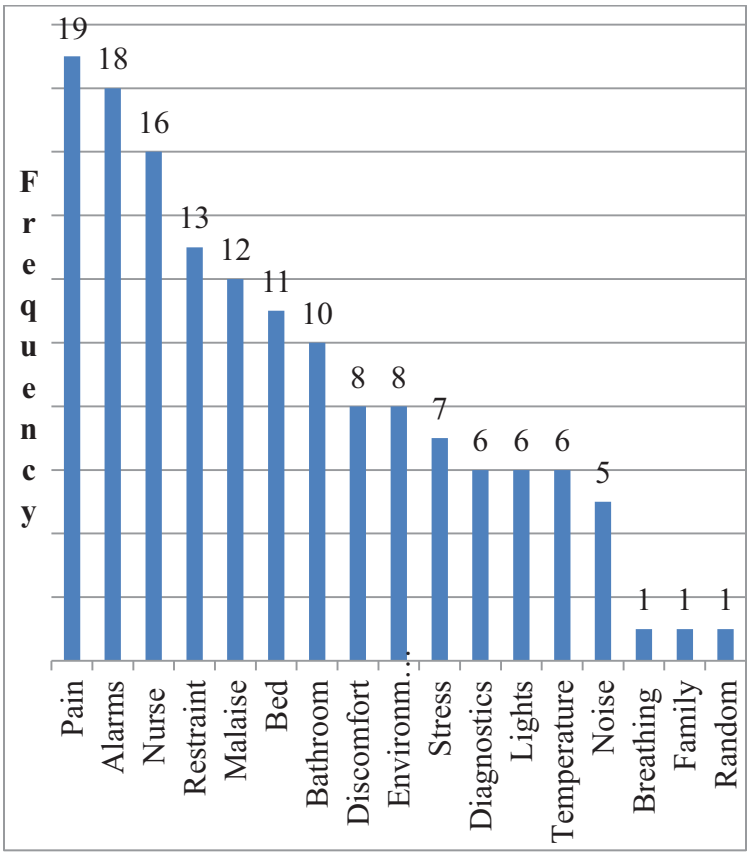
Table 12 Night Interruptions questionnaire

Variable	Day 2, *n* = 22 *n* (%)	Day 3, *n* = 15 *n* (%)	Day 4, *n* = 9 *n* (%)
Lights	3 (13.6)	2 (13.3)	1 (11.1)
Alarms alert	7 (31.8)	7 (46.7)	5 (55.6)
Semiprivate room	0 (0)	0 (0)	0 (0)
Noise from antepartum unit	1 (4.5)	0 (0)	0 (0)
Voices outside door	2 (9.1)	1 (6.7)	0 (0)
Noise from elevators	0 (0)	0 (0)	0 (0)
Call bell	0 (0)	0 (0)	0 (0)
Overhead speaker	1 (4.5)	0 (0)	0 (0)
Phones ringing	2 (9.1)	1 (6.7)	0 (0)
Family in room	1 (4.5)	0 (0)	0 (0)
Lab in room	2 (9.1)	3 (20)	0 (0)
X-ray in room	0 (0)	0 (0)	0 (0)
Housekeeping	0 (0)	0 (0)	0 (0)
Nurse in room	9 (40.1)	3 (20)	2 (22.2)
Unfamiliar bed	4 (18.2)	4 (26.7)	2 (22.2)
Unfamiliar environment	5 (22.7)	2 (13.3)	1 (11.1)
Restraint of movement	6 (27.3)	5 (33.3)	2 (22.2)

Table 12—*Continued*

Variable	Day 2, *n* = 22 *n* (%)	Day 3, *n* = 15 n (%)	Day 4, *n* = 9 n (%)
Pain	10 (45.5)	4 (26.7)	4 (44.4)
Malaise	7 (31.8)	4 (26.7)	2 (22.2)
Experiencing stress	5 (22.7)	1 (6.7)	1 (11.1)
Other	8 (36.4)	3 (20)	3 (33.3)

Figure 6 Frequency of sleep interruptions during hospitalization



The results of the data analysis are presented according to the respective research questions.

Research Question 1

Research Question 1 was, What are the sleep experiences (total sleep time, number of arousals/awakenings, and daytime sleep time) in hospitalized antepartum patients?

As described in Chapter III, the St. Mary's Hospital Sleep Questionnaire was used to measure the duration and subjective quality of an individual's previous night's sleep. The St. Mary's Hospital (SMH) Sleep Questionnaire consists of 14 multiple choice and short answer questions evaluating sleep and wake times, daytime sleep, perceptions of and satisfaction with sleep, and early morning sleep behavior over the previous 24 hours (Ellis, Johns, Lancaster, Raptopoulos, Angelopoulos, & Priest, 1981). The questionnaire does not yield a total score.

During hospitalization, the sleep and wake times, daytime sleep, perceptions of and satisfaction with sleep, and early morning sleep behavior over the previous 24 hours varied widely across the sample as presented in Table 13. The range, mean, and standard deviations are provided per item as appropriate. Items with Likert-type responses include the numerical means and the corresponding response choice. Variation in the sample size (e.g. $n = 22$ on Day

2) in Table 13 reflects those participants who did not complete all items on the SMH or answered them incorrectly.

Table 13 St. Mary's Hospital Sleep Questionnaire of total sample

	Day 2 (n = 22)	Day 3 (n = 15)	Day 4 (n = 9)
Variable	Range	Range	Range
Time settled down for the night	6pm–4am	7pm–3am	8pm–3:30am
Time fell asleep last night	9pm–5:30am	8pm–4am	9pm–1:30am
Time finally woke this morning	1:30am–8am	2am–9am	4am–9am
Time got up this morning	5am–11am	2:45am–11am	6am–10:30am
Amount of sleep last night	1–8.5 hrs	3–9 hrs	4–7 hrs

Table 13—*Continued*

	Day 2 (*n* = 22)		Day 3 (*n* = 15)		Day 4 (*n* = 9)	
Variable	Range		Range		Range	
Amount of sleep during the day	0–7 hrs		0–10 hrs		0–10 hrs	
Amount of time to fall asleep	30 min–4.5 hrs		10 min–1.5 hrs		15 min–2 hrs	
		Mean ± *SD*		Mean ± *SD*		Mean ± *SD*
Rating of sleep depth (1–8)	1–7	3.05 (1.79) *Fairly light*[*]	2–7	4.33 (1.23) *Light average*	1–8	4.56 (2.24) *Light average, deep average*

Table 13—*Continued*

	Day 2 (*n* = 22)		Day 3 (*n* = 15)		Day 4 (*n* = 9)	
Variable	Range	Mean ± *SD*	Range	Mean ± *SD*	Range	Mean ± *SD*
Number of times awakened during night (0–7)	0–7	3.82 (1.99)	1–6	2.73 (1.39)	1–6	*n = 8* 3.13 (1.73)

Table 13—*Continued*

	Day 2 (*n* = 22)		Day 3 (*n* = 15)		Day 4 (*n* = 9)	
Variable	Range	Mean ± *SD*	Range	Mean ± *SD*	Range	Mean ± *SD*
Sleep quality (1–6)	1–5	3.18 (1.33) *Fairly** *badly*	2–5	4.00 (.76) *Fairly well*	2–5	n = 8 3.88 (1.25) *Fairly badly, fairly well*
Clear-headedness upon wakening (1–6)	1–6	3.18 (1.62) *Still slightly drowsy*	2–6	3.60 (1.06) *Still slightly drowsy, fairly clear-headed*	1–5	2.89 (1.45) *Still moderately drowsy, still slightly drowsy*

Table 13—*Continued*

	Day 2 (*n* = 22)		Day 3 (*n* = 15)		Day 4 (*n* = 9)	
Variable	Range	Mean ± *SD*	Range	Mean ± *SD*	Range	Mean ± *SD*
Sleep satisfaction (1–5)	1–5	3.00 (1.31) *Slightly unsatisfied*	1–5	3.33 (1.23) *Slightly unsatisfied*	1–4	2.78 (1.20) *Moderately unsatisfied, slightly unsatisfied*
Difficulty getting to sleep (1–4)	1–4	2.23 (.92) *Some*	1–3	n = 14 1.57 (.65) *None or very little to some*	1–3	1.67 (.71) *None or very little to some*

* The italicized text reflects the descriptors of the mean responses on the Likert-type items providing a context for the numerical values

Table 14 presents the SMH results (range, mean, and standard deviations per item as appropriate) for the full protocol subgroup. Items with Likert-type responses include the numerical means and the corresponding response choice.

Table 14 St. Mary's Hospital Sleep Questionnaire of full protocol subgroup

	Day 2 (n = 9)	Day 3 (n = 9)	Day 4 (n = 9)
Variable	Range	Range	Range
Time settled down for the might	7pm–4am	9:30pm–3am	8pm-3:30am
Time fell asleep last night	9pm–5am	11pm–4am	9pm-1:30am
Time finally woke this morning	1:30am–7am	4am–9am	4am-9am
Time got up this morning	5:30am–11am	6:40am–10:30am	6am-10:30am

Table 14—*Continued*

	Day 2 (*n* = 9)		Day 3 (*n* = 9)		Day 4 (*n* = 9)	
Variable	Range		Range		Range	
Amount of sleep last night	1–5.5 hrs		3–9 hrs		4-7 hours	
Amount of sleep during day	0–7 hrs		0–10 hrs		0-10 hours	
Amount of time to fall asleep	30 min–3 hrs		10 min–1.5 hrs		15 minutes – 2 hours	
		Mean ± *SD*		Mean ± *SD*		Mean ± *SD*
Rating of sleep depth (1–8)	1–7	2.44 (2.07) *Light**	2–7	4.67 (1.41) *Light average to deep average*	1-8	4.56 (2.24) *Light average to deep average*

Table 14—*Continued*

	Day 2 (*n* = 9)		Day 3 (*n* = 9)		Day 4 (*n* = 9)	
Variable	Range	Mean ± *SD*	Range	Mean ± *SD*	Range	Mean ± *SD*
Number of times awakened during night (0–7)	1–7	3.89 (2.15)	1–5	2.67 (1.23)	1-6	3.13 (1.73)
Sleep quality (1–6)	1–5	2.56 (1.59) *Badly to fairly badly*	3–5	4.11 (.60) *Fairly well*	2-5	3.88 (1.25) *Fairly badly to fairly well*
Clear-headedness upon wakening (1–6)	1–5	2.78 (1.48) *Still moderately drowsy, still slightly drowsy*	2–5	3.56 (1.01) *Still slightly drowsy to fairly clear-headed*	1-5	2.89 (1.45) *Still moderately drowsy. still slightly drowsy*

Table 14—*Continued*

	Day 2 (*n* = 9)		Day 3 (*n* = 9)		Day 4 (*n* = 9)	
Variable	Range	Mean ± *SD*	Range	Mean ± *SD*	Range	Mean ± *SD*
Sleep satisfaction (1–5)	1–5	2.67 (1.66) *Moderately unsatisfied, slightly unsatisfied*	2–5	3.33 (1.12) *Slightly unsatisfied*	1-4	2.78 (1.20) *Moderately unsatisfied, and slightly unsatisfied*
Difficulty getting to sleep (1–4)	2–4	2.78 (.83) *Some to a lot*	1–3	1.56 (.73) *None or very little to some*	1-3	1.67 (.71) *None or very little to some*

* The italicized text reflects the descriptors of the mean responses on the Likert-type items providing a context for the numerical values

Research Question 2

Research Question 2 was, what is the relationship between the weeks of gestation and woman's sleep experience while hospitalized on an antepartum unit?

Correlations were calculated on weeks of gestation and the SMH on Days 2 through 4. The six SMH Likert-scale questions measuring sleep quality

(Question 5, Question 9, and Question 11), number of awakenings (Question 6), alertness (Question 10), and difficulty falling asleep (Question 13) were used. The only statistically significant correlation between weeks of gestation and difficulty sleeping occurred during the second night of the women's hospitalization. The finding was a moderate, inverse relationship between the weeks of gestation and how well the participants slept the previous night (SMH Question 9) on Day 3 (r = -.563, N = 15, p = .029). This would indicate that participants did not sleep as well on Day 3 the later the weeks of gestation. All other correlations were not statistically significant.

Research Question 3

Research Question 3 was, Is there a difference in a pregnant woman's sleep experience at one month before hospitalization, one week before hospitalization, and during hospitalization on an antepartum unit?

As described in Chapter III, the Pittsburgh Sleep Quality Index was used to measure the frequency of sleep disturbances and subjective sleep quality over the past month and the General Sleep Disturbance Scale was used to measure the frequency of perceived sleep quality and quantity during the previous week.

The dimension scores of the PSQI are summed to produce a global score (range 0–21). A global PSQI score > 5 is considered to be suggestive of significant sleep disturbance (Buysse et al., 1989).

In the present study, 24 participants completed the PSQI only on admission. The mean global score was 8.21 (*SD* = 3.27), with scores ranging from 2 to 14. Of the total sample (*N* = 24), 21 participants (87.4%) had a global score > 5, suggestive of significant sleep disturbance. The seven subscale scores were only used to calculate the global score in this study.

The GSDS has 21 items that evaluate various aspects of sleep disturbance including sleep quality, sleep onset latency, sleep quantity, sleep maintenance, early awakening, use of medication to promote sleep, and excessive daytime sleepiness. Each item is rated on a 0 (never) to 7 (every day) numeric rating scale. The 21 items are summed to yield a total score that could range from 0 (no disturbance) to 147 (extreme disturbance). Total scores of 43 and higher on the GSDS indicate a clinically significant level of sleep disturbance (K. A. Lee, 1992).

In the present study, one participant did not complete the GSDS on admission. Another participant did not answer the first question of the GSDS on admission. Twenty-two participants completed the GSDS on admission, and nine participants completed the GSDS since admission to the hospital on Day 4. Table 15 and Table 16 list the mean total scores, standard deviations, and ranges for the GSDS for both the total sample (*n* = 22) and full protocol subgroup (*n* =9).

Table 15 General Sleep Disturbance Scale of total sample

	On admission (n = 22)		Day 4 (n = 9)	
Variable	Mean ± *SD*	Range	Mean ± *SD*	Range
GSDS total score Total Score	51.00 (18.57)	12–-87	49.33 (21.65)	18–-81

Table 16 General Sleep Disturbance Scale of full protocol subgroup

	On admission (n = 9)		Day 4 (n = 9)	
Variable	Mean ± *SD*	Range	Mean ± *SD*	Range
GSDS total score	54.25 (23.72)	12–-77	49.33 (21.65)	18–-81

Prior to hospitalization

Due to the small sample size, descriptive statistics were used to describe the sample's sleep experience at one month before hospitalization (PSQI) and one week before hospitalization (GSDS). In the present study, the majority of the participants had a global PSQI score greater than the cutoff score (> 5), suggestive of significant sleep disturbance. The mean total score on the GSDS for the total sample at admission, the mean total score of the full protocol subgroup (n = 9) on

the GSDS at admission, and the mean total score on the GSDS since admission to the hospital were greater than the cutoff score (≥ 43),) indicating a clinically significant level of sleep disturbance. Based on these findings, the majority of the women in this study experienced sleep disturbances prior to their admission to the hospital.

During hospitalization

Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) perception of sleep depth significantly increased over time, F(2,16) = 4.145, p =.035. Pairwise comparisons using the Bonferroni adjustment for comparisons indicated that ratings of sleep depth significantly differed (p = .017) between Day 2 (mean = 2.44) and Day 3 (mean = 4.67). The effect size was calculated as a partial eta-squared of .34.

Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) perception of sleep quality significantly increased over time, F(2,14) = 4.25, p =.036. Pairwise comparisons using the least significance difference adjustment for comparisons indicated that sleep quality significantly differed (p = .040) between Day 2 (mean = 2.50) and Day 3 (mean = 4.00). The effect size was calculated as a partial eta-squared of .51.

Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) self-report of difficulty in falling asleep the previous night decreased over time, F(2,16) = 8.46, p=.003. Pairwise comparisons

using the Bonferroni adjustment for comparisons indicated that difficulty in falling asleep the previous night significantly differed (p = .007) between Day 2 (mean = 2.78) and Day 3 (mean = 1.56). The effect size was calculated as a partial eta-squared of .38.

Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) self-report of the number of nightly awakenings was not statistically significant, F(2,14) = 1.096, p = .361. Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) perception of sleep satisfaction was not statistically significant, F(2,16) = 1.222, p = .321. Repeated measures analyses of variance revealed that participants in the full protocol subgroup's (n = 9) self-report of clear-headedness upon awakening was not statistically significant, F(2,16) = 2.098, p = .155.

Reliability Analyses

The PSQI was administered to the 24 participants in the study only on admission to the antepartum unit. The internal consistency of the PSQI was evaluated in this study resulting in a Cronbach's alpha of 0.71 for the global and subscale scores.

A Pearson's product-moment correlation was run to determine the relationship between the GSDS total score on admission and the GSDS total score since admitted to the hospital. This analysis was run on the data from the 9 participants who completed the study through Day 4. There was a strong, positive

correlation between the GSDS total score on admission and the GSDS total score since admitted to the hospital, which was statistically significant ($r = .904$, $n = 9$, $p = .002$), indicating strong test-retest reliability. The internal consistency of the GSDS was evaluated in this study with a Cronbach's alpha of 0.947 for the GSDS on admission and GSDS since admitted to the hospital.

The internal consistency of the three SMH Likert-scale questions measuring sleep quality (Question 5, Question 9, and Question 11) was evaluated in the full protocol subgroup of nine participants with Cronbach's alphas of .91 on Day 2, .58 on Day 3, and .82 on Day 4. Given that data were collected over three nights in a small subset of the total sample and that sleep varies from night to night, the internal consistency seems adequate.

Summary

This chapter provided the summary of the study results for this group of 24 participants who were hospitalized on an antepartum unit. Difficulties in retaining participants through Day 4 were encountered. During the study period, nine of the 24 participants completed the entire study.

The majority of participants had preexisting sleep disturbances, as evidenced by the PSQI and the GSDS on admission. The women reported both internal and external factors that interrupted their sleep during hospitalization. There was a significant moderate, inverse relationship between the weeks of gestation and how well the participants slept the previous night on Day 3. The full

protocol subgroup's (n = 9) perception of sleep depth and sleep quality among the full protocol subgroup (n = 9) significantly increased over time. Their self-report of difficulty in falling asleep the previous night significantly decreased over time.

Chapter 5

Discussion

A discussion of the results of this descriptive correlational study of the sleep experiences of hospitalized antepartum women is presented in this chapter. Interpretations of the findings of the study are discussed within the context of current literature and the study's conceptual framework. In addition, study limitations, lessons learned, and recommendations for future research and practice are presented.

Interpretation of the Findings

Description of the Sample

Admissions to the antepartum unit used in the study were less than anticipated, resulting in recruitment of a convenience sample of 24 participants instead of the projected 50, and a final sample of only 9. Since the sample was so small and under-powered, the results should be considered with caution. The majority of the total sample (n = 24) were unmarried (75%) and members of a minority (91.7%) Only 53.3% of the women were employed and 66.6% had a current income of less than $30,000 annually. The majority of the participants stated that they experienced troubled sleep one or more times a week during the past month (83.3%). Perhaps the stressors of single motherhood and poor financial resources contributed to sleeping difficulties. Ko, Chang, & Chen (2010) reported that stress affected sleep quality of pregnant women, and Naud et al

(2010) found that poor sleep in trimesters two and three was associated with an annual family income less than $40,000 ($p$ = 0.03) and single motherhood (p = 0.01). This issue should be explored further with a large sample of women with varying economic resources and marital statuses.

Research Question 1

During the participants' hospitalization on the antepartum unit, the sleep and wake times, daytime sleep, perceptions of and satisfaction with sleep, and early morning sleep behavior over the previous 24 hours showed wide variations. The women's' sleep experiences were consistent with findings from previous studies. However, the study finding suggesting single motherhood and low economic status may influence the sleep experience of hospitalized antepartum women is not commonly found in the literature. Considering the small sample size, different groups of women (e.g. N = 24 and n = 9), and the wide variability in the data, any observed trends should be interpreted with caution.

Research Question 2

Correlational statistical analysis showed a significant moderate, inverse relationship between the weeks of gestation and how well the participants slept the previous night on Day 3 in the hospital. As the number of weeks of gestation increased, women found it more difficult to sleep. All subjects were in the second (33.3%) or third (66.7%) trimester since the hospital where the study was conducted rarely admits women to the antepartum unit during the first 20 weeks

of gestation. The findings are consistent with previous studies which found that women's sleep tends to deteriorate as the pregnancy progresses. Women usually have fairly normal sleep patterns during the second trimester, and the majority of sleep disturbances occur during the third trimester (Week 27 to the end of the pregnancy) (Balserak & Lee, 2011). The presence of an artifact in the data due to the small sample size may provide an explanation for the single significant correlation on Day 3 of the hospitalization.

Research Question 3

Only data from the nine subjects who completed the entire study could be used to determine if there were differences in pregnant women's sleep experience at one month before hospitalization, one week before hospitalization, and during hospitalization on an antepartum unit. The GSDS scores on admission and during hospitalization on the antepartum unit were greater than the cutoff scores, indicating a clinically significant level of sleep disturbance. Gallo and Lee (2008) found that based on the GSDS scores of the high-risk antepartum patients they studied, their women also had sleep disturbances (Mean = 3.88 (*SD* = 1.16). An unexpected finding in the current study was that the women's GSDS scores during hospitalization decreased during the hospitalization while those of the Gallo and Lee study increased. Though both samples of women experienced sleep disturbance, the clinical significance of these observed differences is unknown

and warrants caution in interpretation due to the current study's small sample size. Future studies should explore these differences.

Conceptual Model

K.A. Lee's (2011) conceptual model of impaired sleep for the childbearing family provided the theoretical guidance for this study (see Figure 2). The findings of this study support the relationship derived from the model. In the present study, both sleep deprivation and sleep disruption led to sleep loss. Pregnant women are at high risk for sleep deprivation and sleep disruption by nature of the pregnancy itself. When pregnant patients are hospitalized for antepartal complications, they are at higher risk for sleep loss due to the change in health status and environment (K. A. Lee, 2011). This model can continue to provide theoretical guidance for future studies of hospitalized antepartum women.

SMH Sleep Questionnaire

The clinical utility of the SMH Sleep Questionnaire should be questioned as only overall nightly trends during the course of hospitalization could be described. Cutoff scores are not available for the SMH Sleep Questionnaire, making results difficult to score and compare to the other measurement tools used in the present study. Further development of the SMH Questionnaire including clinically relevant cutoff scores for sleep disturbance would improve its clinical and research applications.

First Night Effect and Data Collection Schedule

Analyses indicated that the sleep experiences of the hospitalized antepartum patients differed significantly between Day 2 and Day 3. The sleep experiences of Day 3 and Day 4 did not show statistical differences. The first-night effect may produce results that are not representative of an individual's sleep pattern. The first- night effect may be caused by such factors as the change in the sleeping environment or reactions to a stressful environment (Natale et al., 2009; Tamaki et al., 2005). Based on the findings of the present study, the research design in future studies could be modified to collect data through Day 3 rather than through Day 4. Changing the data collection schedule would also address the attrition rates experienced in this study due to short term hospitalization periods. Further exploration of the outcomes of sleep disturbances during the short term hospitalizations is also needed.

Limitations

Small convenience samples and large attrition rates within a study period limit the options for statistical analyses of the data as well as the generalizability of the study findings. In this study, the convenience sample of 24 participants, including the nine who completed the study through Day 4, as per the research design, limited the data analysis to descriptive rather than inferential statistics and precluded generalizable interpretations of the findings to all patients hospitalized for antepartum complications.

Statistical power is defined as the probability of detecting an effect given that an association exists. An acceptable level of power is 80% or greater (Dallato, 2008). A post-hoc power analysis was conducted. With a convenience sample of nine participants who completed the study through Day 4 as per the research design (i.e. full protocol subgroup), a probability of 0.05 and effect sizes ranging from .34-.51, power in the present study ranged from 0.16-.34. Using the same descriptive correlational research design as the present study, a sample size of 25-63 would be required to obtain an acceptable level of power for the effect sizes (.34-.51) obtained in the present study. The current study was too underpowered to detect differences in the population effect sizes. A Type II error is likely due to the small sample size of the present study and, therefore, the results must be interpreted with caution.

Self-report measures are generally not as accurate as physiological measures such as PSG or actigraphy. The gold standard for measuring sleep, PSG is the most valid and reliable objective measure that assesses physiological processes during sleep periods. Sleep medicine professionals at the present study site do not perform inpatient PSG.

The SMH Questionnaire does not have available cutoff scores. Without cutoff scores, the researcher was unable to compare the findings from the SMH to the PSQI and GSDS scores. The lack of cutoff scores also limited the clinical significance of the SMH findings.

This study focused on the perceptual aspects of sleep. Sleep loss is cumulative. Participants may not have been aware of its effects on cognitive function or mood. Inaccuracies when recalling their sleep patterns over the past month, the past week, and the previous night may have been present. Participants may have responded to the questionnaires in a manner that reflects social norms or expectations. Yet, Fontaine (2005) notes that the best measure of sleep quality is the patient's own report.

An assumption of this study was that health- related information was recorded accurately in medical records. Women's healthcare professionals use shorthand notation to describe a woman's obstetrical history. This notation includes the number of pregnancies, term births, preterm births, abortions/miscarriages, and living children. Participants in this study recorded this same information on their demographic profile. As patients do not describe their obstetrical history in the same manner as healthcare professionals, discrepancies between the participant's responses and the medical record were sometimes noted. For the purposes of this study, the participant's responses were used for the data analysis.

Lessons Learned

Conducting this descriptive correlational study resulted in many lessons learned. The sample size must be increased in future studies to show overall sleep patterns of hospitalized antepartum patients. Potential strategies to increase the

sample size include using multiple facilities, expanding recruitment beyond antepartum units, including 24 hour coverage for recruitment and data collection, and decreasing the timeframe of the study.

The researcher used several successful strategies in the recruitment of women on the antepartum unit. For example, the researcher informed the nursing staff of the research study during staff meetings and through Institutional Review Board-approved flyers posted on the unit. The researcher visited the antepartum unit in the morning to collect data on those participants currently enrolled in the study and in the evening to recruit additional participants. The nursing staff became familiar with the researcher's presence on the unit. As a result, the nursing staff notified the researcher when new patients were admitted to the antepartum unit.

Although a major strength of the study was the consistency of a single researcher collecting all data throughout the study period, this resulted in missed opportunities to recruit participants who were admitted outside of the researcher's presence on the antepartum unit. Four participants were ineligible due to the time of their admission. In future studies, additional research staff including nursing staff should be trained in data collection procedures to ensure all potential participants are recruited within the admission.

To address the high attrition rate encountered in the present study, additional sites with high risk antepartum units and designated research teams are

needed to reach a sample size large enough to determine whether (1) being in the hospital affects sleep in pregnant women, (2) gestational age influences sleep while hospitalized, and (3) patient's usual sleep patterns influence sleep during hospitalization.

The researcher had clinical experience in the care of antepartum patients and was able to interact with the participants with confidence and in a positive manner. Only five women declined to participate in the study during the data collection period. The researcher waited until late morning to collect data on those participants currently enrolled in the study and waited to recruit additional participants in the evening until after dinner. This recruitment timeframe respected the privacy and daily schedules of the hospitalized women. The informed consent process and all data collection time points were not rushed. This approach allowed participants time to reflect, ask questions, and establish a rapport with the researcher. The women shared personal details of their lives that they may not have shared with their primary nursing staff. As a result, patients may have been more likely to participate in this study than if a different approach was used.

A couple of participants did not complete or incorrectly completed the GSDS. The lesson learned was the importance of checking that participants have completed all the items on all questionnaires. This strategy will eliminate the need for dropping a participant's data from an analysis.

One of the participants hospitalized with an admitting diagnosis of migraines shared with the researcher that she was very concerned about her insurance coverage due to a recent buyout of her current employer. Changes in her job responsibilities, hours, and benefits were going to impact her family responsibilities. Her hospitalization may cause her to miss orientation, potentially delaying her paycheck. This was a very stressful and anxiety provoking situation for her. This example of unexpected anecdotal findings shared with the researcher during the data collection process suggests that a qualitative and mixed method approach is needed to understand the experience of hospitalized antepartum women. A researcher needs to be open and ready for the unexpected throughout the research process.

Six women who were admitted to the labor and delivery unit for magnesium sulfate therapy to treat preterm labor or preeclampsia were excluded from participating in the current study due to this treatment. Magnesium sulfate is a natural calcium channel blocker, may function as an adjuvant to perioperative anesthetic and analgesic management, and may result in better sleep quality post-operatively due to its sedative effect (Lee & Kwon, 2009; Saadawy, Kaki, Abd El Latif, Abd-Elmaksoud, & Tolba, 2010; Shulz-Stubner, Wettmann, Reyle-Hahn, & Roissant, 2001; Wilder-Smith, Knopfli, Wilder-Smith, 1997). Side effects of magnesium therapy include muscle weakness, lack of energy, blurred vision, slurred speech, headache, nausea and vomiting, flushing, and nasal congestion

(Simhan & Caritis, 2013). In magnesium sulfate therapy, continuous fetal heart rate and uterine activity monitoring, indwelling urinary catheter insertion, and ongoing assessments are ordered and result in frequent interruptions throughout both the wake and sleep periods. Including women receiving such therapies such as magnesium sulfate will provide information related to sleep disturbances in antepartum women receiving a critical intervention during their pregnancy.

Conclusions

The sleep experiences for a group of 24 participants who were hospitalized on an antepartum unit were described. During the study period, nine of the 24 participants completed the study through Day 4, as per the research design (i.e., full protocol subgroup). The majority of participants had preexisting sleep disturbances, as evidenced by the PSQI and the GSDS on admission. The women reported both internal and external factors that interrupted their sleep during hospitalization. There was a significant moderate, inverse relationship between the weeks of gestation and how well the participants slept the previous night on Day 3. The full protocol subgroup's (n = 9) perception of sleep depth and sleep quality significantly increased over time. Their self-report of difficulty in falling asleep the previous night significantly decreased over time. All other calculations were not statistically significant.

The results of this study are consistent with the study reporting that sleep disturbances are common in hospitalized antepartum women.

Recommendations for Future Research

The clinical condition of a pregnant woman and her need for ongoing interventions or monitoring determine the necessity for continued hospitalization. Deciding whether or not a hospitalized patient is ready for discharge requires the evaluation of medical, psychosocial, logistic, and economic factors. The health care provider must balance the medical necessity of ongoing hospitalization with attempts to reduce length of stay and increase patient quality of life (Alper, O'Malley, & Greenwald, 2013). As a result, patients are discharged from the antepartum unit as soon as they are medically stable.

In the present study, participants were either discharged or delivered their babies prior to Day 4, the end of the study period. In future studies, the research design should be modified to consider all patients who are admitted and subsequently discharged from the antepartum unit prior to Day 4.

The gold standard for measuring sleep, PSG is the most valid and reliable objective measure that assesses physiological processes during sleep periods, but is not practical in the hospital setting. Actigraphy distinguishes between sleep and wakefulness using activity as a proxy measure of sleep, but it is not always an accurate measure of sleep because some people do not move when they are awake. However, it may be more accurate than subjects' perceptions of their sleep and should be considered in future studies. Measurement reliability would be enhanced by using both objective and subjective measures such as patient

perceptions about sleep quality together with objective measurements such as actigraphy.

The unexpected anecdotal findings previously discussed highlight the need for future qualitative and mixed method approaches to explore the impact of socioeconomic status, stress, and anxiety on both pre-hospitalization and during hospitalization sleep patterns. Sleep loss is linked with increased risk for depression (National Sleep Foundation, 2011a). Sleep quality and depression has been found to be clinically relevant during early pregnancy (Jomeen & Martin, 2007). Ko et al. (2010) found poorer sleep quality and sleep latency were most prevalent during the third trimester. They found a high prevalence of antepartal depression in pregnant women and that depressed women had worse sleep quality than nondepressed women in all groups (Ko et al., 2010). From birth to 6 months postpartum, lack of sleep, sleep deprivation, and fatigue are commonly expressed as women adapt to the new demands of motherhood (Dennis & Ross, 2005; Gay et al., 2004; Goyal et al., 2007; Horiuchi & Nishihara, 1999; Hunter et al., 2009; Karacan et al., 1969; Kennedy et al., 2007; K. A. Lee, Zaffke, & McEnany, 2000; Matsumoto et al., 2003; Shinkoda et al., 1999; Signal et al., 2007; Swain et al., 1997). Future studies should utilize a longitudinal design to follow women throughout the pregnancy continuum to determine if antepartal sleep quality is a predictor of antepartal and postpartum depression.

As discussed earlier, six women receiving magnesium sulfate therapy were excluded from the current study. The side effect profile of magnesium therapy warrants continuous monitoring of both the fetus and the mother resulting in frequent interruptions through both the awake and sleep periods. Future studies should focus on the sleep patterns of those patients undergoing magnesium sulfate therapy.

Future research studies should focus on more than simply reporting levels of sleep disturbances that are above or below the cutscore criteria, as defined by the PSQI or GSDS. Clinical implications of extreme deviations versus minimal deviations above the cutoff scores should be explored to determine the long-term consequences on maternal and fetal outcomes. Cutoff scores are not available for the SMH Sleep Questionnaire, making results difficult to score and to compare to other measurement tools.

An assumption in this study included that the physical environment within the hospital setting results in sleep disturbances. When people are hospitalized, they bring with them their own habitual behaviors concerning rest and sleep. Future research studies should compare the hospitalized patients to those patients who have been ordered by their physician to maintain bed rest at home.

Studies on sleep loss in pregnancy including the single study on the antepartum hospitalized patient suggest that sleep disruption in pregnancy is a continuum and may have implications for the postpartum period (Edwards &

Sullivan, 2008). Emerging literature suggests associations between maternal sleep and several major risk factors for stillbirth, including maternal obesity, preeclampsia, gestational diabetes, and intrauterine growth restriction (O'Brien, 2012). Short sleep duration and habitual snoring are associated with gestation glucose intolerance (Facco, Grobman, Kramer, Ho, & Zee, 2010). Poor sleep quality during pregnancy has been associated with increased risk for longer labors, Caesarean section delivery, and preterm delivery (K. A. Lee & Gay, 2004; Okun et al., 2009). Future research should examine longitudinally the effects of sleep loss on adverse maternal and fetal outcomes.

Hourly rounding is becoming popular in clinical agencies because it has been shown to decrease patient falls, decrease call light usage, and increase patient satisfaction (Assi, Wilson, Bodino, Bognar, & Lemenski, 2008; Culley, 2008; Meade, Bursell, & Ketelsen, 2006). However, the finding that 45.8% of the participants in the current study were awakened by a nurse in the room suggests that hourly rounding may be counterproductive in an antepartum unit. Purposeful and scheduled hourly rounding includes behaviors such as assessing the "four Ps"— pain, position, potty needs, and personal items (Studor Group, 2005). Hourly rounding is decreased at night to facilitate sleeping. When patients are sleeping, nurses continue to observe patients and resume more thorough rounding when patients awaken or are aroused for patient care activities. The challenge lies in anticipating and being attentive to the needs of the patient while simultaneously

fostering an environment conducive for uninterrupted, restorative sleep. Anecdotally, a participant mentioned she awoke each time the nurse released the latch of the door to enter the room. Future studies should examine hourly rounding and patient satisfaction in relation to sleep.

Recommendations for Practice

Sleep hygiene is a variety of practices that promote quality nighttime sleep and daytime alertness. Essential sleep hygiene practices include (a) avoiding napping during the day, (b) avoiding stimulants too close to bedtime, (c) exercising to promote quality sleep, (d) avoiding large meals or spicy foods close to bedtime, (e) ensuring exposure to natural light, (f) establishing a relaxing bedtime routine, (g) associating the bed with only sleeping, and (h) creating a relaxing sleep environment (National Sleep Foundation, 2013). Sleep disturbances are a common complaint in hospitalized patients, characterized by decline in sleep quality, difficulty in staying asleep, or difficulty falling asleep (Bloom et al., 2009). Nurses should educate patients on pharmacologic and nonpharmacologic interventions that may avoid or minimize sleep disturbances during their hospitalization and after discharge (Koski, 2011).

Treatment of any specific symptom that is preventing sleep should improve patients' sleep (e.g., antacid for the treatment of heartburn). Nurses can minimize environmental factors by (a) responding quickly to alarms, (b) keeping patient doors closed, (c) enforcing quiet times and visiting hours, (d) offering

sleep hygiene tools such as eye masks or ear plugs, (e) performing patient care activities during the day when possible, and (f) reorienting patients to the time of day by opening and closing the drapes as appropriate (Koski, 2011).

Some participants experienced multiple awakenings during the night due to the timing of their medications. The philosophy of patient-centered care centers around the patient and her particular health care needs (Frampton, Gilpin, & Charmel, 2003). In patient-centered care, the individual patient is considered when developing the plan of care. Patient care activities should be clustered to allow uninterrupted time for adequate sleep. Care should be customized to reflect individual patient needs. Nursing should coordinate with pharmacy the timing of medications to reduce the number of times nurses must enter the patient's room during the night. Patient care must move beyond merely completing routine tasks. Patient care and the hospital environment can be improved by empowering front-line nurses to advocate for their patients by developing and implementing patient-centered practices that promote sleep on antepartum units.

Nurses and patients should collaborate on a mutually beneficial plan to address both the medical needs as well as the individual preferences of the patient. One participant in this study mentioned that a nurse entered her room in the middle of the night to cover her 24-hour urine collection container with ice. She voiced frustration with being disturbed for such a task. Although nurses must ensure that the specimen remains cold throughout the collection period (Johns

Hopkins Medicine, n.d.), they should educate the patient about the need to keep the specimen cool and coordinate this step with other patient care activities. Based on the findings of this study, the coordination of patient care activities on antepartum units should be discussed among the nursing staff to determine the optimal plan of care for the hospitalized antepartum women.

The distribution of sleep states and stages is affected by many common drugs (Carskadon & Dement, 2010). Any medication passing through the blood-brain barrier has the potential to alter sleep quality and sleep architecture by acting on the central nervous system, cardiovascular system, or respiratory system (Roehrs & Roth, 2012). In the present study, 29.2% of enrolled participants received a tocolytic medication (e.g., calcium channel blocker), 45.8% of enrolled participants received a pharmacological sleep aid (i.e., hypnotic sedative), and 29.2% of enrolled participants received a steroidal medication (e.g., corticosteroid). Nurses should consider medication side effects when developing a sleep-promoting plan of care.

Summary

A discussion of the results of this descriptive correlational study of the sleep experiences of hospitalized antepartum women were presented in this chapter. Interpretations of the findings of the study were discussed within the context of current literature and the study's conceptual framework. In addition,

study limitations, lessons learned, and recommendations for future research and practice were presented.

Definitions

Sleep deprivation. Inadequate amount of sleep due to poor sleep hygiene, lack of consistent bedtime, care-giving, or developmental stages.

Sleep disruption. Fragmentation of sleep related to medication, health issues, pregnancy, or sleep disorders.

Sleep efficiency. The total amount of time a person slept divided by the total amount of time spent in bed.

Sleep hygiene. Practices necessary to maintain quality nighttime sleep and full daytime alertness.

Sleep latency. The time it takes a person to fall asleep once the lights are turned off.

Sleep loss. Getting less sleep than needed for optimal functioning.

Total sleep time. Total amount of sleep in a 24-hour period.

Abbreviations

CDC	Centers for Disease Control and Prevention
CRP	C-reactive protein
EEG	Electroencephalogram
EMG	Electromyogram
EOG	Electrooculogram
EPDS	Edinburgh Postnatal Depression Scale
GSDS	General Sleep Disturbance Scale
IL-6	Interleukin-6
MI	Modification indices
NREM	Nonrapid eye movement
PSG	Polysomnography
PSQI	Pittsburgh Sleep Quality Index
REM	Rapid eye movement
SMH	St. Mary's Hospital Sleep Questionnaire
SWS	Slow wave sleep
TNF-α	Tumor necrosis factor-α
WASO	Wake after sleep onset

Appendix A

Informed Consent

METHODIST HEALTH SYSTEM
RESEARCH INFORMED CONSENT

Sleep Experiences of Hospitalized Antepartum Patients

(IRB#_____._____._____)

Principal Investigator: Andrea M. Erwin, MSN, RN, PhD Candidate
Chair: Barbara Raudonis, PhD, RN

Are you in any other research studies? Yes _____ No _____
Please initial your response

You have been invited to participate in a research study. The doctors, nurses, and staff at Methodist study the nature of disease and attempt to improve methods of diagnosis and treatment. This is called clinical research. Understanding this study's risks and benefits will allow you to make an informed judgment about whether to be part of it. This process is called informed consent.

This consent form may contain words that you do not understand. Please ask the study investigator or the study staff to explain any words or information that you do not clearly understand. You may take home an unsigned copy of this consent form to think about or discuss with family or friends before making your decision.

PURPOSE

Both being pregnant and being in the hospital can influence sleep. The purposes of this study are to determine (1) whether being in the hospital affects sleep in pregnant women, (2) whether your usual sleep patterns influence your sleep, and (3) whether the length of your pregnancy influences your sleep in the hospital.

You have been asked to participate in this study because you have been admitted to the antepartum unit at Methodist Dallas Medical Center due to complications with your pregnancy.

Approximately 50 participants will be enrolled in the study.

PROCEDURE:

If you agree to volunteer for the study, the following things will happen:

1. BASELINE

    a. Informed Consent (Research) – After discussing the study with you, a research informed consent will also be reviewed and signed before any study-related procedures are performed. You will also be given time to ask and have your questions answered. If you agree to volunteer for the study, you will be asked to sign the consent form. If you decide not to volunteer for the study, you will not be enrolled in the study.

    b. Demographic Profile – Information such as age, ethnicity, years of education, occupation, and marital status will be collected. It should take you 5-10 minutes to complete the questions.

    c. Medical & Medication History – Your medical records will be reviewed, and a medical history will be collected from you. Medical information will include gravidity (number of pregnancies), parity (number of deliveries and/or miscarriages), admitting diagnosis, weeks of gestation, treatment orders (i.e. frequency of electronic fetal monitoring), activity (e.g. bed rest, bathroom privileges), and medications.

    d. Questionnaires – A couple questionnaires will be given as part of the Baseline. The questionnaires will include questions about your usual sleep patterns during the past month as well as the past week prior to being admitted to the hospital.
        i. Pittsburgh Sleep Quality Index (PSQI): Questions relate to your usual sleep habits during the past month. It should take you 5-10 minutes to complete the questionnaire.
        ii. General Sleep Disturbance Scale (GSDS) - Questions relate to your sleep patterns in the past week. It should take you 5-10 minutes to complete the questionnaire.

2. DAY 2

    a. St. Mary's Hospital (SMH) Sleep Questionnaire – Questions relate to your sleep behavior over the previous 24 hours. It should take you 5-10 minutes to complete the questionnaire.

b. Night Interruptions - Question relates to any sleep interruptions you experienced during the night. It should take you 5-10 minutes to complete the question.

3. DAY 3

a. St. Mary's Hospital (SMH) Sleep Questionnaire – Questions relate to your sleep behavior over the previous 24 hours. It should take you 5-10 minutes to complete the questionnaire.
b. Night Interruptions - Question relates to any sleep interruptions you experienced during the night. It should take you 5-10 minutes to complete the question.

4. DAY 4

a. St. Mary's Hospital (SMH) Sleep Questionnaire – Questions relate to your sleep behavior over the previous 24 hours. It should take you 5-10 minutes to complete the questionnaire.
b. Night Interruptions - Question relates to any sleep interruptions you experienced during the night. It should take you 5-10 minutes to complete the question.
c. General Sleep Disturbance Scale (GSDS) - Questions relate to your sleep patterns since you were admitted to the hospital. It should take you 5-10 minutes to complete the questionnaire.

Tool	Admission	Day 2	Day 3	Day 4
Demographic Profile	X			
Medical/Medication History	X			
PSQI	X			
GSDS	X			X
SMH Sleep Questionnaire		X	X	X
Night Interruptions		X	X	X

RISKS

The questionnaires used in this study of your sleep involve no specific risks or discomforts beyond those of a standard clinical questionnaire or interview

situation. You may feel upset at the review of your pregnancy and/or sleep experiences, or you may feel boredom or fatigue.

COST

All procedures conducted for the purposes of this research study will be provided free of charge.

PAYMENT FOR PARTICIPATION AND/OR REIMBURSEMENT OF EXPENSES

Each study participant will receive a $10 gift card from local merchants for her time and effort upon completion of her study participation.

ALTERNATIVE METHODS/TREATMENTS

There are no alternative procedures or treatments if you choose not to participate in this study.

AUTHORIZATION TO USE AND DISCLOSE INFORMATION FOR RESEARCH PURPOSES

Federal regulations give you certain rights related to your health information. These include the right to know who will be able to get the information and why they may be able to get it. The study investigator must get your authorization (permission) to use or give out any health information that might identify you.

What information may be used and given to others?
If you choose to be in this study, the study investigator will get personal information about you. This may include information that might identify you. The study investigator may also get information about your health including:

- Medical and research records
- Questionnaires

Who may use and give out information about you?
Information about your health may be used and given to others by the study investigator and staff. They might see the research information during and after the study.

Who might get this information?
Information about you and your health, which might identify you, may be given to:

- Methodist Institutional Review Board (IRB)
- University of Texas at Arlington IRB

Why will this information be used and/or given to others?
Information about you and your health that might identify you may be given to others to carry out the research study.

The results of this research may be published in scientific journals or presented at medical meetings, but your identity will not be disclosed.

The Methodist IRB may review the information. The IRB is a group of people who perform independent review of research as required by regulations.

What if I decide not to give permission to use and give out my health information?
By signing this consent form, you are giving permission to use and give out health information listed above for the purposes described above. If you refuse to give permission, you will not be able to be in this research.

May I review or copy the information obtained from me or created about me?
You have the right to review and copy your health information. However, if you decide to be in this study and sign this permission form, you will not be allowed to look at or copy your information until after the research is completed.

May I withdraw or revoke (cancel) my permission?
This permission will not stop automatically.

You may withdraw or take your permission to use and disclose your health information at any time. If you withdraw your permission, you will not be able to continue being in this study.

When you withdraw your permission, no new health information, which might identify you, will be gathered after that date. Information that has already been gathered may still be used and given to others. This would be done if it were necessary for the research to be reliable.

Is my health information protected after it has been given to others?
If you give permission to give your identifiable health information to a person or business, the information may no longer be protected. There is a risk that your information will be released to others without your permission. Your personal information may be disclosed if required by law.

Your records for this study may be sent by facsimile transmission (FAX machine) or over the Internet. It is possible that your records could be sent to the wrong person.

QUESTIONS

If you have any questions concerning your participation in this study, contact:

Name: Andrea M. Erwin, MSN, RN, PhD Candidate
Address: Methodist Dallas Medical Center
1441 N. Beckley Ave., Dallas, TX, 75203
Phone: 214-947-1582

If you have any questions about your rights as a research participant, you may contact:
Methodist Health System Institutional Review Board
Director: Phyllis Everage
1441 N. Beckley Avenue
Dallas, Texas, 75203
214-947-2542

Methodist IRB is a group of people who perform independent review of research.

Do not sign this consent form unless you have had a chance to ask questions and have received satisfactory answers to all of your questions.

If you agree to participate in this study, you will receive a signed and dated copy of this consent form for your records.

VOLUNTARY PARTICIPATION AND WITHDRAWAL

Participation in this study is voluntary. You may decide not to participate in this study or you may withdraw from this study at any time without penalty or loss of benefits to which you are otherwise entitled at this site. You will be informed of any significant new findings that develop during the investigation that may affect your willingness to continue in the study.

You should tell your study investigator about all of your past and present health conditions and allergies of which you are aware, and all drugs and medications which you are presently using.

Your participation in this study may be stopped at any time by the study investigator without your consent because:

- the study investigator thinks it is necessary for your health or safety;
- you have not followed study instructions; or
- administrative reasons require your withdrawal.

If you leave the study before the final regularly scheduled visit, you may be asked by the study investigator to make a final visit for some needed/required study procedures.

CONSENT

I have read the information in this consent form (or it has been read to me). All my questions about the study and my participation have been answered. I freely consent to participate in the research study. I authorize the use and disclosure of my health information to the parties listed in the authorization section of this consent for the purposes described above. By signing this consent form, I have not waived any of the legal rights which I otherwise would have as a participant in a research study.

CONSENT SIGNATURE:

_____

Patient Signature Printed Name

Date_____

Appendix B

Demographic Profile

Please complete the following information.

Your current age:_____

Your marital status:

☐ Never married

☐ Married

☐ Divorced/separated

☐ Widowed

What is your ethnic background?

☐ African American

☐ Asian

☐ Caucasian

☐ Hispanic

☐ Other:_____

Did you take any childbirth classes during your pregnancy or previous pregnancy?

☐ Yes

☐ No

How many times have you been pregnant? _____

How many live births have you had? _____

How many miscarriages have you had? _____

How many abortions have you had? _____

During the past month, how often have you had trouble sleeping?

☐ None

☐ Less than once a week

☐ Once or twice a week

☐ 3-4 times a week

☐ 5-6 times a week

☐ Nightly

What is your current occupation?_____

Your education? (Mark the highest level completed)
☐ Some high school or less ☐ Technical/trade school graduate ☐ Undergraduate degree

☐ High school graduate ☐ Some College ☐ Post-graduate degree

What is your current annual income level?

☐ Under $15,000 ☐ $15,000 - $29,999 ☐ $30,000 – $49,999 ☐ $50,000 - $69,999

☐ More than $70,000 ☐ Do not wish to answer

Appendix C

Medical Information

Admitting Diagnosis:
☐ Preterm labor
☐ Multiple Gestation
☐ Diabetes
☐ Pregnancy-induced hypertension
☐ Placental abnormalities
☐ Hyperemesis Gravidarum
☐ Urinary tract infection/Pyelonephritis
☐ Other: _____

Treatment Orders:
Frequency of electronic fetal monitoring (Tocometer or Ultrasound or both):
☐ Continuous
☐ Twice a day
☐ Once a day
☐ Every 4 hours
☐ Every 2 hours

Other treatments:_____

_____

_____

_____

Activity Orders:
☐ Bed rest – Strict
☐ Bed rest – Bathroom Privileges
☐ May Shower

Other Activities: _____

_____

_____

_____

Weeks Gestation: _____

Psychiatric History:

☐ History of postpartum depression
☐ History of psychiatric disorders
☐ Suicide Risk Assessment
● Have you considered harming yourself?
● Do you have plans to harm yourself?

Medications & IV Solutions
(Include only the mediations that she received during the study).

Drug Name and Dosage	Route	Times Given	Dose/Rate

Appendix D

Pittsburgh Sleep Quality Index

Subject's Initials_____ ID# _____Date _____ Time _____ AM PM

INSTRUCTIONS:
The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed).

HOURS OF SLEEP PER NIGHT _____

For each of the remaining questions, check the one best response. Please answer all questions.

5. During the past month, how often have you had trouble sleeping because you

a. Cannot get to sleep within 30 minutes

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

b. Wake up in the middle of the night or early morning

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

c. Have to get up to use the bathroom

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

d. Cannot breathe comfortably

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

e. Cough or snore loudly

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

f. Feel too cold

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

g. Feel too hot

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

h. Had bad dreams

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

i. Have pain

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

j. Other reason(s), please describe

_____

_____

How often during the past month have you had trouble sleeping because of this?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

6. During the past month, how would you rate your sleep quality overall?

Very good _____

Fairly good _____

Fairly bad _____

Very bad _____

7. During the past month, how often have you taken medicine to help you sleep (prescribed or "over the counter")?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all _____

Only a very slight problem _____

Somewhat of a problem _____

A very big problem _____

10. Do you have a bed partner or roommate?

No bed partner or roommate _____

Partner/roommate in other room _____

Partner in same room, but not same bed _____

Partner in same bed _____

If you had a roommate or bed partner, ask him/her how often in the past month you have had…

a. Loud snoring

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

b. Long pauses between breaths while asleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

c. Legs twitching or jerking while you sleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

d. Episodes of disorientation or confusion during sleep

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

e. Other restlessness while you sleep; please describe

_____

_____

_____

Not during the past month_____	Less than once a week_____	Once or twice a week_____	Three or more times a week_____

Note. Adapted from *Pittsburgh Sleep Quality Index,* by D. J. Buysse, C. F. Reynolds, T. H. Monk, S. R. Berman, & D. J. Kupfer, 1989*, Psychiatry Research, 28,* 193-213. Copyright 1989 by University of Pittsburgh. Reprinted with permission.

Appendix E

General Sleep Disturbance Scale (GSDS)

DATE:_____

Instructions:
Please CHECK (✓) the response which best describes your sleep patterns in the past week.

How often in the <u>past week</u> did you:

	Never							Everyday
1. have difficulty getting to sleep	0	1	2	3	4	5	6	7
2. wake up during your sleep period	0	1	2	3	4	5	6	7
3. wake up too early at the end of a sleep period	0	1	2	3	4	5	6	7
4. Feel rested upon awakening at the end of a sleep period	0	1	2	3	4	5	6	7
5. sleep poorly	0	1	2	3	4	5	6	7
6. feel sleepy during the day	0	1	2	3	4	5	6	7
7. struggle to stay awake during the day	0	1	2	3	4	5	6	7
8. feel irritable during the day	0	1	2	3	4	5	6	7
9. feel tired or fatigue during the day	0	1	2	3	4	5	6	7
10. feel satisfied with the quality of your sleep	0	1	2	3	4	5	6	7
11. feel alert and energetic during the day	0	1	2	3	4	5	6	7
12. get too much sleep	0	1	2	3	4	5	6	7
13. get too little sleep	0	1	2	3	4	5	6	7
14. take a nap at a scheduled time	0	1	2	3	4	5	6	7
15. fall asleep at an unscheduled time	0	1	2	3	4	5	6	7

	Never							Everyday
16. drink an alcoholic beverage to help you to get to sleep	0	1	2	3	4	5	6	7
17. use tobacco to help you get to sleep	0	1	2	3	4	5	6	7
18. use marijuana to help you get to sleep	0	1	2	3	4	5	6	7
19. use an over-the-counter sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
20. use a prescription sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
21. use an aspirin or other analgesic to help you get to sleep	0	1	2	3	4	5	6	7

Appendix F

General Sleep Disturbance Scale (GSDS)

DATE:_____

Instructions:
Please CHECK (✓) the response which best describes your sleep patterns in the past week.

How often since admitted to the hospital did you:

	Never							Everyday
1. have difficulty getting to sleep	0	1	2	3	4	5	6	7
2. wake up during your sleep period	0	1	2	3	4	5	6	7
3. wake up too early at the end of a sleep period	0	1	2	3	4	5	6	7
4. Feel rested upon awakening at the end of a sleep period	0	1	2	3	4	5	6	7
5. sleep poorly	0	1	2	3	4	5	6	7
6. feel sleepy during the day	0	1	2	3	4	5	6	7
7. struggle to stay awake during the day	0	1	2	3	4	5	6	7
8. feel irritable during the day	0	1	2	3	4	5	6	7
9. feel tired or fatigue during the day	0	1	2	3	4	5	6	7
10. feel satisfied with the quality of your sleep	0	1	2	3	4	5	6	7
11. feel alert and energetic during the day	0	1	2	3	4	5	6	7
12. get too much sleep	0	1	2	3	4	5	6	7
13. get too little sleep	0	1	2	3	4	5	6	7
14. take a nap at a scheduled time	0	1	2	3	4	5	6	7
15. fall asleep at an unscheduled time	0	1	2	3	4	5	6	7

	Never							Everyday
16. drink an alcoholic beverage to help you to get to sleep	0	1	2	3	4	5	6	7
17. use tobacco to help you get to sleep	0	1	2	3	4	5	6	7
18. use marijuana to help you get to sleep	0	1	2	3	4	5	6	7
19. use an over-the-counter sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
20. use a prescription sleeping pill to help you get to sleep	0	1	2	3	4	5	6	7
21. use an aspirin or other analgesic to help you get to sleep	0	1	2	3	4	5	6	7

Appendix G

St. Mary's Hospital Sleep Questionnaire

Today's date ____/_____/____ Age: _____ yrs Female _____

At what time did you:

1. settle down for the night? _____ o'clock
2. fall asleep last night? _____
3. finally wake this morning? _____
4. get up this morning? _____
5. Was your sleep....
    1. very light
    2. light
    3. fairly light
    4. light average
    5. deep average
    6. fairly deep
    7. deep
    8. very deep
6. How many times did you wake up?
    0. not at all
    1. once
    2. twice
    3. three times
    4. four times

5. five times

6. six times

7. more than 6 times

7. How much sleep did you have **last night**?
   _____ hrs and ____ minutes

8. How much sleep did you have **during the day yesterday**?
   _____hrs and____ minutes

9. How well did you sleep **last night**?

   1. very badly

   2. badly

   3. fairly badly

   4. fairly well

   5. well

   6. very well

If you **did not** sleep well, what was the trouble? (e.g., restless, etc.)

1. _____

2. _____

3. _____

10. How clear-headed did you feel after getting up this morning?

    1. still very drowsy indeed
    2. still moderately drowsy
    3. still slightly drowsy
    4. fairly clear-headed
    5. alert
    6. very alert

11. How satisfied were you with last night's sleep?

    1. very unsatisfied
    2. moderately unsatisfied
    3. slightly unsatisfied
    4. fairly satisfied
    5. completely satisfied

12. Were you troubled by waking early and being unable to get off to sleep again?

    1. No
    2. Yes

13. How much difficulty did you have in getting off to sleep last night?

    1. none or very little
    2. some
    3. a lot

4. extreme difficulty

14. How long did it take you to fall asleep last night?

____ hrs and ___ minutes

Note. Adapted from "Mary's Hospital Sleep Questionnaire: A Study of Reliability," by B. W. Ellis, M. W. Johns, R. Lancaster, P. Raptopoulos, N. Angelopoulos, & R. G. Priest, 1981, *Sleep, 4,* 93–97. Copyright by Associated Professional Sleep Societies. Reprinted with permission.

Appendix H

Night Interruptions

Check any of the following that woke you up last night:

- ☐ Lights
- ☐ Alarms alert (i.e., blood pressure, IV, EKG, oxygen, fetal monitors)
- ☐ Semiprivate room
- ☐ Noise from the antepartum unit
- ☐ Voices outside the door
- ☐ Noise from the elevators
- ☐ Call bell ringing
- ☐ Overhead speaker/announcements
- ☐ Phones ringing
- ☐ Family in the room
- ☐ Lab in the room
- ☐ X-Ray in the room
- ☐ Housekeeping duties
- ☐ Nurse in the room
- ☐ Unfamiliar bed
- ☐ Unfamiliar environment
- ☐ Restraint of movement from telemetry monitor or fetal monitors
- ☐ Experiencing pain
- ☐ Not feeling well
- ☐ Experiencing stress
- ☐ Other: _____

Appendix I

Permission to Use Conceptual Framework

From: Lee, Kathryn (SON) <kathryn.lee@nursing.ucsf.edu>
To: 'Andrea Erwin' <anerwin11@verizon.net>
RE: Dissertation

Sent: Tue 1/3/2012 5:09 PM

Hi Andrea - good to hear from you, and that you are back on track.
Of course you can use any framework for you scholarship - I'm honored, particularly since doctoral students are the most critical! But ... on one condition .... I expect you to improve it!
Happy New Year!
kathy

Kathryn Lee, RN, PhD, FAAN, CBSM
Professor and Associate Dean for Research Director, T32 Nurse Research Training in Symptom Management UCSF School of Nursing Box 0606 UCSF Rm N411Y 2 Koret Way San Francisco CA 94143-0606
(415) 476-4442

-----Original Message-----
From: Andrea Erwin [mailto:anerwin11@verizon.net]
Sent: Saturday, December 31, 2011 1:37 PM
To: Lee, Kathryn (SON)
Subject: RE: Dissertation

Dr. Lee,

Happy New Year!

I apologize for the extreme delay in responding. This has been a rough year for me. I have experienced many life events that have resulted in the delay of my progress. I am now back on track and hope to finish my dissertation in the coming year.

I came across your conceptual model of impaired sleep in the childbearing family. May I use it as my conceptual framework?

Thank you for checking in with me. I appreciate it and hope to report my findings to you soon!

Andrea

Appendix J

Permission to Use Figures

DEPARTMENT OF SLEEP DISORDERS MEDICINE
Sleep Disorders & Research Center

2799 West Grand Blvd., CFP-3
Detroit, MI 48202-2689
(313) 916-4417 Office

September 19, 2012

Andrea Erwin, MSN, RN, Ph.D. Candidate
Methodist Health System
Department of Education
1441 N. Beckley Ave
Dallas, TX 75203

Dear Ms. Erwin:

Thank you for your letter requesting permission to use Figure 3, *Characteristics EEG, EOG and EMG patterns for wakefulness, REM sleep, and NREM sleep* in the *Teacher's Guide* of the *Information about Sleep* section.

Permission is granted to use the figure listed above.

Sincerely,

Timothy Roehrs

Timothy Roehrs, Ph.D.
Director of Research, Sleep Disorders Medicine

BSCS Permission Form

Request Date: 30 August 2012

Requested By:	Andrea Erwin anerwin11@verizon.net
Description:	NIH3 module: *Sleep, Sleep Disorders, and Biological Rhythms*, figures 3 and 4
For Use In:	proposal for dissertation
Use Requirements:	- Figure 3 is a non-BSCS image and needs the permission of Dr. Timothy Roehrs, Sleep Disorders Center, Henry Ford Hospital, 2799 West Grand Blvd, Clara Ford Pavilion, 3rd Floor, Detroit, MI 48202. - Figure 4: Credit as shown below must be obviously given in relation to the figure. Any other use requires new permission.
Credit Line:	Copyright © 2003 BSCS. All rights reserved. Used with permission.
Reference:	BSCS. (2003). *Sleep, Sleep Disorders, & Biological Rhythms*. NIH publication No. 04-4989.

Signed:

Stacey Luce
Production Coordinator
6 September 2012

Appendix K

Permission to Use PSQI

From: Shablesky-Cade, Melissa [mailto:shableskym@upmc.edu]
Sent: Thursday, April 08, 2010 2:26 PM
To: 'anerwin11@verizon.net'
Subject: FW: Dissertation

Dear Andrea,

You have my permission to use the PSQI for your research study. You can find the instrument, scoring instructions, and other useful information at www.sleep.pitt.edu under the Instruments tab. Please be sure to cite the 1989 paper in any publications that result. Good luck with your research.

Sincerely,

Daniel J. Buysse, M.D.
Professor of Psychiatry and Clinical and Translational Science
University of Pittsburgh School of Medicine
E-1127 WPIC
3811 O'Hara St.
Pittsburgh, PA 15213
T: (412) 246-6413
F: (412) 246-5300
buyssedj@upmc.edu

From: Andrea Erwin [mailto:anerwin11@verizon.net]
Sent: Monday, March 29, 2010 10:19 PM
To: Shablesky-Cade, Melissa
Subject: Dissertation

Ms. Shablesky-Cade,

My name is Andrea Erwin. I am a fourth-year doctoral student in the College of Nursing at the University of Texas at Arlington. I successfully passed comps during the Fall semester and am now a PhD candidate. I am putting together my proposal for dissertation. I am interested in studying sleep characteristics in hospitalized antepartum patients and would like to use the Pittsburgh Sleep Quality Index in my study. What is the process for obtaining permission to use the questionnaire?

Thanks,
Andrea Erwin, MSN, RN

Appendix L

Permission to Use GSDS

From: Lee, Kathryn (SON) [mailto:kathryn.lee@nursing.ucsf.edu]
Sent: Tuesday, March 30, 2010 9:21 AM
To: 'Andrea Erwin'
Subject: RE: Dissertation

Dear Andrea – it is very exciting to hear that you plan to replicate Dr. Gallo's study! You are welcome to use the materials that she sent you, no problem. If you need the GSDS in Spanish we have that as well.
Good luck with your research! Let me know if I can help with your analysis. If you use SPSS, I have syntax files available.
Kathy Lee

From: Andrea Erwin [mailto:anerwin11@verizon.net]
Sent: Monday, March 29, 2010 6:40 PM
To: Lee, Kathryn (SON)
Subject: Dissertation

Dr. Lee,

My name is Andrea Erwin. I am a fourth year doctoral student in the College of Nursing at the University of Texas at Arlington. I successfully passed comps during the Fall semester and am now a PhD candidate. I am putting together my proposal for dissertation. I came across your sleep characteristics in hospitalized antepartum patients article during my lit review and spoke with Dr. Gallo a few weeks ago regarding replicating the study for my dissertation.

Dr. Gallo sent me your General Sleep Disturbance Scale and the Sleep Diary used in the study. May I use the tools in my study? Do you have any additional feedback regarding the scale?

Do you have any suggestions on how to proceed (i.e. lessons learned, etc.)?

Thank you in advance for your response.

Andrea M. Erwin, MSN, RN

Appendix M

Permission to Use SMH Sleep Questionnaire

From: Andy Miller [mailto:amiller@aasmnet.org]
Sent: Wednesday, July 28, 2010 11:00 AM
To: Erwin, Andrea M
Subject: request for permssion

Hi Andrea,

Your request for permission to use the St. Mary's Hospital Sleep Questionnaire in your study came to my attention. You have our permission to use this at no charge. Please cite the source:

Ellis BW, Johns MW, Lancaster R, Raptopoulos P, Angelopoulos N, Priest RG. The St. Mary's Hospital sleep questionnaire: A study of reliability. Sleep 1981;4(1):93-97.

If there is anything else you may need please don't hesitate to contact me.

Best regards,

Andy

Andrew Miller
American Academy of Sleep Medicine
2510 N. Frontage Road
Darien, IL 60561-1511
Tel: 630-737-9700
Fax: 630-737-9790
E-mail amiller@aasmnet.org
Work Hours: M-F 7:30-4:00

References

Aaron, J. N., Carlisle, C. C., Carskadon, M. A., Meyer, T. J., Hill, N. S., & Millman, R. P. (1996). Environmental noise as a cause of sleep disruption in an intermediate respiratory care unit. *Sleep, 19,* 707–710. Retrieved from http://www.journalsleep.org

Adam, K. (1980). Sleep as a restorative process and a theory to explain why. *Progress in Brain Research, 53,* 289–305. http://dx.doi.org/10.1016/S0079-6123(08)60070-9

Adam, K., & Oswald, I. (1977). Sleep is for tissue restoration. *Journal of the Royal College of Physicians of London, 11,* 376–388. http://www.rcplondon.ac.uk/resources/clinical-medicine-journal

Afshari, J. T., Ghomian, N., Shameli, A., Shakeri, M. T., Fahmidehkar, M. A., Mahajer, E., . . . Emadzadeh, M. (2005). Determination of interleukin-6 and tumor necrosis factor-alpha concentrations in Iranian-Khorasanian patients with preeclampsia. *BMC Pregnancy Childbirth, 5,* 14–19. http://dx.doi.org/10.1186/1471-2393-5-14

Agnew, H. W., & Webb, W. B. (1972). Measurement of sleep onset by EEG criteria. *American Journal of EEG Technology, 12*(3), 127–134. Retrieved from http://www.aset.org

Åkerstedt, T., Hume, K., Minors, D., & Waterhouse, J. (1994). The meaning of good sleep: A longitudinal study of polysomnography and subjective sleep

quality. *Journal of Sleep Research, 3,* 152–158. http://dx.doi.org/10.1111/j.1365-2869.1994.tb00122.x

Åkerstedt, T., & Nilsson, P. M. (2003). Sleep as restitution: An introduction. *Journal of Internal Medicine, 254,* 6–12. http://dx.doi.org/10.1046/j.1365-2796.2003.01195.x

Alper, E., O'Malley, T. A., & Greenwald, J. (2013, May). *Hospital discharge*. Retrieved from http://www.uptodate.com/contents/hospital-discharge

American Pregnancy Association. (2007). *Calculating your dates: Gestation, conception & due dates.* Retrieved from http://www.americanpregnancy.org/duringpregnancy/calculatingdates.html

American Psychiatric Association. (1994). *Diagnostic and statistical manual for mental disorders* (4th ed.). Washington, DC: Author.

Ancoli-Israel, S., Cole, R., Alessi, C., Chambers, M., Moorcroft, W., & Pollak, C. P. (2003). The role of actigraphy in the study of sleep and circadian rhythms. *Sleep, 26,* 342–392. Retrieved from http://www.journalsleep.org

Assi, M. J., Wilson, P., Bodino, J., Bognar, L., & Lemenski, M. (2008). Why making the rounds makes sense. *American Nurse Today, 3*(2), 12. Retrieved from http://www.americannursetoday.com

Aurell, J., & Elmqvist, D. (1985). Sleep in the surgical intensive care unit: Continuous polygraphic recordings of sleep in nine patients receiving

postoperative care. *British Medical Journal, 290,* 1029–1032. http://dx.doi.org/10.1136/bmj.290.6474.1029

Balserak, B. I., & Lee, K. A. (2011). Sleep disturbances and sleep-related disorders in pregnancy. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (pp. 1572–1586). Philadelphia, PA: Elsevier Saunders.

Banks, S., & Dinges, D. F. (2007). Behavioral and physiological consequences of sleep restriction. *Journal of Clinical Sleep Medicine, 3,* 519–528. Retrieved from http://www.aasmnet.org/jcsm/

Baratte-Beebe, K. R., & Lee, K. A. (1999). Sources of midsleep awakenings in childbearing women. *Clinical Nursing Research, 8,* 386–397. http://dx.doi.org/10.1177/10547739922158377

Bartha, J. L., Romero-Carmona, R., Comino-Delgado, R. (2003). Inflammatory cytokines in intrauterine growth retardation. *Acta Obstetricia et Gynecologica Scandinavica, 82,* 1099–1102. http://dx.doi.org/10.1046/j.1600-0412.2003.00259.x

Beebe, K. R., & Lee, K. A. (2007). Sleep disturbance in late pregnancy and early labor. *The Journal of Perinatal & Neonatal Nursing, 21*, 103–108. http://dx.doi.org/10.1097/01.JPN.0000270626.66369.26

Bei, B., Milgrom, J., Ericksen, J., & Trinder, J. (2010). Subjective perception of sleep, but not its objective quality, is associated with immediate

postpartum mood disturbances in healthy women. *Sleep, 33,* 531–538. Retrieved from http://www.journalsleep.org

Benca, R. M., & Quintas, J. (1997). Sleep and host defenses: A review. *Sleep, 20,* 1027–1037. Retrieved from http://www.journalsleep.org

Beyerman, K. (1987). Etiologies of sleep pattern disturbance in hospitalized patients. In A. M. McLane (Ed.), *Classification of nursing diagnoses* (7th ed., pp. 193–198). St. Louis, MO: Mosby.

Biological Sciences Curriculum Study (BSCS). (2003). *Sleep, sleep disorders, and biological rhythms* (NIH Pub. No. 04-4989). Retrieved from http://science.education.nih.gov/supplements/nih3/sleep/default.htm

Bloom, H. G., Ahmed, I., Alessi, C. A., Ancoli-Israel, S., Buysse, D. J., Kryger, M. H., . . . Zee, P. C. (2009). Evidence-based recommendations for the assessment and management of sleep disorders in older persons. *Journal of the American Geriatrics Society, 57,* 761–789. http://dx.doi.org/10.1111/j.1532-5415.2009.02220.x

Boyar, R. M., Finkelstein J. W., Kapen, S., & Hellman, L. (1975). Twenty-four hour prolactin (PRL) secretion pattern during pregnancy. *Journal of Clinical Endocrinology & Metabolism, 40,* 1117–1120. http://dx.doi.org/10.1210/jcem-40-6-1117

Broughton, R., & Baron, R. (1978). Sleep patterns in the intensive care unit and on the ward after acute myocardial infarction. *Electroencephalography*

and Clinical Neurophysiology, 45, 348–360. http://dx.doi.org/10.1016/0013-4694(78)90187-6

Brunner, D. P., Munch, M., Biedermann, K., Huch, R., Huch, A., & Borbely, A. A. (1994). Changes in sleep and sleep electroencephalogram during pregnancy. *Sleep, 17,* 576–582. Retrieved from http://www.journalsleep.org

Buysse, D. J., Reynolds, C. F., III, Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. *Psychiatry Research, 28,* 193–213. http://dx.doi.org/10.1016/0165-1781(89)90047-4

Carpenter, J. S., & Andrykowski, M. A. (1998). Psychometric evaluation of the Pittsburgh Sleep Quality Index. *Journal of Psychosomatic Research, 45,* 5–13. http://dx.doi.org/10.1016/S0022-3999(97)00298-5

Carskadon, M. A., Brown, E. D., & Dement, W. C. (1982). Sleep fragmentation in the elderly: Relationship to daytime sleep tendency. *Neurobiology of Aging, 3,* 321–327. http://dx.doi.org/10.1016/0197-4580(82)90020-3

Carskadon, M. A., & Dement, W. C. (1987). Sleepiness in the normal adolescent. In C. Guilleminault (Ed.), *Sleep and its disorders in children* (pp. 53–66). New York, NY: Raven Press.

Carskadon, M. A., & Dement, W. C. (2010). Normal human sleep: An overview. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice*

of sleep medicine (5th ed., pp. 16–26). Philadelphia, PA: Elsevier Saunders.

Carsten, M. E. (1998). Endocrinology of pregnancy and parturition. In N. F. Hacker & J. G. Moore (Eds.), *Essentials of obstetrics and gynecology* (pp. 76–84). Philadelphia, PA: WB Saunders.

Christensen, M. (2005). Noise levels in a general surgical ward: A descriptive study. *Journal of Clinical Nursing, 14,* 156–164. http://dx.doi.org/10.1111/j.1365-2702.2004.01040.x

Closs, S. J. (1990). Factors affecting the sleep of patients on surgical wards in Scotland. In S. G. Funk, E. M. Tornquest, M. T. Champagne, L. A. Copp, & R. A. Wiese (Eds.). *Key aspects of recovery: Improving nutrition, rest and mobility* (pp. 223–231). New York, NY: Springer.

Coble, P. A., Reynolds, C. F. III, Kupfer, D. J., Houck, P. R., Day, N. L., & Giles, D. E. (1994). Childbearing in women with and without a history of affective disorder: II. Electroencephalographic sleep. *Comprehensive Psychiatry, 35,* 215–224. http://dx.doi.org/10.1016/0010-440X(94)90194-5

Cottrell, L., & Karraker, K. H. (2002). Correlates of nap taking in mothers of young infants. *Journal of Sleep Research, 11*, 209–212.

Cousins, L., Rigg, L., Hollingsworth, D., Meis, P., Halberg, F., Brink, G., & Yen, S. S. C. (1983). Qualitative and quantitative assessment of the circadian

rhythm of cortisol in pregnancy. *American Journal of Obstetrics and Gynecology, 145,* 411–416. Retrieved from http://www.ajog.org

Culley, T. (2008). Reduce call light frequency with hourly rounds. *Nursing Management, 39*(3), 50–52. http://dx.doi.org/10.1097/01.NUMA.0000313098.19766.d0

Cunningham, E. (2001). Coping with bed rest: Moving towards research-based nursing interventions. *AWHONN Lifelines, 5*(5), 50–55. http://dx.doi.org/10.1111/j.1552-6356.2001.tb01416.x

Czeisler, C. A., Weitzman, E. D., Moore-Ede, M. C., Zimmerman, J. C., & Knauer, R. S. (1980). Human sleep: Its duration and organization depend on its circadian phase. *Science, 210,* 1264–1267. http://dx.doi.org/10.1126/science.7434029

Czeisler C. A., Zimmerman, J. C., Ronda, J. M., Moore-Ede, M. C., & Weitzman, E. D. (1980). Timing of REM sleep is coupled to the circadian rhythm of body temperature in man. *Sleep, 2,* 329–346. Retrieved from http://www.journalsleep.org

Dattalo, P. (2008). *Determining sample size: Balancing power, precision, and practicality*. New York, NY: Oxford University Press.

Dekker, G. A., & Sibai, B. M. (1999). The immunology of preeclampsia. *Seminars in Perinatology, 23,* 24–33. http://dx.doi.org/10.1016/S0146-0005(99)80057-3

Dement, W. C. (2011). History of sleep physiology and medicine. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (5th ed., pp. 3–15). Philadelphia, PA: Elsevier Saunders.

Dennis, C.-L., & Ross, L. (2005). Relationships among infant sleep patterns, maternal fatigue, and development of depressive symptomology. *Birth, 32,* 187–193. http://dx.doi.org/10.1111/j.0730-7659.2005.00368.x

Doan, T., Gardiner, A., Gay, C. L., & Lee, K. A. (2007). Breast-feeding increases sleep duration of new parents. *Journal of Perinatal and Neonatal Nursing, 21,* 200–206. http://dx.doi.org/10.1097/01.JPN.0000285809.36398.1b

Driver, H. S., & Shapiro, C. M. (1992). A longitudinal study of sleep stages in young women during pregnancy and postpartum. *Sleep, 15,* 449–453. Retrieved from http://www.journalsleep.org

Drucker-Colín, R. (1995). The function of sleep is to regulate brain excitability in order to satisfy the requirements imposed by waking. *Behavioral Brain Research, 69,* 117–124. http://dx.doi.org/10.1016/0166-4328(95)00008-H

Dzaja, A., Arber, S., Hislop, J., Kerkhofs, M., Kopp, C., Pollmächer, T., . . . Tobler, I. (2005). Women's sleep in health and disease. *Journal of Psychiatric Research, 39,* 55–76. http://dx.doi.org/10.1016/j.jpsychires.2004.05.008

Edwards, N., & Sullivan, C. E. (2008). Sleep-disordered breathing in pregnancy. *Sleep Medicine Clinics, 3,* 81–95. http://dx.doi.org/10.1016/j.jsmc.2007.10.010

Ellis, B. W., Johns, M. W., Lancaster, R., Raptopoulos, P., Angelopoulos, N., & Priest, R. G. (1981). The St. Mary's Hospital Sleep Questionnaire: A study of reliability. *Sleep, 4,* 93–97. Retrieved from http://www.journalsleep.org

Ersser, S., Wiles, A., Taylor, H., Wade, S., Walsh, R., & Bentley, T. (1999). The sleep of older people in hospital and nursing homes. *Journal of Clinical Nursing, 8,* 360–368. http://dx.doi.org/10.1046/j.1365-2702.1999.00267.x

Evans, M. I., Dick., M. J., & Clark, A. S. (1995). Sleep during the week before labor: Relationships to labor outcomes. *Clinical Nursing Research, 4,* 238–252. http://dx.doi.org/10.1177/105477389500400302

Facco, F. L., Grobman, W. A., Kramer, J., Ho, K. H., & Zee, P. C. (2010). Self-reported short sleep duration and frequent snoring in pregnancy: Impact on glucose metabolism. *American Journal of Obstetrics & Gynecology, 203,* 142.e1–142.e5. http://dx.doi.org/10.1016/j.ajog.2010.03.041

Facco, F. L., Kramer, J., Ho, K. H., Zee, P. C., & Grobman, W. A. (2010). Sleep disturbances in pregnancy. *Obstetrics & Gynecology, 115,* 77–83. http://dx.doi.org/10.1097/AOG.0b013e3181c4f8ec

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and

biomedical sciences. *Behavior Research Methods, 39,* 175–191. http://dx.doi.org/10.3758/BF03193146

Feinberg, I. (1983). Schizophrenia: Caused by a fault in programmed synaptic elimination during adolescence? *Journal of Psychiatric Research, 17,* 319–334. http://dx.doi.org/10.1016/0022-3956(82)90038-3

Fontaine, D. K. (2005). Impact of the critical care environment on the patient. In P. G. Morton, D. K. Fontaine, C. M. Hudak, & B. M. Gallo (Eds.), *Critical care nursing: A holistic approach* (8th ed., pp. 36–45). Philadelphia, PA: Lippincott Williams & Wilkins.

Frampton, S. B., Gilpin, L., & Charmel, P. A. (2003). *Putting patients first: Designing and practicing patient-centered care*. San Francisco, CA: Jossey-Bass.

Freedman, N. S., Gazendam, J., Levan, L., Pack, A. I., & Schwab, R. J. (2001). Abnormal sleep/wake cycles and the effect of environmental noise on sleep disruption in the intensive care unit. *American Journal of Respiratory and Critical Care Medicine, 163,* 451–457. http://dx.doi.org/10.1164/ajrccm.163.2.9912128

Freedman, N. S., Kotzer, N., & Schwab, R. J. (1999). Patient perception of sleep quality and etiology of sleep disruption in the intensive care unit. *American Journal of Respiratory and Critical Care Medicine, 159,* 1155–1162. http://dx.doi.org/10.1164/ajrccm.159.4.9806141

Freeman, D. J., McManus, F., Brown, E. A., Cherry, L., Norrie, J., Ramsay, J. E., . . . Greer, I. A. (2004). Short- and long-term changes in plasma inflammatory markers associated with preeclampsia. *Hypertension, 44,* 708–714. http://dx.doi.org/10.1161/01.HYP.0000143849.67254.ca

Friess, E., Tagaya, H., Trachsel, L., Holsboer, F., & Rupprecht, R. (1997). Progesterone-induced changes in sleep in male subjects. *American Journal of Physiology, Endocrinology, and Metabolism, 272,* E885–E891. Retrieved from http://ajpendo.physiology.org

Gallo, A.-M., & Lee, K. A. (2008). Sleep characteristics in hospitalized antepartum patients. *JOGNN*: *Journal of Obstetric, Gynecologic & Neonatal Nursing, 37,* 715–721. http://dx.doi.org/10.1111/j.1552-6909.2008.00297.x

Gay, C. L., Lee, K. A., & Yee, S.-Y. (2004). Sleep patterns and fatigue in new mothers and fathers. *Biological Research for Nursing, 5,* 311–318. http://dx.doi.org/10.1177/1099800403262142

Goldenberg, R. L., Cliver, S. P., Bronstein, J., Cutter, G. R., Andrews, W. W., & Mennemeyer, S. T. (1994). Bed rest in pregnancy. *Obstetrics & Gynecology, 84,* 131–136. Retrieved from http://journals.lww.com/greenjournal/toc/1994/07000

Goodman, J. D. S., Brodie, C., & Ayida, G. A. (1998). Restless legs syndrome in pregnancy. *British Medical Journal, 297,* 1101–1102. http://dx.doi.org/10.1136/bmj.297.6656.1101-a

Gorny, S. W., & Spiro, J. R. (2001, Summer). Comparing different methodologies used in wrist actigraphy. *Sleep Review,* 40–42. Retrieved from http://www.sleepreviewmag.com

Goyal, D., Gay, C. L., & Lee, K. A. (2007). Patterns of sleep disruption and depressive symptoms in new mothers. *Journal of Perinatal and Neonatal Nursing, 21,* 123–129. http://dx.doi.org/10.1097/01.JPN.0000270629.58746.96

Gupta, M. A., Schork, N. J., & Gay, C. (1992). Nocturnal leg cramps in pregnancy: A prospective study of clinical features. *Sleep Research, 21,* 294. Retrieved from EBSCOhost database.

Hayashi, M., Ueda, Y., Ohkura, T., & Inaba, N. (2005). Interleukin-6 concentrations in the placenta and blood in normal pregnancies and preeclampsia. *Hormone and Metabolic Research, 37,* 419–424. http://dx.doi.org/10.1055/s-2005-870231

Hayashi, M., Ueda, Y., Yamaguchi, T., Sohma, R., Shibazaki, M., Ohkura, T., & Inaba, N. (2005). Tumor necrosis factor-alpha in the placenta is not elevated in pre-eclamptic patients despite its elevation in peripheral blood.

American Journal of Reproductive Immunology, 53, 113–119. http://dx.doi.org/10.1111/j.1600-0897.2005.00253.x

Heaman, M., & Gupton, A. (1998). Perceptions of bed rest by women with high-risk pregnancies: A comparison between home and hospital. *Birth, 25,* 252–258. http://dx.doi.org/10.1046/j.1523-536X.1998.00252.x

Hedman, C., Pohjasvaara, T., Tolonen, U., Suhonen-Malm, A. S., & Myllylä, V. V. (2002). Effects of pregnancy on mothers' sleep. *Sleep Medicine, 3,* 37–42. http://dx.doi.org/10.1016/S1389-9457(01)00130-7

Hertz, G., Fast, A., Feinsilver, S. H., Albertario, C. L., Schulman, H., & Fein, A. M. (1992). Sleep in normal late pregnancy. *Sleep, 15,* 246–251. Retrieved from http://www.journalsleep.org

Hilton, B. A. (1976). Quantity and quality of patients' sleep and sleep-disturbing factors in a respiratory intensive care unit. *Journal of Advanced Nursing, 1,* 453–468. http://dx.doi.org/10.1111/j.1365-2648.1976.tb00932.x

Hobson, J. A. (1989). *Sleep*. New York, NY: Scientific American Library.

Holcberg, G., Huleihel, M., Sapir, O., Katz, M., Tsadkin, M., Furman, B., . . . Myatt, L. (2001). Increased production of tumor necrosis factor-alpha TNF-alpha by IUGR human placenta. *European Journal of Obstetrics & Gynecology and Reproductive Biology, 94,* 69–72. http://dx.doi.org/10.1016/S0301-2115(00)00321-3

Holst, R.-M., Mattsby-Baltzer, I., Wennerholm, U.-B., Hagberg, H., & Jacobsson, B. (2005). Interleukin-6 and interleukin-8 in cervical fluid in a population of Swedish women in preterm labor: Relationship to microbial invasion of the amniotic fluid, intra-amniotic inflammation, and preterm delivery. *Acta Obstetricia et Gynecologica Scandinavica, 84,* 551–557. http://dx.doi.org/10.1111/j.0001-6349.2005.00708.x

Horiuchi, S. (1994). Changes in sleep patterns of young women from late pregnancy to postpartum. *Japan Academic Nursing Science, 14,* 38–47. Retrieved from EBSCOhost database.

Horiuhi, S. & Nishihara, K. (1999). Analyses of mothers' sleep logs in postpartum periods. *Psychiatry and Clinical Neurosciences, 53,* 137–139. http://dx.doi.org/10.1046/j.1440-1819.1999.00519.x

Humphries, J. D. (2008). Sleep disruption in hospitalized adults. *Medsurg Nursing, 17,* 391–395. Retrieved from http://www.medsurgnursing.net

Hunter, L. P., Rychnovsky, J. D., & Yount, S. M. (2009). A selective review of maternal sleep characteristics in the postpartum period. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 38,* 60–68. http://dx.doi.org/10.1111/j.1552-6909.2008.00309.x

Irwin, M. R., Wang, M., Campomayor, C. O., Collado-Hidalgo, A., & Cole, S. (2006). Sleep deprivation and activation of morning levels of cellular and

genomic markers of inflammation. *Archives of Internal Medicine, 166,* 1756–1762. http://dx.doi.org/10.1001/archinte.166.16.1756

Isaia, G., Corsinovi, L., Bo, M., Santos-Pereira, P., Michelis, G., Aimonino, N., & Zanocchi, M. (2010). Insomnia among hospitalized elderly patients: Prevalence, clinical characteristics and risk factors. *Archives of Gerontological Geriatrics, 52,* 133–137. http://dx.doi.org/10.1016/j.archger.2010.03.001

Johns Hopkins Medicine. (n.d.). *24-hour urine collection*. Retrieved March 31, 2013, from http://www.hopkinsmedicine.org/healthlibrary/test_procedures/urology/24-hour_urine_collection_92,P08955/

Johns, M. W., Large, A. A., Masterson, J. P., & Dudley, H. A. F. (1974). Sleep and delirium after open heart surgery. *British Journal of Surgery, 61,* 377–381. http://dx.doi.org/10.1002/bjs.1800610513

Jomeen, J., & Martin, C. R. (2007). Assessment and relationship of sleep quality to depression in early pregnancy. *Journal of Reproductive and Infant Psychology, 25,* 87–99. http://dx.doi.org/10.1080/02646830601117308

Jomeen, J., & Martin, C. R. (2008). The impact of choice of maternity care on psychological health outcomes for women during pregnancy and the postnatal period. *Journal of Evaluation in Clinical Practice, 14*(3), 391-398. http://dx.doi.org/10.1111/j.1365-2753.2007.00878.x

Jones, L., Hoggart, B., Withey, J., Donaghue, K., & Ellis, B. W. (1979). What the patients say: A study of reactions to an intensive care unit. *Intensive Care Medicine, 5,* 89–92. http://dx.doi.org/10.1007/BF01686054

Joseph, A., & Ulrich, R. (2007, January). Sound control for improved outcomes in healthcare settings. *The Center for Heath Design*. Retrieved from http://www.healthdesign.org

Kahn, D. M., Cook, T. E., Carlisle, C. C., Nelson, D. L., Kramer, N. R., & Millman, R. P. (1998). Identification and modification of environmental noise in an ICU setting, *Chest, 114,* 535–540. http://dx.doi.org/10.1378/chest.114.2.535

Kamysheva, E., Skouteris, H., Wertheim, E. H., Paxton, S. J., & Milgrom, J. (2008). Examination of a multi-factorial model of body-related experiences during pregnancy: The relationships among physical symptoms, sleep quality, depression, self-esteem, and negative body attitudes. *Body Image, 5,* 152–163. http://dx.doi.org/10.1016/j.bodyim.2007.12.005

Kang, M. J., Matsumoto, K., Shinkoda, H., Mishima, M., & Seo, Y. J. (2002). Longitudinal study of sleep-wake behaviours of mothers from pre-partum to post-partum using actigraph and sleep logs. *Psychiatry and Clinical Neurosciences, 56,* 251–252. http://dx.doi.org/10.1046/j.1440-1819.2002.00992.x

Karacan, I., Heine, W., Agnew, H. W., Webb, W. B., & Ross, J. J. (1968). Characteristics of sleep patterns during late pregnancy and the postpartum periods. *American Journal of Obstetrics and Gynecology, 101,* 579–585. Retrieved from http://www.ajog.org

Karacan, I., & Williams, R. L. (1970). The relationship of sleep disturbances to psychopathology. *International Psychiatry Clinics, 7,* 93–111. Retrieved from EBSCOhost database.

Karacan, I., Williams, R. L., Hursch, C. J., McCaulley, M., & Heine, M. W. (1969). Some implications of the sleep patterns of pregnancy for postpartum emotional disturbances. *British Journal of Psychiatry, 115,* 929–935. http://dx.doi.org/10.1192/bjp.115.525.929

Keenan, S. A., & Hirshkowitz, M. (2010). Monitoring and staging human sleep. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (5th ed., pp. 1602–1609). Philadelphia, PA: Elsevier Saunders.

Kennedy, H. P, Gardiner, A., Gay, C., & Lee, K. A. (2007). Negotiating sleep: A qualitative study of new mothers. *Journal of Perinatal and Neonatal Nursing, 21,* 114–122. http://dx.doi.org/10.1097/01.JPN.0000270628.51122.1d

Kivelä, A., Kauppila, A., Leppäluoto J., & Vakkuri, O. (1989). Serum and amniotic fluid melatonin during human labor. *Journal of Clinical*

Endocrinology and Metabolism, 69, 1065–1068. http://dx.doi.org/10.1210/jcem-69-5-1065

Knill, R. L., Moote, C. A., Skinner, I., & Rose, E. A. (1990). Anesthesia with abdominal surgery leads to intense REM sleep during the first post-operative week. *Anesthesiology, 73,* 52–61. http://dx.doi.org/10.1097/00000542-199007000-00009

Ko, S.-H., Chang, S.-C., & Chen, C.-H. (2010). A comparative study of sleep quality between pregnant and nonpregnant Taiwanese women. *Journal of Nursing Scholarship, 42,* 23–30. http://dx.doi.org/10.1111/j.1547-5069.2009.01326.x

Koski, R. R. (2011). Treatment of insomnia in hospitalized patients. *U.S. Pharmacist, 36*(1), HS-12–HS-18. Retrieved from http://www.uspharmacist.com

Krueger, J. M., & Majde, J. A. (1990). Sleep as a host defense: Its regulation by microbial products and cytokines. *Clinical Immunology and Immunopathology, 57,* 188–199. http://dx.doi.org/10.1016/0090-1229(90)90033-M

Krueger, J. M., & Majde, J. A. (2003). Humoral links between sleep and the immune system: Research issues. *Annals of the New York Academy of Sciences, 992,* 9–20. http://dx.doi.org/10.1111/j.1749-6632.2003.tb03133.x

Landis, C. A., & Heitkemper, M. M. (2011). Sleep and sleep disorders. In S. M.L. Lewis, S. R. Dirksen, M. M. Heitkemper, L. Bucher, & I. M. Camera (Eds.), *Medical-surgical nursing: Assessment and management of clinical problems* (8th ed., pp. 112–126). St. Louis, MO: Elsevier Mosby.

Laskowska, M., Leszczyńska-Gorzelak, B., Laskowska, K., & Oleszczuk, J. (2006). Evaluation of maternal and umbilical serum TNFalpha levels in preeclamptic pregnancies in the intrauterine normal and growth-restricted fetus. *Journal of Maternal-Fetal and Neonatal Medicine, 19,* 347–351. http://dx.doi.org/10.1080/14767050600637937

Lauderdale, D. S., Knutson, K. L., Yan, L. L., Liu, K., & Rathouz, P. J. (2008). Self-reported and measured sleep duration: How similar are they? *Epidemiology, 19,* 838–845. http://dx.doi.org/10.1097/EDE.0b013e318187a7b0

Lauri, S., Lepistö, M., & Käppeli, S. (1997). Patients' needs in hospital: Nurses' and patients' views. *Journal of Advanced Nursing, 25,* 339–346. http://dx.doi.org/10.1046/j.1365-2648.1997.1997025339.x

Lee, D. H., & Kwon, I. C. (2009). Magnesium sulfate has beneficial effects as an adjuvant during general anaesthesia for Caesarean section. *British Journal of Anaesthesia, 103,* 861–866. http://dx.doi.org/10.1093/bja/aep265

Lee, K. A. (1992). Self-reported sleep disturbances in employed women. *Sleep, 15,* 493–498. Retrieved from http://www.journalsleep.org

Lee, K. A. (1998). Alterations in sleep during pregnancy and postpartum: A review of 30 years of research. *Sleep Medicine Review, 2,* 231–242. http://dx.doi.org/10.1016/S1087-0792(98)90010-7

Lee, K. A. (2003). Impaired sleep. In V. Carrieri-Kohlman, A. M. Lindsey, & C. M. West (Eds.), *Pathophysiological phenomena in nursing: Human responses to illness* (3rd ed., pp. 363–385). St. Louis, MO: Elsevier Saunders.

Lee, K. A. (2011). Sleep promotion in the childbearing family. In N. Redeker & G. P. McEnany (Eds.), *Sleep disorders and sleep promotion in nursing practice* (pp. 261–276). New York, NY: Springer.

Lee, K. A., & Gay, C. L. (2004). Sleep in late pregnancy predicts length of labor and type of delivery. *American Journal of Obstetrics & Gynecology, 191,* 2041–2046. http://dx.doi.org/10.1016/j.ajog.2004.05.086

Lee, K. A., Landis, C., Chasens, E. R., Dowling, G., Merritt, S., Parker, K. P., . . . Weaver, T. E. (2004). Sleep and chronobiology: Recommendations for nursing education. *Nursing Outlook, 52,* 126–133. http://dx.doi.org/10.1016/j.outlook.2003.12.002

Lee, K. A., McEnany, G., & Zaffke, M. E. (2000). REM sleep and mood state in childbearing women: Sleepy or weepy? *Sleep, 23,* 877–884. Retrieved from http://www.journalsleep.org

Lee, K. A., & Zaffke, M. E. (1999). Longitudinal changes in fatigue and energy during pregnancy and the postpartum period. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 28,* 183–191. http://dx.doi.org/10.1111/j.1552-6909.1999.tb01983.x

Lee, K. A., Zaffke, M. E., & Baratte-Beebe, K. (2001). Restless legs syndrome and sleep disturbance during pregnancy: The role of folate and iron. *Journal of Women's Health & Gender-Based Medicine, 10,* 335–341. http://dx.doi.org/10.1089/152460901750269652

Lee, K. A., Zaffke, M. E., & McEnany, G. (2000). Parity and sleep patterns during and after pregnancy. *Obstetrics & Gynecology, 95,* 14–18. http://dx.doi.org/10.1016/S0029-7844(99)00486-X

Leigh, T. J., Bird, H. A., Hindmarch, I., Constable, P. D. L., & Wright, V. (1988). Factor analysis of the St. Mary's Hospital Sleep Questionnaire. *Sleep, 11,* 448–453. Retrieved from http://www.journalsleep.org

Lichstein, K. L., Stone, K. C., Donaldson, J., Nau, S. D., Soeffing, J. P., Murray, D., . . . Aguillard, R. N. (2006). Actigraphy validation with insomnia. *Sleep, 29,* 232–239. Retrieved from http://www.journalsleep.org

Little, B. C., Matta, R. J., & Zahn, T. P. (1974). Physiological and psychological effects of progesterone in man. *Journal of Nervous & Mental Disease, 159,* 256–262. http://dx.doi.org/10.1097/00005053-197410000-00004

Lowdermilk, D. L. (2012). Anatomy and physiology of pregnancy. In D. L. Lowdermilk, S. E. Perry, K. Cashion, & K. R. Alden (Eds.), *Maternity & women's health care* (10th ed., pp. 298–306). St. Louis, MO: Elsevier Mosby.

MacKensie, D. J., & Galbrun, L. (2007). Noise levels and noise sources in acute care hospital wards. *Building Services Engineering Research and Technology, 28,* 117–131. http://dx.doi.org/10.1177/0143624406074468

Mackey, M. C., & Coster-Schulz, M. A. (1992). Women's views of the preterm labor experience. *Clinical Nursing Research, 1,* 366–384. http://dx.doi.org/10.1177/105477389200100406

Maloni, J. A. (1998, June 10). Despite side effects, bed rest a common prescription for high-risk pregnancy. *University of Wisconsin-Madison News.* Retrieved from http://www.news.wisc.ed/3345

Maloni, J. A., & Kasper, C. E. (1991). Physical and psychosocial effects of antepartum hospital bed rest: A review of the literature. *Journal of Nursing Scholarship, 23,* 187–192. http://dx.doi.org/10.1111/j.1547-5069.1991.tb00667.x

Maloni, J. A., & Kutil, R. M. (2000). Antepartum support group for women hospitalized on bed rest. *MCN: The American Journal of Maternal/Child Nursing, 25,* 204–210. http://dx.doi.org/10.1097/00005721-200007000-00008

Maloni, J. A., Margevicius, S. P., & Damato, E. G. (2006). Multiple gestation: Side effects of antepartum bed rest. *Biological Research for Nursing, 8,* 115–128. http://dx.doi.org/10.1177/1099800406291455

Maloni, J. A., & Park, S. (2005). Postpartum symptoms after antepartum bed rest. *Journal of Obstetric, Gynecologic & Neonatal Nursing, 34,* 163–171. http://dx.doi.org/10.1177/0884217504274416

Manber, R., Colrain, I. M., & Lee, K. A. (2002). Sleep disorders. In S. G. Kornstein & A. H. Clayton (Eds.), *Women's mental health: A comprehensive textbook* (pp. 274-294). New York, NY: Guilford Press.

Matsumoto, K., Shinkoda, H., Kang, M. J., & Seo, Y. J. (2003). Longitudinal study of mother's sleep-wake behaviors and circadian time patterns from late pregnancy to postpartum—monitoring of wrist actigraphy and sleep logs. *Biological Rhythm Research, 34,* 265–278. http://dx.doi.org/10.1076/brhm.34.3.265.18812

May, K. A. (2001). Impact of prescribed activity restriction during pregnancy on women and families. *Health Care for Women International, 22,* 29–47. http://dx.doi.org/10.1080/073993301300003063

McDade, T. W., Hawkley, L. C., & Cacioppo, J. T. (2006). Psychosocial and behavioral predictors of inflammation in middle-aged and older adults: The Chicago Health, Aging, and Social Relations Study. *Psychosomatic*

Medicine, 68, 376–381. http://dx.doi.org/10.1097/01.psy.0000221371.43607.64

McFadden, E. N., & Giblin, E. C. (1971). Sleep deprivation in patients having open-heart surgery. *Nursing Research, 20,* 249–253. http://dx.doi.org/10.1097/00006199-197105000-00010

Meade, C. M., Bursell, A. L., & Ketelsen, L. (2006). Effects of nursing rounds on patients' call light use, satisfaction, and safety. *American Journal of Nursing, 106*(9), 58–70. http://dx.doi.org/10.1097/00000446-200609000-00029

Meier-Ewert, H. K., Ridker, P. M., Rifai, N., Regan, M. M., Pricell, N. J., Dinges, D. F., & Mullington, J. M. (2004). Effect of sleep loss on C-reactive protein, an inflammatory marker of cardiovascular risk. *Journal of the American College of Cardiology, 43,* 678–683. http://dx.doi.org/10.1016/j.jacc.2003.07.050

Menon, R., Merialdi, M., Lombardi, S. J., & Fortunato, S. J. (2006). Differences in the placental membrane cytokine response: A possible explanation for the racial disparity in preterm labor. *American Journal of Reproductive Immunology, 56,* 112–118. http://dx.doi.org/10.1111/j.1600-0897.2006.00394.x

Methodist Health System. (n.d.). *Methodist Health System facts and statistics.* Retrieved April 5, 2013, from http://www.methodisthealthsystem.org/About

Miller, W. C., Gardner, N., & Mlott, S. R. (1976). Psychosocial support in the treatment of severely burned patients. *Journal of Trauma, 16,* 722–725. http://dx.doi.org/10.1097/00005373-197609000-00007

Mindell, J. A., & Jacobson, B. J. (2000). Sleep disturbances during pregnancy. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 29,* 590–597. http://dx.doi.org/10.1111/j.1552-6909.2000.tb02072.x

Moline, M. L., Broch, L., Zak, R., & Gross, V. (2003). Sleep in women across the life cycle from adulthood through menopause. *Sleep Medicine Reviews, 7,* 155–177. http://dx.doi.org/10.1053/smrv.2001.0228

Morris, L. G. T., Kleinberger, A., Lee, K. C., Liberatore, L. A., & Burschtin, O. (2008). Rapid risk stratification for obstructive sleep apnea, based on snoring severity and body mass index. *Otolaryngology—Head and Neck Surgery, 139,* 615–618. http://dx.doi.org/10.1016/j.otohns.2008.08.026

Morrison, B., Ludington-Hoe, S., & Anderson, G. C. (2006). Interruptions to breastfeeding dyads on postpartum day 1 in a university hospital. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 35,* 709–716. http://dx.doi.org/10.1111/j.1552-6909.2006.00095.x

Murphy, F., Bentley, S., Ellis, B. W., & Dudley, H. (1977). Sleep deprivation in patients undergoing operation: A factor in the stress of surgery. *British Medical Journal, 2,* 1521–1522. http://dx.doi.org/10.1136/bmj.2.6101.1521-a

Natale, V., Plazzi, G., & Martoni, M. (2009). Actigraphy in the assessment of insomnia: A quantitative approach. *Sleep, 32,* 767–771. Retrieved from http://www.journalsleep.org

National Heart, Lung, and Blood Institute (NHLBI). (n.d.). *Sleep disorders information.* Retrieved October 27, 2011, from http://www.nhlbi.nih.gov/health/public/sleep.index.htm

National Institutes of Health (NIH). (2005). NIH State-of-the-Science Conference statement on manifestations and management of chronic insomnia of adults. *NIH Consensus Science Statements, 22*(2), 1–30. Retrieved from http://consensus.nih.gov/2005/insomnia.htm

National Sleep Foundation. (2011a). *How much sleep do we really need?* Retrieved from http://www.sleepfoundation.org/article/how-sleep-works/how-much-sleep-do-we-really-need

National Sleep Foundation. (2011b). *Pregnancy and sleep.* Retrieved from http://www.sleepfoundation.org/article/sleep-topics/pregnancy-and-sleep

National Sleep Foundation. (2013). Sleep hygiene. Retrieved from http://www.sleepfoundation.org/article/ask-the-expert/sleep-hygiene

Naud, K., Ouellet, A., Brown, C., Pasquier, J.-C., & Moutquin, J.-M. (2010). Is sleep disturbed in pregnancy? *Journal of Obstetrics and Gynaecology Canada, 32,* 28–34. Retrieved from http://www.jogc.com

Nishihara, K., & Horiuchi, S. (1998). Changes in sleep patterns of young women from late pregnancy to postpartum: Relationships to their infants' movements. *Perceptual and Motor Skills, 87,* 1043–1056. http://dx.doi.org/10.2466/pms.1998.87.3.1043

O'Brien, L. M. (2012). Sleep disruption and adverse pregnancy outcomes. *BMC Pregnancy and Childbirth, 12*(Suppl 1), A11–A12. http://dx.doi.org/10.1186/1471-2393-12-S1-A11

Ohayon, M. M., Carskadon, M. A., Guilleminault, C., & Vitiello, M. V. (2004). Meta-analysis of quantitative sleep parameters from childhood to old age in healthy individuals: Developing normative sleep values across the human lifespan. *Sleep, 27,* 1255–1273. Retrieved from http://www.journalsleep.org

Okun, M. L., Hall, M., & Coussons-Read, M. E. (2007). Sleep disturbances increase interleukin-6 production during pregnancy: Implications for pregnancy complications. *Reproductive Sciences, 14,* 560–567. http://dx.doi.org/10.1177/1933719107307647

Okun, M. L., Roberts, J. M., Marsland, A. L., & Hall, M. (2009). How disturbed sleep may be a risk factor for adverse pregnancy outcomes: A hypothesis. *Obstetrical & Gynecological Survey, 64,* 273–280. http://dx.doi.org/10.1097/OGX.0b013e318195160e

Okun, M. L., Schetter, C. D., & Glynn, L. M. (2011). Poor sleep quality is associated with preterm birth. *Sleep, 34,* 1493–1498. Retrieved from http://www.journalsleep.org

Orr, W. C., & Stahl, M. L. (1977). Sleep disturbances after open heart surgery. *American Journal of Cardiology, 39,* 196–200. http://dx.doi.org/10.1016/S0002-9149(77)80191-4

Pacini, C. M., & Fitzpatrick, J. J. (1982). Sleep patterns of hospitalized and non-hospitalized aged individuals. *Journal of Gerontological Nursing, 8,* 327–332. Retrieved from http://www.healio/journals/jgn

Patel, M., Chipman, J., Carlin, B. W., & Shade, D. (2008). Sleep in the intensive care unit setting. *Critical Care Nursing Quarterly, 31,* 309–318. http://dx.doi.org/10.1097/01.CNQ.0000336817.89300.08

Pérez de Ciriza, A., Otamendi, S., Ezenarro, A., & Asiain, M. C. (1996). Factors causing stress in patients in intensive care units. *Enfermeria Intensiva, 7,* 95–103. Retrieved from http://www.sciencedirect.com/science/journal/11302399

Petre-Quadens, O., & De Lee, C. (1974). Sleep-cycle alterations during pregnancy, postpartum, and the menstrual cycle. In M. Ferin, F. Halberg, R.M. Richart, & R. I. van de Weile (Eds.), *Biorhythms and human reproduction: A conference sponsored by the International Institute for the Study of Human Reproduction* (pp. 335–351). New York, NY: Wiley.

Prinz, P. N. (1977). Sleep patterns in the healthy aged: Relationship with intellectual function. *Journal of Gerontology, 32,* 179–186. http://dx.doi.org/10.1093/geronj/32.2.179

Prinz, P. N., Peskind, E. R., Vitaliano, P. P., Raskind, M. A., Eisdorfer, C., Zemcuznikov, N., & Gerber, C. J. (1982). Changes in the sleep and waking EEGs of nondemented and demented elderly subjects. *Journal of the American Geriatrics Society, 30,* 86–93. Retrieved from http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1532-5415/

Pulling, C., & Seaman, S. (1993). Sleep: A reality or dream for the hospitalized adult? *Canadian Journal of Cardiovascular Nursing, 3*(4), 7–12. Retrieved from http://www.cccn.ca/

Quigley, M. E., Ishizuka, B., Ropert, J. F., & Yen, S. S. C. (1982).The food-entrained prolactin and cortisol release in late pregnancy and prolactinoma patients. *Journal of Clinical Endocrinology & Metabolism, 54,* 1109–1112. http://dx.doi.org/10.1210/jcem-54-6-1109

Quillin, S. I. M. (1997). Infant and mother sleeping patterns during 4th postpartum week. *Issues in Comprehensive Pediatric Nursing, 20,* 115–123. http://dx.doi.org/10.3109/01460869709026882

Raymond, I., Nielsen, T. A., Lavigne, G., Manzini, C., & Choinière, M. (2001). Quality of sleep and its daily relationship to pain intensity in hospitalized adult burn patients. *Pain, 92,* 381–388. http://dx.doi.org/10.1016/S0304-3959(01)00282-2

Rechtschaffen, A., & Kales, A. (1968). *A manual of standardized terminology, techniques and scoring system for sleep stages of human subjects* (NIH Publication No. 204). Washington, DC: Government Printing Office.

Redeker, N. S. (2008). Challenges and opportunities associated with studying sleep in critically ill adults. *AACN Advanced Critical Care, 19,* 178–185. http://dx.doi.org/10.1097/01.AACN.0000318121.49136.89

Redeker, N. S., Hedges, C., & Booker, K. J. (2011). Sleep in adult acute and critical care settings. In N. S. Redeker & G. P. McEnany (Eds.), *Sleep disorders and sleep promotion in nursing practice* (pp. 321–338). New York, NY: Springer.

Redeker, N. S., & McEnany, G. P. (2011). The nature of sleep disorders and their impact. In N. S. Redeker & G. P. McEnany (Eds.), *Sleep disorders and sleep promotion in nursing practice* (pp. 43–52). New York, NY: Springer.

Redeker, N. S., Ruggiero, J. S., & Hedges, C. (2004a). Patterns and predictors of sleep disturbance after cardiac surgery. *Research in Nursing and Health, 27,* 217–224. http://dx.doi.org/10.1002/nur.20023

Redeker, N. S., Ruggerio, J. S, & Hedges, C. (2004b). Sleep is related to physical function and emotional well-being after cardiac surgery. *Nursing Research, 53,* 154–162. http://dx.doi.org/10.1097/00006199-200405000-00002

Redeker, N. S., Tamburri, L., & Howland, C. L. (1998). Prehospital correlates of sleep in patients hospitalized with cardiac disease. *Research in Nursing and Health, 21,* 27–37. http://dx.doi.org/10.1002/(SICI)1098-240X(199802)21:1<27::AID-NUR4>3.0.CO;2-V

Redwine, L., Dang, J., Hall, M., & Irwin, M. (2003). Disordered sleep, nocturnal cytokines, and immunity in alcoholics. *Psychosomatic Medicine, 65,* 75–85. http://dx.doi.org/10.1097/01.PSY.0000038943.33335.D2

Reid, E. (2001). Factors affecting how patients sleep in the hospital environment. *British Journal of Nursing, 10,* 912–915. Retrieved from http://www.britishjournalofnursing.com

Reynolds, C. F., III, Serody, L., Okun, M. L., Hall, M., Houck, P. R., Patrick, S., . . . Nofzinger, E. A. (2010). Protecting sleep, promoting health in later life: A randomized clinical trial. *Psychosomatic Medicine, 72,* 178–186. http://dx.doi.org/10.1097/PSY.0b013e3181c870a5

Richards, K.C., & Bairnsfather, L. (1988). A description of night sleep patterns in the critical care unit. *Heart and Lung, 17,* 35–42. Retrieved from http://www.heartandlung.org

Richardson, A., Crow, W., Coghill, E., & Turnock, C. (2007). A comparison of sleep assessment tools by nurses and patients in critical care. *Journal of Clinical Nursing, 16,* 1660–1668. http://dx.doi.org/10.1111/j.1365-2702.2005.01546.x

Richardson, P. (1996). Sleep in pregnancy. *Holistic Nursing Practice, 10*(4), 20–26. Retrieved from http://journals.lww.com/hnpjournal/

Richter, M. S., Parkes, C., & Chaw-Kant, J. (2007). Listening to the voices of hospitalized high-risk antepartum patients. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 36,* 313–318. http://dx.doi.org/10.1111/j.1552-6909.2007.00159.x

Rigg, L. A., & Yen, S. S. C. (1977).Multiphasic prolactin secretion during parturition in human subjects. *American Journal of Obstetrics & Gynecology, 128,* 215–218. Retrieved from http://www.ajog.org/

Roehrs, T. A. (Ed.). (2011). *Medications and sleep, an issue of sleep medicine clinics.* Philadelphia, PA: Saunders.

Roehrs, T. A., & Roth, T. (2012, September). *The effects of medications on sleep quality and sleep architecture.* Retrieved from

http://www.uptodate.com/contents/the-effects-of-medications-on-sleep-quality-and-sleep-architecture

Romero, R., Espinoza, J., Gonçalves, L. F., Kusanovic, J. P., Friel, L. A., & Nien, J. K. (2006). Inflammation in preterm and term labour and delivery. *Seminars in Fetal and Neonatal Medicine, 11,* 317–326. http://dx.doi.org/10.1016/j.siny.2006.05.001

Rosen, E. A. A. (2009). *Sleep characteristics in breastfeeding and formula-feeding mothers* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (AAT No. 3389404)

Rychnovsky, J., & Hunter, L. P. (2009). The relationship between sleep characteristics and fatigue in healthy postpartum women. *Women's Health Issues, 19,* 38–44. http://dx.doi.org/10.1016/j.whi.2008.07.015

Saadawy, I. M., Kaki, A. M., Abd El Latif, A. A., Abd-Elmaksoud, A. M., & Tolba, O. M. (2010). Lidocaine vs. magnesium: Effect on analgesia after a laparoscopic cholecystectomy. *Acta Anaesthesiologica Scandinavica, 54,* 549–556. http://dx.doi.org/10.1111/j.1399-6576.2009.02165.x

Sable, M. R. & Herman, A. A. (1997). The relationship between prenatal health behavior advice and low birth weight. *Public Health Reports, 112,* 332–339. Retrieved from http://www.publichealthreports.org

Sahota, P. K., Jain, S. S., & Dhand, R. (2003). Sleep disorders in pregnancy. *Current Opinion in Pulmonary Medicine, 9,* 477–483. http://dx.doi.org/10.1097/00063198-200311000-00005

Sánchez-Ortuño, M. M., Edinger, J. D., Means, M. K., & Almirall, D. (2010). Home is where sleep is: An ecological approach to test the validity of actigraphy for the assessment of insomnia. *Journal of Clinical Sleep Medicine, 6,* 21–29. Retrieved from http://www.aasmnet.org/jcsm/

Santiago, J. R., Nolledo, M. S., Kinzler, W., & Santiago, T. V. (2001).Sleep and sleep disorders in pregnancy. *Annuals of Internal Medicine, 134,* 396–408. http://dx.doi.org/10.7326/0003-4819-134-5-200103060-00012

Sareli, A. E., & Schwab, R. J. (2008). The sleep-friendly ICU. *Critical Care Clinics, 24,* 613–626. http://dx.doi.org/10.1016/j.ccc.2008.02.007

Schorr, S. J., Chawla, A., Devidas, M., Sullivan, C. A., Naef, R. W., III, & Morrison, J. C. (1998). Sleep patterns in pregnancy: A longitudinal study of polysomnography recordings during pregnancy. *Journal of Perinatology, 6,* 427–430. Retrieved from http://www.nature.com/jp/

Schroeder, C. A. (1996). Women's experience of bed rest in high-risk pregnancy. *Image: Journal of Nursing Scholarship, 28,* 253–258. http://dx.doi.org/10.1111/j.1547-5069.1996.tb00360.x

Schweiger, M. S. (1972). Sleep disturbance in pregnancy. A subjective survey. *American Journal of Obstetrics & Gynecology, 114,* 879–882. Retrieved from http://www.ajog.org

Serón-Ferré, M., & Ducsay, C. A., &Valenzuela, G. J. (1993). Circadian rhythms during pregnancy. *Endocrinology Review, 14,* 594–609. http://dx.doi.org/10.1210/edrv-14-5-594

Shamsuzzaman, A. S., Winnicki, M., Lanfranchi, P., Wolk, R., Kara, T., Accurso, V., & Somers, V. K. (2002). Elevated C-reactive protein in patients with obstructive sleep apnea. *Circulation, 105,* 2462–2464. http://dx.doi.org/10.1161/01.CIR.0000018948.95175.03

Shinkoda, H., Matsumoto, K., & Park, Y. M. (1999). Changes in sleep-wake cycle during the period from late pregnancy to puerperium identified from the wrist actigraph and sleep logs. *Psychiatry and Clinical Neurosciences, 53,* 133–135. http://dx.doi.org/10.1046/j.1440-1819.1999.00518.x

Shulz-Stübner, S., Wettmann, G., Reyle-Hahn, S. M., & Rossaint, R. (2001). Magnesium as part of balanced general anaesthesia with propofol, remifentanil and mivacurium: A double-blind, randomized prospective study in 50 patients. *European Journal of Anaesthesiology, 18,* 723–729. http://dx.doi.org/10.1046/j.1365-2346.2001.00921.x

Signal, T. L., Gander, P. H., Sangalli, M. R., Travier, N., Firestone, R. T., & Tuohy, J. F. (2007). Sleep duration and quality in healthy nulliparous and

multiparous women across pregnancy and post-partum. *Australian and New Zealand Journal of Obstetrics and Gynaecology, 41,* 16–22. http://dx.doi.org/10.1111/j.1479-828X.2006.00672.x

Simhan, H. N., & Caritis, S. (2013, June). *Inhibition of acute preterm labor*. Retrieved from http://www.uptodate.com/contents/inhibition-of-acute-preterm-labor

Skouteris, H., Wertheim, E. H., Germano, C., Paxton, S. J., & Milgrom, J. (2009). Assessing sleep during pregnancy: A study across two time points examining the Pittsburgh Sleep Quality Index and associations with depressive symptoms. *Women's Health Issues, 19,* 45–51. http://dx.doi.org/10.1016/j.whi.2008.10.004

Soehren, P. (1995). Stressors perceived by cardiac surgical patients in the intensive care unit. *American Journal of Critical Care, 4,* 71–76. Retrieved from http://ajcc.aacnjournals.org

Southwell, M. T., & Wistow, G. (1995). Sleep in hospitals at night: Are patients' needs being met? *Journal of Advanced Nursing, 21,* 1101–1109. http://dx.doi.org/10.1046/j.1365-2648.1995.21061101.x

Spiegel, K., Luthringer, R., Follenius, M., Schaltenbrand, N., Macher, J. P., Muzet, A., & Brandenberger, G. (1995). Temporal relationship between prolactin secretion and slow-wave electroencephalic activity during sleep. *Sleep, 18,* 543–548. Retrieved from http://www.journalsleep.org

Sprague, A. E. (2004). The evolution of bed rest as a clinical intervention. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 33,* 542–549. http://dx.doi.org/10.1177/0884217504268523

Stinton, C. M. & McCarley, R. W. (2000). Neuroanatomical and neurophysiological aspects of sleep: Basic science and clinical relevance. *Seminars in Clinical Neuropsychiatry, 5*(1), 6–19. Retrieved from EBSCOhost database.

Stone, K. L., & Ancoli-Israel, S. (2011). Actigraphy. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (5th ed., pp. 1668–1675). Philadelphia, PA: Elsevier Saunders.

Strange, L. B., Parker, K. P., Moor, M. L., Strickland, O. L., & Bliwise, D. L. (2009). Disturbed sleep and preterm birth: A potential relationship? *Clinical & Experimental Obstetrics & Gynecology, 36,* 166–168. Retrieved from http://www.irog.net/en-CA/

Stremler, R., & Wolfson, A. R. (2011). The postpartum period. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (5th ed., pp. 1587–1591). Philadelphia, PA: Elsevier Saunders.

Studor Group. (2005). *Give your nurses back 166 hours every month*. Retrieved from http://www.studergroup.com/newsletter/Vol1_Issue3/vol1_i3_sec1.htm

Suziki, S., Dennerstein, L., Greenwood, K. M., Armstrong, S. M., Sano, T., & Satohisa, E. (1993).Melatonin and hormonal changes in disturbed sleep during late pregnancy. *Journal of Pineal Research, 15,* 191–198. http://dx.doi.org/10.1111/j.1600-079X.1993.tb00904.x

Swain, A. M., O'Hara, M. W., Starr, K. R., & Gorman, L. L. (1997). A perspective study of sleep, mood, and cognitive function in postpartum and nonpostpartum women. *Obstetrics and Gynecology, 90,* 381–386. http://dx.doi.org/10.1016/S0029-7844(97)89252-6

Tamaki, M., Nittono, H., Hayashi, M., & Hori, T. (2005). Examination of the first-night effect during sleep-onset period. *Sleep, 28,* 195–202. Retrieved from http://www.journalsleep.org

Teng, F. L, See, L. C., Cheng, P. J., & Lee, J. T. (2007). The quality of sleep and its associated factors in the puerperium women. *Chang Gung Nursing, 18,* 449–510. Retrieved from EBSCOhost database.

Thomas, K. A., & Foreman, S. W. (2005). Infant sleep and feeding pattern: Effects on maternal sleep. *Journal of Midwifery and Women's Health, 50,* 399–404. http://dx.doi.org/10.1016/j.jmwh.2005.04.010

Topf, M. (1992). Effects of personal control over hospital noise on sleep. *Research in Nursing and Health, 15,* 19–26. http://dx.doi.org/10.1002/nur.4770150105

Topf, M., & Davis, J. E. (1993). Critical care unit noise and rapid eye movement (REM). *Heart & Lung, 22,* 252–258. Retrieved from http://www.journals.elsevier.com/heart-and-lung-the-journal-of-acute-and-critical-care/

Tranmer, J. E., Minard, J., Fox, L. A., & Rebelo, L. (2003). The sleep experience of medical and surgical patients. *Clinical Nursing Research, 12,* 159–173. http://dx.doi.org/10.1177/1054773803012002004

University of Pittsburgh Sleep Medicine Institute. (2013, January). *Instruments: Pittsburgh Sleep Quality Index (PSQI).* Retrieved from http://www.sleep.pitt.edu/content.asp?id=1484&subid=2316

U.S. Department of Health & Human Services. (n.d.). *Informed consent—FAQs:* Retrieved September 18, 2012, from http://answers.hhs.gov/ohrp/categories/1566

Vgontzas, A. N., Zoumakis, E., Bixler, E. O., Lin, H. M., Follett, H, Kales, A., & Chrousos, G. P. (2004). Adverse effects of modest sleep restriction on sleepiness, performance, and inflammatory cytokines. *Journal of Clinical Endocrinology & Metabolism, 89,* 2119–2126. http://dx.doi.org/10.1210/jc.2003-031562

Vogel, I., Thorsen, P., Curry, A., Sandager, P., & Uldbjerg, N. (2005). Biomarkers for the prediction of preterm delivery. *Acta Obstetricia et*

Gynecologica Scandinavica, 84, 516–525. http://dx.doi.org/10.1080/j.0001-6349.2005.00771.x

Von Känel, R., Dimsdale, J. E., Ancoli-Israel, S., Mills, P. J., Patterson, T. L., McKibbin, C. L., . . . Grant, I. (2006). Poor sleep is associated with higher plasma proinflammatory cytokine interleukin-6 and procoagulant marker fibrin D-dimer in older caregivers of people with Alzheimer's disease. *Journal of the American Geriatrics Society, 54,* 431–437. http://dx.doi.org/10.1111/j.1532-5415.2005.00642.x

Webb, W. B. (1974). Sleep as an adaptive process. *Perceptive Motor Skills, 38,* 1023–1027. http://dx.doi.org/10.2466/pms.1974.38.3c.1023

Webster, R. A., & Thompson, D. R. (1986). Sleep in hospital. *Journal of Advanced Nursing, 11,* 447–457. http://dx.doi.org/10.1111/j.1365-2648.1986.tb01272.x

Weitzman, E. D., Czeisler, C. A., Zimmerman, J. C., & Ronda, J. M. (1980). Timing of REM and stages 3 + 4 sleep during temporal isolation in man. *Sleep, 2,* 391–407. Retrieved from http://www.journalsleep.org

Wilder-Smith, C. H., Knøpfli, R., & Wilder-Smith, O. G. (1997). Perioperative magnesium infusion and postoperative pain. *Acta Anaesthesiologica Scandinavica, 41,* 1023–1027. http://dx.doi.org/10.1111/j.1399-6576.1997.tb04830.x

Williams, L., Morrow, B., Shulman, H., Stephens, R., D'Angelo, D., & Fowler, C. I. (2009). *2002 PRAMS surveillance report: Multistate exhibits hospitalizations for pregnancy-related complications.* Atlanta, GA: U.S. Department of Health and Human Services, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention.

Wilson, V. S. (1987). Identification of stressors related to patients' psychologic response to the surgical intensive care unit. *Heart and Lung, 16,* 267–273. Retrieved from http://www.journals.elsevier.com/heart-and-lung-the-journal-of-acute-and-critical-care

Wolfson, A. R., Crowley, S. J., Anwer, U., & Bassett, J. L. (2003). Changes in sleep patterns and depressive symptoms in first-time mothers: Last trimester to one-year postpartum. *Behavioral Sleep Medicine, 1,* 54–67. http://dx.doi.org/10.1207/S15402010BSM0101_6

Wolfson, A. R., & Lee, K. A. (2005). Pregnancy and the postpartum period. In M. H. Kryger, T. Roth, & W. C. Dement (Eds.), *Principles and practice of sleep medicine* (4th ed., pp. 1278–1286). Philadelphia, PA: Elsevier Saunders.

Yamazaki, A., Lee, K. A., Kennedy, H. P., & Weiss, S. J. (2005). Sleep-wake cycles, social rhythms and sleeping arrangement during Japanese

childbearing transition. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 34,* 342–348. http://dx.doi.org/10.1177/0884217505276156

Yinnon, A. M., Ilan, Y., Tadmor, B., Altarescu, G., & Hershko, C. (1992). Quality of sleep in the medical department. *British Journal of Clinical Practice, 46,* 88–91. Retrieved from http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1742-1241/issues

Young, J. S., Bourgeois, J. A., Hilty, D. M., & Hardin, K. A. (2008). Sleep in hospitalized medical patients, part 1: Factors affecting sleep. *Journal of Hospital Medicine, 3,* 473–482. http://dx.doi.org/10.1002/jhm.372

Zulley, J. (1980). Distribution of REM sleep in entrained 24 hour and free-running sleep-wake cycles. *Sleep, 2,* 377–389. Retrieved from http://www.journalsleep.org

Zulley, J., Wever, R., & Aschoff, J. (1981). The dependence of onset and duration of sleep on the circadian rhythm of rectal temperature. *Pflugers Archives, 39,* 314–318. Retrieved from http://www.springer.com/biomed/human+physiology/journal/424

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