

# A Selective Review of Maternal Sleep Characteristics in the Postpartum Period

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## ABSTRACT

**Objective:** To determine the current knowledge of postpartum womens' sleep patterns, sleep disturbances, consequences of sleep disturbances, and known strategies for prevention in order to provide best practice recommendations for health care providers.

**Data Sources:** A literature search from 1969 through February 2008 was conducted using the CINHL, Index of Allied Health Literature, Ovid, PsycINFO, and PubMed electronic databases in addition to reference lists from selected articles and other key references. Search terms included sleep, postpartum, sleep deprivation, and sleep disturbance.

**Study Selection:** A critical review of all relevant articles from the data sources was conducted with attention to the needs of postpartum womens' sleep and implications for health care providers.

**Data Extraction:** Literature was reviewed and organized into groups with similar characteristics.

**Data Synthesis:** An integrative review of the literature summarized the current state of research related to sleep alterations in postpartum women.

**Conclusions:** Postpartum women experience altered sleep patterns that may lead to sleep disturbances. The most common reasons for sleep disturbances are related to newborn sleep and feeding patterns. Although present, the relationships among sleep disturbance, fatigue, and depression in postpartum women lack clarity due to their ambiguous definitions and the variety of the studies conducted. Providers should encourage prenatal education that assists the couple in developing strategies for decreasing postpartum sleep deprivation. Alterations of in-hospital care and home care should be incorporated to improve the new family's sleep patterns.

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From birth to 6 months postpartum is an especially stressful and sensitive time for mothers as they focus on incorporating a new member into the family structure. Lack of sleep, sleep deprivation, and fatigue are commonly expressed concerns as women adapt to the new demands of motherhood (Dennis & Ross, 2005; Gay, Lee, & Yee, 2004; Goyal, Gay, & Lee, 2007; Horiuchi & Nishihara, 1999; Karacan, Williams, Hirsch, McCaulley, & Heine, 1969; Kennedy, Gardiner, Gay, & Lee, 2007; Lee, Zaffke, & McEnany, 2000; Matsumoto, Shinkoda, Kang, & Seo, 2003; Shinkoda, Matsumoto, & Park, 1999; Signal et al., 2007; Swain, O'Hara, Starr, & Gorman, 1997). Sleep disturbances (altered maternal sleep patterns), especially in the early months, are associated with nighttime newborn feeding, care, and sleeping patterns (Dennis & Ross; Doan, Gardiner, Gay, & Lee, 2007; Horiuchi & Nishihara; Shinkoda et al.; Thomas & Foreman, 2005).

It has been difficult to study postpartum maternal sleep behavior for several reasons. First, objective sleep measures such as polysomnography (PSG) and actigraphy can be intrusive, actually contributing to sleep disturbances for new mothers. Second, subjective measures such as daily sleep diaries and sleep logs require daily consistency in tracking sleep behavior and consume time that a mother could be using for more productive postpartum tasks.

Studies of postpartum sleep deprivation, fatigue, and depression are difficult to synthesize or compare due to different methodologies; varied data collection methods, including self-report sleep diaries/logs, questionnaires, actigraphy, and PSG; small sample sizes; variance in time of data collection during the postpartum period; and failure to control for independent variables. This has made findings from sleep research studies hard to translate

into practice for health care providers or to provide pragmatic solutions for parents.

This article reviews what is currently known about maternal sleep during the early parenting experience in the postpartum period. The authors first discuss normal sleep. Maternal postpartum sleep studies are then reviewed, followed by causes for sleep disturbances and the known relationships among sleep, fatigue, and depression. Research studies that have been conducted on strategies to improve sleep quality are presented in addition to nursing strategies to assist mothers with improved sleep quality before birth, in the hospital, and at home. Recommendations for future research are discussed. The Appendix A provides definitions of sleep terminology.

Review articles were discovered through an English-only literature search using the Cumulative Index of Allied Health Literature, Ovid, PsycINFO, and PubMed electronic databases in addition to reference lists from selected articles and other key references. The time period for the search was from January 1969 through February 2008. Search terms included sleep, postpartum, sleep deprivation, and sleep disturbance. All articles were reviewed by the authors. Consensus on articles to include was based on the articles' relevancy, currency, and ability to contribute to the breadth and depth of knowledge concerning postpartum maternal sleep.

## Normal Sleep Patterns

"Normal" adults average 7 to 9 hours of sleep per day and repeat the wake-sleep pattern on an approximate 24-hour cycle. Physiologically, sleep is divided into two phases: rapid eye movement (REM) sleep, during which dreams take place, and nonrapid eye movement (NREM) sleep, which is further divided into four stages. Stage 1, in which an individual can easily be awakened, represents the transition from wakefulness to sleep. Stage 2 represents the first true sleep stage. Stages 3 and 4, referred to as *delta sleep*, are the deepest form of sleep, characterized by difficulty in awakening an individual during these stages. During sleep, individuals cycle through one complete REM and NREM stage approximately every 90 minutes, with approximately five cycles in an 8-hour period (Chiong, 2008).

## Sleep In Postpartum Women

### Studies Using Control Participants

Quillin (1997) reported that women at 1 month postpartum slept a total average of 7.53 hours per 24-hour period, of which 6.15 were nocturnal com-

pared with the nonpregnant average of 8.43 hours average total. At 3 to 4 months postpartum Cottrell and Karraker (2002) reported women sleeping an average of 6.75 hours per night, whereas at 4 to 10 weeks, Thomas and Foreman (2005) reported a mean total sleep time of 7.18 hours per night. A decrease in total sleep from 7.56 hours in the third trimester to 6.34 hours 4 to 5 months postpartum was found among a convenience sample of 101 Japanese women using sleep logs for documentation (Yamazaki, Lee, Kennedy, & Weiss, 2005).

Karacan et al. (1969) were the first to examine postpartum maternal sleep awakenings and NREM-REM sleep characteristics. They documented differences in 10 postpartum women 3 to 4 days postbirth compared with nonpregnant and pregnant control participants. The study group contained more sleep awakenings, an increased amount of Stage 0 sleep, a reduction in Stage 4 sleep, and a reduction in REM sleep. Participants were tested by electroencephalographic recordings in a hospital setting, with omission of the standard 2 a.m. newborn feeding.

In 2003, Matsumoto et al. found that women's total sleep time, sleep efficiency, and circadian amplitude decreased and that wake after sleep onset (WASO) in the early postpartum period increased. Matsumoto et al. also noted that women increased their length of daytime naps to compensate for nocturnal sleep deprivation. All variables improved over time; however, at 15 weeks postpartum most had still not returned to the level of the nonpregnant control group. Circadian amplitude was considered restored at Week 10 because the WASO and length of daytime naps slowly decreased. Both sleep logs and actigraphy were used for data collection.

In 2004 Gay et al. used actigraphy and self-report questionnaires to study 72 postpartum couples during the first month postpartum. They reported that women had increased sleep disruption compared with the last month of pregnancy that was primarily due to less nocturnal sleep, more daytime napping, and more WASO periods. Three earlier studies with small samples, one with PSG (Horiuchi, 1994) and two with actigraphy and sleep logs (Kang, Matsumoto, Shinkoda, Mishima, & Seo, 2002; Shinkoda et al., 1999) confirmed decreased sleep efficiency in the early postpartum period compared with late pregnancy, with improved postpartal sleep efficiency over time.

Using sleep diaries, Swain et al. (1997) confirmed that postpartum women, compared with control

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## First-time mothers experienced a greater initial decrease in sleep efficiency than multiparas.

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participants, had the most disturbed sleep patterns during the first week postpartum, with improvement by Week 3, although sleep patterns still did not equal the control patterns. Postpartum women experienced more nocturnal awakenings, stayed awake longer, slept later in the morning, and napped more during the day than control participants. Findings also suggested that sleep loss might affect new mothers' memory and psychomotor task performance.

Most recently, Signal et al. (2007) studied 19 women with wrist actigraphs to record sleep start and stop times along with a written sleep diary at 1 and 6 weeks postpartum. The most severe sleep disturbance occurred during the first week postpartum, with the least sleep, the most sleep episodes and variability in day-to-day sleep, and more daytime napping. Although not the same as prepregnancy, sleep variables again were improved by 6 weeks postpartum.

### Studies Without Control Participants

Two studies with small sample sizes demonstrated similar results concerning maternal sleep patterns. One study used sleep logs from 5 to 12 weeks (Horiuchi & Nishihara, 1999) and one used PSG from 9 to 12 weeks (Nishihara, Horiuchi, & Uchida, 1997). Both studies found that nocturnal wake time and percent of wake time gradually decreased over time as newborns developed a circadian sleep-wake rhythm. Both research studies, in addition to a third (Nishihara & Horiuchi, 1998) used PSG data from 1 to 6 weeks postpartum to identify two types of sleep patterns, interrupted and uninterrupted, with the uninterrupted pattern increasing with postpartum length.

### Effects of Parity, Feeding Method, and Type of Birth

Tribotti, Lyons, Blackburn, Stein, and Withers' (1988) survey of 237 postpartum women reported the most prevalent sleep disturbances (66%) in the first 3 months postpartum occurred for primiparas; those with Cesarean sections had the most sleep disturbance symptomology. Walters and Lee (1996) and Signal et al. (2007) reported decreased sleep efficiency to be more common in primiparas than multiparas. Lee et al. (2000) studied 29 postpartum mothers in a home environment at 1 and 3 months

with PSG. All mothers breastfed and supplemented with bottles. Sleep disturbances were greater in the first month. First-time mothers experienced a greater initial decrease in sleep efficiency than multiparas. All mothers experienced disturbed sleep patterns from nocturnal awakenings for feeding newborns at 1 month, with less total sleep time and decreased sleep efficiency compared with third trimester pregnant values. By 3 months, first-time and multiparas sleep patterns were similar, with a return to prepregnant deep sleep and total sleep time, although all continued to experience a decrease in sleep efficiency. Deep sleep took precedence over REM sleep when trying to recover from sleep deprivation.

Research remains murky concerning sleep patterns in breastfeeding versus bottle-feeding mothers. Quillin (1997) found that breastfeeding mothers had more nighttime awakenings and sleep fragmentation, but similar amounts of sleep because of napping as bottle-feeding mothers in 24-hour sleep periods. More recently, Doan et al.'s (2007) randomized clinical trial of one hundred and thirty-three 3 months postpartum couples found that those women who breastfed during the evening and throughout the night averaged 40 to 45 minutes more sleep than bottle-feeding mothers. In addition, those mothers who used formula for their newborns self-reported more sleep disturbances. Data were collected using self-report patient diaries, wrist actigraphy, and Lee's (1992) 21-item general Sleep Disturbance Scale (Cronbach's  $\alpha = .82$ ).

Studies have demonstrated significant changes in sleep patterns of women in the early postpartum period with common characteristics for all mothers, especially in the first month, being a decrease in sleep efficiency, a decrease in total sleep time and an increase in WASO. Primiparas and mothers who give birth via Cesarean section appear to be at greater risk for sleep disturbances.

## Causes of Postpartum Sleep Disturbances

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### Hormonal Changes

Hormonal changes that occur in the postpartum period have been implicated in women's postpartum sleep disturbances. The decline of progesterone, with its sedative properties, in the immediate postpartum period (Albrecht & Pepe, 1990; Lee et al. 2000; Moline, Broch, Zak, & Gross, 2003; Swain et al., 1997) or changes in melatonin levels

that can affect circadian rhythms within the first 3 months (Parry et al., 2006) may contribute to postpartum sleep disturbances. Nishihara, Horiuchi, Eto, Uchida, and Honda (2004) hypothesized that the increase they discovered in the power spectra of the delta and theta wave frequency ranges (measurement of brain electrical activity waves frequency in Hertz) during postpartum mothers' sleep was related to either a rebound effect from sleep deprivation related to infant care or from prolactin release associated with breastfeeding.

The most common causes of sleep disturbances are directly related to newborn care, specifically sleep and feeding patterns (Dennis & Ross, 2005; Gay et al., 2004; Horiuchi & Nishihara, 1999; Huang, Carter, & Guo, 2004; Shinkoda et al., 1999). Thomas and Foreman (2005) found that infant sleep and feeding patterns dictated maternal sleep patterns. They reported that male newborns caused more sleep disturbance than female newborns. Lentz and Killien (1991) reported that in a hospital setting during the first 48 hours postpartum, the most common reasons for nocturnal awakening were the need to feed the newborn, followed by being awakened by the nurse for procedures such as vital signs, and, last, the need to use the bathroom. Women self-reported better sleep when able to complete a normal 90 minutes sleep cycle. The authors concluded that the hospital was a disruptive environment that did little to restore a women's vitality after childbirth.

### Fatigue and Depression

In early sleep studies of postpartum women, some researchers found little relationship between sleep disruption and fatigue (Troy, 1999; Webster, 1994), whereas others reported positive correlations (Dennis & Ross, 2005; Gay et al., 2004; Kennedy et al., 2007; Lee & Zaffke, 1999; Wambach, 1998). Among other variables, Wambach measured quantity and quality of sleep using the Verran Snyder-Halpern Sleep Scale (Snyder-Halpern & Verran, 1987) and fatigue with two self-report measures in 41 women. Maternal sleep disturbance positively correlated with fatigue at 3 days, 3, 6, and 9 weeks postpartum, and maternal sleep effectiveness correlated with fatigue at 3 and 6 weeks postpartum. Lee and Zaffke found that fragmented sleep correlated with fatigue 3 months after birth. Trained scorers analyzed sleep tapes, with established interrater reliability that was blind to the study's protocol.

Kennedy et al. (2007) used audiotaped, semistructured interviews of 20 postpartum to learn more

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about sleep patterns. Mothers who reported significant sleep disturbances also reported morning fatigue. Gay et al. (2004) studied 72 couples using wrist actigraphy and questionnaires during the last month of pregnancy and the first month postpartum. Both mothers and fathers reported increased fatigue and sleep disturbances in the postpartum period.

Most recently, Rychnovsky and Hunter's (2009) secondary data analysis examined the relationship between the sleep characteristics of disturbance, supplementation, and effectiveness and postpartum fatigue among 109 healthy, postpartum women. Snyder-Halpern and Verran's (1987) 16-item subjective Sleep Characteristic Scale and a 30-statement fatigue questionnaire (Pugh, Milligan, Parks, Lenz, & Kitzman, 1999) were used to measure fatigue and sleep at 2 days, 2 and 6 weeks postpartum. At all three points of measurement, fatigue had a higher correlation with sleep disturbance, indicating that higher levels of fatigue are associated with more sleep disturbance. No association was found between fatigue and sleep supplementation. Levels of fatigue had a negative correlation with sleep effectiveness at all measurement points, 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.

In a large sample of 505 women who were 8 weeks or less postpartum and who had completed questionnaires, Dennis and Ross (2005) found an association between maternal sleep deprivation of less than 6 hours in a 24-hour period, poor infant sleep patterns, and self-reported fatigue and new-onset depression.

Using the Pittsburgh Sleep Quality Index Questionnaire (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) with 163 women at 3 weeks postpartum, Huang et al. (2004) discovered a relationship between poor sleep and depression. Depressed mothers identified four significant sleep-related factors: sleep disturbances, daytime dysfunctions, decreased sleep duration, and a perception that infant care performance was affected by daytime sleepiness. Ugarriza (2002) interviewed postpartum women with depression and found that lack of

sleep was just one of many factors reported by women that contributed to depression.

In a longitudinal descriptive study, Goyal et al. (2007) followed 124 women who completed a questionnaire on sleep and depressive symptoms. Questionnaires were completed in the third trimester and at 1, 2, and 3 months postpartum. Interestingly, this sample also included a subset of women who were already known to have depression. Women with symptoms of depression at 3 months postpartum reported significantly greater sleep disturbance, trouble falling asleep, waking earlier, and a higher frequency of daytime sleepiness. Women with noted depressive symptoms in the third trimester continued to have more sleep disturbances at 3 months postpartum than women who did not report depression.

In a critical review, Ross, Murray, and Steiner (2005) reported that there was little evidence to suggest that late-pregnancy, intrapartum, or early postpartum sleep loss was associated with "postpartum blues." Despite numerous studies linking postpartum sleep disturbance, fatigue, and depression, Ross et al. reported a lack of clarity concerning their relationships. In particular, limitations to maternal sleep studies are that inadequate sleep, sleep disturbances, sleep deprivation, and fatigue may also be a symptom of depression (Lee, McEnany, & Zaffke, 2000).

## Treatments and Strategies to Decrease Sleep Deprivation

Although it is evident that many postpartum women suffer from sleep disorders and/or deprivation, few researchers have developed or examined clinical strategies to improve the quality of sleep. It is essential to discover evidence-based interventions and strategies to improve maternal sleep following childbirth.

Quillin and Glenn (2004) examined newborn feeding methods and sleep arrangements with maternal sleep patterns in first-time mothers during the first 4 weeks postpartum. The 33 participants used a self-report sleep instrument. Breastfeeding mothers reported more sleep than bottle-feeding mothers if they coslept with their newborns for any amount of time during the night. The authors suggested that a reduction in sleep loss could occur if mothers were encouraged to cosleep using a safety checklist that included among other items a firm bed or mat on the floor or an infant bed that at-

taches to the side of the bed. Milligan, Flenniken, and Pugh (1996) reported that mothers experienced less fatigue and felt more rested when they breastfed in the side-lying position (cosleep position) instead of sitting up. Study results also supported napping during the day while the infant was asleep.

Stremmler et al. (2006) found that first-time mothers assigned to a behavioral-educational sleep-intervention program had more nighttime sleep and that fewer rated their sleep as a problem compared with the control group. The intervention consisted of a 45-minute, one-to-one meeting with a nurse to provide sleep information and strategies such as maternal relaxation techniques, interpreting newborn cues, and self-consoling measures and general maternal and newborn sleep hygiene. The information provided by the nurse was reinforced in an 11-page educational booklet given to each participant. Maternal encouragement was provided with a weekly phone call during the 6 weeks postpartum. The randomized, controlled study used baseline questionnaires at 1 and 6 weeks, daily sleep diaries, and mother and infant actigraphy at 6 weeks. Mothers in the intervention group experienced more nighttime sleep and fewer ratings of sleep as a problem. Newborns had fewer nighttime awakenings and longer nighttime sleep patterns.

An interesting prophylactic strategy for those postpartum women at high risk for depression has been studied through retrospective chart review and phone contact follow up (Steiner, Fairman, Jansen, & Causey, 2002). Women at risk were provided longer hospital stays of up to 5 days, private rooms, and rooming out at night, with breastfeeding babies provided breast milk that had been pumped during the day. Benzodiazepine by prescription was also offered to the mother as needed. Participants demonstrated less depression via the Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987) and fewer psychiatric admissions.

Although not evidence based, some authors have advocated decreased visiting hours, the use of demand feedings, rooming out if desired, and longer hospital stays to decrease sleep disturbance in the early postpartum period (Errante, 1985; Gardner, 1991). At-home strategies proposed by Huang et al. (2004) included keeping a newborn sleep log so a mother could "guesstimate" quiet times for napping, moderate physical activity during the day, and the creation of an environment conducive to sleep.

## Nursing Implications

### Prenatal Education

Mercer (2004) stressed that “becoming a mother” begins during pregnancy, as women seek information on how to care for themselves and their baby before, during, and after birth. Few if any researchers have examined the use or effect of prenatal anticipatory educational guidance by health care providers and childbirth educators to mitigate sleep disturbances in the postpartum period.

Nichols and Humenick (2000) stated that women are unprepared for the demands of parenting, including fatigue, lack of sleep, and need for support in the postpartum period. They suggested inviting relatively new parents with newborns to childbirth education classes to provide personalized, lived “action” stories about the sleep and fatigue that new parents experience and its effect on parenting, work schedules, and interpersonal relationships. In addition, prenatal education should emphasize information on improper and proper sleep hygiene that has proven effective in the general population: no television, vigorous exercise, stimulants, or heavy meals close to bedtime and the use of sleep relaxation techniques, lavender spray, and white noise or soothing music to help the mother drift off to sleep. Parents can also be asked to identify their own sleep hygiene strategies that have already proven successful. Kennedy et al. (2007) offered practical anticipatory guidance such as understanding the restorative and necessary function of sleep, the practice of alcohol avoidance, and accepting outside offers of infant care to allow for uninterrupted sleep.

Couples can be encouraged to develop proactive strategies based on their own individual circumstances. Discussions before birth such as who will care for the newborn during evening and nighttime hours; who works when, how much, and how often; ways to conserve energy; and realistic expectations of household chores should be addressed. Of utmost importance is a discussion of who, if anyone, will assist parents in the early postpartum period. Invariably there will be family members and friends who are truly supportive and those who are there for social visitation only. The later visitor may be an unneeded distraction, cause of anxiety, and rob parents of energy and sleep time needed for the transition to parenthood.

### Postpartum Sleep While Hospitalized

Common sense dictates that, for low-risk mothers who give birth in a hospital setting, this intimate time

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**Well postpartum women should be able to forego nighttime interruptions by nurses for vital signs and other unnecessary reasons.**

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of bonding and new transitions should be treated with respect for the becoming-a-mother process and not as an illness. Frequent causes for in-hospital sleep disturbance are institutionally based (Lentz & Killien, 1991). Well postpartum women should be able to forego nighttime interruptions by nurses for vital signs and other unnecessary reasons. Instead, nursing time can be better used to assist with breastfeeding or to provide “newborn watching” to decrease maternal anxiety and stress while new mothers are sleeping. Private rooms and bathrooms should be a minimum mandated provision for all new hospitalized parents. Other institutional requirements such as signing of birth certificates, health care provider visits, as well as education and discharge instructions should be bundled work tasks to minimize interruption of parent-newborn iterations and rest times. Pain from operative incisions, breast pain, and common discomforts should be treated aggressively. Nurses can monitor visitation on the basis of the family's preferences, and many hospitals now provide afternoon parent-baby quiet times that encourage restful atmospheres.

### Sleep at Home

Finding someone to assist with nighttime awakenings of the infant (excluding breastfeeding) will decrease sleep disturbance, leading to a decrease in fatigue. Postpartum mothers should also be encouraged to go to bed when their baby does at nighttime and to not stay up to finish household chores or other domestic duties. There is some evidence to suggest that short daytime napping may not be restorative to mothers (Rychnovsky & Hunter, 2009). This is because REM restorative sleep occurs in the last stages of the typical 90 minutes sleep cycle, increases over multiple cycles, and is affected by circadian rhythms (Ross et al., 2005). The clustering of household activities during the day and sharing duties may help the mother to conserve energy. A balanced diet and limitation of visitors in the early postpartum period may be helpful. Mothers who are in tune with the infant's sleep-wake cycles should be encouraged to try to lengthen wakeful periods during the day to promote longer nighttime sleep periods (Ricci, 2007).

Mothers may have better sleep when the newborn is allowed to sleep in close proximity (Lee et al., 2000;



Nishihara & Horiuchi, 1998). Mothers experiencing sleep disturbance might benefit from being given "permission" to turn off baby monitors. Discouraging the mother from sleeping on a couch or in a high-traffic, noisy area can be other strategies to improve sleep effectiveness.

## Recommendations for Future Research

It is imperative to understand the meaning of sleep characteristics, sleep disturbance, and sleep deprivation for the postpartum woman and her family if nurses are to provide useful and evidence-based strategies to enhance restorative sleep. To do so, nurse researchers first need to use qualitative methodologies to learn the "lived" meaning of sleep experiences for postpartum woman: enough sleep, inadequate sleep, disturbed sleep, sleep deprivation, and strategies that assisted with or did not aid the woman in achieving quality sleep. With these data, nurses can begin to test strategies learned from mothers and family members in larger and varied samples to provide evidence-based interventions that can enhance sleep hygiene.

It is clear that more research is needed to learn the causal relationships among sleep disturbance, depression, and fatigue in postpartum women. Furthermore, nurses must encourage sleep research that examines more independent variables such as type of help available to postpartum mothers, employment outside the home, number and age of other children, sleeping location of mother and infant, the amount of emotional and physical support from significant others, and the structure of the family (i.e., nuclear, extended, consanguineal, matrifocal, single-parent, adoptive, older parents, and grandparents raising grand infants). Last, an underexplored area of concern, maternal stress surrounding early newborn care and becoming a mother, is worthy of additional research in relationship to sleep characteristics.

## Conclusions

In her seminal work on motherhood, Rubin (1961) stated, "If a new mother does not obtain a sufficient amount of sleep, she might develop sleep hunger which can affect her physical and emotional well-being" (p. 684). Postpartum sleep issues and fatigue are an inevitable problem facing postpartum mothers. It is difficult to master the role of becoming a mother with competence if one is unable to recover physically from birth and restore physical equilibrium (Mercer, 2004). Strategies in any postpartum setting that can improve the mother's sleep

effectiveness and reduce sleep disturbance may lead to improved mental and physical well being and to improved enjoyment of motherhood.

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## Appendix. Sleep Terminology Definitions

<p><b>Actigraphy</b></p> <p>The use of a wrist instrument, worn by a sleeping subject, that continuously records motion data during sleep with a battery operated microprocessor that senses motion.</p>	<p><b>Sleep deprivation</b></p> <p>A mental and physical state that arises when restorative sleep over a cumulative period of time has not been attained or has been disturbed/inhibited. Sleep deprivation can cause an inability to concentrate, loss of memory, impaired reaction time and motor skills, and, rarely, hallucinations and erratic behavior</p>
<p><b>Brain wave activity</b></p> <p><i>Alpha waves:</i> EEG wave activity that occurs during quiet wakefulness, such as when the eyes are closed. The frequency of alpha waves is between 8 and 12 Hz. It is indicative of the relaxed wakeful state in humans</p> <p><i>Beta waves:</i> EEG wave activity with a frequency of 13–35 Hz that is typically seen in active, alert, wakefulness</p> <p><i>Delta waves:</i> EEG activity with a frequency less than 4 Hz that occur chiefly in deep sleep Stages 3–4 of non-REM sleep</p> <p><i>Theta waves:</i> EEG wave activity with a frequency of 4–8 Hz that occur in a person who is awake but relaxed and drowsy. Associated with the light sleep Stages 1 and 2 or a person who is awake but relaxed and drowsy</p> <p><i>Delta sleep:</i> Stage(s) of sleep in which EEG delta waves are prevalent or predominant (sleep Stages 3 and 4, respectively). It is regarded as the most restorative time of sleep</p>	<p><b>Sleep disruption</b></p> <p>Any altered sleep pattern. Examples are difficulty falling asleep and difficulty staying asleep</p>
<p><b>NREM sleep</b></p> <p>A state of sleep characterized by four stages that range from light dozing to deep sleep; 75% of sleep is spent in NREM sleep. In Stages 3 and 4 of NREM sleep, there is a decrease in blood pressure, muscle activity, and respiratory rate as the sleeper relaxes</p>	<p><b>Sleep disorders</b></p> <p>Physical and psychological conditions or disturbances of sleep and wakefulness, usually caused by abnormalities that occur during sleep or by abnormalities of specific sleep mechanisms</p>
<p><b>Polysomnogram</b></p> <p>Also called a PSG, sleep study, or sleep test; a noninvasive test that records vital signs and physiological information during a night of sleep. It includes measurements from an electroencephalogram, electro-oculogram, and electromyogram readings from the scalp and face while asleep and plots these variables against time</p>	<p><b>Sleep efficiency</b></p> <p>The proportion of sleep in the period potentially filled by sleep; that is, the ratio of total sleep time in bed</p>
<p><b>REM sleep</b></p> <p>Also known as "paradoxical" sleep, this state of sleep is characterized by REM, muscle paralysis, and irregular breathing, heart rate, and blood pressure. Dreaming takes place during REM sleep</p>	<p><b>Sleep hygiene</b></p> <p>The practice of achieving and maintaining proper habits to promote good sleep</p>
<p><b>Sleep</b></p> <p>A physical and mental resting state in which a person becomes relatively inactive and unaware of his or her environment</p>	<p><b>Sleep stages</b></p> <p><i>Stage 1:</i> The brief, dozing stage of NREM sleep in which a person transitions to very light sleep and can be awakened easily, characterized by low voltage EEG and slow rolling eye movements; 5% of NREM sleep is spent in Stage 1</p> <p><i>Stage 2:</i> The stage of consolidated sleep in NREM sleep characterized by sleep spindles and K-complexes; 45% of NREM sleep is spent in Stage 2</p> <p><i>Stage 3:</i> The stage of deeper sleep in NREM sleep characterized by delta waves interspersed with smaller, faster waves; 12% of NREM sleep is spent in Stage 3</p> <p><i>Stage 4:</i> The stage of very deep sleep in NREM sleep almost exclusively composed of delta waves and the stage in which sleep terrors or sleepwalking may occur; 13% of NREM sleep is spent in Stage 4</p> <p><i>Note.</i> EEG = electroencephalogram; NREM = nonrapid eye movement; REM = rapid eye movement. Based on Chiong (2008) and Talk about Sleep. Information from the Talk about Sleep web site used with permission.</p>