PERINATAL MOOD DISTURBANCES

Despite commonly held beliefs of joy and happiness, women are vulnerable to mood disturbances during the perinatal period. Postpartum blues, or baby blues, is a transient form of moodiness experienced by up to 85% of new mothers 3 to 4 days after delivery, which usually dissipates within a week. A smaller but notable percentage of new mothers experience a major depressive disorder during pregnancy (up to 20%) or the postpartum period (about 12%–16%). Although postpartum blues is generally considered a normal event that does not impair functioning, perinatal depression is a psychiatric condition that requires clinical attention.

The exact causes of postpartum blues and perinatal depression are under ongoing research. Serum levels of many circulating hormones (e.g., estrogen, progesterone, prolactin, thyroid hormones) increase gradually over the course of pregnancy and then decrease precipitously within days of delivery, followed by a slower retreat from extravascular compartments. These changes coincide with the occurrence of perinatal mood disturbances, but neither single nor combined biochemical factors have been identified as direct contributors. Several psychosocial factors have been shown to increase the risk for perinatal mood disturbances, including antenatal anxiety and depressive symptoms, the presence of psychiatric history, marital conflict, lack of social support, and stressful life events.

Sleep disturbance has only recently been studied as a possible contributing factor to perinatal mood disturbances. This article describes the effect of the perinatal period on the sleep of mothers and reviews the literature relating disrupted sleep and perinatal mood disturbances.

SLEEP DURING PREGNANCY AND THE POSTPARTUM PERIOD

Methods of Sleep Measurement

In this literature, sleep has been assessed by a variety of methods, each with advantages and disadvantages. Subjective measurements of sleep...
include self-report questionnaires, rating scales, and sleep diaries and are the most widely used methods in childbearing women. Subjective methods are nonintrusive and easy to administer. They reflect women’s overall perception rather than an accurate assessment of actual sleep.

Objective sleep assessment typically involves polysomnography (PSG) and/or actigraphy. PSG is an electrophysiological study of sleep that collects physiologic information and plots them against time. Although typically conducted in a sleep laboratory, in a perinatal population, PSG is more commonly used in an ambulatory form in a woman’s own home. Although PSG gives detailed assessments of sleep duration and quality, as well as sleep architecture, it is compromised by a relatively higher cost as well as involving an unnatural sleeping environment as a result of equipment discomfort. An actigraph is a watchlike device that estimates sleep duration and quality based on wrist movement. It is capable of continuous measurement of sleep over multiple days or even weeks in participants’ natural environment with minimum intrusion.

Studies have shown differences between self-report, PSG, and actigraphy-measured sleep parameters. For example, self-reported sleep duration has been found to be longer than that measured by actigraphy and PSG during the second and third trimesters, whereas self-reported sleep-onset latency (SOL) was found to be longer than that measured by PSG in both pregnant and nonpregnant women.

**Sleep Characteristics During the Perinatal Period**

Sleep and wake patterns are significantly challenged during the perinatal period. New mothers are exposed to possible chronic sleep disruption and fragmentation during pregnancy, acute sleep deprivation during labor and immediate postpartum periods, as well as chronic partial sleep deprivation and disruption during the first few months after giving birth to the newborn.

**Subjective sleep**

In cross-sectional studies, pregnant women have self-reported poorer sleep than nonpregnant controls. Longitudinal studies provide insight into specific changes in sleep over the perinatal period. For example, in a study of 325 pregnant women with sleep measured by self-report, there was an increase in nighttime awakenings and a decrease in sleep efficiency (SE) beginning in the first trimester and continuing throughout pregnancy. Perceived total sleep time (TST) increased during the first trimester and then slightly decreased during the second trimester, followed by a substantial decrease during late pregnancy. This finding suggests that women perceive their sleep to be disrupted from as early as the first trimester despite an increase in sleep duration. Sleep tends to gradually improve during the postpartum period. In a small study (N = 7), sleep diaries kept continuously from 5 to 12 weeks post partum showed a progressive decrease in wake after sleep onset. The same study also noted that from 9 to 12 weeks post partum, women’s sleep patterns were associated with their reports of infant sleep-wake patterns and feeding practices.

**Objective sleep**

Cross-sectional PSG studies have revealed significant differences in sleep architecture in pregnant women compared with nonpregnant controls. One of the earliest studies compared PSG measures of 7 women in the last month of pregnancy with 9 age-matched nonpregnant controls and found that the pregnant group had longer SOL, more nighttime awakenings, less TST, and less slow wave sleep (SWS). A similar study compared 12 women in the third trimester to 10 nonpregnant controls and found that pregnant women had lower SE largely caused by nighttime awakenings, more stage 1 sleep, and a lower percentage of rapid-eye-movement (REM) sleep; however, no group differences in TST or SWS were found. Longitudinal PSG studies are rare. Lee and colleagues obtained ambulatory PSG-measured sleep in 31 women before pregnancy, at each trimester, and at 1 and 3 months post partum. The TST was the lowest at 1 month post partum, averaging 6.2 hours, followed by the third trimester and prepregnancy baseline, and was the highest during the first trimester, averaging 7.4 hours. SE decreased progressively across pregnancy, from 93% before pregnancy to 81% at 1 month post partum. There was no significant difference in REM sleep over time, but SWS progressively decreased throughout pregnancy. A general improving trend in all aspects of sleep was observed at 3 months post partum, although neither sleep quality nor quantity returned to prepregnancy levels.

Studies using actigraphy have confirmed the PSG finding that nighttime sleep deteriorates progressively throughout pregnancy, particularly during the last weeks of gestation, being the poorest on the night before delivery. A recent actigraphy study of the weeks immediately before and after delivery reported that, although nighttime sleep was significantly disrupted after giving birth, napping significantly increased, resulting in the
TST across 24 hours remaining relatively stable (Fig. 1). Unlike the antenatal period, when naps were most likely to occur during early afternoon, during the first postpartum week, naps were evenly distributed across late morning to early evening (Fig. 2). These findings suggest that immediately after giving birth, sleep was redistributed across 24-hour periods, raising questions as to the restorative value of sleep new mothers obtain. Similar to findings in PSG studies, actigraphy-measured sleep showed an improving trend further into the postpartum period, with reports that at 10 weeks post partum, sleep patterns were similar to that in the third trimester, although sleep quality was still worse than matched controls.14

Factors that Affect Sleep During the Perinatal Period

Several factors contribute to the changes in sleep during the perinatal periods described earlier (see Lee17 for an earlier review).

Physiologic alterations

Elevated levels of progesterone during pregnancy have been associated with increased daytime sleepiness and shorter SOL during the first trimester. Some have also suggested that progesterone might have an inhibitory effect on smooth muscles, leading to increased urinary frequency during early pregnancy.17 Physical discomforts during pregnancy have been widely acknowledged as sleep disrupting.18 These discomforts include increased urination, nausea, tender breasts, headache, vaginal discharge, flatulence, constipation, shortness of breath, backache, and heartburn.17 These symptoms often persist throughout pregnancy with varying degrees of severity and can lead to sleep disruption.

Sleep disorders

Increased prevalence of some sleep disorders during pregnancy has been linked to sleep fragmentation and increased daytime sleepiness among affected women. A study of 502 pregnancies19 reported regular snoring in 23% of the sample, whereas only 4% of the same sample reported regular snoring before pregnancy. Changes in the respiratory system during pregnancy, such as reduced pharyngeal dimensions,20 decreased nasal patency, and increased congestion and rhinitis,21 have been proposed as potential contributors to snoring. The prevalence of restless legs syndrome (RLS) has been observed to increase during pregnancy22 and to resolve rapidly post partum.23 A large cross-sectional study involving approximately 16,000 pregnant women24 found that 15% reported RLS symptoms at 3 to 4 months of gestation, which increased to 23% at term. Iron deficiency and serum folate levels have been investigated as contributing factors.22

Infant behavior

The various needs of the newborn are the main contributing factors to sleep disruptions during the postpartum period. Feeding and caretaking often lead to multiple nighttime awakenings in new parents and more so when temperament of the infant is difficult.25,26 Actigraphy studies have shown that maternal sleep was closely associated with infant sleep/wake behaviors during the first 3 months post partum.10,27 In addition, the number of self-report infant-related nighttime awakenings, but not the self-estimated total wake time, was found to be associated with perceived sleep quality,28 highlighting the role of sleep disruption over reduced TST in perceived sleep quality.

Labor

As would be anticipated, birth-giving, especially nighttime labor, has been associated with acute sleep deprivation throughout delivery and the week immediately afterward. Some studies have reported that caesarean sections were associated with shorter TST and more frequent nighttime awakenings than vaginal deliveries, probably because of discomfort and other factors related to surgical recovery.29

Parity

Parity has not been shown to have a consistent effect on sleep. Some investigators have described multiparas mothers as having less efficient sleep than nulliparas from before pregnancy until 3 months post partum, mainly because of an increased number of brief nocturnal awakenings,30 whereas others31 have observed a greater deterioration in objective sleep and increased number of daytime naps in nulliparas during the third trimester and 1 week post partum. Although no differences have been reported in objective TST, percentage of REM sleep, and percentage of SWS, multiparas tend to initiate SWS quicker than nulliparas.13

SLEEP AND PERINATAL MOOD DISTURBANCES

Changes in sleep during the perinatal period coincide with the occurrence of perinatal mood disturbances. Given the intimate relationship between sleep disturbances and mood in the nonpregnant population,32 several studies have assessed the impact of sleep on mood among new mothers.
Fig. 1. Mean values for sleep variables during the third trimester, the 6 days before delivery, the day of delivery, and the 6 days after delivery. The top panel (A) shows changes in daily number of naps, average nap duration, and total nap time. The middle panel (B) shows changes in nighttime SE and wake after sleep onset. The bottom panel (C) shows changes in total nighttime sleep and total 24-hour sleep. N = 24, \(^a\) \(P<.05\), \(^b\) \(P<.01\), when compared with the third-trimester value using paired sample t tests. (Data from Coo Calcagni S, Bei B, Milgrom J, et al. The relationship between sleep and mood in first-time and experienced mothers. Behav Sleep Med 2012;10:167–79.)
Sleep Measured Subjectively

Most studies that have explored the relationship between sleep and mood during the perinatal period measured sleep subjectively and found poor perceived sleep quality to be more common among women with higher levels of depressive symptoms than nondepressed women during pregnancy.33 A study comparing clinically depressed and nondepressed pregnant women34 found that, although fragmented sleep was more frequently reported by depressed women during mid to late pregnancy overall, both depressed and nondepressed women reported their sleep to be disturbed at 36 weeks’ gestation. This finding suggests that, although depression is associated with poorer reported sleep, sleep disturbance is likely a common experience in late pregnancy. With regard to the postpartum period, a study27 that followed up 124 women from the third trimester to 1, 2, and 3 months post partum found a significant association between reported sleep disruption and depressed mood during the postpartum period. More specifically, postpartum women with higher levels of depressive symptoms reported higher levels of sleep disturbance, reduced TST, increased SOL, more early morning awakenings, and increased daytime sleepiness compared with those with lower depressive symptoms. A similar longitudinal study35 followed up 38 women from the last trimester to the first year post partum and found that self-reported sleep characteristics during the third trimester, such as increased TST, later rise times, and longer naps, were associated with more depressive symptoms at about 2 to 4 weeks post partum. These results were inconsistent with previous findings that less TST was associated with poorer mood and suggest a complex interaction between sleep and mood during pregnancy and postpartum periods.

The significant association between sleep complaints and poorer mood during the perinatal period have led to investigations into poor sleep being a risk factor for perinatal depression. A study on 273 pregnant women across the 3 trimesters of pregnancy found that poor subjective sleep quality in the first and second trimesters significantly predicted depressive symptoms in the second and third trimesters, respectively.36 In 51 women with a history of depression, self-reported poor sleep at 36 weeks’ gestation predicted the development of postpartum depression by 4 weeks after childbirth.37 In addition, sleep complaints across the first 17 postpartum weeks have been associated with a higher risk for recurrent depression in women with prior depressive disorder but who were not depressed during pregnancy.38 These findings suggest that sleep complaints are not only relevant to concurrent mood during the perinatal period but might also be a risk factor for future mood problems, particularly among women who are vulnerable to depression.

Sleep Measured Objectively

Few studies have explored the relationship between perinatal mood and sleep using PSG. Lee and colleagues13 studied the relationship between sleep and depressive symptoms in 31 women who were assessed on 5 occasions: at every trimester of pregnancy and at 3 to 4 and 11 to 12 weeks post partum. From the third trimester to 1 month
post partum, women who reported a lower mood showed greater reductions in the percentage of REM sleep; women with more positive mood, on the other hand, had more stable sleep, and smaller increases in percentage wake. Additionally, PSG sleep quality was significantly associated with cognitive functioning, with poorer sleep linked to higher levels of confusion, poorer concentration, and more forgetfulness.

Several recent studies on sleep and mood during the perinatal period incorporated actigraphy as an objective measurement of sleep and reported stronger relationship between mood and self-report sleep compared with actigraphy-assessed sleep. For example, among 160 women in early gestation, a sleep diary, but not actigraphy-assessed sleep deficiency, was found to be significantly associated with more depressive symptoms. A cross-sectional study compared self-report and actigraphy-measured sleep at 3 months post partum among 21 depressed and 21 age- and parity-matched nondepressed mothers. The investigators reported that, although the depressed group reported significantly more sleep complaints compared with the nondepressed group, actigraphy-assessed sleep quality was compromised in both groups and did not differ significantly between the two groups.

It has been noted that although overall the relationship between actigraphy-assessed sleep and mood is weak, it is not the case for all sleep parameters. A recent longitudinal study of 25 healthy nulliparas measured sleep during the third trimester and at the 2nd, 6th, 10th, and 14th postpartum week. Consistent with previous findings, the investigators reported a strong association between self-report sleep and depressive symptoms; the study also reported that, although little relationship was found between actigraphy-measured nighttime sleep duration and depressive symptoms, sleep maintenance parameters measured by actigraphy, such as higher sleep fragmentation and wake after sleep onset (WASO), and lower SE were also significantly correlated with higher depressive symptoms. Tsai and Thomas explored the role of sleep regularity in maternal mood among 26 healthy nulliparas and found that higher variability of actigraphy-assessed nighttime sleep duration was associated with a greater number of symptoms of depression in the first 3 postpartum months. In addition to the type of sleep parameters under question, Coo and colleagues suggested that the strength of the relationship between sleep and mood might vary depending on the timing of assessment. They studied 29 healthy mothers and assessed sleep and mood during the third trimester, the first 2 postpartum weeks, and 10 to 12 weeks post partum. The relationship between both subjective and actigraphy-measured sleep and mood was stronger during the first 2 weeks post partum compared with that during pregnancy or 10 to 12 weeks post partum.

Daytime napping behaviors increase during the postpartum period; in individuals experiencing poor sleep, napping is commonly associated with daytime sleepiness and a conscious effort to make up for the perceived poor sleep the night before. However, few studies have integrated the role of daytime sleep in understanding the relationship between sleep and mood in the perinatal period. In a study that assessed sleep and mood in 44 healthy women from the third trimester to 1 week post partum, Bei and colleagues found that, although actigraphy-measured nighttime sleep quality or duration were not strongly associated with antepartum or postpartum mood, poorer subjective nighttime sleep, higher sleep-related daytime dysfunction, as well as a greater number of daytime naps were significantly associated with mood disturbances during the third trimester and at 1 week post partum. These studies suggest that, in addition to nighttime sleep duration and quality, the awareness of sleep’s impact during waking hours might also be critical in the occurrence of perinatal mood disturbances.

**INTERVENTION STUDIES**

The increasing recognition of the impact of disrupted sleep on new mothers’ mood has encouraged intervention studies aimed to improve sleep during the perinatal period. Most of the intervention studies have targeted infant sleep through the delivery of parenting skills with the intention of improving parental sleep and well-being. For example, a randomized controlled study showed that reducing infant sleep problems through behavioral intervention led to significantly decreased maternal depressive symptoms, an effect that was sustained at 4 months after the intervention.

Limited intervention studies have targeted parental sleep. Lee and Gay applied sleep hygiene and bedroom environment improvements in a randomized controlled trial and showed that sleep improved among parents who were less socioeconomically equipped but not among those who were socioeconomically advantaged. A mindful yoga pilot study of 15 nulliparous women reported reduced nighttime awakenings and improved SE in the second, but not the third, trimester. A behavioral- and education-based
randomized controlled pilot study with combined interventions for 30 new mothers and their infants reported that the intervention lengthened the infants’ longest sleep period and increased the mothers’ TST.48

Sleep-improving interventions that selectively target women with perinatal mood and sleep problems are currently under development and have shown promising results. An open pilot trial of cognitive behavioral therapy for insomnia (CBTi) has recently been carried out in women with coexisting postpartum depression and insomnia.49 In this study, 12 women participated in a 5-week individual treatment program covering psychoeducation, behavioral strategies for better sleep, sleep hygiene, relaxation, and changing unhelpful thoughts and beliefs about sleep. Modifications to conventional CBTi were made based on postpartum needs, for example, more flexible sleep schedules to accommodate variable infant sleep, allowing naps of short duration and appropriate timing, skills on managing infant sleep, and incorporating partners’ support. Comparing measures taken before and after the intervention, there was significant improvement in symptoms of depression, duration and quality of sleep, and fatigue. Despite being a small open trial, this study suggests that a brief course of CBTi tailored to the postpartum period might improve both sleep and mood in new mothers with insomnia and depression.

As there are little data on whether sleep medications are safe for lactating women, and the use of medication often raises concerns in women during the perinatal period, effective nonpharmacologic treatment of problematic sleep is of particular relevance for perinatal women. Such interventions are further encouraged by the aforementioned findings that subjective perception of sleep shares a stronger relationship with mood problems than its objective duration or quality. Future intervention studies may benefit from incorporating cognitive components that have the potential to alter women’s perspectives on pregnancy-related sleep disturbances and install a positive outlook and increase self-efficacy.

SUMMARY

Studies using both objective and subjective methods have confirmed that sleep is disrupted during pregnancy and postpartum periods, with pregnancy-related physical changes, childbirth, and infant care being the most significant contributing factors. The most consistent findings on pregnancy-related sleep changes are (1) a gradual decrease in TST and SE throughout pregnancy; (2) acute sleep deprivation during labor and the immediate postpartum period; and (3) continued compromise for at least 3 months post partum.

Pregnancy-related sleep disruptions are inevitable in the process of becoming a mother. Further, there is strong evidence that self-report sleep complaints are associated with poor mood during the perinatal period, and poor perceived sleep might be a risk factor for both antepartum and postpartum mood disturbances. Findings regarding the relationship between objectively assessed sleep and mood have been mixed, with some studies reporting weak relationships between the two, and some suggesting certain aspects of objective sleep, such as sleep continuity and regularity being related to mood. The stronger relationship between mood and subjectively compared with objectively measured sleep during the perinatal period highlights the importance of women’s perception and conscious awareness of poor sleep in their emotional well-being. Future research is needed to address women’s subjective experiences of sleep problems, which are likely more susceptible to guidance and changes than the often inevitable and uncontrollable aspects of sleep disruption itself.

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