Sleep Disturbances in Depressed and Non-Depressed Pregnant Women

Dr. Michele L. Okun, Ph.D.[1], **Ms. Kerith Kiewra, BA**[1], **Mr. James F. Luther, MA**[2], **Dr. Stephen R. Wisniewski, Ph.D.**[2], and **Dr. Katherine L. Wisner, MD, MS**[3]

[1] Sleep Medicine Institute and Department of Psychiatry, University of Pittsburgh School of Medicine, Pittsburgh, PA

[2] Department of Epidemiology, University of Pittsburgh, Pittsburgh, PA

[3] Departments of OB/GYN, Epidemiology, and Women's Studies, University of Pittsburgh, Pittsburgh, PA

Abstract

Background—Sleep disturbances and symptoms of depression are common during pregnancy. Both are independent and interrelated risk factors for adverse outcomes. It is unclear the degree to which sleep differs between depressed and non-depressed pregnant women. We sought to 1), describe and compare sleep disturbances in depressed pregnant and non-depressed pregnant women, 2) determine the impact of selective serotonin reuptake inhibitors (SSRI) treatment on sleep, and 3)evaluate whether sleep at 20 weeks is associated with increased depressive symptoms and major depressive disorder (MDD) in later pregnancy.

Methods—Pregnant women (N = 240) were recruited in the second trimester (20 weeks gestation) and assigned to depressed (N = 59) and non-depressed (N = 181) groups based on a SCID diagnosis of major depressive disorder. The Structured Interview Guide for the Hamilton Rating Scale with Atypical Depression Supplement (SIGH-ADS) was administered at 20, 30 and 36 weeks gestation from which the sleep variables were obtained.

Results—Depressed women had more fragmented sleep at each assessment (p values ≤ .05). However, the frequency of insomnia symptoms was greater for depressed women only at 20 weeks gestation. SSRI use, regardless of MDD status, did significantly affect several sleep variables. Among the non-depressed women, those with short or longer sleep duration, symptoms of insomnia and long periods of nocturnal waketime had higher SIGH-ADS scores later in pregnancy (p values = < .05).

Conclusions—At 20 and 30 weeks gestation sleep was more disturbed in depressed pregnant women compared to non-depressed pregnant women. At 36 weeks, sleep was disturbed regardless

Address Correspondence: Dr. Okun at 3811 O' Hara St., E-1124, Pittsburgh, PA 15213. Telephone: 412-586-9434. Fax: 412-246-5300. okunml@upmc.edu.

of depression status or SSRI use. Among the non-depressed women, disturbed sleep in conjunction with SSRI use was associated with higher depressive symptoms.

Keywords

Sleep; depression; pregnancy; women; SIGH-ADS; insomnia; SSRI

Introduction

Sleep disturbances, a common complaint in pregnancy, can result from myriad physiological, hormonal, vascular and metabolic changes [1–3]. In a recent poll from the National Sleep Foundation, over 79% of women reported that their sleep was different during pregnancy than at any other time, however no distinction was made as to which aspect of sleep the women were describing [4]. While it is accepted that sleep progressively worsens across the gestational period [2;5;6], our current knowledge relies heavily on a small handful of reports with one or two assessments Multiple assessments of sleep and how it changes across pregnancy may be clinically relevant given the recent hypothesis that sleep disturbance is associated with an increased risk for adverse pregnancy outcomes [3].

In addition to the ubiquitous and ill-defined nature of disturbed sleep during pregnancy, depression is also frequently observed among childbearing women with estimates ranging from 10% to 25% [7;8]. Prenatal depression is a significant risk factor for preterm birth [9–12] and postpartum depression [13–15], both of which are clinically important since children born to depressed mothers are at an increased risk of low birth weight, more disorganized sleep, and decreased slow wave activity [16].

Particularly relevant to pregnant women is that disturbed sleep is both a defining feature of the diagnosis of depression [17], and is a prodromal symptom of both new and recurrent depressive episodes [18–21]. While this relationship has been studied extensively in non-pregnant cohorts, only a few recent studies have explored the relationship between sleep and depression during pregnancy [22–25]. Women defined as having depression or a history of depression report poorer sleep quality [24–26] and more sleep disturbances [22] than women without depression. Evaluation of this relationship is important since it is unclear whether women with concomitant depression and sleep disturbances are at an increased risk for adverse pregnancy outcomes.

The literature suggests that the most common sleep complaints among non-depressed pregnant women are poor sleep quality and continuity [2;3;5;27]. However, very little information is available concerning the influence of depression on sleep during pregnancy. We are aware of only one study that effectively described and compared sleep in pregnant women clinically diagnosed with major depression [22]. Despite the importance of this contribution, the sleep information was derived from visual analogue scales (VAS) and data on the quantitative aspects of sleep during pregnancy are needed.

Sleep is distinctly disturbed in depressed individuals and is a recognized risk factor for depression [18;19;21]. Yet, the importance of these associations has not been effectively translated onto pregnancy [20;27]. Therefore, the purpose of this study was first to describe and compare various sleep parameters between depressed and non-depressed women across pregnancy, and between women taking an SSRI and not taking an SSRI across pregnancy. We also evaluated whether sleep disturbance at 20 weeks among non-depressed women was associated with increased depressive symptoms and MDD in later pregnancy. We hypothesized that depressed pregnant women would have significantly poorer sleep than non-depressed pregnant women at all time points. We also expected that women taking an

SSRI would have more sleep disturbance since SSRI use is associated with poorer subjective sleep [28;29]. Lastly, we anticipated that among the non-depressed women, poorer sleep would be associated with greater depressive symptoms and probability of MDD.

Methods

This secondary analysis describes and compares sleep information collected as part of a larger study evaluating how major depression and antidepressant treatment impact pregnancy and neonatal outcomes. Details of the parent study, including recruitment process, inclusion and exclusion criteria are described elsewhere [30]. Briefly, the study design was a prospective observational study of community dwelling pregnant women who were either depressed or not depressed and/or taking an SSRI or not. Participants included here (N = 240) represent women enrolled who were pregnant (< 20 weeks), 15–44 years old, and for whom we have sleep data. Participants were recruited from community advertisements at two sites (Cleveland OH and Pittsburgh PA) and provided written informed consent. IRB approval was obtained from both sites.

Depression Measures

Women were evaluated at 20 weeks with the Structured Clinical Interview for DSM-IV (SCID) [31]. Depression severity was assessed with the 25-item Structured Interview Guide for the Hamilton Depression Rating Scale with Atypical Depression Supplement (SIGH-ADS), [32] which includes all versions of the Hamilton Rating Scale for Depression (HRSD), and questions pertaining to atypical depressive symptoms, and the Longitudinal Interval Follow-up Evaluation (LIFE) [33] at 20, 30 and 36 weeks gestation. The SIGH-ADS and HRSD-17 provide a global measure of depressive symptoms. The HRSD-17 ranges from 0–52 with a score ≥ 18 being indicative of moderate depression whereas ≤ 7 suggests remission [34]. The atypical questions contribute a score that ranges from 0–26. The LIFE is an adjunct to the initial SCID used for determining the course of a previously established diagnosis or whether a new one has developed [33]. Change in depression symptoms status was measured with the HRSD-17 and the SIGH-ADS score. Change in the presence of major depressive disorder was evaluated with the LIFE. Treatment with an SSRI was determined by charting drug dosage at each maternal assessment (20, 30 and 36 weeks). Serum drug levels were also used to confirm exposure. [35]

Sleep measures

Sleep variables were ascertained from the 25-item SIGH-ADS at 20, 30 and 36 weeks gestation. There are 14 questions in the SIGH-ADS that ask about sleep. Questions request the participant to reflect on her sleep over the previous 7 days. Sleep variables include sleep onset latency (time it took to fall asleep), wake after sleep onset, sleep duration, nap duration, 24-hour sleep duration (nocturnal sleep plus naps), sleep efficiency (time asleep/ time in bed, reported as a percentage) and symptoms of insomnia (difficulty initiating or maintaining sleep and early morning awakenings). Sleep onset latency, wake after sleep onset, nap duration, 24-hour duration and nocturnal sleep duration are all reported in minutes. With regards to the insomnia questions, the participant was identified as having "insomnia" if she endorsed "complaints of nightly difficulty falling asleep," "waking during the night with any getting out of bed (except to void)," or "unable to fall asleep again if gets out of bed." These responses reflected the most severe of the possible choices.

Statistical Analyses

Descriptive statistics were estimated for continuous measures using means and standard deviations, and frequencies and proportions for categorical measures. When continuous measures met distributional assumptions of normality, Student's *t*-tests were used to test

group differences; otherwise, the non-parametric Kruskal-Wallis test was used. For categorical measures, chi-square tests were performed. When expected cell frequencies violated distributional assumptions, Fisher's exact test was performed. The ANOVA procedure was used to compare continuous sleep measures among women according to their depression by SSRI status while chi-square tests were used to compare the groups on categorical measures. Significant overall tests of association were followed up with post hoc pairwise comparisons and multiple tests were corrected using the Bonferroni method ($p < 0.0083$).

Logistic regression models were estimated to test whether sleep measures at 20 weeks gestation among non-depressed women predict emergent MDD at 30 and 36 weeks gestation adjusting for SSRI use. In order to test the association between sleep and MDD across gestation for all women, a repeated measures mixed logistic regression model was estimated for each sleep measure adjusting for SSRI use. An interaction term between sleep measure and SSRI use was estimated to adjust for the effect of SSRI on sleep. A random intercept was included in each model and the covariance across the repeated measures was assumed to be unstructured.

Results

Demographic characteristics of the sample are shown in Table 1. The mean age of women was approximately 30 years. They were primarily Caucasian and about 60% were college educated and currently employed. The majority of women were married and more than a third were having their first child. Table 1 also reports demographic characteristics of women who had major depression or were not depressed at 20 weeks gestation. Depressed women were similar in age, race, and marital status to non-depressed women (p values > .05), but they had more children, were less educated, and were more likely to be unemployed (p values < .05).

Depression and sleep characteristics are shown in Table 2 with corresponding p-values. As expected, the Hamilton Rating Scale for Depression (HRSD-17 item score) (p values < .0001) and the SIGH-ADS score (p values < .0001) were significantly higher among the depressed women compared to the non-depressed women at all assessments. The sleep of the depressed women was also different compared to non-depressed women. At 20 weeks gestation, pregnant women with depression took significantly longer to fall asleep (p = .0002), spent more time awake at night (p < .0001), and had lower sleep efficiency (p < .0001) than the non-depressed women. A larger percentage of depressed women endorsed problems of insomnia (p = .0004), took longer naps (p = .0133)and indicated they had a sleep duration of <7 hours (p = .0079) more frequently than non-depressed women. There was no difference in the amount of time spent in bed (p = .45). A similar pattern was observed at 30 weeks gestation. Depressed women had longer sleep latencies (p < .0001), spent more time awake at night (p = .0413), and had lower sleep efficiency (p = .001). However, by 30 weeks gestation the difference in percentage of depressed and non-depressed women reporting symptoms of insomnia was not statistically significant (p = .49), nor was the number of women reporting a sleep duration <7 hours (p = .92). By 36 weeks gestation depressed women still had longer sleep latencies (p = .0057), spent more time awake at night (p = .03), and had poorer sleep efficiency (p = .001), but the sleep of non-depressed women became progressively worse. Symptoms of insomnia (p = .15), total sleep duration (p = .94), short sleep duration (p = .58), and time in bed (p = .20) did not differ between the two groups. The overall trend across gestation is improvement in sleep by week 30 and slight worsening at week 36.

Among the women who were depressed, a considerable number were taking antidepressant medication at some point during the pregnancy. Thus, we compared the sleep between women who were taking medications and those who were not taking medications (Table 3). At 20 weeks' gestation, women who were taking an SSRI spent more time awake at night (p = .007), spent more time napping (p = .04), spent more time in bed (p = .0005), and had poorer sleep efficiency (p = .05) than women not taking an SSRI. At 30 weeks' gestation, women taking an SSRI took significantly longer to fall asleep (p = .0003), spent more time awake at night (p = .04), and had lower sleep efficiency (p = .003) than women not taking an SSRI. Similar patterns were again noted at 36 weeks'. Women taking an SSRI took significantly longer to fall asleep (p = .003), spent more time awake at night (p = .04), and had lower sleep efficiency (p = .04) than women not taking an SSRI.

We further evaluated whether the presence of concurrent depression and the use of anti-depressant medications was associated with any differences in sleep (Table 4). The most substantial differences occurred at 20 weeks gestation. Depressed women who were not taking an SSRI (58.5%) reported more symptoms of insomnia than non-depressed who were not taking an SSRI (29.4%) (p < .001). Sleep onset latency was significantly longer among women who were currently depressed and taking an anti-depressant medication (39.4 ±20.1 min) compared to non-depressed women regardless if they were (25.2 ± 27.0 min, p = .005) or were not taking an antidepressant medication (25.2 ± 39.6 min) (p < .001). Wake after sleep onset was longer in women with MDD whether they were taking an SSRI (49.7 ± 37.0 min) or not (75.3 ± 105 min) compared to non-depressed women not on an SSRI (28.1 ± 44.0 min) (p's<.001). At 30 weeks, fewer differences were significant as sleep among the four groups converged. Sleep onset latency was significantly longer among women with current depression regardless of medication use (34.4 ± 38.3 and 30.9 ± 16.4 min) compared to non-depressed and non-medicated women (23.1 ± 63.8 min) (p values .006 and < .001, respectively). There were no group differences in wake after sleep onset. By week 36, there were no significant differences in sleep onset latency among any of the four groups (after correcting for the Type I error).

Lastly, we evaluated whether individual sleep variables at 20 weeks gestation were associated with depression severity corresponding to a MDD diagnosis at 30 and 36 weeks gestation (Table 5). Overall, symptom severity remained constant across gestation. Only five of the non-depressed women were identified as depressed at 30 weeks and 14 by week 36. We found that women who were depressed at 30 weeks nap twice as much as those who were not depressed after adjusting for SSRI use (p = .02, models not shown). Women who nap for more than 30 minutes a day at 20 weeks were 8 times more likely to develop MDD at week 30 (OR = 7.91, 95% CI 1.05–59.4). At week 36 women who became depressed spent twice as much time not sleeping as those who were not depressed after adjusting for SSRI use (p = .02). Time not sleeping at 20 weeks was also associated with an increased risk for developing MDD at week 36 (OR = 1.006, 95% CI 1.001–1.02, models not shown). Finally, repeated measures indicated that both a delay in sleep onset (F(1, 376) = 12.21, p < .0005) and more time spent awake (F(1, 376) = 10.39, p = .001) were associated with an increased odds of developing MDD controlling for SSRI use (models not shown).

Discussion

This report describes and compares specific sleep measures in a cohort of depressed and non-depressed pregnant women. We showed that depressed women have significantly more fragmented sleep, as reflected by longer sleep latencies, longer periods of nocturnal wakefulness, and poorer sleep efficiency, during the second half of pregnancy. However, sleep deprivation, as reflected by total sleep time and symptoms of insomnia only differed between the two groups at 20 weeks gestation. It is likely that typical physiological changes

that occur towards the end of pregnancy, such as increased abdominal size and physical discomfort, in addition to increasing progesterone levels [36;37] account for the congruence between groups in the third trimester. However, it is worth noting that the rate of insomnia increased among the non-depressed women by 36 weeks to approximately 40% of the sample which is consistent with several reports. [6;27] These disparate sleep patterns suggest that the significance of disturbed sleep among depressed pregnant women may be more important in earlier gestation. We speculate that in early gestation the interaction between depressive symptoms and disturbed sleep may have a greater impact on maternal physiology and subsequent adverse outcomes. Depression and disturbed sleep are both associated with inflammation and neuroendocrine dysregulation [38–41]. Disturbances or alterations in maternal physiology, such as inflammation, anemia or high norepinephrine levels, particularly in early gestation, have been identified to increase the risk for preterm birth [42–44] Further investigation is warranted to determine whether disturbed sleep is associated with adverse pregnancy outcomes via dysregulation of these biological pathways.

This is the first report, as far as we are aware, to evaluate data that contain SSRI use and sleep in pregnant women. While SSRIs are the first line of pharmacologic treatment for depression, [45] clinicians are often hesitant to prescribe them during pregnancy and women are resistant to taking them. The medications used by these women had differential effects on sleep despite being associated with symptomatic and functional improvement. [46] A range of SSRIs used allowed us to evaluate only the effects of this class of drugs rather than individual medication effects. It is also likely that a subset of women, within the course of treatment for depressive symptoms, experienced improvement in sleep. [28] Further exploration indicated differential effects of depression on sleep that varied according to whether the women were taking an SSRI. These data are however, in accordance with the existing literature. SSRIs often have short-term sleep disturbing properties, but are commonly used to treat symptoms of insomnia as well as depression in women. Not all antidepressants have the same effects on sleep. [28;29] Some have been shown to reduce REM sleep (tricyclics), while others alter sleep consolidation and architecture that may be relevant to clinical response (SSRIs). [29;47] Future studies should explore the specific effects of SSRIs on both subjective and physiological measures of sleep in depressed as well as non-depressed pregnant women.

The literature describing and comparing sleep in depressed and non-depressed women is sparse. Our findings corroborate and extend the literature that sleep is more disturbed among depressed pregnant women. [22;24;25] We also contribute by providing evidence that the sleep of non-depressed pregnant women becomes progressively worse across pregnancy whereas the sleep of depressed pregnant women starts poor and remains poor. Depression does not influence sleep independently. It is very likely that sociodemographic factors contribute to the dynamics of this relationship. In the current cohort, for example, depressed women delivered more children, were more likely to be at a lower SES level, and more likely unemployed. These sociodemographic characteristics are known to contribute to sleep problems and higher levels of depression. [48–50] These findings merit further investigation in order to determine whether the changes in sleep are solely a result of depression and pregnancy or further exacerbated by demographic factors.

We further sought to extend the current literature on disturbed sleep and the potential for increased risk for greater depressive symptoms among those who were not depressed at 20 weeks. We found that several aspects of poor sleep are associated with higher depressive symptoms and an increased risk for developing MDD, which corroborate the existing literature. [18;20;21;51] Women who become depressed took twice as long to fall asleep, spent twice as much time awake, and had worse sleep efficiency than women who did not become depressed. Interestingly, we found that among the women who were not depressed

at 20 weeks gestation, those who napped for more than 30 minutes per day were at an 8-fold risk for developing MDD by week 30. This is consistent with data from Wolfson et al [27]who found that longer nap times in late pregnancy were associated with higher depressive symptoms in the postpartum.

This is only the second study to evaluate sleep in pregnant women who were clinically diagnosed with depression and the first to have three time assessments across pregnancy. Field and colleagues [22] evaluated 253 women at approximately 22 and 32 weeks gestation and found greater sleep disturbances determined by visual analogue scales among the depressed women. This is also the first study to utilize interview-assessed sleep information collected by a clinician. Previous studies have relied on self-report questionnaires such as the Pittsburgh Sleep Quality Index (PSQI) [24;25] or visual analogue scales. [22] While not the gold standard for measuring sleep, the SIGH-ADS [32] allows for a more detailed and quantitative account of the various sleep parameters known to be associated with depression, including sleep onset latency, wake after sleep onset and symptoms of insomnia. [18;28] Furthermore, while the PSQI has good validity in depressed and/or pregnant populations, [24;52] the recall period is over the previous 30 days. The SIGH-ADS, [32] on the other hand, asks about the previous 7 days. This period of recall is considered more reliable. Ideally, sleep diaries would be used in order to capture the daily variability in sleep across a longer time period in conjunction with objective sleep measures, such as actigraphy or polysomnography.

The current findings support the growing evidence that depressed women have more sleep disturbances than non-depressed women. [22;53;54] While this study has several positive attributes, including a large community-dwelling cohort that was followed prospectively across pregnancy and the use of "gold standard" tools for clinical diagnosis of depression, there are some limitations. First, sleep data were based on retrospective recall only. While this is a common data collection method, data collected in a prospective manner, such as with sleep diaries, would assist and confirm the participant reports. The interpretations and associations with future depressive symptoms would also be enhanced with prospective assessments of sleep. We also did not have a sleep quality question available. Since sleep disturbance is both a physiological as well as psychological stressor, it would have been useful to describe and compare the quality of these women's sleep. Finally, pre-pregnancy sleep or sleep during the first trimester would have further allowed for a more careful longitudinal examination of sleep disturbances across the whole gestational period.

Nonetheless, the data have important clinical implications. We show that specific components of sleep are distinctly more disturbed in depressed pregnant women compared to non-depressed pregnant women. Pregnant women who are depressed or have a history of depression are more vulnerable to adverse pregnant outcomes. [55] Hence, evaluating and screening for sleep problems during pregnancy in conjunction with treating depression could augment the prevention and/or amelioration of the current, as well as future, depressive episode. These findings are particularly important given the elevated risk for future depressive episodes among individuals who have sleep problems. [19;54]

Acknowledgments

Reference List

1. Baratte-Beebe KR, Lee K. Sources of midsleep awakenings in childbearing women. Clin Nurs Res. 1999; 8(4):386–397. [PubMed: 10855105]

2. Lee KA. Sleep during pregnancy and postpartum. 2006; (82):629–635.

3. Okun ML, Roberts JM, Marsland AL, Hall M. How disturbed sleep may be a risk factor for adverse pregnancy outcomes. Obstet Gynecol Surv. 2009; 64(4):273–280. [PubMed: 19296861]

4. National Sleep Foundation. Summary of Findings of the 2007 Sleep in America Poll. 2007.

5. Mindell JA, Jacobson BJ. Sleep disturbances during pregnancy. J Obstet Gynecol Neonatal Nurs. 2000; 29(6):590–597.

6. Okun ML, Coussons-Read ME. Sleep disruption during pregnancy: how does it influence serum cytokines? J Reprod Immunol. 2007; 73(2):158–165. [PubMed: 17074396]

7. Bennett HA, Einarson A, Taddio A, Koren G, Einarson TR. Prevalence of depression during pregnancy: systematic review. Obstet Gynecol. 2004; 103(4):698–709. [PubMed: 15051562]

8. Marcus SM. Depression during pregnancy: rates, risks and consequences--Motherisk Update 2008. Can J Clin Pharmacol. 2009; 16(1):e15–e22. [PubMed: 19164843]

9. Dayan J, Creveuil C, Marks MN, Conroy S, Herlicoviez M, Dreyfus M, Tordjman S. Prenatal depression, prenatal anxiety, and spontaneous preterm birth: a prospective cohort study among women with early and regular care. Psychosom Med. 2006; 68(6):938–946. [PubMed: 17079701]

10. Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction 21. Arch Gen Psychiatry. 2010; 67(10):1012–1024. [PubMed: 20921117]

11. Li D, Liu L, Odouli R. Presence of depressive symptoms during early pregnancy and the risk of preterm delivery: a prospective cohort study. Hum Reprod. 2009; 24(1):146–153. [PubMed: 18948314]

12. Wisner KL, Sit DK, Hanusa BH, Moses-Kolko EL, Bogen DL, Hunker DF, Perel JM, Jones-Ivy S, Bodnar LM, Singer LT. Major depression and antidepressant treatment: impact on pregnancy and neonatal outcomes 12. Am J Psychiatry. 2009; 166(5):557–566. [PubMed: 19289451]

13. Marcus SM, Heringhausen JE. Depression in childbearing women: when depression complicates pregnancy. Prim Care. 2009; 36(1):151–65. ix. [PubMed: 19231607]

14. McCoy SJ, Beal JM, Shipman SB, Payton ME, Watson GH. Risk factors for postpartum depression: a retrospective investigation at 4-weeks postnatal and a review of the literature. J Am Osteopath Assoc. 2006; 106(4):193–198. [PubMed: 16627773]

15. Wisner KL, Chambers C, Sit DK. Postpartum depression: a major public health problem. JAMA. 2006; 296(21):2616–2618. [PubMed: 17148727]

16. Field T, Diego M, Hernandez-Reif M. Prenatal depression effects on the fetus and newborn: a review. Infant Behav Dev. 2006; 29(3):445–455. [PubMed: 17138297]

17. Tsuno N, Besset A, Ritchie K. Sleep and depression. J Clin Psychiatry. 2005; 66(10):1254–1269. [PubMed: 16259539]

18. Breslau N, Roth T, Rosenthal L, Andreski P. Sleep disturbance and psychiatric disorders: a longitudinal epidemiological study of young adults. Biol Psychiatry. 1996; 39(6):411–418. [PubMed: 8679786]

19. Ford DE, Cooper-Patrick L. Sleep disturbances and mood disorders: an epidemiologic perspective. Depress Anxiety. 2001; 14(1):3–6. [PubMed: 11568977]

20. Okun ML, Hanusa BH, Hall M, Wisner KL. Sleep complaints in late pregnancy and the recurrence of postpartum depression. Behav Sleep Med. 2009; 7(2):106–117. [PubMed: 19330583]

21. Perlis ML, Giles DE, Buysse DJ, Tu X, Kupfer DJ. Self-reported sleep disturbance as a prodromal symptom in recurrent depression. J Affect Disord. 1997; 42(2–3):209–212. [PubMed: 9105962]

22. Field T, Diego M, Hernandez-Reif M, Figueiredo B, Schanberg S, Kuhn C. Sleep disturbances in depressed pregnant women and their newborns. Infant Behav Dev. 2007; 30(1):127–133. [PubMed: 17292785]

23. Goyal D, Gay CL, Lee KA. Patterns of sleep disruption and depressive symptoms in new mothers. J Perinat Neonatal Nurs. 2007; 21(2):123–129. [PubMed: 17505232]

24. Jomeen J, Martin CR. Assessment and relationship of sleep quality to depression in early pregnancy. Journal of Reproductive and Infant Psychology. 2007; 25(1):97–99.

25. Skouteris H, Germano C, Wertheim EH, Paxton SJ, Milgrom J. Sleep quality and depression during pregnancy: a prospective study. J Sleep Res. 2008; 17(2):217–220. [PubMed: 18482110]

26. Coble PA, Reynolds CF, Kupfer DJ, Houck PR, Day NL, Giles DE. Childbearing in women with and without a history of affective disorder. II. Electroencephalographic sleep. Compr Psychiatry. 1994; 35(3):215–224. [PubMed: 8045112]

27. Wolfson AR, Crowley SJ, Anwer U, Bassett JL. Changes in sleep patterns and depressive symptoms in first-time mothers: last trimester to 1-year postpartum. Behav Sleep Med. 2003; 1(1):54–67. [PubMed: 15600137]

28. Argyropoulos SV, Wilson SJ. Sleep disturbances in depression and the effects of antidepressants. Int Rev Psychiatry. 2005; 17(4):237–245. [PubMed: 16194795]

29. Armitage R. The effects of antidepressants on sleep in patients with depression. Can J Psychiatry. 2000; 45(9):803–809. [PubMed: 11143829]

30. Wisner KL, Sit DK, Hanusa BH, Moses-Kolko EL, Bogen DL, Hunker DF, Perel JM, Jones-Ivy S, Bodnar LM, Singer LT. Major depression and antidepressant treatment: impact on pregnancy and neonatal outcomes 12. Am J Psychiatry. 2009; 166(5):557–566. [PubMed: 19289451]

31. First, MB.; Gibbon, M.; Spitzer, RL.; Williams, JBW. User's Guide for the Structured Interview for DSM-IV Axis I Disorders - Research Version (SCID-1, version 2.0, February 1996 final version). 1996.

32. Williams, JBW.; Terman, M. Structured Interview Guide for the Hamilton Depression Rating Scale with Atypical Depression Supplement (SIGH-ADS). 2003.

33. Keller MB, Lavori PW, Friedman B, Nielsen E, Endicott J, Donald-Scott P, Andreasen NC. The Longitudinal Interval Follow-up Evaluation. A comprehensive method for assessing outcome in prospective longitudinal studies. Arch Gen Psychiatry. 1987; 44(6):540–548. [PubMed: 3579500]

34. Hamilton M. A rating scale for depression. J Neurol Neurosurg Psychiatry. 1960; 23:56–62. [PubMed: 14399272]

35. Wisner KL, Sit DK, Hanusa BH, Moses-Kolko EL, Bogen DL, Hunker DF, Perel JM, Jones-Ivy S, Bodnar LM, Singer LT. Major depression and antidepressant treatment: impact on pregnancy and neonatal outcomes 12. Am J Psychiatry. 2009; 166(5):557–566. [PubMed: 19289451]

36. Lancel M, Faulhaber J, Schiffelholz T, Romeo E, Di Michele F, Holsboer F, Rupprecht R. Allopregnanolone affects sleep in a benzodiazepine-like fashion. J Pharmacol Exp Ther. 1997; 282(3):1213–1218. [PubMed: 9316828]

37. Lancel M, Faulhaber J, Holsboer F, Rupprecht R. Progesterone induces changes in sleep comparable to those of agonistic GABAA receptor modulators. Am J Physiol. 1996; 271(4 Pt 1):E763–E772. [PubMed: 8897866]

38. Cyranowski JM, Marsland AL, Bromberger JT, Whiteside TL, Chang Y, Matthews KA. Depressive symptoms and production of proinflammatory cytokines by peripheral blood mononuclear cells stimulated in vitro. Brain Behav Immun. 2007; 21(2):229–237. [PubMed: 16996242]

39. Groer MW, Morgan K. Immune, health and endocrine characteristics of depressed postpartum mothers. Psychoneuroendocrinology. 2007; 32(2):133–139. [PubMed: 17207585]

40. Irwin M, Clark C, Kennedy B, Christian GJ, Ziegler M. Nocturnal catecholamines and immune function in insomniacs, depressed patients, and control subjects. Brain Behav Immun. 2003; 17(5):365–372. [PubMed: 12946658]

41. Okun ML, Hall M, Coussons-Read ME. Sleep disturbances increase interleukin-6 production during pregnancy: implications for pregnancy complications. Reprod Sci. 2007; 14(6):560–567. [PubMed: 17959884]

42. Allen LH. Biological mechanisms that might underlie iron's effects on fetal growth and preterm birth 1. J Nutr. 2001; 131(2S-2):581S–589S. [PubMed: 11160591]

43. Wadhwa PD, Culhane JF, Rauh V, Barve SS. Stress and preterm birth: neuroendocrine, immune/ inflammatory, and vascular mechanisms. Matern Child Health J. 2001; 5(2):119–125. [PubMed: 11573837]

44. Wadhwa PD, Culhane JF, Rauh V, Barve SS, Hogan V, Sandman CA, Hobel CJ, Chicz-Demet A, Dunkel-Schetter C, Garite TJ, Glynn L. Stress, infection and preterm birth: a biobehavioural perspective. Paediatr Perinat Epidemiol. 2001; 15(Suppl 2):17–29. [PubMed: 11520397]

45. Wisner KL, Gelenberg AJ, Leonard H, Zarin D, Frank E. Pharmacologic treatment of depression during pregnancy. JAMA. 1999; 282(13):1264–1269. [PubMed: 10517430]

46. Wisner KL, Sit DK, Hanusa BH, Moses-Kolko EL, Bogen DL, Hunker DF, Perel JM, Jones-Ivy S, Bodnar LM, Singer LT. Major depression and antidepressant treatment: impact on pregnancy and neonatal outcomes 12. Am J Psychiatry. 2009; 166(5):557–566. [PubMed: 19289451]

47. Masand PS, Gupta S. Selective serotonin-reuptake inhibitors: an update. Harv Rev Psychiatry. 1999; 7(2):69–84. [PubMed: 10471245]

48. Lee KA, Zaffke ME, McEnany G. Parity and sleep patterns during and after pregnancy. Obstet Gynecol. 2000; 95(1):14–18. [PubMed: 10636494]

49. Neter E, Collins NL, Lobel M, Dunkel-Schetter C. Psychosocial predictors of postpartum depressed mood in socioeconomically disadvantaged women. Womens Health. 1995; 1(1):51–75. [PubMed: 9373373]

50. Waters MA, Lee KA. Differences between primigravidae and multigravidae mothers in sleep disturbances, fatigue, and functional status. J Nurse Midwifery. 1996; 41(5):364–367. [PubMed: 8916676]

51. Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? JAMA. 1989; 262(11):1479–1484. [PubMed: 2769898]

52. Skouteris H, Wertheim EH, Germano C, Paxton SJ, Milgrom J. Assessing sleep during pregnancy: a study across two time points examining the Pittsburgh Sleep Quality Index and associations with depressive symptoms. Womens Health Issues. 2009; 19(1):45–51. [PubMed: 19111787]

53. Armitage R, Hoffmann R, Trivedi M, Rush AJ. Slow-wave activity in NREM sleep: sex and age effects in depressed outpatients and healthy controls. Psychiatry Res. 2000; 95(3):201–213. [PubMed: 10974359]

54. Ross LE, Murray BJ, Steiner M. Sleep and perinatal mood disorders: a critical review. J Psychiatry Neurosci. 2005; 30(4):247–256. [PubMed: 16049568]

55. Wisner KL, Sit DK, Hanusa BH, Moses-Kolko EL, Bogen DL, Hunker DF, Perel JM, Jones-Ivy S, Bodnar LM, Singer LT. Major depression and antidepressant treatment: impact on pregnancy and neonatal outcomes 12. Am J Psychiatry. 2009; 166(5):557–566. [PubMed: 19289451]

Table 1

Demographic measures of pregnant women by depression status at 20 weeks gestation.

		Depressed at Week 20		
Measure	All (N=240)	Yes (N=59)	No (N=181)	p-value
Age	29.9 ± 5.9	30.1 ± 6.6	29.8 ± 5.7	0.72
Race				0.45
White	188 (78.7)	43 (72.9)	145 (80.6)	
Black	42 (17.6)	13 (22.0)	29 (16.1)	
Other	9 (3.8)	3 (5.1)	6 (3.3)	
Education				0.001
<High school	17 (7.1)	10 (16.9)	7 (3.9)	
High school	27 (11.3)	6 (10.2)	21 (11.6)	
Some college	48 (20.0)	17 (28.8)	31 (17.1)	
College	90 (37.5)	15 (25.4)	75 (41.4)	
Graduate school	58 (24.2)	11 (18.6)	47 (26.0)	
Employed	142 (59.4)	26 (44.1)	116 (64.4)	0.006
Marital status				0.35
Single	58 (24.2)	16 (27.1)	42 (23.2)	
Married/cohabiting	173 (72.1)	40 (67.8)	133 (73.5)	
Divorced/separated	8 (3.3)	2 (3.4)	6 (3.3)	
Widowed	1 (0.4)	1 (1.7)	0 (0.0)	
Parity	2.0 ± 1.2	2.6 ± 1.5	1.8 ± 1.0	0.0006
Parity				0.0026
1	83 (39.7)	11 (22.4)	72 (45.0)	
2	75 (35.9)	18 (36.7)	57 (35.6)	
3+	51 (24.4)	20 (40.8)	31 (19.4)	
Smoked during pregnancy	32 (14.7)	10 (20.0)	22 (13.2)	0.23
Drank during pregnancy	71 (32.6)	15 (30.6)	56 (33.1)	0.74

Table 2

Depression and sleep measures among pregnant women by depression status at 20, 30, and 36 weeks gestation.

Measure	Depressed at Week 20			Depressed at Week 30			Depressed at Week 36		
	Yes (N=59)	No (N=181)	p	Yes (N=59)	No (N=181)	p	Yes (N=59)	No (N=181)	p
$HRSD_{17}$	11.2 ± 3.8	3.5 ± 2.9	<.0001	7.8 ± 3.5	3.6 ± 3.0	<.0001	8.9 ± 4.2	3.3 ± 2.2	<.0001
Atypical symptoms	5.6 ± 2.1	3.0 ± 2.1	<.0001	5.1 ± 2.6	3.1 ± 2.4	<.0001	4.6 ± 2.1	3.3 ± 2.5	0.0005
$SIGH\text{-}ADS_{25}$	16.8 ± 4.2	6.6 ± 4.3	<.0001	12.8 ± 5.2	6.7 ± 4.5	<.0001	13.5 ± 5.8	6.6 ± 3.8	<.0001
$Atypical/SIGH\text{-}ADS_{25}$	34.1 ± 12.5	48.8 ± 26.3	<.0001	38.2 ± 15.7	46.1 ± 24.9	0.01	35.0 ± 9.2	49.6 ± 24.6	<.0001
HRSD Insomnia *	33 (55.9)	55 (30.4)	0.0004	18 (36.0)	65 (41.9)	0.46	18 (52.9)	57 (39.3)	0.147
Sleep onset delay	49.2 ± 58.1	25.2 ± 37.8	0.0002	32.8 ± 30.0	23.5 ± 59.6	<.0001	36.9 ± 40.2	21.7 ± 28.0	0.006
Middle insomnia	67.5 ± 90.5	32.3 ± 50.9	<.0001	51.1 ± 53.1	35.8 ± 43.5	0.04	71.9 ± 95.9	45.6 ± 51.6	0.03
Time napping	49.1 ± 68.9	47.1 ± 208	0.01	34.5 ± 53.3	23.7 ± 37.8	0.32	33.7 ± 55.8	48.4 ± 168	0.58
Time in bed	547 ± 133	527 ± 81	0.45	521 ± 91	524 ± 120	0.46	548 ± 128	514 ± 97	0.20
Time not sleeping	117 ± 104	57.5 ± 73.1	<.0001	83.9 ± 64.9	59.2 ± 74.0	0.001	109 ± 105	67.3 ± 62.7	0.007
Time sleeping	430 ± 155	470 ± 99	0.07	437 ± 104	465 ± 109	0.12	439 ± 104	446 ± 103	0.71
Sleeps <7 hours	23 (39.0)	39 (21.5)	0.008	15 (30.0)	45 (29.0)	0.90	16 (47.1)	54 (37.2)	0.29
Sleeps >9 hours	10 (16.9)	29 (16.0)	0.87	5 (10.0)	28 (18.1)	0.18	7 (20.6)	20 (13.8)	0.32
Time sleeping & napping	480 ± 175	517 ± 232	0.43	472 ± 105	487 ± 116	0.54	482 ± 119	494 ± 195	0.94
Sleep efficiency†	78.2 ± 19.1	89.1 ± 13.1	<.0001	83.6 ± 13.4	89.1 ± 10.3	0.001	81.0 ± 13.7	86.9 ± 11.3	0.010

Abbreviations HRSD Hamilton rating scale for depression; SIGH-ADS Structured interview guide for the Hamilton depression rating scale with atypical depression supplement.

NOTES: Data are presented as Mean ± standard deviation or number (percent) where appropriate. All depression measures reflect total scores less sleep item scores. Continuous measures of sleep are presented in minutes.

*
Defined as having at least one of the following symptoms: "nightly difficulty falling asleep," "waking during the night (except for voiding)," and "waking up early, unable to get back to sleep."

†
100 * time sleeping/time in bed.

Table 3

Depression and sleep measures among pregnant women by SSRI status at 20, 30, and 36 weeks gestation.

Measure	SSRI at Week 20			SSRI at Week 30			SSRI at Week 36		
	Yes (N=46)	No (N=194)	p	Yes (N=46)	No (N=159)	p	Yes (N=36)	No (N=143)	p
HRSD$_{17}$	6.6 ± 4.2	5.1 ± 4.6	0.01	6.5 ± 3.9	4.1 ± 3.3	0.0001	6.2 ± 4.6	3.9 ± 2.9	0.007
Atypical symptoms	4.0 ± 2.4	3.6 ± 2.4	0.27	4.2 ± 2.5	3.4 ± 2.6	0.04	4.0 ± 2.2	3.4 ± 2.5	0.07
SIGH-ADS$_{25}$	10.5 ± 5.6	8.7 ± 6.2	0.03	10.6 ± 5.6	7.5 ± 5.0	0.0004	10.2 ± 6.1	7.3 ± 4.5	0.01
Atypical/SIGH-ADS$_{25}$	38.1 ± 18.6	46.9 ± 25.4	0.01	39.8 ± 15.4	45.4 ± 24.9	0.07	44.6 ± 18.8	47.4 ± 24.2	0.53
HRSD Insomnia[*]	19 (41.3)	69 (35.6)	0.47	19 (41.3)	64 (40.3)	0.90	20 (55.6)	55 (38.5)	0.06
Sleep onset delay	30.8 ± 25.3	31.2 ± 48.3	0.02	28.2 ± 21.3	25.1 ± 60.3	0.0003	29.7 ± 27.3	23.3 ± 32.0	0.03
Middle insomnia	53.0 ± 63.0	38.1 ± 64.8	0.007	48.9 ± 46.1	36.8 ± 46.2	0.04	60.0 ± 55.1	48.2 ± 64.7	0.04
Time napping	64.8 ± 182	43.7 ± 185	0.04	37.5 ± 58.1	23.2 ± 36.2	0.17	42.0 ± 60.7	46.5 ± 168	0.10
Time in bed	559 ± 80	526 ± 99	0.005	538 ± 91	519 ± 119	0.11	536 ± 94	516 ± 106	0.22
Time not sleeping	83.8 ± 80.4	69.3 ± 86.7	0.02	77.1 ± 48.7	61.8 ± 77.9	0.0018	89.7 ± 63.8	71.6 ± 76.3	0.02
Time sleeping	475 ± 101	456 ± 120	0.32	461 ± 98	458 ± 112	0.86	446 ± 100	445 ± 104	0.95
Sleeps <7 hours	9 (19.6)	53 (27.3)	0.28	11 (23.9)	49 (30.8)	0.36	15 (41.7)	55 (38.5)	0.72
Sleeps >9 hours	9 (19.6)	30 (15.5)	0.50	6 (13.0)	27 (17.0)	0.52	6 (16.7)	21 (14.7)	0.77
Time sleeping & napping	544 ± 206	500 ± 222	0.03	493 ± 89	481 ± 119	0.31	488 ± 114	492 ± 196	0.63
Sleep efficiency[†]	85.1 ± 13.5	86.8 ± 15.9	0.05	85.3 ± 10.7	88.4 ± 11.5	0.003	83.2 ± 11.2	86.5 ± 12.1	0.04

Abbreviations HRSD Hamilton rating scale for depression; SIGH-ADS Structured interview guide for the Hamilton depression rating scale with atypical depression supplement.

NOTES: Data are presented as Mean ± standard deviation or number (percent) where appropriate All depression measures reflect total scores less sleep item scores. Continuous measures of sleep are presented in minutes.

[*] Defined as having at least one of the following symptoms: "nightly difficulty falling asleep," "waking during the night (except for voiding)," and "waking up early, unable to get back to sleep."

[†] 100 * time sleeping/time in bed.

Table 4

Sleep measures among pregnant women by depression and SSRI status at 20, 30, and 36 weeks gestation.

	Depressed		Not depressed		p	Pairwise comparisons					
	+SSRI (A) (N=18)	-SSRI (B) (N=41)	+SSRI (C) (N=28)	-SSRI (D) (N=153)		AB	AC	AD	BC	BD	CD
Week 20											
HRSD Insomnia†	9 (50.0)	24 (58.5)	10 (35.7)	45 (29.4)	0.004	0.543	0.337	0.075	0.063	<.001*	0.505
Sleep onset delay	39.4 ± 20.1	53.5 ± 68.3	25.2 ± 27.0	25.2 ± 39.6	0.001	0.453	0.005*	<.001*	0.216	0.017	0.294
Middle insomnia	49.7 ± 37.0	75.3 ± 105	55.2 ± 75.8	28.1 ± 44.0	<.0001	0.803	0.276	<.001*	0.242	<.001*	0.023
Time napping	69.1 ± 66.7	40.9 ± 68.8	62.0 ± 229	44.4 ± 205	0.007	0.024	0.010	<.001*	0.709	0.303	0.768
Time in bed	556 ± 79	542 ± 151	561 ± 82	521 ± 79	0.04	0.424	0.752	0.088	0.164	0.671	0.008*
Time not sleeping	89.2 ± 50.7	129 ± 119	80.4 ± 95.6	53.3 ± 67.7	<.0001	0.254	0.032	<.001*	0.010	<.001*	0.053
Time sleeping	467 ± 95	414 ± 174	481 ± 106	468 ± 98	0.042	0.135	0.652	0.968	0.050	0.061	0.527
Sleeps <7 hours	4 (22.2)	19 (46.3)	5 (17.9)	34 (22.2)	0.01	0.080	0.721	1.000	0.015	0.002*	0.605
Sleeps >9 hours	3 (16.7)	7 (17.1)	6 (21.4)	23 (15.0)	0.80						
Time sleeping & napping	542 ± 124	454 ± 188	545 ± 247	512 ± 230	0.03	0.031	0.439	0.050	0.083	0.048	0.313
Sleep efficiency‡	83.6 ± 10.2	75.8 ± 21.5	86.0 ± 15.3	89.7 ± 12.6	<.0001	0.177	0.059	<.001*	0.008*	<.001*	0.090
Week 30	(N=23)	(N=27)	(N=23)	(N=132)							
HRSD Insomnia†	9 (39.1)	9 (33.3)	10 (43.5)	55 (41.7)	0.86						
Sleep onset delay	30.9 ± 16.4	34.4 ± 38.3	25.4 ± 25.3	23.1 ± 63.8	<.0001	0.353	0.090	<.001*	0.557	0.006*	0.027
Middle insomnia	48.9 ± 46.7	53.0 ± 58.8	48.9 ± 46.5	33.5 ± 42.7	0.07						
Time napping	49.4 ± 69.4	21.9 ± 30.2	25.0 ± 41.2	23.5 ± 37.4	0.45						
Time in bed	518 ± 72	524 ± 105	558 ± 104	518 ± 122	0.23						
Time not sleeping	79.8 ± 50.1	87.4 ± 76.1	74.3 ± 48.1	56.6 ± 77.5	0.001	0.769	0.791	0.003*	0.961	0.007*	0.014
Time sleeping	438 ± 87	437 ± 117	484 ± 104	462 ± 110	0.35						
Sleeps <7 hours	5 (21.7)	10 (37.0)	6 (26.1)	39 (29.5)	0.67						
Sleeps >9 hours	0 (0.0)	5 (18.5)	6 (26.1)	22 (16.7)	0.05						
Time sleeping & napping	487 ± 88	459 ± 117	499 ± 91	485 ± 120	0.56						
Sleep efficiency‡	84.0 ± 12.5	83.2 ± 14.3	86.6 ± 8.6	89.5 ± 10.6	0.001	0.763	0.629	0.003*	0.808	0.010	0.022
Week 36	(N=14)	(N=20)	(N=22)	(N=123)							

| Week 20 | Depressed | | Not depressed | | p | Pairwise comparisons | | | | | | |
	+SSRI (A) (N=18)	-SSRI (B) (N=41)	+SSRI (C) (N=28)	-SSRI (D) (N=153)		AB	AC	AD	BC	BD	CD
HRSD Insomnia[†]	9 (64.3)	9 (45.0)	11 (50.0)	46 (37.4)	0.21						
Sleep onset delay	34.6 ± 28.3	38.5 ± 47.5	26.6 ± 26.8	20.9 ± 28.2	0.02	0.680	0.349	0.019	0.510	0.032	0.126
Middle insomnia	58.2 ± 37.4	81.5 ± 122	61.1 ± 64.8	42.8 ± 48.7	0.06						
Time napping	54.6 ± 75.9	19.3 ± 31.5	33.9 ± 48.9	50.8 ± 180	0.23						
Time in bed	567 ± 92	534 ± 149	515 ± 91	513 ± 98	0.26						
Time not sleeping	92.9 ± 53.4	120 ± 130	87.7 ± 70.7	63.7 ± 60.7	0.01	0.861	0.516	0.018	0.570	0.039	0.049
Time sleeping	474 ± 104	414 ± 98	428 ± 95	450 ± 104	0.29						
Sleeps <7 hours	5 (35.7)	11 (55.0)	10 (45.5)	44 (35.8)	0.37						
Sleeps >9 hours	4 (28.6)	3 (15.0)	2 (9.1)	18 (14.6)	0.46						
Time sleeping & napping	542 ± 123	441 ± 99	453 ± 95	500 ± 206	0.11						
Sleep efficiency[‡]	83.3 ± 9.9	79.4 ± 16.0	83.1 ± 12.2	87.6 ± 11.0	0.02	0.649	0.795	0.051	0.481	0.024	0.052

Abbreviations HRSD Hamilton rating scale for depression; SIGH-ADS Structured interview guide for the Hamilton depression rating scale with atypical depression supplement.

NOTES: Data are presented as Mean ± standard deviation or number (percent) where appropriate. All depression measures reflect total scores less sleep item scores. Continuous measures of sleep are presented in minutes.

*
Significant after Bonferroni correction (p < .0083).

[†] Defined as having at least one of the following symptoms: "nightly difficulty falling asleep," "waking during the night (except for voiding)," and "waking up early, unable to get back to sleep."

[‡] 100 * time sleeping/time in bed.

Table 5

Depression and sleep measures of pregnant women who were not depressed at 20 weeks gestation by depression status at 20, 30, and 36 weeks gestation.

Measure	Week 20	Week 30				Week 36			
	All (N=181)	All (N=154)	+MDD (N=5)	-MDD (N=149)	p	All (N=135)	+MDD (N=14)	-MDD (N=121)	p
HRSD$_{17}$	3.5 ± 2.9	3.8 ± 3.1	8.4 ± 4.0	3.6 ± 3.0	0.01	3.6 ± 2.7	7.9 ± 3.2	3.1 ± 2.1	<.0001
Atypical symptoms	3.0 ± 2.1	3.2 ± 2.4	5.6 ± 1.5	3.1 ± 2.4	0.01	3.1 ± 2.3	3.8 ± 1.2	3.1 ± 2.3	0.05
SIGH-ADS$_{25}$	6.6 ± 4.3	7.0 ± 4.6	14.0 ± 2.5	6.7 ± 4.5	0.001	6.7 ± 4.1	11.7 ± 3.9	6.1 ± 3.7	<.0001
Atypical/SIGH-ADS$_{25}$	48.8 ± 26.3	45.5 ± 24.6	42.7 ± 18.5	45.6 ± 24.8	0.80	48.1 ± 24.9	33.5 ± 8.5	49.9 ± 25.7	<.0001
HRSD Insomnia	55 (30.4)	65 (42.2)	4 (80.0)	61 (40.9)	0.16	53 (39.3)	6 (42.9)	47 (38.8)	0.77
Sleep onset delay	25.2 ± 37.8	24.0 ± 60.4	34.0 ± 49.4	23.7 ± 60.8	0.77	22.2 ± 29.4	44.3 ± 46.7	19.6 ± 25.8	0.003
Middle insomnia	32.3 ± 50.9	36.9 ± 44.6	62.0 ± 57.2	36.1 ± 44.1	0.14	49.9 ± 67.2	82.9 ± 135	46.1 ± 54.1	0.14
Time napping	47.1 ± 208	25.5 ± 38.7	56.0 ± 41.6	24.5 ± 38.4	0.02	47.2 ± 171	20.5 ± 21.8	50.1 ± 180	0.76
Time in bed	527 ± 81	521 ± 120	489 ± 52	522 ± 122	0.51	515 ± 107	567 ± 157	509 ± 99	0.19
Time not sleeping	57.5 ± 73.1	60.9 ± 75.0	96.0 ± 59.3	59.8 ± 75.3	0.10	72.1 ± 77.5	127 ± 142	65.8 ± 64.2	0.02
Time sleeping	470 ± 99	460 ± 109	393 ± 67	463 ± 110	0.09	443 ± 106	440 ± 114	443 ± 105	0.86
Sleeps <7 hours	39 (21.5)	47 (30.5)	2 (40.0)	45 (30.2)	0.64	52 (38.5)	5 (35.7)	47 (38.8)	0.82
Sleeps >9 hours	29 (16.0)	26 (16.9)	0 (0.0)	26 (17.4)	0.59	19 (14.1)	3 (21.4)	16 (13.2)	0.42
Time sleeping & napping	517 ± 232	484 ± 115	449 ± 52	486 ± 117	0.43	490 ± 199	471 ± 119	492 ± 206	0.70
Sleep efficiency	89.1 ± 13.1	88.7 ± 10.6	80.4 ± 12.3	89.0 ± 10.5	0.09	86.3 ± 12.3	78.9 ± 16.5	87.2 ± 11.5	0.04

Abbreviations HRSD Hamilton rating scale for depression; MDD major depressive disorder; SIGH-ADS Structured interview guide for the Hamilton depression rating scale with atypical depression supplement.

NOTES: Data are presented as Mean ± standard deviation or number (percent) where appropriate. All depression measures (except MDD) reflect total scores less sleep item scores.