

TO SLEEP OR NOT TO SLEEP, THAT IS THE QUESTION: SLEEP, ANXIETY AND
DEPRESSIVE SYMPTOMS IN PREGNANCY

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ABSTRACT

ALEXIS BLAKE MILLER: Sleep, Anxiety and Depressive Symptoms in Pregnancy

(Under the direction of Dr. Danielle J. Maack)

Pregnancy is a time associated with many changes in a woman's body including hormonal, metabolic, physical, and physiological changes (Miller, 2004; Okun, Kiewra, Luther, Wisniewski, & Wisner, 2011). A related concern is pregnant women and the impact of disturbed sleep. According to the Centers for Disease Control and Prevention (CDC), over 36% of the population in Mississippi experience an insufficient amount of sleep (CDC, 2014). Moreover, sleep disturbances in pregnancy are significantly associated with antenatal depressive and anxiety symptoms (Volkovich, Tikotzky, & Manber, 2015; Yu et al., 2017).

The present study assessed potential relations between sleep disturbances, anxiety, depressive symptoms and other potential covariates (i.e. maternal age and gravidity) in pregnant Mississippi women.

Participants included 438 pregnant women (76.6% Caucasian; $M_{\text{age}} = 28.30$) recruited at a local OB/GYN clinic in North Mississippi. Sleep disturbances, depressive and anxiety symptoms were assessed using the Pittsburgh Sleep Quality Index (PSQI), Edinburgh Postnatal Depression Scale (EPDS), and Depression, Anxiety, and Stress Scale – 21 (DASS-21), respectively.

Sleep, measured by PSQI, was significantly positively associated with depression symptoms assessed by EPDS ($r = .26, p < .01$) and anxiety symptoms measured by DASS-21 ($r = .33, p < .01$). A linear regression demonstrated that antenatal anxiety is a significant predictor of sleep disturbances while controlling for depression, $F(2, 296) = 18.44, p < .001$. Additionally, correlation analysis demonstrated no significant relationship between disturbed sleep, and age ($r = -.03, p = .66$) or disturbed sleep, and gravidity ($r = .01, p = .81$).

Anxiety symptoms during pregnancy are a distinct predictor of sleep disturbances in pregnancy. Sleep disturbances, antenatal anxiety and depressive symptoms were all associated with one another. Screening followed by intervention or prevention should be incorporated into routine obstetric appointments in hopes of caring for both the physical and mental well-being of the pregnant woman and her unborn child.

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LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
DASS-21	Depression, Anxiety, and Stress Scale – 21
EPDS	Edinburgh Postnatal Depression Scale
IUGR	intra-uterine growth restriction
M	mean
PSQI	Pittsburgh Sleep Quality Index
REM	rapid eye movement
SD	standard deviation

1. Introduction

1.1 Pregnancy

Many women will experience pregnancy during their lifetimes. During 2016 alone approximately 3.95 million women in the United States, including 38,000 women from Mississippi, became pregnant and gave birth (Martin, Hamilton, Osterman, Driscoll, & Drake, 2018). Pregnancy is a time associated with many changes in a woman's body. There are significant changes during pregnancy including hormonal, metabolic, physical, and physiological changes (Miller, 2004; Okun, Kiewra, Luther, Wisniewski, & Wisner, 2011). For example, levels of estrogen and progesterone increase over the course of gestation, peaking at the point of full-term (Nodine & Matthews, 2013). Additionally, pregnant women often experience a series of common discomforts such as breast tenderness, difficulty getting comfortable at night, fetal movement, frequent urination, leg cramps, lower back pain, and nausea and vomiting (Mindell, Cook, & Nikolovski, 2015; Nodine & Matthews, 2013; Pien & Schwab, 2004). Some prevalent discomforts such as frequent urination, difficulty getting comfortable at night, and lower back pain increase throughout pregnancy and become most severe during the third trimester. On the other hand, complaints of nausea and vomiting are much more common during the first trimester. Many of these changes are generally assumed to be normal

for most pregnant women and are often explained as a result of a woman's body accommodating the growth of the fetus.

Since there are so many changes that are common during pregnancy, it can be difficult to distinguish normal fluctuations and symptoms from those that are problematic. For instance, some of these common symptoms in pregnancy such as frequent urination and difficulty finding a comfortable sleeping position contribute to disturbed sleep, even though the sleep problems may not be diagnosable as a particular sleep disorder (Mindell et al., 2015). Pregnant women experience more sleep disturbances than non-pregnant women (Mindell et al., 2015). Furthermore, these sleep disturbances are associated with adverse maternal and fetal outcomes. These adverse outcomes include intra-uterine growth restriction (IUGR), preeclampsia, pre-term birth, longer labor times, increased pain perception during labor, and higher rates of cesarean deliveries (Beebe & Lee, 2007; Chang, Pien, Duntley, & Macones, 2010; Edwards, 2000; Ekholm, Polo, Rauhala, & Ekblad, 1992; Lee & Gay, 2004; Okun, Roberts, Marsland, & Hall, 2009). Studies suggest that inflammation is a significant contributor to the relationship between sleep and the aforementioned adverse outcomes (Chang et al., 2010; Okun et al., 2009). Based on these outcomes associated with disturbed sleep in pregnancy, current research suggests that sleep disturbances should be viewed as a modifiable health behavior that can be improved rather than simply a common change associated with pregnancy (Okun, Tolge, & Hall, 2014).

Similarly, antenatal depression is significantly associated with pre-term birth (Dayan et al., 2006). A study by Clout and Brown (2015) found that women who had a cesarean delivery experienced higher levels of antenatal depression and anxiety.

Pregnant women (N = 139) were assessed with self-report measures for both anxiety and depressive symptoms. The results demonstrated that women who underwent cesarean delivery, both elective and emergency, had higher antenatal depression and anxiety scores compared to women who did not undergo a cesarean delivery. Additionally, sleep disturbances in pregnancy are significantly associated with antenatal depressive and anxiety symptoms (Volkovich, Tikotzky, & Manber, 2015; Yu et al., 2017). Sleep disturbances, anxiety, and depression as well as other factors such as the age and gravidity status of pregnant women are of interest, particularly in regards to their relationship with one another and the effects they have during pregnancy.

1.2 Sleep

According to the Centers for Disease Control and Prevention (CDC), over 36% of the population in Mississippi experience an insufficient amount of sleep (CDC, 2014). The symptoms associated with disturbed sleep include daytime sleepiness, difficulty falling or staying asleep, poor sleep quality, and insufficient sleep quantity. The significant number of people affected by disturbed sleep and the associated symptoms results in a substantial burden on society and the economy. It is estimated that insufficient sleep costs the United States between \$280 and \$411 billion dollars annually, most of which is due to lost productivity caused by daytime sleepiness (Hafner, Stepanek, Taylor, Troxel, & Stolk, 2016).

Sleep and mood disturbances are significantly related to one another, particularly in regards to depression and anxiety as forms of disturbed mood (Taylor, Lichstein, Durrence, Reidel, & Bush, 2005). The proposed underlying mechanisms for the

relationship between sleep and mood include emotional neural networks, mechanisms related to rapid eye movement (REM) sleep, and emotional information processing (Kahn, Sheppes, & Sadeh, 2013). Each of these mechanisms influences emotions in a unique way, but all contribute to a negative mood following disturbed sleep. For example, REM sleep is considered to be a regulator in regards to emotional adaptability, therefore, adjusting emotional processes in the brain as need be. Other neurobiological mechanisms for this relationship are still relatively poorly understood.

There is a significant association between sleep disturbances and depression in the general population (Tsunno, Besset, & Ritchie, 2005). A meta-analysis conducted by Baglioni et al. (2011) found depression to be a significant predictor of disturbed sleep. Non-depressed people with disturbed sleep were significantly more likely to develop depression compared to individuals without sleep disturbances (Baglioni et al., 2011). Many previous studies have also established sleep disturbances as a predictor of depressive symptoms (Baglioni et al., 2010; Baglioni et al., 2011; Riemann, 2009). Disturbed sleep is now considered not only a symptom of depression but also a predictor, or risk factor, as well.

There is also a very close relationship between sleep disturbances and anxiety, in general (Spoormaker & Bout, 2005; Taylor et al., 2005). People experiencing disturbed sleep also had significantly higher levels of anxiety and depressive symptoms compared to those without disturbed sleep in a study by Taylor et al. (2005). Participants from a community sample (N = 772) were assessed using self-report measures for symptoms of anxiety, depression, and insomnia. The results suggested that there is a significant and close relationship between anxiety, depression, and insomnia symptoms. Anxiety and

depression are highly comorbid during pregnancy (Biaggi, Conroy, Pawlby, & Pariante, 2016; Figueiredo & Conde, 2011). Symptoms of anxiety and depression follow a pattern that mirrors one another over the course of the antenatal period and into the postpartum period (Clout & Brown, 2015; Heron, O'Connor, Evans, Golding, & Glover, 2004). Given the relationship between these factors in the general population, this is also of interest in the pregnant population, especially given the impact of various changes experienced in the antenatal period.

1.21 Sleep in pregnancy

Pregnancy is associated with sleep disturbances beginning in the first trimester and increasing over the course of pregnancy with up to 90% of women experiencing some sleep disturbances in the third trimester (Facco, Kramer, Ho, Zee, & Grobman, 2010; Pien & Schwab, 2004; Van der Zwan et al., 2017). Pregnant women often experience decreased sleep quality and quantity as pregnancy progresses, more frequent waking after falling asleep, and less REM sleep (Facco et al., 2010; Miller, 2004; Okun et al., 2009; Signal, 2007; Tsai, Lin, Wu, Lee, & Lee, 2016). Increased levels of estrogen lower the time spent in REM sleep; therefore, it is understood that the increase in estrogen throughout pregnancy has a negative impact on the amount of REM sleep pregnant women experience (Nodine & Matthews, 2013).

Sleep disturbances during pregnancy, even as early as 10-12 weeks of gestation, may affect cardiometabolic risk factors such as hypertension and obesity which are known to result in adverse outcomes for both mother and fetus including preeclampsia, gestational diabetes, higher rates of cesarean delivery, neural tube defects, and cardiac

malformations (Guelinckx, Devlieger, Beckers, & Vansant, 2008; Haney, Buysse, Rosario, Chen, & Okun, 2014; Sohlberg, Stephansson, Cnattingius, & Wikstrom, 2012; Watkins & Botto, 2001). Additionally, sleep disturbances late in pregnancy are associated with pre-term birth, prolonged labor, increased pain perception, and increased likelihood of having cesarean deliveries (Beebe & Lee, 2007; Lee & Gay, 2004; Micheli et al., 2011).

According to a review of the current literature, self-reported sleep disturbances during pregnancy have been associated with poor mood (Bei, Coe, & Trinder, 2015). A study by Yu et al. (2017) found that subjective sleep disturbances in pregnancy are associated with both depression and anxiety. Pregnant women (N = 1653) were assessed with self-report measures for anxiety, depression, and sleep. Results suggest that sleep disturbances in pregnancy are significantly associated with antenatal depression and anxiety symptoms. Additionally, it has been determined that antenatal depression and anxiety symptoms are two of the strongest risk factors for development of post-partum depression (Buist et al., 2008). These findings indicate that the relationship between sleep and mood disturbances such as anxiety and depression during pregnancy should be further assessed.

1.22 Sleep and Depression during pregnancy

It has been estimated that between 7% and 20% of women experience depressive symptoms during pregnancy (Bennett, Einarson, Taddio, Koren, & Einarson, 2004; Biaggi et al., 2016). Depression and disturbed sleep in pregnancy have a complex and close relationship. As previously established in non-pregnant populations, a study by

Okun (2015) suggests both an additive and bidirectional relationship between sleep disturbances and depression during the antenatal period (Kahn et al., 2013). For example, pregnant women with disturbed sleep are more likely to develop depressive symptoms which, in turn, increases sleep disturbances. Studies have found that depressed pregnant women experienced significantly more sleep disturbances compared to non-depressed pregnant women, even after controlling for anxiety (Field et al., 2007; Okun et al., 2011; Ruiz-Robledillo, Canário, Dias, Moya-Albiol, & Figueiredo, 2015). This study further emphasizes the strong relationship between sleep and depression even when controlling for a highly comorbid factor such as anxiety.

1.23 Sleep and anxiety during pregnancy

Elevated anxiety symptoms during pregnancy are a risk factor for developing antenatal depression, indicating the extent to which these factors are comorbid (Biaggi et al., 2016). Research suggests that the presence of antenatal anxiety serves as a predictor for the development of postpartum depression after controlling for antenatal depression (Heron et al., 2004).

Sleep disturbances are significantly associated with both depressive and anxiety symptoms during the antenatal period (Volkovich et al., 2015; Yu et al., 2017). However, subjective sleep during pregnancy increases the risk of postnatal depressive symptoms but not postnatal anxiety (Tham et al., 2016). There is evidence for a bidirectional relationship between sleep and depression during pregnancy as well as comorbidity between antenatal depression and antenatal anxiety. However, there is a lack of information regarding the innerworkings of these three factors together. One

study by Swanson, Pickett, Flynn, and Armitage (2011) found that there was no relationship between sleep disturbances and depressive symptoms after controlling for anxiety symptoms in pregnancy. Pregnant women (N = 114) were assessed using self-report measures to evaluate anxiety, depression, and sleep. Results suggested that anxiety symptoms are a more significant contributor to antenatal sleep disturbances than depressive symptoms. These findings further illustrate the need for a more in depth look at the relationship and interaction between sleep disturbances, anxiety and depressive symptoms in pregnancy.

1.24 Other factors during pregnancy

The relationship between maternal age and sleep during the antenatal period is not well understood. Higher age has been associated with increased sleep disturbances in non-pregnant populations (Facco et al., 2010; Sahdin, 2009). While some studies have found similar associations between sleep and maternal age, more research must be conducted to better understand how these factors are related. Additionally, younger age has been significantly associated with antenatal anxiety and depressive symptoms (Biaggi et al., 2016).

The gravidity status of pregnant women is another factor that is not well understood, particularly in its relation to sleep. There is currently very limited, if any, literature describing the relationship between gravidity status and sleep disturbances during pregnancy. More women will achieve multigravida status as they advance in age which may cause age to influence the relationship between gravidity and disturbed sleep.

1.3 Present Study

Given the complex relationship between sleep disturbances and symptoms of anxiety and depression during pregnancy, further investigation needs to be completed. This study aimed to further the understanding of different factors leading to distress in pregnancy. Specifically, a study goal was to examine the relationship between subjective sleep disturbances, anxiety symptoms, and depressive symptoms in pregnancy. Based on the previous research that suggests there is a significant yet complex association between these three variables, it was hypothesized that sleep disturbances, anxiety, and depression will all be significantly associated with one another. Additionally, a second study goal was to assess the relationship between antenatal anxiety and sleep disturbances when controlling for antenatal depression. It was hypothesized that a significant relationship between antenatal anxiety and sleep disturbances during pregnancy will remain after removing the contributing components of depressive symptoms. Finally, associated factors of pregnancy, maternal age and gravidity, were assessed in order to further understand the relationship between each of these factors and sleep disturbances during pregnancy. It was hypothesized that there will be a significant relationship between maternal age and sleep disturbances and between gravidity and sleep disturbances.

2. Methods

2.1 Participants and Procedure

Participants included 438 pregnant women who were recruited at an OB/GYN clinic in North Mississippi. Pregnant women that agreed to participate in the study were informed of the study purpose and procedures prior to signing an informed consent form. Participants were then given Pittsburgh Sleep Quality Index (PSQI), Depression, Anxiety, and Stress Scale – 21 (DASS-21), Edinburgh Postnatal Depression Scale (EPDS), in addition to several other questionnaires relevant to a larger ongoing study. Participants were between the ages of 18 and 45 with an average age of 28.30 years. The ethnic background of participants consisted of 76.6% Caucasian, 20.6% African American, 1.6% multiracial, and 1.2% Asian with 3% identifying as Hispanic or Latina. Multigravida women constituted 71.6% of participants whereas 28.4% of participants had not been pregnant prior to the current pregnancy.

2.2 Measures

2.2.1 Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) is a 19 item self-report measure to assess an individual's quality of sleep over the last month. The PSQI measures sleep quality, sleep latency, sleep

duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, and daytime sleepiness. The global PSQI score is derived from equally weighting all components of the PSQI and can range from 0 to 21. A higher score on the PSQI indicates worse sleep quality (Buysse et al., 1989). The PSQI sleep quality subscale was used as a metric of sleep for the pregnant women in this study.

2.2.2 Depression, Anxiety, and Stress Scale – 21

The Depression, Anxiety, and Stress Scale – 21 (DASS-21; Lovibond & Lovibond, 1995) is a 21 item self-report measure that assesses symptoms of depression, anxiety, and stress experienced over the last week. DASS-21 asks the participant to choose the number, which indicates how much the statement applied to her over the past week on a scale from 0, meaning did not apply at all, to 3, meaning applied very much or most of the time. For example, one item asks the participant to rate the statement “I was worried about situations in which I might panic and make a fool of myself.” (Lovibond & Lovibond, 1995). The DASS-anxiety subscale was used in this study as a metric of anxiety in pregnant women.

2.2.3 Edinburgh Postnatal Depression Scale

The Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) is a 10 item self-report measure used to assess depressive symptoms during the antenatal and postpartum periods. One item on the EPDS asks the participant “I have looked forward with enjoyment to things: 1) As much as I ever did, 2) Rather less than I used to, 3) Definitely less than I used to, 4) Hardly at all” (Cox et al., 1987).

The scores range from 0 to 30 with higher scores indicating increased depression. Therefore, selection of an answer choice with a higher numerical value indicates increased depressive symptoms. The EPDS total score was used in this study as a metric of depressive symptoms of pregnant women.

3. Results

Hypothesis 1: *Sleep disturbances, anxiety, and depression will all be significantly associated with one another.*

Pearson correlations were run to assess the relationship between anxiety, depression, and sleep quality during pregnancy. As can be seen in Table 1, sleep disturbances evaluated using the PSQI were positively significantly correlated with both pregnancy-related depression symptoms assessed by EPDS ($r = .26, p < .01$) and anxiety symptoms measured by DASS-21 ($r = .33, p < .01$). Pregnancy-related depression symptoms evaluated by the EPDS and anxiety symptoms assessed by DASS-21 were also positively significantly associated with each other ($r = .54, p < 0.01$).

Hypothesis 2: *A significant relationship between antenatal anxiety and sleep disturbances during pregnancy will remain after removing the contributing components of depressive symptoms.*

A linear regression was performed to assess variance in sleep disturbances predicted by antenatal anxiety while controlling for antenatal depression. Results demonstrated that anxiety in pregnancy is a significant predictor of sleep disturbances while controlling for depression, $F(2, 296) = 18.44, p < .001$. Only anxiety was a unique contributor to the model ($\beta = 0.26, p < .001$), with the contribution of depressive

symptoms non-significant ($\beta = 0.11, p = 0.10$). The R^2 value was 0.11 which indicates that 11.1% of the sleep disturbances can be uniquely attributed to the contribution of anxiety symptoms.

Hypothesis 3: There will be a significant relationship between maternal age and sleep disturbances and between gravidity and sleep disturbances.

Pearson correlations were used to test the potential relationship between sleep disturbances and age (see Table 1). Results of the correlation analysis demonstrated no significant relationship between sleep disturbances measured by the PSQI and age ($r = -.03, p = .66$). Additionally, correlations were also used to assess the relationship between sleep disturbances evaluated by the PSQI and gravidity. Results indicated that there was no significant relationship between sleep disturbances and gravidity status ($r = .01, p = .81$).

Table 1. Correlations between sleep disturbances, anxiety symptoms, and other variables as reported by pregnant women.

	M (SD)	PSQI Sleep Quality Score	DASS-21 Anxiety Scale
EPDS Total Score	7 (5)	.26**	.54**
DASS-21 Anxiety Scale	3 (3)	.33**	--
Maternal Age	28.30 yrs	-.03	--
Gravidity	.716 multigravida	.01	--

Note. M = Mean; SD = Standard Deviation; DASS-21 = Depression, Anxiety, and Stress Scale; EPDS = Edinburgh Postnatal Depression Scale; PSQI = Pittsburgh Sleep Quality Index; ** $p < 0.01$ level

4. Discussion

4.1 Sleep, Anxiety, and Depression

Sleep disturbances, anxiety symptoms, and depressive symptoms in pregnancy are all very prevalent amongst pregnant women, especially compared to the non-pregnant population (Bennett et al., 2004; Biaggi et al., 2016; Mindell et al., 2015; Van der Zwan et al., 2017). The present study examined the relationship between each of these factors. The results supported the hypothesis that each of these factors is significantly and positively related to one another, which is not surprising since previous studies have demonstrated the comorbidity and close relationship of these symptoms, particularly in non-pregnant populations.

The presence of sleep disturbances, anxiety, and/or depression during pregnancy can result in negative fetal and maternal outcomes. For example, disturbed sleep has been associated with preeclampsia, pre-term birth, longer labor times, increased pain perception during labor, and higher rates of cesarean deliveries (Beebe & Lee, 2007; Chang et al., 2010; Edwards, 2000; Ekholm et al., 1992; Lee & Gay, 2004; Okun et al., 2009). Antenatal anxiety is considered a risk factor for the development of postpartum depression as well as behavioral and emotional problems in children (Heron et al., 2004; O'Connor, 2002). As these three constructs are associated with one another and have evidenced poor outcomes for both the pregnant woman and fetus, continued focus on mental health concerns during pregnancy seems prudent.

4.2 Sleep and Anxiety

While it is clear that sleep, anxiety, and depression are related during pregnancy, there is still uncertainty surrounding the way that these factors interact with one another. The present study examined the specific relationship between sleep disturbances and anxiety symptoms while controlling for depressive symptoms. The hypothesis was supported with results suggesting that anxiety is a predictor of sleep disturbances in pregnancy whereas depression is not. These findings indicate that depressive symptoms were not the driving force behind antenatal sleep disturbances in this pregnant population, despite the previous literature citing the bidirectional and additive relationship between sleep disturbances and depression during pregnancy. With equivocal findings, it is clear that more research is needed to have a specific understanding of the innerworkings between these three factors. Previous literature extensively reports on the relationship between anxiety and depression as well as between depression and sleep during the antenatal period. However, there is much to be determined in regards to anxiety and sleep disturbances in pregnancy or anxiety in general in the pregnant population.

Antenatal anxiety is very prevalent in pregnancy with an estimated 23% of pregnant women experiencing anxiety symptoms while pregnant; moreover, this is approximately 2-3 times more prevalent than antenatal depression (Bayrampour, McDonald, & Tough, 2015). The results of the present study suggest that antenatal anxiety is a predictor of sleep disturbances in pregnancy. This finding adds to previous literature that demonstrates antenatal anxiety may be more concerning for

pregnant women than depressive symptoms (Heron et al., 2004). These findings further underscore the importance of screening for antenatal anxiety across pregnancy in order to intervene these anxiety symptoms in an effort to prevent the other symptoms such as postpartum depression and sleep disturbances that are predicted by anxiety in pregnancy.

4.3 Sleep and Other Factors

There is limited literature regarding how maternal age and gravidity status relate to sleep disturbances during pregnancy. The results of the present study found no significant relationship between neither maternal age and sleep disturbances nor gravidity status and sleep disturbances. These findings did not support the hypotheses made about these factors. While there was a limited amount of previous research about these factors to base the hypothesis on, the results were still surprising.

Given the previously established association between higher age and increased sleep disturbances in non-pregnant populations, it was hypothesized that there would be a significant relationship between age and sleep disturbances (Facco et al., 2010; Sahdin, 2009). However, this was not found in the results. The absence of an association between age and sleep may be influenced by other factors that often go along with increased age such as more stable socioeconomic status and other factors that may mitigate the effects of age on sleep that are seen in non-pregnant populations.

There was also no significant association found between gravidity status and sleep disturbances in pregnancy. While this was not in support of the hypothesis, it was not

necessarily surprising. There are very few studies that have examined the relationship between gravidity and sleep during pregnancy, so there was very few little literature from which to base the hypothesis. Since there are many common changes and discomforts that occur during pregnancy, these factors may equally affect women across pregnancy regardless of whether they have been pregnant before or not. Therefore, these common symptoms in pregnancy that can contribute to sleep disturbances may affect primigravida and multigravida women with a very similar nature. This would result in little influence of gravidity status on sleep disturbances.

4.4 Potential Limitations and Future Directions

The present study, although having the strength of a large, pregnant sample, had some potential limitations that should be considered. Self-report measures were used to assess sleep, anxiety, and depression, which are screening instruments as opposed to structured clinical interviews that offer accurate diagnostics. The information received via self-report measures relies on the participant to accurately evaluate themselves for each response. For these reasons, future studies could examine these factors using diagnostic measures, in addition to self-report measures, in order to provide a more accurate depiction of certain clinical sleep disturbances, anxiety, and depression in pregnancy.

The ethnic breakdown of the sample is another potential limitation of this study. The majority of the sample, 76.6%, was classified as Caucasian. This limits the overall generalizability of the results as ethnic differences could account for differences experienced across symptoms. Future studies should focus on recruiting a

more diverse sample of participants, particularly in regards to ethnic background of the participants, in order to be more representative of the entire population of pregnant women.

Another potential limitation of the present study is the lack of grouping participant data according to the trimester or gestational age. This study analyzed data from various points across pregnancy, and all of these points were included in the statistical analyses without distinguishing between trimesters or gestational age. This limits the generalizability of the results to all points of pregnancy since each trimester of pregnancy is characterized by varying changes and discomforts. For example, it is clear that pregnant women in their third trimester experience more discomforts due to the size of the fetus. These symptoms often include frequent urination, difficulty getting comfortable at night, frequent nocturnal awakening, difficulty breathing while lying flat, and lower back pain. Studies in the future should group participant data by trimester or gestational age prior to performing statistical analyses and interpreting the results. This will provide a more accurate depiction of the particular factors affecting women during each period of pregnancy. Gestational time may influence the severity of sleep disturbances during certain time frames of the pregnancy and alter the relations between sleep, anxiety symptoms, and depressive symptoms. Future studies can then assess if the results of the present study still remain true after breaking the data down by trimester.

Additionally, studies in the future would benefit from a more specific focus on sleep during pregnancy. The results of the present study indicated that 11.1% of sleep disturbances can be uniquely attributed to the contribution of anxiety symptoms.

While this is significant, anxiety symptoms only account for a mere 11.1% of the sleep disturbances experienced during pregnancy. More research could evaluate other factors that uniquely contribute to sleep disturbances in pregnancy. Given the adverse outcomes associated with disturbed sleep in pregnancy, it would be valuable to know what other factors contribute to these sleep disturbances. These findings could improve screening for factors that negatively impact sleep during pregnancy in order to prevent and also intervene when pregnant women are experiencing disturbed sleep.

5. Conclusion

The present study demonstrated that antenatal anxiety symptoms are a distinct predictor of sleep disturbances in pregnancy. Not surprisingly, sleep disturbances, antenatal anxiety and depressive symptoms were all associated with one another. The current study also indicated that sleep disturbances in pregnancy are not related to maternal age or gravidity.

These findings have important clinical implications. Given the association between sleep, anxiety, and depression during pregnancy, it would be beneficial for patients to be screened for these symptoms during routine obstetric appointments, followed by intervention or prevention if needed. In partnership with obstetric physicians, psychologists should administer the screenings and interpret the results. Early detection and intervention of even one of these disturbances has the potential to decrease the likelihood of experiencing the other two symptoms. For example, early screening for sleep disturbances could lead to early intervention and prevention of anxiety, depressive symptoms, and further sleep disturbances throughout pregnancy.

Ultimately, psychologists and physicians, working with one another, have a unique opportunity to evaluate pregnant women for psychological issues such as disturbed sleep, anxiety and depressive symptoms during routine obstetric appointments. This integrated approach to patient care can aid in the sustained well-being, both physical and mental, of the pregnant woman and her child over the course of pregnancy.

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