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Postpartum Depression and Sleep Loss in First Time Mothers

by

Deepika Goyal

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Nursing

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

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Deepika Goyal

This work is dedicated to my family, with love and gratitude to:
Henryk, Sophia, Nina, Nick, Harbant, Adersh, Philip, Ravi, Radha Krishan, and
Shakuntala Devi

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ABSTRACT

POSTPARTUM DEPRESSION AND SLEEP LOSS IN FIRST TIME MOTHERS

Deepika Goyal

University of California, San Francisco, 2007

The purpose of this study was to describe depressive symptoms and sleep in first-time mothers. Predictors of postpartum depressive symptoms, including perceived stress, social support, and maternal adjustment were also examined. Another purpose was to compare objective and subjective sleep in mothers with and without depressive symptoms in the third trimester (Time 1) and at 12 weeks postpartum (Time 2).

This descriptive, correlational, longitudinal, secondary analysis utilized data from two randomized clinical trials. Depressive symptoms, psychosocial measures, and subjective and objective sleep measures were collected on a sample of 161 first-time mothers between the ages of 18 and 43 years.

The Center for Epidemiologic Studies Depression Scale (CES-D) was used to measure depressive symptoms. Mean CES-D scores at Time 1 (12.2 ± 7.0) significantly improved at Time 2 (8.8 ± 6.7). However, of the 46 women scoring in the depressed range at Time 1, 32.6 % ($n = 15$) continued to experience depressive symptoms at 12 weeks postpartum. Of the 115 women with minimal symptoms at Time 1, 7% ($n = 8$) experienced depressive symptoms at 12 weeks postpartum. Depressive symptoms and sleep disturbance were significantly associated at Time 1 and Time 2. Overall sleep disturbance, minutes to fall asleep, ability to stay asleep, and daytime sleepiness significantly improved from late pregnancy to 12 weeks postpartum. Women with

depressive symptoms in the late third trimester and 12 weeks postpartum reported significantly more sleep disturbance, trouble falling asleep and more daytime sleepiness than women without depressive symptoms. Fifty-seven percent of the variance in mothers' depressive symptoms at 12 weeks postpartum was explained by six independent variables. However, antenatal CES-D score alone was a significant predictor of postpartum depression scores, accounting for 16.7% of the variance in depression scores at 12 weeks postpartum.

The results of this study underscore the need for health care providers to assess depressive symptoms and sleep during pregnancy and during the first few postpartum months. Furthermore, results suggest that complaints of sleep disturbance, especially prolonged sleep onset latency and increased daytime sleepiness, may be relevant screening questions in relation to risk for postpartum depression.

APPROVED:

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CHAPTER I

INTRODUCTION

Depression, especially after childbirth is highly stigmatized and many women suffer in silence (Beck & Indman, 2005; Halbreich & Karkun, 2006; Shakespeare, Blake & Garcia, 2003; Tam, Newton, Dern & Parry, 2002). Recent media headlines and legislation mandating perinatal education have brought postpartum mood disorders to the forefront. Timely diagnosis, effective treatment, and adequate follow-up of depression have become such major issues that a national task force was convened to establish guidelines for the detection and treatment of PPD (The U.S Preventative Services Task Force; USPSTF, 2002). Health care providers are now having conversations about postpartum mood disorders with their patients and more women are being identified. However, treatment options are limited with two main modalities being pharmacological or psychotherapy based. Many women are hesitant to take medications if they are breastfeeding. The Academy of Pediatrics (AAP) classifies most antidepressants as drugs of concern given the effects on nursing infants remains unknown (American Academy of Pediatrics Committee on Drugs, 2001). The unfavorable side-effects of serotonin reuptake inhibitors (SSRIs), the most commonly prescribed medications for PPD, include low libido and weight gain which may be discouraging for new mothers already going through physiologic changes. Difficulty scheduling appointments, transportation issues, stigma of mental illness, discrimination by insurance companies, and childcare issues are all barriers to women obtaining much needed psychiatric help and contributes to the number of missed clinical appointments (Sobey, 2002).

Non-pharmacological and more time-efficient interventions need to be identified in order to provide mothers with greater options for PPD treatment. In order for this to occur, other possible causes and predictors of PPD need to be documented. Sleep disturbance has been found to be highly correlated with mood disorders in the general population (Ford & Kamerow, 1989; Ustun, Privett, Lecrubier, Weiller, Simon, et al., 1996). Despite the similarities between symptoms of sleep disturbance and symptoms of depression in the general population (Ford & Cooper-Patrick, 2001), relatively few studies have examined this relationship in the prenatal period or during the first few months postpartum. Historically, disturbed sleep has been overlooked as a possible cause or predictor of PPD.

Significance of the Research

Given the large body of literature examining predictors and treatment for PPD, there still remains a lack of non-pharmacological evidence-based treatment. The purpose of my program of research is to identify, non-pharmacological, and time-efficient alternate interventions for women suffering with PPD. This study will describe subjective and objective sleep disturbance and depressive symptoms, in a sample of first time mothers in the third trimester of pregnancy and at again at 12 weeks postpartum. Depressive symptoms and sleep will also be described and compared in women with and without depressive symptoms at both time points. Levels of social support, perceived stress, and maternal adjustment and inquiry into their moderating effect on the relationship between sleep and depressive symptoms will also be examined. Results will

provide direction for interventions that may be more acceptable to new mothers. The specific aims and related hypotheses of this study were:

Aim # 1: to describe self-report depressive symptoms (Center for Epidemiologic Studies Scale for Depression, CES-D), self-report sleep (General Sleep Disturbance Scale, GSDS, total scores and subscale scores), self-report diary variables (bedtime, wake time, rise time), and objective sleep (sleep onset latency, SOL, total sleep time, TST, amount of time awake between midnight and 6:00 a.m. WAKE), in a sample of new mothers in the third trimester (Time 1) and at 12 weeks postpartum (Time 2).

Hypothesis 1.1: There will be no significant difference in depressive symptoms between the third trimester and 12 weeks postpartum.

Hypothesis 1.2: There will be no significant difference in subjective and objective sleep between the third trimester and 12 weeks postpartum.

Aim # 2: to describe level of social support and level of perceived stress in a sample of new mothers ($n = 161$) in the third trimester of pregnancy (Time 1) and at 12 weeks postpartum (Time 2). Aim 2 is also to describe the scores (mean $\pm$ SD) of maternal adjustment at 12 weeks postpartum.

Hypothesis 2.1 states that there will be no significant difference in level of social support and perceived stress between the third trimester and 12 weeks postpartum.

Aim # 3: To determine the relationship between depressive symptoms and sleep disturbance in the third trimester and at 12 weeks postpartum.

Hypothesis 3.1: There will be a negative relationship between frequency of depressive symptoms and wake time (WAKE) during the night in the third trimester.

Hypothesis 3.2: There will be a negative relationship between frequency of depressive symptoms and WAKE at 12 weeks postpartum.

Hypothesis 3.3: There will be a negative relationship between frequency of depressive symptoms and total sleep time (TST) in the third trimester.

Hypothesis 3.4: There will be a negative relationship between frequency of depressive symptoms and TST at 12 weeks postpartum.

Hypothesis 3.5: There will be a negative relationship between frequency of depressive symptoms and GSDS SOL or subjective diary sleep onset latency (SOL) in the third trimester.

Hypothesis 3.6: There will be a negative relationship between frequency of depressive symptoms and GSDS SOL subjective diary SOL at 12 weeks postpartum.

Aim # 4: To compare self-report measures of perception of sleep (GSDS total, subscales, diary) and objective sleep measures (TST, WAKE) between women with and without depressive symptoms in the third trimester and to compare women with and without depressive symptoms in the third month postpartum.

Hypothesis 4.1: There will be no significant difference in subjective sleep variables (GSDS total, subscales, diary) between women with CES-D scores ≤ 15 and ≥ 16 in the third trimester.

Hypothesis 4.2: There will be no significant difference in the objective sleep variables (TST, WAKE) between women with CES-D scores ≤ 15 and ≥ 16 in the third trimester.

Hypothesis 4.3: There will be no significant difference in subjective sleep variables between women with CES-D scores ≤ 15 and ≥ 16 at 12 weeks postpartum.

Hypothesis 4.4: There will be no significant difference in objective sleep variables (TST, WAKE) between women with CES-D ≤ 15 and ≥ 16 at 12 weeks postpartum.

Aim # 5: To examine the relationship of mean Time 2 depressive symptoms with socioeconomic (income, education, third trimester work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables.

Hypothesis 5.1: There will be no significant statistical differences in mean Time 2 depression scores based on socioeconomic level (education level, income, Time 1 work status) or perinatal variables (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding).

Aim # 6: To examine the relationship of depressive symptoms to demographic (age, race, income, education, third trimester work status, 12 week postpartum work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables at 12 weeks postpartum, after controlling for third trimester depressive symptoms. The following hypothesis will be tested:

Hypothesis 6.1: There will be no significant relationship between frequency of depressive symptoms and demographic variables (age, race, income, education, third trimester work status, postpartum work status) or perinatal variables (vaginal or cesarean delivery, male or female infant, breast or formula feeding) at 12 weeks postpartum, after controlling for third trimester depressive symptoms.

Aim # 7: To examine the role of social support, perceived stress, and maternal adjustment as moderators of the relationship between sleep disturbance and depressive symptoms at 12 weeks postpartum, after controlling for third trimester depressive symptoms.

Hypothesis 7.1: The relationship between frequency of depressive symptoms and sleep disturbance will be influenced (or moderated) by social support, perceived stress, and maternal adjustment at 12 weeks postpartum.

Significance of the Findings

Testing hypotheses one through seven will add to the existing literature expanding on the current body of literature on postpartum depression. The first aim will describe depressive symptoms of new mothers in the third trimester and at 12 weeks postpartum. Results will provide evidence-based data to support or contradict current depression rates in the antepartum and postpartum periods. This first aim will also describe the subjective and objective sleep of new mothers in the third trimester and at 12 weeks postpartum. Aim two will describe the level of social support and perceived stress in new mothers in the third trimester and at 12 weeks postpartum. Maternal adjustment will also be described at 12 weeks postpartum. Aim three will provide much needed results understanding how amount of sleep and perceived quality of sleep contribute to depressive symptoms. Aim four will further our understanding of why prenatal depressive symptoms resolve in the postpartum period for some women and why other women with prenatal depressive symptoms continue being symptomatic in the postpartum period. Aim five will examine the relationship between depressive symptoms at 12 weeks postpartum and sociodemographic and perinatal variables. Aim six will identify sociodemographic and perinatal predictors for postpartum depressive symptoms. Lastly, aim seven will identify whether social support, perceived stress, and postpartum maternal adjustment moderate the relationship between the relationship of sleep and

depressive symptoms at 12 weeks postpartum. Findings from this study will aid in identifying areas that may be key in developing non-pharmacological interventions for postpartum depression.

Organization of the Chapters

The dissertation is organized into five chapters. Chapter one has introduced some of the current issues with treating PPD, the significance of my research, and the aims and hypotheses of the study. Potential application of findings to clinical practice has also been discussed. Chapter two begins with a historical look at PPD and treatment, continues with a state of the science section that presents the literature on antenatal depression, PPD, and the associations of PPD and sleep disturbance, level of social support, perceived stress, and maternal adjustment. A conceptual framework for examining PPD is presented next. Following the conceptual framework, a critical review of the literature examining current intervention and treatment modalities is presented.

Chapter two concludes with the gaps in current knowledge about PPD, treatment of PPD, and the rationale and significance for this study. Chapter three discusses the methodology for this secondary analysis including research design, instrumentation, and data analysis. Results are presented in Chapter 4, and Chapter 5 summarizes the main findings of this research together with clinical implications, strengths and weaknesses, and conclusions together with implications for future research. Appendices A through F provide examples of each of the screening questionnaires for each study as well as a copy of each of the instruments used in this study.

CHAPTER II

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Introduction

Theories about the etiology of postpartum depression (PPD) have been proposed and pondered for centuries. *The Book of Genesis* makes one of the earliest references to mood changes in the postpartum, “with pain thou shall bear children,” with the original Hebrew word for “pain” also meaning “sorrow” or “sadness” (Bloch, Daly & Rubinow, 2003). Hippocrates suggested the biological etiology of PPD over 2000 years ago (460 BC) proposing that “puerperal fever” is caused by suppressed lochial discharge traveling to the brain led to “agitation, delirium and attacks of mania” in postpartum women (Cox, 1986). Hippocrates wrote about a case in the *Third Book of the Epidemics* of a woman who gave birth to twins and experienced severe insomnia and restlessness within a few days postpartum (Destounis, 1966). French psychiatrist Marcé (1858) suggested disturbances in psychological behavior in postpartum women were due to the changes in their pelvic organs (Marcé, 1858). The American Medical Association coined the term “lactational insanity” to connect a women’s emotional rollercoaster after childbirth in the early nineteenth century (1893) to increases in the hormone prolactin (Rohe, 1996). In contrast, Esquirol, a French psychiatrist in the nineteenth century, wrote of the mental alienation of those recently confined and of nursing women, perhaps making early associations between social isolation and the development of PPD.

It was not until the introduction of modern psychiatric nosology in the early twentieth century that PPD was classified as a mental disorder (Bloch, et al., 2003).

Despite the early historical writings about PPD, the diagnostic criteria for depression after childbirth was not included in the American Psychological Association's (APA) *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* until 1994 (American Psychiatric Association, 1994).

Historically, theories of depressive illness including PPD have been compartmentalized into biological or psychosocial etiologies (Stern & Kruckman, 1983). Biological theories are largely endocrine-related based on the dramatic hormonal shifts immediately after giving birth and an imbalance of neurochemicals in the brain (Garcia-Toro & Aguirre, 2007; Hamilton & Harberger, 1992). Psychosocial theories focus on life experiences or life stressors and encompass changes, adjustments, culture, and the vulnerability experienced by new parents (Affonso, Lovett, Paul, Arizmendi, Nussbaum, et al., 1991; Arizmendi & Affonso, 1987; Garcia-Toro & Aguirre, 2007; Gjerdingen, Froberg & Fontaine, 1990; Nicholson, 1990). However, factors such as sleep loss and infant care during the night can affect both biological and psychosocial mechanisms of PPD.

The next sections of this chapter will review the state of the science and current thinking about prenatal and PPD, the association between PPD and sleep, the association between PPD and social support, the association between PPD and perceived stress, and lastly the association between PPD and maternal adjustment. Following this, a conceptual framework for examining PPD will be presented and will provide the organization for the review of literature. The review of the literature will focus on the current interventions and treatment available to postpartum mothers. Next, gaps in the current body of literature will be outlined. In

conclusion, the contribution that my study can make to help further our understanding of PPD will be presented.

State of the Science

The pregnancy and postpartum period is a joyful and exciting time for most mothers. However, the transition and adaptation to a newborn can be especially difficult for first-time mothers who may have little or no past experience to draw upon. Affective mood disorders are among the common morbidities of pregnancy and the postpartum period. The mood disorders that can occur during pregnancy and postpartum include antenatal depression, blues, postpartum depression (PPD), and postpartum psychosis. Each mood disorder has a specific constellation of symptoms characterized by the onset of emotional symptoms in the weeks or months surrounding childbirth (Sichel, 2000). Given the overlap of symptoms among the mood disorders, it is helpful to outline their differences, their unique risk factors, substantial differences in severity, and approaches to treatment.

Antenatal Depression

Antenatal depression is defined as depressive symptoms anytime during the prenatal period. Historically, antenatal depression has been relatively understudied as many researchers exclude women with a history of antenatal depression in studies examining postpartum depression. Recent research indicates antenatal depression is a significant problem with prevalence rates up to 20 - 50% (Austin, 2004; Bowen & Muhajarine, 2006; Chaudron, 2003; Chen, Chan, Tan & Lee, 2004; Kim, Mandell, Crandall, Kuskowski, Dieperink, et al., 2006). The range of these prevalence figures may

partly be due to differences in diagnostic measurement and in differences in definition of the depression. Research also suggests that depressive symptoms in the postpartum period may actually be a continuation of pre-pregnancy and/or antenatal symptoms for up to half of postpartum women (Chaudron, 2003). Antenatal depression is at risk of being under diagnosed given the focus in on maternal and fetal well-being (Bowen & Muhajarine, 2006). More recently, researchers have started to examine the rates of antenatal and postpartum depression and their associations. Results suggest that depressive symptoms during the antenatal period are more common than during the postpartum period. Risk factors identified for the development of antenatal depression include a history of depression, lack of a social network or partner, low socioeconomic status, and an unplanned pregnancy (Bowen & Muhajarine, 2006).

In secondary analysis, researchers in Sweden contacted women who screened positive for a psychiatric diagnosis in the second trimester of their pregnancy ($n = 220$) along with a random sample of healthy women ($n = 500$) 3 - 6 months after delivery. The prevalence of depressive symptoms in the 220 women decreased significantly after the delivery (29.2%) during pregnancy versus (16.5) 3 - 6 months postpartum (Andersson, Sundstrom-Poromaa, Wulff, Astrom & Bixo, 2006). The authors noted a limitation of this study was a single psychiatric assessment during the second trimester and another assessment 3 - 6 months postpartum. Raising questions regarding whether symptoms were unchanged, situational, or whether they had developed after the first assessment.

Postpartum Blues

Postpartum blues is the most common of the three postpartum mood disorders affecting 26 - 85% of all postpartum women (Altshuler, Cohen, Moline, Kahn, Carpenter, et al., 2001; Beck, Reynolds & Rutowski, 1992; Harding, 1989; Wood, Thomas, Droppleman & Meighan, 1997). The high frequency of the blues places them as a common part of the normal postpartum experience for many women (Epperson, 1999). For most women the blues are short lived and transient in nature, usually peaking 4-5 days after delivery and resolving by the tenth postpartum day (Epperson, 1999). The blues are characterized by periods of mild depression alternating with periods of happiness, (Wood, et al., 1997), malaise, fatigue, tearfulness, anxiety, clouding of consciousness, irritability, and headache (Beck, et al., 1992; Ugarriza, 2000). Due to their mild symptoms and self-limiting nature pharmacological treatment is generally not prescribed and they usually subside by 10-14 days (Kendall-Tackett & Kantor, 1993; O'Hara, 1995). However, the blues cannot simply be disregarded as a normal part of childbirth. If physical symptoms and depressed mood persist longer than 2 weeks, women should be evaluated for PPD; this is especially true if the patient has a history of depression (Bhatia & Bhatia, 1999). Evidence suggests that severe blues places women at a higher risk for PPD later in the postpartum period (Cox, Connor & Kendell, 1982; Hanna, Jarman & Savage, 2004; Hannah, Adams, Lee, Glover & Sandler, 1992).

Postpartum Depression

PPD is a well-documented global phenomenon that affects women all over the world. An estimated 5 - 15% of pregnancies worldwide are casualties to PPD with 500,000 women suffering from PPD each year in the United States (Beck & Gable,

2001b; Dobie & Walker, 1992; Gale & Harlow, 2003; Kumar & Robson, 1984; O'Hara & Swain, 1996; Wisner, Parry & Piontek, 2002a). The Diagnostic and Statistical Manual of Mental Disorders-text revision 4th Edition (*DSM-IV-TR*) (American Psychiatric Association., 2000) defines PPD as a moderate to severe mood disorder comparable to a major depressive episode with a constellation of specific symptoms that occur in the first few weeks postpartum. However, experts in the field define PPD as an onset of a depressive episode two weeks to 12 months after giving birth to an infant (O'Hara & Swain, 1996; Sichel & Driscoll, 2002; The Marcé Society, 2006). Characterized by tearfulness, mood swings, despondency, and inability to cope with the care of the baby, symptoms of PPD most often start in the third month postpartum (Kendall-Tackett & Kantor, 1993; O'Hara, 1995; Steiner, 1990).

Untreated PPD can have significant sequelae on the maternal-child bond (Beck, 1995, 1996c), the infant's development (Beck, 1996b, 1998), and the family (Tammentie, Tarkka, Astedt-Kurki, Paavilainen & Laippala, 2004). Given that postpartum blues is short-lived and usually resolves in the first few weeks postpartum, and postpartum psychosis is extremely rare, the current study is focused on depressive symptoms that persist into the third month postpartum. To date, the majority of research into the phenomenon of PPD has largely focused on correlates and predictors (Beck, 1995, 1998, 2001; Beeghly, Weinberg, Olson, Kernan, Riley, et al., 2002; Bergant, Heim, Ulmer & Illmensee, 1999; Bozoky & Corwin, 2002; Da Costa, Larouche, Dritsa & Brender, 2000; Henshaw, 2003; Matthey, Barnett, Kavanagh & Howie, 2001) and the role of social support (Adewuya, Fatoye, Ola, Ijaodola & Ibibami, 2005; Beck, 1996a; Logsdon, Birkimer & Usui, 2000; Logsdon & Usui, 2001).

Postpartum Psychosis

The third type of postpartum affective disorder, postpartum psychosis, is the most uncommon, but most severe of the three postpartum mood disorders. Postpartum psychosis affects 1 - 2 women out of every 1000 who give birth; however, this is the mood disorder that receives the most sensational coverage in the media (Altshuler, et al., 2001; Gale & Harlow, 2003; Pariser, Nasrallah & Gardner, 1997; Robertson, Grace, Wallington & Stewart, 2004). Postpartum psychosis presents with sudden onset within the first 48-72 hours after giving birth and up to 2- 4 weeks into the postpartum period (Gale & Harlow, 2003; Sichel, 2000). Presenting symptoms include agitation, pressured speech, auditory and visual hallucinations, delusions, inability to sleep, confusion, and poor appetite (Sichel, 2000). Classified as a medical emergency, a diagnosis of postpartum psychosis requires immediate referral to a psychiatrist and hospitalization for intensive inpatient treatment (Gale & Harlow, 2003) as the woman is at increased risk for suicide and/or infanticide (Sichel, 2000).

Given the blues is short-lived and usually resolves in the first few weeks postpartum and postpartum psychosis is extremely rare, the current study focused on depressive symptoms that are present at the third month postpartum, when the experience of being a new mother appears to be at a more stable point in time.

Sleep Disturbances in Childbearing Women

Sleep disruption in new mothers has been likened to that of shift workers (Monk, 2005). According to Monk, humans are “biologically hard-wired to be active during the day and sleepy at night” (2005, p. 674). New mothers often experience disrupted sleep unless they have help from a husband, partner, other family member, friend or live-in help (Gay, Lee & Lee, 2004; Lee & Zaffke, 1992; Lee, 1998; Lee, McEnany & Zaffke, 2000b). Sleep disruption and the resulting sleep deprivation have been associated with deficits in short-term memory, slower reaction time, and impaired motor skills (Harrison & Horne, 2000), all of which are critical attributes for a new mother who is usually the infant’s primary care-taker.

Antenatal Sleep

Sleep disturbance is a common complaint in pregnant women and has been well-documented in the literature. (Hertz, Fast, Feinsilver, Albertario, Schulman, et al., 1992; Lee & DeJoseph, 1992; Lee, et al., 2000b; Mindell & Jacobson, 2000; Santiago, Nodello, Kinzler & Santiago, 2001; Schweiger, 1972; Suzuki, Dennerstein, Greenwood, Armstrong & Satohisa, 1994). Prenatal sleep disturbance is so prevalent that The American Academy of Sleep Medicine recognizes pregnancy-associated sleep disorder as a diagnosis. Some researchers suggest hormone changes play a part in the sleep disturbance (Lee, et al., 2000b; Santiago, et al., 2001). Hormonal changes lead to physiological changes including increased blood volume, increased renal blood flow, and dilation of the renal pelvis and ureters (Marchant, 1978; Trakada, Tsapanos & Spiropoulos, 2003; Worth, Onyeije, Ferber, Pondo & Divon, 2002). These physiological changes together with the mechanical effects of an enlarged uterus predispose women to

frequent urination which leads to multiple nighttime trips to the bathroom (Sahota, Jain & Dhand, 2003). Other causes for sleep disturbance in pregnancy include insomnia and difficulty falling asleep (Mellinger, Balter & Uhlenhuth, 1985), restless legs syndrome (RLS) (Lee, Zaffke & Baratte-Beebe, 2001), snoring, and sleep apnea (Mindell & Jacobson, 2000).

Antenatal sleep time (< 6 hours per night) has also been associated with longer labor length and a greater risk of a cesarean delivery than women who sleep at least 8 hours at night, after controlling for infant birth weight (Lee & Gay, 2004). Other researchers have suggested that sleep disturbance during pregnancy is associated with increased symptoms of postpartum blues (Wilkie & Shapiro, 1992).

Although there are conflicting theories regarding altered sleep in pregnancy, it has been determined that sleep in pregnant women is definitely different than sleep in non-pregnant women (Brunner, Munch & Biedermann, 1994; Hertz, et al., 1992)

Postpartum Sleep

New mothers rarely get enough sleep; in fact poor sleep begins in the third trimester and often extends into the postpartum period until the infant is sleeping through the night. Moreover, the first few months postpartum has been identified as a key time for sleep disturbance for new mothers (Campbell, 1986; Lee, Zaffke & McEnany, 2000c; Nishihara, Horiuchi, Eto & Uchida, 2000; Shinkoda, Matsumoto & Park, 1999; Swain, O'Hara, Starr & Gorman, 1997; Wilkie & Shapiro, 1992). It has also been well documented that poor sleep and mood are associated. However, the normalization of poor sleep in the postpartum period neglects its potential as an etiology of morbidity, especially for PPD. Despite the similarities between symptoms of sleep disturbance and

symptoms of depression in the general population (Ford & Cooper-Patrick, 2001) relatively few researchers have examined the relationship between sleep quality and depression in the prenatal period or during the first few months postpartum.

Research demonstrates that new mothers sleep less and are awake approximately 20% more of the time in the first six weeks postpartum (Nishihara & Horiuchi, 1998). A survey of 231 primiparous and multiparous women 72 hours after delivery (vaginal or cesarean) revealed that 66% complained of sleep disturbance (Tribotti, Lyons, Blackburn, Stein & Withers, 1988). Postpartum women generally report more interrupted sleep, have demonstrated lower sleep efficiency, and decreased total sleep time (Blyton, Sullivan & Edwards, 2002). Furthermore, sleep does not settle into a pattern until later (weeks 9-12) in response to the development of the infant's own sleep-wake cycle (Nishihara, Horiuchi & Uchida, 1997). Both of these studies revealed the mother's wakefulness in the first 12 weeks postpartum was associated with their infant's movements and feeding demands. Other researchers analyzed mothers' (n = 8) sleep logs at five and 12 weeks postpartum and results revealed significant differences in total sleep time and wake time (Horiuchi & Nishihara, 1999) between the two time points which supports Nishihara and colleagues' earlier (1997, 1998) findings.

Despite the fact that disturbed sleep and fatigue are common complaints for many childbearing women, researchers are now examining sleep deprivation and its association with postpartum depressive symptoms (Dennis & Ross, 2005; Gay, et al., 2004; Horiuchi & Nishihara, 1999; Lee, Yip, Leung & Chung, 2000a; Lee & Zaffke, 1999; Pugh & Milligan, 1995; Shinkoda, et al., 1999; Whiffen, 1992). One researcher prospectively investigated the relationship between sleep disruption and development of the postpartum

blues in 63 Scottish women. The hypothesis that sleep disruption on the nights following childbirth increased the risk of developing the blues was not supported. However, accrued sleep loss from nighttime labor did increase the incidence of the blues during the first postpartum week (Wilkie & Shapiro, 1992).

Zaffke (1999) noted a 20% preconception report of fatigue climbed to 50 - 64% among women in the immediate postpartum period. Symptoms of fatigue include inability to concentrate and apathy (Ludwig & Strasser, 2001). Furthermore, exhaustion from lack of sleep has been rated in the top four contributing factors of PPD (Small, Brown, Lumley & Astbury, 1994).

Karacan and colleagues (Karacan, Williams, Hirsch, McCaulley & Heine, 1969) were among the first to suggest depressive symptoms and sleep disturbance may be associated in the prenatal and postpartum period. They examined the sleep of 13 women (7 primigravidas and 6 multigravidas) prenatally and two women during the postpartum period. They noted wide fluctuations in the amount of sleep from early pregnancy to 4-6 months postpartum. Their findings have implications for postpartum mental health; however, no measures of well-being were reported. Swain and colleagues (Swain, et al., 1997) examined 30 postpartum women and found a high correlation between self-reported sleep and mood during the first three weeks postpartum. More recently, Lee and colleagues (Lee, et al., 2000c) found that sleep and depressive symptoms were strongly associated at one month postpartum. Huang and colleagues (Huang, Carter & Guo, 2004) compared the postpartum sleep of 163 depressed and non-depressed first-time Taiwanese mothers living in Taiwan, and the depressed mothers reported more overall sleep disturbance than the non-depressed mothers. Wolfson and colleagues (Wolfson, Crowley,

Anwer & Bassett, 2003) examined depressive symptoms and sleep patterns from the late pregnancy to one year postpartum and noted an association between sleep patterns in late pregnancy and depressive symptoms in the first few weeks postpartum.

Social Support, Stress, and Maternal Adjustment in Childbearing Women

The birth of a child can be joyful, demanding, and stressful for parents (Muslow, Caldera, Pursley, Reifman & Huston, 2002). It has been suggested that a lack of social support, stress, the transition to motherhood, and adjusting to the new infant all contribute to the development of PPD. The next few sections of the chapter will discuss these concepts in more detail.

Social Support

Given pregnancy and the postpartum are joyful for most women, they are often trying and demanding as well. A supportive relationship with a spouse or other family may enhance feelings of well-being and positive affect among other things. Support in pregnancy and postpartum may also be related to help with daily chores and child care (Collins, Dunkel-Schetter, Lobel & Scrimshaw, 1993). A lack of social support in pregnancy has been associated with increased levels of stress and PPD all of which have been well-documented in the literature (Affonso, et al., 1991; Beck, 2001; Howell, Mora & Leventhal, 2006; Logsdon, Birkimer, Simpson & Looney, 2005; Martin, Brown, Goldberg & Brockington, 1989; O'Hara, 1986; O'Hara, Rehm & Campbell, 1983; Stein, Cooper, Campbell, Day & Altham, 1989; Webster, Linnane, Dibley, Hinson, Starrenburg, et al., 2000).

Results with a sample of pregnant low-income women (N = 129) suggested women who received more social support experienced less depressive symptoms

(measured with the CES-D) (Collins, et al., 1993).

Depressive symptoms were associated with a poor marital relationship in another sample of 202 primiparous women at 6, 9 and 12 months postpartum. The women were primarily educated, white, middle-class, married women in their early 30s who returned to work within the first postpartum year. Results indicated that marital adjustment and child-care stress significantly influenced maternal depression symptoms at 9 months postpartum. The findings from this suggested a poor marital relationship contributed to poor social support which in turn was associated with postpartum maternal depression (Merchant, Affonso & Mayberry, 1995).

Stress

Psychological stress is defined as “a relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984, p. 21). An individual engages in judgment, discrimination, and reaction to a situation based on antecedent experiences as well as evaluation of the impact on well-being. A first-time mother is an example of this as she may be unable to draw upon her own previous personal experience with pregnancy or PPD. However, she may have antecedent experience where a friend or colleague has experienced a similar situation. Some other factors that determine how a woman adapts to the physical and emotional life changes after childbirth include family experiences, quality of her childhood, family relationships, quality of her marriage, and other current personal relationships (Morse, 1993).

Stress (14-item Perceived Stress Scale, PSS) and distress (12-item General Health Questionnaire) were assessed in 865 women during pregnancy and the prevalence for

high stress was between 22-53% (Rondo, Ferreira, Nogueira, Ribeiro, Lobert, et al., 2003). Pregnant women reported significantly higher levels of emotional distress on the Brief Symptom Inventory than community controls (Otchet, Carey & Adam, 1999). As part of a Swedish study researchers studied the contribution stress made independently to pregnancy related symptoms in pregnant women (N = 476) (Rodriguez, Bohlin & Lindmark, 2001). Results suggested stress (measured with the PSS) contributed 75% of the independent variance in the prevalence and frequency of 27 symptoms during pregnancy including difficulty sleeping and fatigue. For most postpartum women the main stressor may be the lack of sleep due to the needs of the new baby (Quillin, 1997). It has been suggested that social support may act as a buffer for a person's mental health in times of high stress (Cohen & Wills, 1985).

Maternal Adjustment

Meleis and Trangenstein (1994) define a transition as “a change in health status, relationships, expectations or abilities ...a passage from one life phase, condition, or status to another...” (p. 256). Examples of transitions include pregnancy and motherhood (Meleis & Trangenstein, 1994; Schumacher & Meleis, 1994). It has been well-documented that the period surrounding the birth of a first child can be a particularly challenging and stressful transition for parents (Heinicke, 1995). New mothers are predisposed to experience stress and anxiety during the first few weeks postpartum. Not only are new mothers coping with extreme physiological changes, but they must also quickly become acquainted with their new infant's behaviors and abilities (Brouse, 1988). Successful maternal adjustment to her new infant is key, as depressive symptoms in the pregnancy and

postpartum can significantly affect a new mother's ability to cope with life events and parenting tasks (Beck, 1993, 1996c, 1999; Mercer, 1981, 1985; Mercer, 2004; Misri, Reebye, Milis & Shah, 2006).

A convenience sample of primiparous women (N = 136) in their last trimester of pregnancy completed questionnaires 9 - 14 weeks postpartum including a perceived competence scale and a depression measure. Postpartum depressive symptoms were negatively related to all measures of maternal role attainment ($r = -.20$ to $-.35$, $p < .01$) (Fowles, 1996, 1998).

Conceptual Framework

The two main viewpoints that are most often used to explain the phenomenon of depressive illness today are the biological and the psychosocial perspective. Biological theories are largely viewed through the lens of a predominantly Western medical model through which PPD is considered a pathological process and a psychiatric illness (Beck, 2002). Dalton (1989) suggested PPD was more an issue of endocrinology than psychiatry whereas other empiricists believe biological theories identify markers defined as reproducible organic findings which are consistently found in persons with a specific disorder (Dobie & Walker, 1992). The speculation about the etiology of PPD is not new. Early writings by Hippocrates in 460 BC proposed agitation and mania associated with the postpartum period were caused by diversion of breast-milk to the brain (Cox, 1986). Trotula of Salerno, a gynecologist in the early eleventh century, hypothesized that postpartum emotion was caused by an overly moist womb. He postulated it was the extra water from the womb that flooded the brain which in turn caused involuntary shedding of

tears (Steiner, 1990). PPD was not examined scientifically until the eighteenth century when a French psychiatrist, Marcé, wrote a Treatise on Insanity on Pregnant and Lactating Women which is thought to be the only comprehensive book in the world literature on the subject (Marcé, 1858).

Other biological causes implicated in the development of PPD are reproductive hormonal changes (estrogen, progesterone, & prolactin) (Abou-Saleh, Ghubash, Karim, Krymski & Bhai, 1998; Gruen, 1993; Gyermek & Soyka, 1975; Hendrick, Altshuler & Suri, 1998), cortisol changes (Harris, Lovett & Newcombe, 1994; O'Hara, 1995), low hemoglobin levels (Corwin, Murray-Kolb & Beard, 2003), thyroid disorders (Harris, Othman & Davies, 1992; Kuijpers, Vader, Drexhage, Wiersinga, van Son, et al., 2001; McCoy, Beal & Watson, 2003; Pop, de Rooy & Vader, 1991), and biological circadian rhythm disturbance (Armitage, Hoffmann & Rush, 1999; Healy, 1987; Wirz-Justice, 1995).

Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis was a reproducible finding in major depression outside pregnancy and postpartum (Carroll, Curtis & Mendels, 1976). However, HPA axis disturbances do not differ between non-pregnant and postpartum women with MMD. Although higher cortisol levels have been associated with maternity blues (Handley, Dunn, Waldron & Baker, 1980), most studies have failed to show an association between cortisol levels and PPD (Abou-Saleh, et al., 1998; Harris, 1994; O'Hara, Schlechte, Lewis & al., 1991). Symptoms of fatigue, apathy, and an inability to concentrate are common (Ludwig & Strasser, 2001) in anemia (low hemoglobin level) which has also been implicated in the development of PPD (Corwin, et al., 2003).

In the early 1970's Engel (1977) challenged this thinking and proposed a new framework to understand human illness that integrated the biomedical and psychological perspectives. The resulting biopsychosocial framework suggests that biomedical and psychosocial variables in illness are not separate but in fact interconnected and interdependent (Engel, 1977, 1981). Since Engel first proposed the biopsychosocial framework in 1977, researchers across all disciplines including medical, nursing, and psychiatry have adopted this model in their fields of study (Buerki & Adler, 2005; Engel, 1983; Follick, Smith & Turk, 1984; Ginsburg, 1995; Kreipe & Yussman, 2003; Richter, 1999; Shaver, 1985; Weiss, 1980).

The proposed conceptual framework suggests that PPD is multidimensional in nature. It further suggests that the both biological and psychosocial etiologies are related to sleep changes in the postpartum period. Future research must incorporate multiple measures to best capture the phenomenon of PPD from the psychosocial and biological viewpoints. Researchers agree that the phenomenon of PPD is complex, with multiple biomedical and psychosocial factors. Despite hundreds of years of speculation and research we appear to be no closer to discovering the 'true' causative factors of PPD. Given the multiple factors in the literature that have been attributed to the development of PPD, the biopsychosocial framework appears to provide the best fit to help further our understanding of this devastating illness.

The aims and hypotheses of my study were formulated to examine certain relationships from within the proposed conceptual framework. More specifically, I was interested in the roles of fragmented sleep, perceived stress, level of social

support, and level of maternal adjustment and how (and if) they affected the development of depressive symptoms at 12 weeks postpartum in first-time mothers.

The literature review will continue with this same line of inquiry focusing on the links between sleep, perceived stress, social support, and maternal adjustment and postpartum depressive symptoms. Other concepts (marked with an asterisk) from the conceptual framework will also guide the literature review and provide a thorough discussion and critique of biological and psychosocial factors associated with postpartum depression (Figure 2.0).

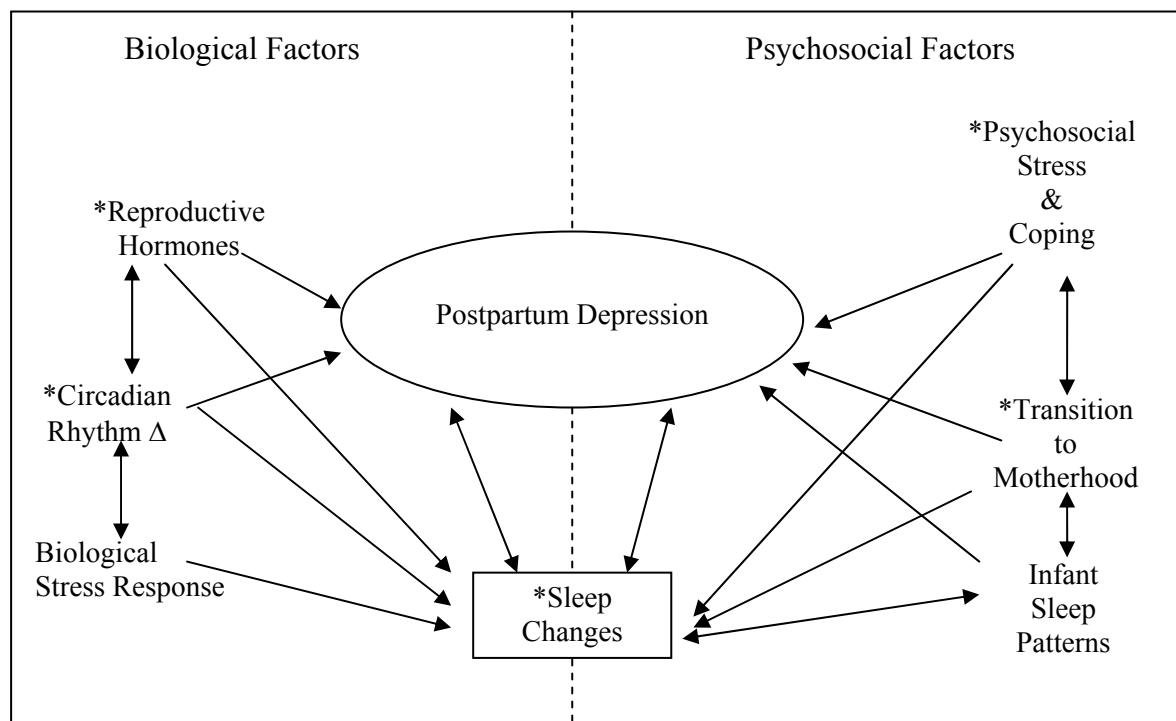


Figure 2.0. Schematization of postpartum depression and associated etiologies.

Critical Review of the Literature

The focus of this review is to critically examine the current body of knowledge regarding intervention and treatment of PPD. A biopsychosocial conceptual framework will be used to help organize the literature. The chapter concludes with strengths and weaknesses of the body of literature as a whole. Lastly, identification of the gaps in the literature will provide suggestions for future research and the rationale for conducting the secondary analysis.

In order to provide a current review of treatment for PPD, studies published between January 1, 1997 and January 31, 2007 were included. PubMed, CINAHL, Medline, Cochrane Library, and PsychInfo electronic databases were searched for relevant studies. Keywords included *postpartum depression*, *postnatal depression*, *intervention*, *psychosocial*, *biomedical*, *antidepressant*, *hormonal*, *sleep*, *maternal adjustment*, *social support*, *stress*, and *circadian rhythm*, with additional research identified from study references. Studies were included in this review if they were written in English, published in peer-reviewed journals, had a primary aim clearly stating intervention or treatment for PPD that was initiated in the postpartum period, and women were not more than 12 months postpartum. The literature search revealed over 100 studies employing biological and psychosocial-based treatment in the postpartum period. The biological interventions section will include antidepressant medications, reproductive hormonal therapy, and other complimentary and alternative (CAM) modalities (sleep deprivation, bright light therapy, prescribed exercise). The psychosocial intervention section of the paper will review interventions based on cognitive behavioral therapy (CBT), interpersonal therapy (IPT), peer support, group therapy, and partner support.

A total of 18 studies met the inclusion criteria for this review. Eight studies examined biological interventions, and ten studies utilized psychosocial-based interventions. Two studies evaluated a combination of biological (antidepressant therapy) and psychosocial interventions (CBT). One will be discussed in the antidepressant section (Appleby et al., 1997) and the other (Misri et al., 2004) will be discussed in the CBT section as these best fit the aims of the studies. Unless otherwise stated, all of the studies had appropriate human subjects and ethical review. Additionally, all reported levels of significance were $p < 0.05$ and 95% confidence intervals (CI).

Biological Interventions for Postpartum Depression

Antidepressant Medication

Estrogen is a lipid-based molecule derived from cholesterol which is abundant in the central nervous system (Grigoriadis & Kennedy, 2002). One of the functions of estrogen is to modulate neurotransmitter systems including dopamine, serotonin, norepinephrine, acetylcholine, and glutamate. The relationship between estrogen, neurotransmitters, and mood disorders is thought to be mediated through the serotonergic system (Grigoriadis & Kennedy, 2002). A postpartum decline in estrogen levels may alter the serotonergic system and contribute to PPD. Antidepressant preparations, especially selective serotonin reuptake inhibitors (SSRIs) have been used with positive results in the treatment of premenstrual dysphoric disorder (PMDD) (Metzl & Angel, 2004). The etiology of PMDD is theorized to be related to hormonal imbalance. Several studies have used SSRIs in the treatment of depressive symptoms during pregnancy and in the postpartum period using the same theoretical assumptions as PMDD. Despite the prevalence of PPD only four research studies investigating antidepressant therapy as an intervention for PPD met the criteria for this review. Two studies examined SSRI antidepressants (Appleby, Warner, Whitton & Faragher, 1997; Stowe, Casarella, Landry & Nemeroff, 1995) and two investigated the use of other antidepressants (Cohen, Viguera, Bouffard, Nonacs, Morabito, et al., 2001; Nonacs, Soares, Viguera, Pearson, Poitras, et al., 2005). Although research conducted by Stowe and colleagues (1995) is earlier than January 1997, it represents the first study examining SSRI therapy for PPD and therefore will be included in this review.

Appleby and colleagues (1997) conducted a double-blind RCT to examine the effectiveness of the SSRI fluoxetine (Prozac) and CBT in postpartum women diagnosed with depressed mood. They hypothesized that: a) six counseling sessions would be more effective than one, b) fluoxetine would be more effective than placebo, and c) after one counseling session, fluoxetine and additional sessions of counseling would be equally effective. The second hypothesis will be the focus of this review. The sample included 87 British English speaking women 6 to 8 weeks postpartum who scored ≥ 10 on the Edinburgh Postnatal Depression Scale (EPDS) (Cox, Holden & Sagovsky, 1987) and met diagnostic criteria for major/minor depressive disorder. Exclusion criteria included chronic or resistant depression (> 2 years), current alcohol/drug abuse, and breastfeeding. After random assignment to one of four treatment groups, group 1 received fluoxetine and one CBT session ($n = 16$), group 2 received placebo and one CBT session ($n = 17$), group 3 received fluoxetine and six CBT sessions ($n = 13$), and group 4 received placebo and six CBT sessions ($n = 15$). Counseling sessions were based on CBT and focused on feelings of not coping, lack of enjoyable activities, lack of practical support, and caring for older children. Sessions lasted 30 minutes except for the first session that lasted 1.5 hours to allow time for mothers to discuss their current emotional state. The Structured Clinical Interview for *DSM-IV* (SCID) (First, Spitzer, Williams & Gibbon, 1995), EPDS, and the Hamilton Rating Scale for Depression (HAM-D) (Hamilton, 1967) were collected at 1, 4, and 12 weeks post treatment. Statistical tests included ANOVA with repeated measures over time.

Sixty-one (70%) women completed 12 weeks of treatment. No significant differences were noted between women who completed and those who did not complete

the study. The number of women dropping out of each group ranged from six to eight (26- 38%, mean 30%). Three participants gave medication side-effects as the reason for dropping out of the study. Mean age of the women across the four groups ranged from 25.7- 26 years, most were married or partnered, and a high percentages of women in all groups reported unplanned pregnancies (43- 77%). Dropouts were younger than those finishing the study (23.7 ± 6.2 vs. 26.3 ± 5.1 , $t_{85} = 2.06$, $p = 0.04$) and were more likely to have an unemployed partner ($\chi^2 = 3.8$, $df = 1$, $p = 0.05$). Significant reduction in depression scores were reported in all four groups. Overall, fluoxetine was superior to placebo, and six CBT sessions were superior to one session.

This study had several limitations, most concerning of which was a high attrition rate (mean 30%) across all groups. Their life circumstances may have been related to the attrition rate, but it is interesting that those who dropped out had a higher rate of planned pregnancies. In addition breastfeeding women were excluded contributing to selection bias. Fluoxetine is rated by the United States Food and Drug Administration (FDA) as pregnancy category C (Appendix E). This indicates animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans. Minimal information was provided on the actual statistical outcome results and medication dosage, diminishing the validity of the study. No information was provided regarding homogeneity or heterogeneity of the sample limiting generalizability of the results. The study strengths included randomization and an innovative design. Despite the limitations, findings suggest that fluoxetine may be helpful in the treatment of PPD. Out of the three participants who dropped out due to medication side-effects, only one was receiving fluoxetine. This low drop out rate for side-effects adds to the strength

of the study as far as acceptability of the drug. The study would have been strengthened if there were groups that received medication or CBT alone to diminish the confounding effects of the combination of treatments.

Cohen and colleagues (2001) conducted a prospective, 8-week, flexible-dose, open-label study to evaluate the efficacy of the antidepressant venlafaxine (Effexor) on postpartum depressive symptoms. Women diagnosed with major depressive disorder (MDD) with the SCID in the first three months postpartum were invited to participate. Women who were breastfeeding, or had current substance abuse, psychotic, bipolar, or anxiety disorders were excluded. Baseline and outcome measures (HAM-D, the Kellner Symptom Questionnaire, anxiety subscale of the Clinical Global Impressions Scale (CGI) were collected at 2, 4, 6, and 8 weeks. An initial dose of 37.5mg/day venlafaxine was titrated up to a maximum dose of 225mg/day based on depressive symptoms and side effects at biweekly assessments. Optimal outcome was defined as remission (HAM-D score of ≤ 7 or CGI score ≤ 2).

Of the 19 women who enrolled, 15 completed at least the 2-week visit and were included in the analysis. Reasons for dropping out included substance abuse, refusal to take study medication, and initiation of other medications prohibited per study protocol such as oral contraceptive use. Although some participants reported side-effects including sweating ($n = 7$), dry mouth ($n = 6$), nausea ($n = 6$), decrease/loss in libido ($n = 3$), and light-headedness ($n = 3$) none were related to dropping out and most symptoms resolved by the second week of the study. No significant differences were noted between the women who completed the study and those who did not. Analysis was done on the 15 women with last observations carried forward. Mean age of the women was 30.4 years,

most were married (93.3%), and 40% (n = 6) were primiparous. For ten women (67%) the PPD represented a recurrence of MMD with a mean duration of 2.47 ± 2.15 months of illness before entering the study. Mean medication dose was 162.5mg/day with a range of 75- 225mg/day. At the 8-week point 12 (80%) of the women demonstrated remission. Statistically significant improvements in mean HAM-D scores were noted from baseline to endpoint (26.13 ± 5.15 vs. 7 ± 8.14 respectively, $p < .01$). The researchers concluded venlafaxine was efficacious in reducing depressive symptoms in women with PPD.

Study limitations include the open-label design with participants not blinded to treatment, small sample size, lack of randomization, and the lack of intent-to-treat analysis. One limitation of this study is selection bias of excluding women taking oral contraceptives (OCPs) and breastfeeding. Venlafaxine is also rated as pregnancy category C by the FDA (See Appendix X). Despite limitations, this study provides evidence for continued research with SSRIs for the treatment of PPD. An added strength of this study is the tolerability of the drug demonstrated by no drop-outs due to medication side-effects.

More recently, Nonacs and colleagues (2005) evaluated the efficacy of the non SSRI bupropion-SR on PPD in an 8-week open-label design. Eleven U. S. women were enrolled into the study meeting the following inclusion criteria: age between 18- 45 years, onset of depression within 3 months of delivery, and a HAM-D score ≥ 17 . Women with depressive symptoms during pregnancy, with current psychotic symptoms, history of a MMD in the previous 6 months, or use of antidepressants within the past 3 months were excluded. Desired outcome included remission defined as a score ≤ 7 on the HAM-D, and response to medication, defined as a 50% reduction in HAM-D scores from baseline.

Of the 11 women enrolled in the study, analysis was conducted on the 8 (73%) who completed at least 4 weeks of therapy. Most of the women were married (87%, $n = 7$), they were equally divided by nulli- and multiparity, with a mean age of 31.5 years (range 22- 41). Median effective dose of bupropion SR was 262.5mg/day (range 37.5-300mg/day). Final dosage did not correlate with depression scores. Median baseline HAM-D score was 20.5 (range 15-38). The women demonstrated a positive response to treatment with bupropion-SR with statistically significant reduction in HAM-D scores ($p < 0.05$). By end point 75% ($n = 6$) achieved response to treatment demonstrated by a 50% reduction in HAM-D scores from baseline. Three women achieved remission with a HAM-D score ≤ 7 .

The lack of a placebo group and lack of randomization limit the validity of this study. Although reasons for dropping out were provided, no statistical information was available regarding differences between the women who dropped ($n = 3$) out compared to the ones who continued with the study ($n = 8$). Continuation of psychotherapy and concomitant use of medication for insomnia (Ambien) and anxiety (Ativan) are potential confounders. No sample diversity data and the small sample size limit the generalizability of the results. Despite methodological flaws, this small study represents initial research evaluating an SSRI alternative antidepressant for PPD. The intent-to-treat analysis and improvement in depressive symptoms suggests that bupropion is an effective treatment for PPD. Moreover, bupropion SR is classified as category B by the FDA (Appendix E). This indicates that animal studies have failed to demonstrate a risk to the fetus and there are no well-controlled studies in pregnant women, or that animal studies have shown an adverse effect, but adequate and well-controlled studies in pregnant women have failed to

demonstrate a risk to the fetus in any trimester. This adds additional support for further RCTs with larger, diverse samples of women with PPD.

Stowe and colleagues (1995) conducted an 8-week study with an open-label design to evaluate the efficacy of the SSRI sertraline (Zoloft) in the treatment of PPD. U. S. women (N = 26) meeting *DSM-IV* and *DSM-III-R* criteria for major depression symptom onset within 6 months of delivery were enrolled in the study. Measures of mood were obtained at baseline and at 2-week intervals. The Beck Depression Inventory (BDI) and the EPDS were completed at baseline and at 2-week intervals. A psychiatrist blinded to the self-report scores interviewed all women to confirm depressive symptoms at baseline using the 21-item structured interview guide for the Hamilton Rating Scale for Depression (SIGH-D). An initial dose of 50mg/day of sertraline was titrated to a maximum of 200mg/day, adjusting for depressive symptoms and side effects at 2-week intervals to a final mean daily dose of 108mg $\pm$ 37mg/day. Biweekly assessments included self-ratings and psychiatric interviews. SIGH-D score was the primary outcome measure. A positive response to treatment was defined as > 50% reduction from baseline in SIGH-D score, and complete symptom remission was defined as SIGH-D score < 7 upon completion of the study. Data were analyzed on only those women completing 8 weeks of treatment with repeated measures ANOVA.

Mean age of all women was 32.3 years (SD = 4.9), mean onset of PPD was 6.4 (SD = 5.4) weeks, mean education level was 15.3 (SD = 2.6) years, and mean parity was 1.6 (SD = 0.8). Approximately half of the women were primiparas and breastfeeding, and all were married or partnered. Eighty-one percent (n = 21) completed the 8 week study; 20 (95%) women exhibited a positive response and 14 (70%) of those women

demonstrated complete symptom remission. The 5 participants who dropped out did not differ significantly from the remaining subjects on baseline data. Two of the five women reported side-effects from medication as the reason for dropping out. Gastrointestinal upset, decreased appetite, night sweats, headaches, and decreased libido were among the most commonly reported side-effects for all 26 participants.

Based on these results, the researchers suggest sertraline monotherapy was effective in treating PPD. Limitations include the small sample size, exclusion of a placebo group, lack of intent-to-treat analysis, an open-label design with participants not blinded to treatment, and a category C medication. Lack of ethnic or racial description of the sample limits the generalizability of the results. A major strength of this research is that it represents the first to examine the effect of SSRIs on PPD. Pill counts to confirm medication compliance added to the fidelity of the study. The large response rate (95%) and minimal side-effects of the medication are very positive and replication of this study in placebo-controlled designs is indicated.

Synthesis of Antidepressant Literature

These four studies provide continued support for evaluating the efficacy of antidepressants to treat in PPD. However, the studies had multiple limitations including: study design, sample characteristics, exclusion criteria, and attrition. Only one of the four studies used the ‘gold standard’ RCT design (Appleby, et al., 1997) with the rest using open-label designs with no randomization and no placebo groups. All had relatively small convenience samples with limited sample diversity. Three studies enrolled U. S. women, and one study conducted in the United Kingdom had a sample of predominantly white, British women. It has been well documented that cultural and ethnic factors are

significant determinants in patients' responses to psychotropic medication; (Lin, Poland & Lesser, 1986; Lin, Smith & Ortiz, 2001) however, researchers neglected to provide any demographic information to assess cultural diversity. Exclusion of women taking OCPs or breastfeeding and including women undergoing current psychotherapy and concurrent use of medications for anxiety and sleep disorders is concerning. All of these sample characteristics limit the generalizability of findings to the population of all postpartum women with PPD. Overall, women in all studies demonstrated significant mood improvement with the use of antidepressant therapy. A concern of three of the studies reviewed is the use of category C medications which the FDA warns animal studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans. Only Nonacs and colleagues (2005) used a category B drug, bupropion-SR.

Despite their limitations these studies add to the knowledge of effective postpartum treatment. Strengths include confirmation of PPD with baseline psychiatric interviews and assessment of treatment effect with the 17-item HAM-D and 21-item structured interview for the HAM-D both of which have well demonstrated reliability and validity in postpartum women (Boyd, Le & Somberg, 2005). Important directions for future research would be strengthening study design to include larger diverse samples and triangulation of methods with qualitative inquiry on women's experience with taking antidepressants during the postpartum period. This would be particularly informative for why women might drop out of a study and what resources they found helpful in their treatment.

Hormonal Therapy

The prenatal period is a time of prolific growth and dramatic changes in the pre-pregnancy hormonal milieu. Levels of estrogen and progesterone increase up to one hundred times higher during pregnancy than at any other time in a woman's life cycle (McCoy, et al., 2003). The dramatic decline of these hormones after delivery has been implicated in the development of PPD (McCoy, et al., 2003). In contrast, prolactin levels rise during the prenatal period in preparation for lactation and remain high in breastfeeding mothers. Levels of prolactin decline to pre-pregnancy levels in non-lactating women by three months postpartum. The theoretical basis for the use of estrogen and progesterone in the treatment of PPD is replacement of depleted hormones.

Very little research using estrogen to treat PPD within the past 10 years was located that met the criteria for this review. In fact the majority of the research using estrogen was conducted by the same group of researchers (Ahokas, Kaukoranta & Aito, 1999; Ahokas, Kaukoranta, Wahlbeck & Aito, 2001; Ahokas, Turtianinen & Aito, 1998). Others have used transdermal estrogen to treat PPD however, the sample included mothers with children up to 18 months of age which did not fit the criteria for this review (Gregoire, Kumar, Everitt, Henderson & Studd, 1996). Given estrogen is classified as category X by the FDA (animal or humans studies have demonstrated fetal abnormalities and there is positive evidence of human fetal risk based on adverse reaction data), it is not included in this review.

Progesterone has demonstrated a sedating and anxiolytic pathway during pregnancy (McCoy, et al., 2003; Selye, 1941). However, research using progesterone as a treatment for PPD suggested that it actually increased the risk of developing depressive

symptoms in postpartum mothers (Dalton, 1989; Granger & Underwood, 2001; Karuppaswamy & Vlies, 2003; Lawrie, Herxheimer & Dalton, 2000; Lawrie, Hofmeyr, De Jager, Berk, Paiker, et al., 1998). Therefore it will not be included in this review. To date, the only research conducted with prolactin and PPD has involved examining postpartum levels in relation to mood and not for treatment.

Complementary and Alternative Biological Interventions for Postpartum Depression

Many complementary and alternative therapies have been used to treat postpartum depression. Yoga, meditation, infant massage therapy, and acupuncture are among these alternative therapies. Because biologic pathways for these modalities are difficult to establish they will not be addressed in this review. Instead, those interventions with more demonstrable biologic theoretical pathways such as sleep deprivation and bright-light therapy will be included. Although lack of exercise was not discussed as a theoretical etiology for PPD in the conceptual framework, there is research to suggest exercise enhances well-being in depressed persons (Bartholomew, Morrison & Ciccolo, 2005; Dunn, Trivedi, Kampert, Clark & Chambliss, 2005). This is in part related to being outdoors and in the exposure to bright light which helps to synchronize the sleep-wake circadian rhythm and in part due to beta-endorphins and corticosteroids which are associated with both mood and exercise. However, this paper will focus on circadian rhythm synchronization and bright light. The following section will present some of the newer and innovative methods in the literature for treating depression. These include sleep deprivation, bright light therapy, and outdoor group exercise programs.

Sleep Deprivation

Women with major mood disorder (MMD) and premenstrual dysphoric disorder (PMDD) have responded favorably to sleep deprivation interventions (Gillin, 1983; Parry, Cover, Mostofi, LeVeau, Sependa, et al., 1995; Parry & Wehr, 1987) with many patients exhibiting a positive response shortly after 24 hours of sleep deprivation therapy (Gillin, 1983).

Intrigued by these findings, Parry and colleagues (2000) hypothesized sleep deprivation was a non-pharmacologic option for pregnant and postpartum women with MMD. They conducted a prospective pilot study to determine the effect of timed sleep deprivation on mood in pregnancy and the postpartum. Characteristics of the whole sample will be discussed; however results will focus on those women with an onset of depression in the postpartum period. Women (N = 13) with onset of MMD during pregnancy or within the first 12 months postpartum were enrolled in this study. Women with a history of anxiety or bipolar disorders and any current psychotic symptoms were excluded. A baseline psychiatric interview and clinician-administered SCID confirmed MMD. The 21 item Hamilton Rating Scale for Depression (HAM-D), Beck Depression Inventory (BDI), and the Edinburgh Postnatal Depression Scale (EPDS) were also completed during baseline evaluation. Participants underwent a trial of early-night partial sleep deprivation (ESD) or late-night partial sleep deprivation (LSD). Women in the ESD group slept from 0300 -0700h and were deprived of sleep in the early part of the night which primarily consists of deep sleep. Women in the LSD group slept from 2100-0100h and were deprived of sleep for the rest of the night in which REM sleep is most prevalent. A night of recovery sleep (2230-0630h) followed each night of sleep deprivation with a

week of the patient's regular sleep between the two sleep deprivation conditions.

Thirteen women completed the initial evaluation and nine of these completed the study. Six women enrolled in the study between 16-52 weeks postpartum. Demographic data were available on three of the postpartum women. Their age ranged between 25-34 years, two Caucasian, and one was of Hispanic origin. More women responded to LSD (82%) compared with ESD (33%) with increased response following recovery sleep. Women with onset of MMD in the postpartum demonstrated increased improvement with LSD (n = 4, 57%) The results suggested critically timed sleep deprivation may be beneficial to pregnant and postpartum women.

The study was limited by several factors most concerning of which was a lack of randomization. The small heterogeneous sample together with demographic information provided for only five (55%) of the participants further limit generalizability of the findings. No rationale was provided for the lack of a comparison group. It is difficult to have a comparison group so researchers have traditionally used ESD as a placebo given its lack of effect on mood. The deleted items related to sleep and weight from all three depression instruments for the post sleep deprivation screenings can affect the reliability and validity of the instruments. The researchers provided no additional psychometric data regarding the instruments. Selection bias may have been a factor as many of the women had already failed psychiatric intervention including psychotherapy, pharmacotherapy, hospitalization, and electroconvulsive therapy. Although Parry and colleagues (2000) are the only researchers who have evaluated sleep deprivation for PPD treatment, they have opened the door for other researchers to continue this line of questioning. More research is indicated in larger, more diverse populations of postpartum women.

Bright Light Therapy

Lack of bright light exposure in vulnerable persons has been associated with seasonal affective disorder (SAD) (Maskall, Lam, Misri, Carter, Kuan, et al., 1997; Okawa, Shirakawa, Uchiyama, Oguri, Kohsaka, et al., 1996; Rosenthal, Sack, Gillin, Lewy, Goodwin, et al., 1984). Moreover, women are four times more likely than men to develop SAD (Saeed & Bruce, 1998). Research suggests there is an increase in postpartum mood disorders during the autumn and darker months than the spring or lighter months (Hiltunen, Jokelainen, Ebeling, Szajnberg & Moilanen, 2004). It has been suggested that mothers with depressed mood are less likely to spend time outdoors, further contributing to poor mood. Bright-light therapy is a non-pharmacological treatment that has historically been used for MMD which is now being investigated for use in postpartum women. Despite the effectiveness of light therapy, only one study met the inclusion criteria for this review.

Corral and colleagues (2000) are among the first researchers to report the efficacy of bright light therapy and its association with PPD. They reported cases of two Canadian women with PPD who refused antidepressant therapy due to breast feeding and instead consented to a trial of light therapy. Both women self-administered bright light with a 10,000-lux light box, 30 minutes each morning (7:00am- 9:30am) for 4 weeks. Mood was measured at baseline and at the end of the study period with the 29-item HAM-D. Data analysis was limited to percent reduction of HAM-D scores from baseline.

Mrs. A. was a 33 year old primipara whose baseline HAM-D score of 29 decreased to 11 at endpoint. Mrs. B. was a 27 year old multipara (second child) whose baseline HAM-D score decreased from 28 to 12 at the end of the 4-week treatment. Both

of their ending scores represented a 75% reduction in baseline HAM-D scores.

The case report design has several limitations, including lack of randomization, small sample size, and no comparison group, all of which limit the validity of the results. Little sociocultural data were provided, limiting generalizability of the results. Despite the methodological limitations, findings of this case report provide support for continuation of this line of inquiry in larger, diverse samples, with experimental designs.

Prescribed Exercise

Physical exercise has been well documented to improve mood, depression, and anxiety (Cramer, Nieman & Lee, 1991; North, McCullagh & Tran, 1990; Scully, Kremer, Meade, Graham & Dudgeon, 1998). Limited research in women with PPD has revealed possible benefit from exercise programs (Choi & Mutrie, 1996). Furthermore, results of surveys administered to Australian mothers with PPD revealed 90% were in favor of organized community walking programs to help treat their depressive symptoms (Currie & Develin, 2002; Currie & Develin, 2000). Two studies met the criteria for this review. One of these included women with children aged 6 weeks to 18 months (Armstrong & Edwards, 2004). Despite the upper age of 18 months this study is included in the review given the paucity of research in this area.

The first of the two studies by Armstrong and Edwards (2003) was a pilot RCT to evaluate the effects of exercise and social support on PPD. Australian women ($N = 20$) ≤ 12 months postpartum and a baseline EPDS score ≥ 12 were eligible to enroll in the study. All women enrolled in the study underwent baseline fitness testing, and women deemed unable to participate in aerobic exercise were excluded. After baseline fitness testing, women were randomly allocated to an intervention ($n = 10$) or control

group (n = 10). Data were collected at baseline, week 1, 6, and 12. Outcome measures for depressive symptoms included the EPDS, the 12-item General Health Questionnaire (GHQ 12) (Goldberg & Williams, 1988), and the Depression Anxiety Stress Scale (DASS) (Lovibond & Lovibond, 1995). Social support was measured with the Social Support Interview (SSI) (O'Hara, 1995). The intervention group met with their infants in prams (strollers) at 9:30am three times per week (Monday, Wednesday, Friday), walked for 30-40 minutes, and met for refreshments and informal discussion after each walk. The control group received routine primary care, one supportive phone-call in the sixth week, instructions to contact the researchers with any concerns, and to maintain their usual activities. A two-way ANOVA was used to assess for the effect of the intervention over time.

Women were between 21-30 years, all married or in stable relationships, mostly homemakers, and approximately 50% were taking antidepressant medication. Women in the treatment group attended 66% of the time. Illness and prior engagements were the most often cited reasons for non-attendance. Demographics reported similar in both groups with no significant differences between them. A significant main effect for time was noted ($F_{2, 17} = 54.6, p < 0.01$) demonstrating a significant improvement in depressive scores in women in the interventions group compared with the control group at week 6 ($t_{21} = 0.08, p < 0.01$) and week 12 ($t_3 = 8.96, p < 0.01$). The DASS and GHQ-12 analysis revealed a significant main effect for time; however, the interaction of time and group was non-significant suggesting that all women improved over time regardless of group. Two-way ANOVA was used to test for the effect of the intervention over time with all women included in the analyses.

One limitation of this pilot study is the small homogeneous sample. The multidimensional nature of the intervention (exercise, social support) makes it hard to establish which component was most effective in reducing depressive symptoms. An operational definition for ability to perform aerobic exercise was not provided which limits the validity of the results. Future research should employ a three group design to test for effects from social support and exercise. Over half of the women were on antidepressant medication and undergoing therapy to treat their PPD during the study period which can also confound and limit the validity of the results.

Building from their pilot work, Armstrong and Edwards (2004) conducted a 12 week prospective RCT to evaluate the effectiveness of a pram-walking exercise program on depressive symptoms in postpartum women. Australian women ($N = 24$) who had delivered a child within the past 12 months, were able to speak English, and received a score of ≥ 12 on the EPDS were randomly assigned to one of two treatment groups; a pram walking group ($n = 12$) or a social support group ($n = 12$). The pram-walking group met with their infants at 9:30am twice a week (Monday and Wednesday) and walked for 40 minutes. An additional session was encouraged to help build cardiovascular endurance. Women walked for a minimum of 40 minutes at an intensity of 60-75% of their age predicted heart rate. Demonstrations were provided on how to monitor heart rate. The social support group met every Tuesday from 09:30-11:00 a.m. in a local community center along with their children. The aim of the social support group was to provide parental and emotional support and no formal discussions or activities were planned. A two-way ANOVA was used to assess for the effect of the intervention over time. Between-subject factor was group (exercise, support) and the within subject factor

was time (pre-test, 1, 6, & 12 weeks). Depressive symptoms were assessed with the EPDS at all time points.

There was 21% attrition rate with 19 of 24 women completing the study. No differences were reported between those women who completed the study and those who did not. Of the 19 women who completed the study, most were 30 years old, had completed high-school, all were married or in a stable relationship, and had no more than two children. No statistically significant differences were noted between the two groups. Multiple linear regression revealed a significant main effect for time ($F(2, 16) = 12.17, p < .001$) and the interaction of time and group ($F(2, 16) = 5.24, p < .02$), but no effect for group. For the pram-walking group, pre-depression scores decreased significantly by week 6 and week 12; in contrast there were no changes in EPDS scores across the three time points for the social support group. Results suggest the women in the pram-walking group improved their depressive symptoms significantly more than women in the support group.

Limitations include a small sample size and lack of a control group. Intention to treat analysis was not used in the analysis. Originally, 24 women were randomized into the two groups, with 12 women in each group. Five women withdrew early on, three from the pram-walking group and two from the social support group. By not conducting an intention to treat analysis, the outcome effect of depressive symptoms may have been overestimated. A concern of this research is the inclusion of women with their youngest child aged 6 weeks to 18 months. As discussed earlier in the paper, the *DSM-IV* recognizes a depressive episode within the first 4 weeks after childbirth to be postpartum in nature (American Psychiatric Association, 1994). Even the most liberal definitions

state PPD can develop anytime within the first year after childbirth (Marce Society, 2006). No rationale was provided for this which is interesting given their pilot work used the 12 month cut point. By including women with children up to 18 months of age, the researchers are limiting the ability to compare results with other studies as most researchers use a 12 month age limit. Furthermore, a little over half of the women were under the care of a psychologist or other medical professional and currently on antidepressant medication for PPD. These confounders also influence the results and the findings of this study. Further research with larger, diverse samples, and design limiting confounders is indicated. Triangulation using qualitative methods may again tell us why women chose to drop out and what provisions would have helped them stay in the study.

Synthesis of Complementary and Alternative Therapy

Three research areas employing alternative, non-pharmacological, biologically-based treatments for PPD have been reviewed. Some of the methodological concerns include small sample sizes, confounding variables, and limited sample diversity. Light therapy, sleep deprivation, and group exercise programs are all well-documented, efficacious treatment for MMD. Taking these non-pharmacological approaches and applying them to PPD in all aspects of a biopsychosocial framework, is innovative and validates this small body of research. Furthermore, it provides alternative treatments for women suffering from PPD who do not wish to take medication, have side effects from medication, or cannot or wish not to attend individual or group therapy sessions. Lack of research in this area speaks to a gap in the PPD treatment literature.

Psychosocial Interventions for Postpartum Depression

A variety of psychosocial interventions have been used to treat PPD and include: interpersonal psychotherapy (IPT); cognitive-behavioral therapy (CBT); group therapy; peer, partner, and social support; nondirective counseling; relaxation, massage therapy; and mother-infant relationship therapy. In order to manage the vast amount of data retrieved, only studies with objectives that address interventions initiated in the postpartum period and with a focus of support and counseling will be included. Studies evaluating training program, traumatic births, and suboptimal birth outcomes will not be included in this review. Many studies had multiple outcome measures including postpartum adjustment, social adjustment, and maternal child bonding. However, this paper will focus on outcome interventions for depressive symptoms. Appendix D provides a summary of the studies using psychosocial-based interventions for PPD.

Interpersonal Psychotherapy

Developed in the United States, interpersonal psychotherapy (IPT) is brief and focuses on interpersonal dispute, role transition, grief, and interpersonal deficits that are specific problem areas relevant to pregnancy and the birth of a child (Weissman, Markowitz & Klerman, 2000). Addition of themes such as relationship with the infant and partner, and transition back to work provides postpartum clinical application (Stuart & O'Hara, 1995). Two studies using IPT for PPD will be reviewed in this section (Klier, Muzik, Rosenblum & Lenz, 2001; O'Hara, Stuart, Gorman & Wenzel, 2000).

Klier and colleagues (2001) conducted a prospective, open pilot trial to evaluate the efficacy of group IPT for PPD in Vienna, Austria. Inclusion criteria included ability to speak fluent German, a score of ≥ 13 on the 21-item HAM-D, onset of depression

within 6 months postpartum, and a subsequent diagnosis of MMD with postpartum onset with the SCID. Women were excluded if they had suicidal ideation, were currently psychotic, or had any current substance abuse. Thirty-four women were recruited, 22 met inclusion criteria, and a final sample of 17 women were divided into two groups ($n = 10$, $n = 7$) for group IPT with both groups led by the same facilitator. Lack of transportation and childcare were among the reasons given for not participating. No information was provided about how the women were divided into the groups or if the groups differed at all. The intervention began with two 60-minute individual sessions to explain IPT and how it would work within a group, and to identify the focus of the treatment. Nine weekly 90-minute group sessions and a final 60-minute individual termination session completed the intervention. The EPDS and 21-item HAM-D were used to measure depressive symptoms at baseline, post-treatment, and at 6 months.

Seventeen of the 22 Caucasian women completed the study. They had a mean age of 32 years (range 27-41) and mean weeks postpartum were reported as 19 ($SD = 12.9$). Fifteen women had a diagnosis of MMD at baseline, and 2 had a diagnosis of minor depressive disorder per *DSM-IV* criteria. No significant differences were reported between those who dropped out and those women who continued with the study. Eleven women completed all of the study requirements with all participants completing an average of 8.7 sessions. An intention to treat analysis revealed significant reductions in mean scores on the EPDS (16.1 ± 5.4 to 8.9 ± 4.5 , $t = 5.1$, $p < .001$) and HAM-D (19.7 ± 6.2 to 8.0 ± 5.6 , $t = 6.4$, $p < .001$) from baseline to post-treatment. Fifty-eight percent ($n = 10$) of the women demonstrated full remission, defined a priori as a score of ≤ 9 on HAM-D with 6-month follow-up scores significantly lower than baseline.

Limitations include a small sample and lack of a comparison group. Other limitations include the translation of EPDS and HAM-D into German which can alter construct validity as well as reliability of the instruments. Reliability and validity information for the translated instruments was not provided. Interpersonal therapy is available to all persons free of charge as part of the Austrian healthcare system. Some of the women found scheduling was more convenient and flexible through the healthcare system rather than the study protocol which may have contributed to why only eleven women completing all the visits. Strengths include the examination of IPT for women suffering from PPD, as this provides alternative treatment for women not wanting or unable to take any pharmacological therapy.

O'Hara and colleagues (2000) conducted a 12-week RCT to evaluate the efficacy of IPT on postpartum depressive symptoms, postpartum adjustment, and social adjustment. Women ≥ 18 years old, married or partnered for at least 6 months, who met *DSM-IV* criteria for MMD with postpartum onset, and obtained a score of ≥ 12 on the HAM-D were randomly allocated to a treatment ($n = 60$) and a wait-list control (WLC) group ($n = 60$). Women with a prior history of bipolar disorder, schizophrenia, or mental retardation, or current alcohol or substance abuse were excluded. The IPT group received twelve individual, weekly, 1-hour sessions with a trained therapist. The WLC received brief telephone contact at 2, 6, and 10 weeks to evaluate suicide risk and were offered treatment at the end of the study. Both groups were interviewed and assessed for the presence or remission of depressive symptoms with the BDI and HAM-D and postpartum adjustment with the Postpartum Adjustment Questionnaire (PPAQ) every 4 weeks by clinical evaluators not blinded to the women's treatment status. Remission was defined a

priori as a HAM-D score of ≤ 6 or a BDI score of ≤ 9 . Independent samples 2-tailed t-test was used to compare IPT and WLC group demographic characteristics. Repeated measures ANOVA were used to evaluate outcome measures.

Of the women enrolled in the study 12 (20%) withdrew from the IPT group and 9 (15%) withdrew from the WLC group. No significant differences on any variables were noted between the women who dropped out and the ones who completed the study. The mean age of this mostly Caucasian, well-educated sample was 24.9 (SD = 4.9). Most were multiparous (n = 110) and mean weeks postpartum ranged from 4- 45 (mean 19, SD = 12.9). Fifty percent of the women in the treatment group and 31.5% in the WLC group were breastfeeding. HAM-D scores decreased from 19.4 ± 4.6 to 8.3 ± 5.3 in the IPT group, compared to 19.8 ± 5.3 to 16.8 ± 8.4 in the WLC at the end of 12 weeks. BDI scores in IPT group decreased from 23.6 ± 7.2 compared with the WLC where scores decreased from 23.0 ± 6.9 to 19.2 ± 8.7 . There was a 37.5% remission rate as measured by the HAM-D in the IPT group compared to 13.7% in the control group. Similar remission rates were noted with the BDI 43.8% in IPT group compared to 13.7% in the control group. The intent-to-treat analysis suggested IPT was an efficacious treatment for PPD. Although women in the IPT group had significant improvement in their depression scores when compared to the WLC group, no significant difference was noted on the subscale measuring “relationship with new baby” on the PPAQ.

Limitations of this study included a 20% attrition rate in the IPT group and 15% in the WLC group. The homogeneous, well educated, mostly married sample limits generalizability of the findings to all women with PPD. The researchers used clinical evaluators who were not blinded to the subject’s treatment status. The potential

confounding of this was balanced with hopes that establishing relationships between the evaluators and women in the study would help reduce attrition rates. Intention-to-treat analysis and the continued exploration of IPT as an intervention for PPD are major strengths of this study. IPT offers an alternative to women who do not wish to take pharmacological treatment due to breastfeeding or a personal choice. A further strength of this study is the inclusion of breastfeeding mothers. Depression trials usually exclude mothers who are breastfeeding since the effect of antidepressant medication on the developing infant is still under debate.

Synthesis of Interpersonal Therapy

IPT focuses on interpersonal dispute, role transition, grief, and interpersonal deficits that are specific problem areas relevant to pregnancy and the birth of a child (Weissman, et al., 2000). Interestingly, even though O'Hara and colleagues (2000) reported that women in the IPT group had significant improvement in their depression when compared to the WLC group, no differences were noted with regard to their relationships with their children. Ways to enhance the mother-child relationship must be addressed in future research as this is key in transitioning to motherhood. These two studies provide continued support for studying IPT as a treatment for PPD. The study protocol of meeting once a week for a period of 12 weeks must also be addressed in future research. This schedule may be impractical for new mothers, especially if childcare is an issue. O'Hara and colleagues (2000) specifically used clinical evaluators not blinded to the subject's treatment status to help reduce attrition rates; however this did not prevent a 20% attrition rate in the treatment group and 15% in the control group.

Klier and colleagues (2001) study was conducted with the Viennese healthcare system which offers the same services as the study protocol free of charge and reasons given for drop-outs included scheduling and childcare issues. Offering different services than already available and providing free or low-cost childcare may have limited their attrition rates but may be impractical to sustain. Future research should evaluate shorter IPT programs with larger, diverse samples. Other psychosocial therapy that has worked well for treating depression is CBT. The following section will review studies that have evaluated CBT to treat PPD.

Cognitive-Behavioral Therapy

CBT is a framework that targets negative thinking and a general lack of interest in normal activities that are often characteristic symptoms of PPD (Milgrom, Martin & Negri, 1999). CBT focuses on relaxation, activity-scheduling, problem-solving, self-care, and relapse prevention. Three studies using CBT for PPD treatment met the criteria for this review (Appleby, et al., 1997; Craig, Judd & Hodgins, 2005; Honey, Bennett & Morgan, 2002; Meager & Milgrom, 1996; Misri, Reebye, Corral & Milis, 2004). Although Craig and colleagues (2005) and Honey and colleagues (2002) used CBT as a group intervention, they will be also be reviewed in this section.

Craig and colleagues (2005) conducted a pilot, prospective, repeated measures design in a rural area of Victoria, Australia to investigate the effectiveness of a CBT-based therapeutic group program on reducing postpartum anxiety and depressive symptoms. Women who had delivered an infant within the past 12 months and reported emotional difficulties during this time (N = 16) were enrolled. Exclusionary criteria included a history of bipolar or personality disorder, current psychotic symptoms, or

current substance abuse. The EPDS and HADS were used to collect pre and post anxiety and mood data. CBT was administered in a group setting over 9 weeks. Each 2-hour session was conducted by community health workers experienced in counseling. Content focused on CBT strategies including relaxation, activity-scheduling, problem-solving, self-care, and relapse prevention with time allotted for general group discussion.

Fourteen rural Australian women (87%) with a mean age of 28.4 years (range 20-34) completed the 9-week study requirements. Seven women completed 6-week follow-up data and six completed 3 month follow-up data. A significant difference in age was noted between the two women who dropped out (mean age 36.5 years) and those women who completed the study (mean age 28.4 years) ($t(14) = -2.75, p < 0.05$). No other significant differences were noted. A significant reduction in mean EPDS ($t(13) = 6.34, p < 0.001$) and HADS-A ($t(13) = 5.81, p < 0.001$) scores was noted from baseline to post intervention. The results suggested a therapeutic CBT group intervention was effective in reducing postpartum depressive symptoms. Post intervention to 3 month follow-up analysis was significant for the HADS-D ($t = (2.91), p = 0.03$).

Limitations included a small sample and lack of a comparison group. The researchers were not surprised by the small sample given the study was conducted in a rural area of Australia. A major limiting factor of this study was the non-disclosure of sample characteristics beyond age. No information was given about cultural diversity, marital status, parity, education, or medical history. Non-disclosure severely limits the generalizability of the findings to the population. A major strength of this study is that the researchers purposely chose a rural population of postpartum women since the rural experience of PPD is relatively unknown. One study revealed that rural Australian

women were 1.6 times more likely to develop PPD than urban women (Johnstone, Boyce, Hickey, Morris-Yatees & Harris, 2001).

Honey and colleagues (2002) conducted a randomized prospective study to evaluate the efficacy of a controlled psycho-educational group (PEG) intervention (based on CBT) for PPD. British women with a score of ≥ 12 on the EPDS, an infant < 12 months of age, and with no current psychotic symptoms were randomly allocated to the PEG ($n = 23$) and the control (routine primary care, RPC) group ($n = 22$). The PEG intervention included CBT, education, and relaxation facilitated by two health visitors 2 hours per week for 8 weeks. The RPC group was monitored by two additional health visitors not associated with the PEG. Outcome assessments (including the EPDS, an adjustment scale, and a social support scale) were conducted at baseline, 8 weeks and 6 months after the PEG finished.

Mean age of the women in the PEG was 29.3 (SD = 5.36) years and 26.5 (SD = 5.68) years in the RPC. The mean baseline age of the infants was 5.98 (SD = 2.34) months in the PEG and 4.84 (SD = 2.32) months in the RPC. ANOVA on group (PEG & RPC) and times (1-3) as factors revealed an effect of group ($F(1, 36) = 7.12, p = 0.01$), time ($F(2, 43) = 12.06, P < 0.001$) and a significant interaction between group and time ($F(2, 43) = 3.16, p < 0.05$). The results suggest that PEG was an effective form of treatment for women with postpartum depressive mood symptoms and logistic regression revealed that antidepressant use was not a factor in mood reduction between time 1 and 2, or time 2 and 3.

Limitations of this study include a small sample, no explication of randomization procedure, and lack of a baseline diagnostic interview to confirm PPD. Although logistic

regression revealed that antidepressant use was not a factor in mood reduction, it is unclear how many women in each group were on antidepressants. Another limitation is the small change in EPDS score required to indicate a positive response to the intervention. An EPDS score > 12 was required for inclusion into the RCT however, response to treatment was defined as an EPDS score < 13 . This small change in EPDS scores may have overestimated response to treatment results.

Misri and colleagues (2004) conducted a RCT to evaluate the effectiveness of adding CBT to SSRI paroxetine (Paxil) therapy for reducing PPD symptoms. English-speaking women ($N = 35$) between 18- 40 years old, meeting *DSM-IV* criteria for major depression within 6 months postpartum were randomized into two groups. Additional inclusion criteria included birth of a healthy full-term infant (37- 42 weeks), minimum birth weight of 2.5kg, nonsmokers, and willingness to use contraceptive methods to avoid pregnancy during the study. Women were excluded if they exhibited psychotic or suicidal behavior, substance abuse, were receiving psychotherapy, or were currently using psychotherapeutic medication. The treatment group ($n = 19$) received paroxetine and 12 sessions of CBT, and the comparison group ($n = 16$) received paroxetine only. The researchers did not state whether paroxetine was prescribed for administration in the morning or evening. Baseline measures of depression and anxiety were administered by a psychiatrist blinded to group assignment. All participants returned for weekly clinical assessments through week 6, with additional visits in week 8 and 12 to assess medication compliance and side effects. Paroxetine was initiated at 10mg/day with the dosage adjustment per patient symptoms up to a maximum of 50mg/day. Both groups received the same pharmacologic intervention and the treatment group received an additional

twelve, weekly, 1-hour individual CBT therapy sessions. Endpoint was assessed by remission of symptoms, defined as HAM-D and HAM-A scores of ≤ 7 with intention-to-treat analysis. Paired t tests were used to identify changes in the mean scores of groups between baseline and the final visit, and independent t tests evaluated differences between treatment groups. Other analysis included Chi Square and ANOVA with repeated measures.

The study was completed by 32 (92.4%) mostly white (63%) women whose characteristics did not significantly differ from those who chose to drop out. Just over half of the women were breastfeeding their infants. Nausea and sedation were the most commonly reported side-effects; however these were not cited as reasons for dropping out of the study. No differences were noted between the treatment and comparison groups. Intention-to-treat analysis revealed that both the treatment and comparison groups showed a highly significant improvement ($p < 0.01$) in mood and anxiety symptoms. This suggests there was no additional benefit in combining treatment modalities. Independent t test, repeated measures ANOVA, and Chi Square analysis revealed no significant differences between groups.

A limitation of this study is the lack of a placebo group as all women received some form of intervention (medication or CBT). However, this also lends to the strength of this study, as the unfavorable sequelae of untreated PPD have been well documented. By providing all participants with interventions that have demonstrated positive effect on depressed mood adds to the strength of this research. Although favorable results were achieved by week 12, it is unknown if the women would sustain these results once off study protocol. Insisting that women use a contraceptive method while in the study may

have deterred women from enrolling in the study. No operational definition or rationale was provided for this criterion although it is well known that paroxetine is classified as Class C for pregnancy indicating its safety is uncertain and data from human studies do not exist. It was unclear if combined oral contraceptives were an acceptable method of birth control.

Synthesis of Cognitive Behavioral Therapy

Three studies using CBT for postpartum depressive symptoms have been reviewed with results suggesting CBT is efficacious in reducing postpartum depressive symptoms. Two of the studies used RCT design and one was a pilot. Overall methodological limitations included small sample sizes and lack of intention-to-treat analysis. Only two studies included a comparison group but no explanation as to the recruitment or randomization process was provided. Only Misri and colleagues (2004) had an intake *Structured clinical interview for DSM-IV* (SCID) to confirm PPD largely due to the nature of the intervention using an antidepressant medication along with CBT. Not verifying PPD at the start of the study may render any results of reduced mood invalid or unreliable.

Despite methodological concerns, this small group of studies attempted to use CBT and work on issues arising from a woman's transition to motherhood, particularly issues related to lack of social support and expectations of the maternal role. Future research should attempt to enroll larger more diverse samples and address some of the concerns. Other therapies found useful in treating depression are group therapy and counseling. The next section of the chapter will review two studies that have used group therapy and counseling as treatment for PPD (Chen, Tseng, Chou & Wang, 2000;

Ugarriza, 2004; Wickberg & Hwang, 1996).

Group Therapy/Counseling

Chen and colleagues (2000) conducted a RCT to evaluate the effect of weekly supportive group meetings on PPD. Bringing women experiencing PPD in contact together was cited as a major goal of this research. Chinese women with BDI scores ≥ 9 at three weeks postpartum were randomized into an intervention ($n = 30$) and control group ($n = 30$). The intervention consisted of 4 weekly semi-structured group sessions lasting 1.5- 2 hours. The control group received routine primary care (RPC) which was not operationally defined for the reader. Each large group of 30 mothers was divided into smaller groups consisting of 5- 6 mothers. Infants (6- 10 weeks old) were allowed to accompany their mothers. Depressive symptoms (BDI) and perceived stress (PSS) were collected at baseline and at endpoint. Sessions were facilitated by a nurse with content focusing on transition to motherhood, postpartum stress management, communication skills, & life planning. Childcare and refreshments were provided.

The women had a mean age of 29.1 years ($SD = 4.2$) with no significant differences in demographic characteristics of the 2 large groups before the start of the study. No information was provided on any group differences between the smaller groups of 5-6 women. Paired t-tests revealed the women who attended the support group had significantly decreased scores from baseline on both the BDI and PSS (BDI: $t = (-6.14)$, $p < 0.01$; PSS: $t = (-3.75)$, $p < 0.01$) when compared with the control group. Recurring areas of discussion in the small groups centered on the distress caused by a discrepancy between the subject's expectations about the maternal role and the demanding responsibilities of taking care of their infant.

Limitations of this research include non-disclosure of the randomization process, the manner in which women were split into smaller groups, and no discussion about the smaller group differences. Another limitation was the lack of a baseline diagnostic interview to confirm PPD. Since the research was conducted in China the results are mainly generalizable to Chinese women living in China. Other limitations include no operational definition for routine primary care, which leads to reliability and validity issues. A major strength of this study is the investigation of PPD in another culture. Research suggests PPD is a global phenomenon and continued inquiry into how different view and treat PPD adds to this growing body of knowledge. The researchers designed their intervention based on the findings of previous research that suggested lack of social support as a risk for developing PPD (Affonso, et al., 1991; Beck, 2001; Bernazzani, Saucier, David & Borgeat, 1997; Chaudron, Klein, Remington, Palta, Allen, et al., 2001; Logsdon & Usui, 2001). Bringing women suffering from PPD together to promote a social support network adds to the strength of this study.

Ugarriza (2004) conducted a pilot RCT to evaluate the effect of therapy on depressive symptoms based on Gruen's (1993) postpartum depression group therapy model. A secondary aim of the study was to identify barriers that postpartum women face when attending group therapy sessions. A purposive sample of mothers (N = 16) in Florida were randomly assigned to a treatment group (n = 8) and a control group (n = 8). Birth of an infant within the past 12 months and sufficient English skills to complete the questionnaires and to participate in the group therapy were the only inclusion criteria. The BDI-II and the Sociodemographic Questionnaire were collected at baseline and again 10 weeks later. The intervention consisted of 10 weekly sessions, 60

minutes in length facilitated by a graduate mental-health nursing student with lunch and childcare provided. Therapy was based on a three-phase program developed by Gruen's (1993) own review of the literature. The first phase consisted of education and information, stress reduction techniques, and strategies for building social support networks. Phase two addressed self-esteem issues, and phase three focused on grief over unmet expectations of birth and parenting. All of the women had a diagnosis of PPD by their health care provider, however the method of diagnosis was not provided. The matched control group received routine care and completed all outcome measurements. Pre and post BDI-II scores were analyzed with t-tests.

Six (75%) women completed the intervention and were included in the analysis along with the control group. Mean age of the women was 25.9 years ($SD = 2.93$), 64% ($n = 9$) were Hispanic, all came from a high socioeconomic background with at least 2 years of college, and two women had live-in help. No statistically significant differences were noted between women who completed or dropped out of the study or between the two groups. No statistically significant differences were noted between the pre (15.6 ± 1.41) and post (16.0 ± 1.31) BDI-II scores for control group ($t(7) = -2.05$, $p = 0.08$). However, there was a significant difference between the pre ($14.3 \pm .81$) and post-test (13.0 ± 1.9) BDI-II scores for the treatment group ($t(5) = 2.70$, $p = 0.04$) suggesting women reported minimal to no depressive symptoms after the intervention. Discussions revealed barriers women had in attending group therapy sessions. One barrier was adjusting schedules in order to attend the session. A prior family commitment was often cited as a reason for not attending. Despite provision of childcare, another barrier was childcare for ill children.

A small sample size in each group limits the validity of the results. A 25% (n = 2) attrition rate was noted in the treatment group however, intent-to-treat analysis was not conducted. Characteristics of the sample provided other limitations and generalizability issues with a high education level, high level of social support, and high socioeconomic level. A major strength of this study is that the intervention was designed by reviewing the literature and determining what would best help women reduce their level of PPD. Other strengths of this study include the identification of barriers to group therapy including scheduling difficulties and childcare for ill children that can be addressed in future research.

Synthesis of Group Therapy and Counseling Interventions

These two studies provide continued support for research employing psychosocial counseling interventions for PPD. Generalizability of the results is an issue as each sample was unique in socioeconomic status, education level, intervention, and ethnicity. Historically, group therapy interventions have been well received in postpartum women. Replication of studies in diverse populations is indicated in order to be able to better generalize results. Despite the promising results of the group interventions, many women report barriers such as lack of transportation and lack of childcare that prevent them from attending group sessions (Sobey, 2002; Ugarriza, 2004). Individualized interventions such as social and peer support may be better accepted by postpartum women. The following section will review two studies utilizing social and peer-based interventions.

Social and Peer Support

The lack of social support has been found to be a predictor of PPD (Affonso, et al., 1991; Beck, 2001; Logsdon, et al., 2005). This has been the basis for extensive research using social and peer-based interventions for PPD. Despite these findings, only two studies met inclusion criteria for this review. One utilized a social support based intervention (Armstrong, Fraser, Dadds & Morris, 1999) and the other utilized a peer support based intervention (Dennis, 2003).

Armstrong and colleagues (1999) conducted a double-blind, RCT to evaluate the impact of home visits from a visiting home nurse on maternal depression versus standard routine primary care. Australian women who had delivered a healthy live infant and were able to speak English were enrolled into the study (N = 181) and randomly assigned to a treatment (n = 90) and control (n = 91) group. Baseline measures of parenting stress and maternal depression (EPDS) were assessed at baseline and at 6 weeks postpartum. The intervention consisted of a total of 6 months of visits: weekly visits for 6 weeks, twice monthly visits for 6 weeks, and monthly for 3 months. The control group received standard community child health services.

Results of this study were limited to the 6 week findings. A statistically significant difference was noted in those women consenting to participate versus those not participating in history of psychiatric illness (15.2% vs. 7.0%, $p < 0.05$) and financial stress ($F(1, 615) = 3.38$, $p < 0.05$). Compared to the control group, the intervention group included more first time mothers, fewer multiparous women with a history of PPD, fewer reports of partner psychiatric illness, fewer reports of domestic violence history, and more women who were Aboriginal or Torres Strait Islanders. A statistically significant

interaction was found between group and time ($F(1, 169) = 4.23, p < 0.05$) for EPDS scores with a mean score of 5.67 ($SD = 4.14$) in the intervention group compared with a score of 7.90 ($SD = 5.89$) in the comparison group. A significant effect for time was noted for both the intervention group ($F(1, 84) = 28.46, p < 0.05$) and the comparison group ($F(1, 85) = 4.50, p < 0.05$). Also, a statistically significant difference was noted between the groups at 6 weeks ($F(1, 169) = 7.35, p < 0.05$) with intervention EPDS scores significantly better than the comparison group scores. These results suggested group home-based nurse visiting programs may be effective in reducing PPD.

A major strength of this study is the generalizability of the results given a high percentage of women with a history of psychiatric illness and current financial stress enrolled in the study. Also, the intervention group had a higher number of first-time mothers.

Dennis (2003) conducted a pilot RCT to evaluate the effect of peer support (mother-to-mother) on depressive symptoms. English speaking Canadian mothers ($N = 63$) at least 18 years old, who had delivered a singleton full-term pregnancy, were 8-12 weeks postpartum, scoring > 9 on the EPDS, and accessible by local telephone were eligible to participate. A final sample of 42 women were randomly allocated to a treatment ($n = 20$) and a control group ($n = 22$). Women were excluded if they were on antidepressant medication, had a chronic psychiatric condition, or had limited English skills. Women in the treatment group had access to the standard community postpartum services as well as being paired with a peer volunteer. The peer volunteer was another mother with a previous history of PPD who provided individualized telephone-based support after receiving one 4-hour training session. Women in the control group received

standard community care. Intent-to-treat analyses were conducted.

Thirty-three percent ($n = 21$) of women eligible to participate declined. No significant differences were found between mothers who participated and those who were ineligible or declined to participate. Of the 42 enrolled women only one (in the control group) did not complete all assessments. No statistical differences were noted between the women in the two study groups. Most women were 25-34 years old, all were married or partnered, and 70% had other children at home. Over a period of 2 months, peer volunteers logged a mean of 5.4 phone calls ($SD = 3.5$) and a mean of 5.6 attempted phone calls to the mothers ($SD = 2.6$). The mean duration of the phone calls was 34.4 minutes ($SD = 20$). Only 10% ($n = 2$) of the women initiated any phone calls. A significant group difference in depressive symptoms was noted at 4 weeks where 41 % ($n = 9$) of women in the control group had $EPDS > 12$, compared with 10% ($n = 2$) in the intervention group ($\chi^2 = 5.18$, $df = 1$, $p = 0.02$). Findings were similar at the 8 week assessment where 52% ($n = 11$) of the mothers in the control group and 15% ($n = 3$) of mothers in the intervention group continued to score > 12 of the EPDS ($\chi^2 = 6.37$, $df = 1$, $p = 0.01$). Odds ratio suggested mothers who received the peer-group intervention were at least 4 times more likely to have decreased depression scores when compared to mothers who did not receive the intervention, suggesting telephone-based peer support may decrease depressive symptoms in new mothers.

Limitations of this study include a small sample size and local phone requirement which could be cause for selection bias. Another limitation is the EPDS cut-off score of 9 at the initial screening. This is very liberal and most studies use a cut-off score of 12. A cut-off score of 9 could lead to a high false positive rate. However the researcher cited

two community studies that had used the same cut-off score in postpartum women with good sensitivity, specificity, and predictive power. A strength of this study stems from the high (67%) acceptance rate, which suggests that although most women are receptive to peer support but that no single intervention is acceptable to all women. This information can help guide future research and clinical practice. The simple, minimally invasive, yet innovative design lends to the strength of this study.

Synthesis of Social and Peer Support

The limited research ($n = 2$) studies examining social and peer support has been shown to be effective in treating PPD. Both studies demonstrated sound methodology utilizing RCT designs. Armstrong and colleagues (1999) included a sample of highly vulnerable women which increased the generalizability of the results. Dennis (2003) provided a methodologically sound example of research with the small sample being the major limitation. Future research should incorporate these interventions along with qualitative inquiry to identify which interventions are of interest to new mothers with PPD.

Other predictors for PPD include the lack of partner support (Eberhard-Gran, Eskild, Tambs, Samuelsen & Opjordsmoen, 2002; Logsdon & Usui, 2001). Two studies using partner support (Misri, Kostaras, Fox & Kostaras, 2000; Morgan, Matthey, Barnett & Richardson, 1997) were located in the literature. However, Morgan and colleagues included one couple with a 2-year-old child, which exceeds the timeframe of 12 months for this literature review.

Partner Support

Perceived lack of partner support is one of the most consistent correlates of PPD (Eberhard-Gran, et al., 2002; Logsdon & Usui, 2001). However most interventions for PPD do not include partners (Elliott, Sanjack & Leverton, 1988; Fleming, Klein & Corter, 1992), and when they do, partners are hesitant to participate (Stamp, Williams & Crowther, 1995).

Based on these findings, Misri and colleagues (2000) conducted a RCT to evaluate the impact of partner support in the treatment of mothers with PPD. Women in Vancouver, British Columbia (N = 29) meeting *DSM-IV* criteria for MMD with a postpartum onset, with a baseline EPDS score > 12, and who were married or cohabitating were randomly assigned to a support group (n = 16) or a control group (n = 13). All participants attended six therapy visits, once a week for 6 weeks. Women in the control group attended therapy visits alone, whereas in the support group, partners attended the last four visits along with their partners. A final follow-up visit took place one month later (10 weeks from baseline). All women were assessed with the Mini International Neuropsychiatric Interview (MINI) section A (Sheehan, Lecrubier, Sheehan, Amorim, Janavs, et al., 1998), the EPDS, the 37- item Dyadic Adjustment Scale (DAS) (Spanier, 1976), GHQ, and the 25-item Parental Bonding Instrument (PBI) at the first visit and all took questionnaires home for their partners to complete. The visits including the partners focused on couple interaction and review of how partners could help with baby and household chores.

There was a 100% compliance rate for visit attendance and outcome assessments. Mean age of the women in the support group was 32.9 years (SD = 7.2) and 33.5 years

(SD = 4.4) in the control group. Mean age in months of the infant in the support group was 4.9 months (SD = 3.11) and 5.4 months (SD = 3.2) in the control group. Most of the participants were Caucasian and all were married or cohabitating. Descriptive statistics revealed a greater range of age in women in the support group but no statistical significant differences were noted. Relative to the control group, support-group patients had lower EPDS scores from baseline indicating less depressive symptoms by the sixth visit (mean scores 17.0 to 11.4 support, and 18.4 to 14.6 control). Statistically significant differences were seen in the DAS scores from baseline in the support group when compared with the control ($p < 0.05$). Findings suggest that partner support has a measurable effect on women experiencing PPD.

Some of the limitations of this study include a small homogeneous sample and non-disclosure of randomization procedure, all of which limits the validity of the results. Other limitations include significant group differences in baseline characteristics related to partners' marriage appraisals. Although mean EPDS scores decreased from baseline to week six, no statistical significance was noted. The short follow-up period may have not allowed enough time to see a change. One of the main strengths of this research is that it represents the first to include the partner in PPD treatment.

Synthesis of Partner Support

It is well documented that the lack of partner support is predictive of PPD in some women (Eberhard-Gran, et al., 2002; Logsdon & Usui, 2001). Despite these findings, only one study met the inclusion criteria for this review (Misri, et al., 2000). Results of this research support the need for future studies including larger and more diverse samples. Longer follow-up times are also indicated as it is unknown if the effect of the

intervention was sustained beyond 10 weeks.

Discussion

A comprehensive review of the literature examining current treatment for PPD has been presented. It is well-documented that untreated PPD has deleterious effects on the maternal-child relationship, long-term child development, marital relationship, and family functioning (Beck, 1995, 1998; Field, 1995; Gale & Harlow, 2003). It is also known that, if detected early, PPD is relatively easy to treat with effective outcomes. However, what remains relatively unknown is the best way to treat PPD. The 21 studies included in this review for the most part are divided into biological or psychosocial schools of thought with very few incorporating both intervention modalities. The following section provides a brief review of the biological and psychosocial pathways implicated in the development of PPD, the current state of the science of the treatment that addresses that pathway, and directions for future research.

Biological Interventions for Postpartum Depression

Reproductive Hormones

Changes in estrogen, progesterone, and prolactin have all been implicated in the development of PPD. However, the literature review did not identify any research establishing an empirical link between prolactin and the development of PPD. In contrast, postpartum administration of progesterone has been thought to increase the risk of developing depressive symptoms in postpartum mothers (Dalton, 1989; Granger & Underwood, 2001; Karuppaswamy & Vlies, 2003; Lawrie, et al., 2000; Lawrie, et al., 1998) and was not included in this review. The rapid decline of postpartum estrogen levels are thought to contribute to PPD. The relationship between estrogen, neurotransmitters, and mood disorders is thought to be mediated through the serotonergic system (Grigoriadis & Kennedy, 2002). A postpartum decline in estrogen levels may alter the serotonergic system and contribute to PPD. Based on this theory and the positive treatment of premenstrual dysphoric disorder (PMDD) in which estrogen levels are also lower than usual, a growing body of research has used serotonin reuptake inhibitors (SSRIs) and other antidepressants that target neurotransmitters to treat PPD. However, given estrogen is FDA category X, it was not included in this review.

Antidepressant medications, particularly SSRIs have demonstrated positive effects on postpartum mood. Four studies met the criteria for this review and provide continued support for researching SSRIs and non-serotonergic antidepressants for PPD. A high rate of treatment failure and non-compliance in part related to the SSRI side-effect profile make these a poor choice for some new mothers. The lack of controlled trials in nursing mothers to evaluate the effect of antidepressants on the infant is an additional

concern to breastfeeding mothers. Finally, other research has cited the stigma associated with antidepressant medication as a key factor that prevents mothers from obtaining psychiatric help (Gerrard, 2000; McIntosh, 1993; Robinson & Young, 1982; Whitton, Warner & Appleby, 1996). It is also well documented that the clinical effectiveness of antidepressant medications is highly dependent on treatment adherence (Misri, et al., 2004).

The small number of studies located for this review may be attributed in part to the reluctance of taking antidepressant therapy while breastfeeding, fear of untoward effects on the infant, and side effects for the mother herself. Despite the overwhelming evidence demonstrating safety of antidepressant therapy for both infant and mothers the American Academy of Pediatrics (AAP) classifies most antidepressants as drugs of concern given the effects on nursing infants remains unknown (American Academy of Pediatrics Committee on Drugs, 2001). This message suggests a need for non-pharmacological and non-invasive treatments for nursing mothers with PPD. The unfavorable side-effect profile of antidepressants, including low libido and weight gain may also be discouraging for new mothers who are already going through many physiologic changes.

Other researchers have studied the effect of administering estrogen to replace the depleted postpartum levels as an alternative to antidepressant therapy. The theory that underpins estrogen replacement comes from the dramatic decline in postpartum levels almost immediately after birth. The small body of research evaluating estrogen therapy appears promising with a favorable side-effect profile when compared with antidepressants. However, the invasive venipuncture used to monitor serum levels and 3-

8 doses/day are impractical for many patients, in particular new mothers. Other risks associated with estrogen therapy such as thromboembolic events, risk for breast cancer, heart disease and endometrial hyperplasia limit its usability and may also discourage new mothers from estrogen replacement. The studies included in this review were all completed before 2004, before early results caused the National Institutes of Health to stop the Women's Health Initiative study (National Institutes of Health). Findings of this landmark trial suggested an increased risk of stroke and blood clots in some women. These findings may well deter participants from enrolling in newer estrogen therapy studies. Despite all of the issues with estrogen the three studies by Ahokas and colleagues (1998, 1999, 200) demonstrated promising results and need to be replicated by other researchers and in other populations of women. Careful pre-enrollment screening will be needed to help to ensure their safety.

Circadian Rhythm changes

The last decade has brought about newer, innovative, alternative treatment modalities to treat PPD including sleep deprivation, bright light, and exercise. Stemming in part from concerns about medication side-effects, there is an increase in interventions based on complementary and alternative medicine (CAM) principles. These include sleep deprivation, bright light therapy, and exercise programs. The theoretical underpinnings of CAM therapies arise from the alterations of the body's circadian rhythm and sleep-wake cycles. The sleep-wake cycle normally has a period length of approximately 24 hours and synchronizes physiologic processes with the 24-hour light-dark cycle (Weaver, 1998). Disturbances in circadian rhythmicity, whether voluntary (e. g. shift work) or involuntary (e. g. changes associated with being a new mother) have been associated with mental

illness (Vitaletta, Takahashi & Turek, 2001). Zeitgebers (German for “time-giver”) are the cues that help entrain (e. g. synchronize light-dark cycle) circadian rhythms. Light represents the most important Zeitgeber. Light entering through the retina signals the brain, together with other time cues, and helps entrain the sleep-wake cycle to approximately 24 hours. In the absence of light or time cues, the sleep-wake cycle and hormonal rhythms desynchronize and become phase-advanced or phase-delayed, often with manifestations of mood disorders (Shanahan & Czeisler, 2000).

Disruption of sleep in new mothers due to infant care and feeding may lead to sleeping later into the morning and an alteration in the sleep-wake cycle (phase delay). The lack of bright light exposure in vulnerable persons has been associated with seasonal affective disorder (SAD) (Maskall, et al., 1997; Okawa, et al., 1996; Rosenthal, et al., 1984) which is also an issue in depressed mothers if they are sleeping later into the morning and missing morning light. It is theorized that bright light in the morning will help to ‘entrain’ the sleep-wake cycle. Only one study using bright light as an intervention for PPD met the criteria for this review. Corral and colleagues (2000) reported cases of two Canadian women who used light therapy to treat their PPD. The resultant 75% reduction in baseline HAM-D scores for both women is promising and provides continued support for further research with larger more diverse samples.

Sleep deprivation therapy is also based on resynchronization of the sleep-wake cycle. Again, only one researcher has examined this as a possible intervention for postpartum women (Parry, Curran, Stuenkel, Yokimozo, Tam, et al., 2000). Promising results again need to be replicated in larger, more diverse samples.

Outdoor morning exercise also addresses entrainment of the sleep-wake cycle.

However, as discussed earlier, beta-endorphins and corticosteroids also play a role in mood and exercise. These should be addressed in future research with postpartum women especially since levels of beta-endorphins and corticosteroids are elevated during labor and delivery and fall rapidly within a few hours of childbirth (Bacigalupo, Riese, Rosendahl & Saling, 1990; Fajardo, Florido, Villaverde, Oltras, Gonzalez-Ramirez, et al., 1994; Gemelli, Mami, Manganaro, De Luca, Saja, et al., 1988).

The medical and nursing implications of the CAM methods provide alternatives for women who are concerned about the effect of hormones or antidepressant medication on their infant and themselves. The lack of research in CAM therapies for PPD provides direction for future research.

Psychosocial Interventions for Postpartum Depression

Interventions based in the psychosocial discipline provide additional alternatives for PPD treatment. Their non-pharmacological nature provides alternatives to antidepressant and hormonal therapies. The major theme implicated in the development of PPD that was identified from the psychosocial theories was the concept of transition to motherhood.

Transition to motherhood

The psychosocial interventions for PPD included in this review incorporated one or more of the multiple issues related to the transition to motherhood. The interventions: CBT, IPT, group counseling, peer and partner support all have different names but the theoretical foundations are similar in that they are all focused on improving self-esteem, decision-making skills, social support networks, and stress management in order to

facilitate a smoother transition to motherhood. This is important as women with PPD demonstrate a lack of interest in normal activities and can self-isolate, which impedes the transition to motherhood.

CBT is a framework that specifically targets negative thinking and the general lack of interest in normal activities that are key characteristics of PPD (Milgrom, et al., 1999). The studies employing CBT for PPD were often conducted in weekly group sessions over a period of 9-12 weeks. Therapy sessions were typically 1-2 hours long, which is a time-intensive intervention. Other research has cited the stigma of mental illness and discrimination by insurance companies as barriers to women obtaining much needed psychiatric help (Sobey, 2002). Many insurance companies have higher deductibles for mental health care and limit the number of visits with a psychologist or psychiatrist (Sobey). In addition, CBT has been shown to be beneficial during the study period, but very little is known about sustained long-term results of the intervention.

IPT was developed in the U. S. and focuses on interpersonal dispute, role transition, grief, and interpersonal deficits that are specific problem areas relevant to the birth of a child and the transition to motherhood (Weissman, et al., 2000). Addition of themes such as relationship with the infant and partner, and transition back to work provides additional postpartum application (Stuart & O'Hara, 1995). Positive aspects of IPT are that it is usually provided on a one-to-one basis and it is brief nature (usually no more than 12 weeks). However, the negative aspects of IPT include childcare issues and scheduling difficulties.

Although effective in reducing depressive symptoms, research suggests that IPT, CBT, and group therapy interventions are just as effective as antidepressant medications

in treating major depression. However, the postpartum period is chaotic with many adjustments occurring simultaneously. New mothers report that they are already overwhelmed and feel any added activities are burdensome, even if they are of benefit (Ugarriza, 2004). Additionally, these interventions are commonly more time intensive (Simon & VonKorff, 1995) and often not convenient for new mothers. Ugarriza (2004) provided lunch and childcare for the women in her treatment group in hopes of increasing attendance. The women still had difficulty attending, stating family commitments as the barrier. Despite the time intensity and inconvenience of group interventions, they do provide alternatives to pharmacological agents. This is salient given issues surrounding the safety of medications in breast-milk.

Other psychosocial interventions that may be more appealing to new mothers include social, peer, and partner based interventions. The appeal may be two-fold as lack of social support and partner support have been well documented as consistent predictors for PPD (Affonso, et al., 1991; Beck, 2001; Eberhard-Gran, et al., 2002; Logsdon, et al., 2005; Logsdon & Usui, 2001). The three studies in this section utilized a variety of innovative interventions. Dennis (2003) utilized telephone-based support from mothers and a significant reduction was seen in depression scores when compared to the control group. Armstrong and colleagues (1999) evaluated a home visiting program with multidisciplinary weekly case review with significant outcome results. Evidence suggests that spouses also suffer negative consequences from their wives living with PPD (Wood, et al., 1997). By inviting the partners and spouse to participate in the intervention perceived social support is increased and Misri and colleagues (2004) demonstrated a significant reduction in depressive symptoms when partners were included. However, the

intervention consisted of seven clinic visits, which may not be feasible for many postpartum women for reasons stated above. Future research should include qualitative components to identify optimal peer support interventions.

Direction for Future Research

This critical literature review clearly demonstrated the challenge healthcare providers face when planning interventions for PPD. The visible division of biological and psychosocial etiologies is also apparent in current practice where interventions are also divided along similar lines. Very few researchers have utilized a comprehensive biopsychosocial framework for PPD intervention. In two cases where antidepressant medication was combined with CBT, no added benefit was noted from administering both. In fact, antidepressant therapy or the CBT alone were sufficient in reducing PPD symptoms (Appleby, et al., 1997; Misri, et al., 2004).

Future research should strive to take a holistic view of PPD when designing interventions. Based on the review, gaps in the literature and areas for future research include looking at the role of circadian rhythms and sleep in the postpartum period and the association with PPD as well as the effects of perceived stress, level of social support, and how well a new mother transitions to motherhood into account. Sleep disturbance has been implicated through biological and psychosocial pathways and should be a variable when developing and planning interventions for PPD; whether this entails morning walks to entrain the sleep-wake cycle or help at night so the mother can have much needed uninterrupted sleep. My study will provide additional longitudinal, descriptive, and correlational data on depressive symptoms and the relationship to sleep loss in the third

trimester and at 12 weeks postpartum. In addition, social support, perceived stress, and maternal adjustment will be examined. The results of this study will add to the current body of postpartum depression knowledge and identify new areas for intervention.

CHAPTER III

METHODOLOGY

Research Design

The secondary analysis combined two existing datasets utilizing longitudinal, randomized clinical trial research designs. Both parent studies were conducted on first-time parents (N = 243) to test an environmental-behavioral intervention to minimize the sleep disruption and fatigue experienced by new mothers and fathers after the birth of their first infant. Data were obtained in the third trimester, 4 weeks postpartum, 8 weeks postpartum, and 12 weeks postpartum in both parent studies. Data included sociodemographic information, information on type of delivery, gender of infant, breast or formula feeding, objective and subjective sleep, subjective depressive symptoms, and subjective marital satisfaction, perceived stress, and maternal adjustment. Many other data were collected on the partner and the infant.

However, this secondary analysis utilized a longitudinal, descriptive, correlational design. The variables of interest for this secondary analysis included:

(a) sociodemographic information; (b) subjective depressive symptoms; (c) objective sleep measures; (d) subjective sleep perception; (e) level of social support; (f) maternal adjustment, and (g) level of perceived stress.

Sample

Sample Selection and Sample Size

The sample size in this study was dependent on the number of participants in the parent studies who met the criteria for inclusion in this secondary analysis (see Figure 3.1). The first study (study 1) recruited a convenience sample of couples attending childbirth preparation classes ($N = 152$). The original purpose of this first randomized clinical trial was to test an intervention to help new parents (mothers and fathers) sleep better after the birth of their first infant. The intervention consisted of sleep hygiene plus a) infant proximity; b) night light; and c) white noise. These were administered after the third trimester data were collected. There was a small effect of the intervention on sleep at 4 weeks postpartum, but no effect on depressive symptoms. There was no effect of the intervention on depressive symptoms or sleep by 12 weeks postpartum. Eligible couples included those expecting their first child, partnered, at least 18 years of age, willing to participate, and able to read and write English. Women were excluded if they: (a) had a history of mental illness; (b) were expecting multiples; (c) stated current use of medications that alter sleep; (d) had a current diagnosed sleep disorder or a bed partner with a sleep disorder; (e) worked night shift or had a bed partner who worked night shift; (f) had a history of involuntary pregnancy loss; and (g) planned to employ a nanny to help with night-time infant care. Results suggested lower socioeconomic (SES) class families may have a better response to the intervention given the first sample was well educated. Moreover, control group couples were already doing components of the intervention from their own reading (control group contamination).

The second study (study 2) recruited a convenience sample of expectant mothers

from prenatal clinics (N = 91). The purpose of the second randomized control trial was to test the effects of the same intervention on a sample of low socioeconomic status women (may or may not be partnered). Although results of the first study suggested lower SES families may have a better response to the intervention, there was minimal effect of the intervention on sleep at 4 weeks postpartum, and no effect on depressive symptoms or sleep by 12 weeks postpartum. Eligible women included those expecting their first child, partnered, at least 18 years of age, willing to participate, and able to read and write English. Women were excluded if they: (a) were expecting multiples; (b) stated current use of medications that alter sleep; (c) had a current diagnosed sleep disorder or a bed partner with a sleep disorder; and (e) worked night shift or had a bed partner who worked night shift.

Both studies examined the same variables at the same time points. The first study consisted of well-educated and employed couples, with approximately 64% of the couples identifying as Caucasian. The second study sample was better representative of the San Francisco Bay Area with more socioeconomic and ethnic diversity.

The intervention for each study was designed to improve sleep during the first four weeks of postpartum recovery. Given there were no differences between intervention and control groups on outcome variables in the third trimester (intervention took place after third trimester measures) or 12 weeks postpartum, this study reports on the 108 (control group n = 59, intervention group n = 49) women in study 1 and 53 (control group n = 17, intervention group n = 36) women in study 2 who were partnered.

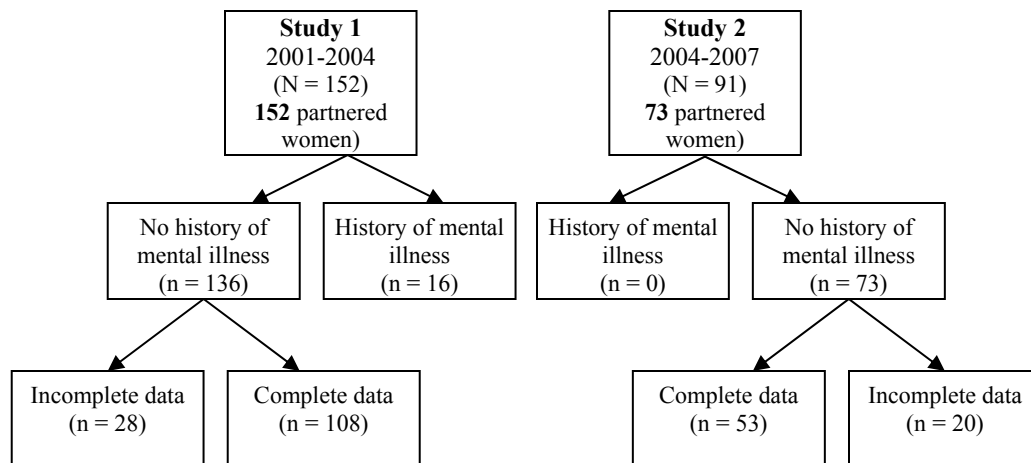


Figure 3.1. Sample selection tree

Rationale for combining subjects from study 1 and 2 included increasing the heterogeneity of the sample and increasing the generalizability of the results to a more diverse population of first-time mothers. The final merged sample remains homogeneous with regard to past history of depression, parity, and the postpartum 12 week assessment time. Only those women from the two samples meeting the following criteria were included the current analysis: (a) pregnant with their first child; (b) at least 18 years of age; (c) able to speak and read English; and (d) currently partnered.

Human Subjects Approval

Human subject's approval was obtained for the two randomized control clinical trials from the Committee on Human Research at the University of California, San Francisco. Participant privacy was maintained per the protocols of the parent studies and for this secondary analysis.

Instrumentation

Demographic measures

Participants were asked to provide sociodemographic information such as age, race/ethnicity, employment, and income. Following childbirth, information was also collected regarding type of delivery (cesarean or vaginal), gender of infant, type of feeding, postpartum complications, infant weight, and employment status. Examples of screening questionnaires are located in Appendix A and B.

Depressive symptoms

The 20-item Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977), was designed to measure the frequency of depressive symptomatology in the general population and was used in both samples (see Appendix C). A thorough critique of six of the commonly used subjective depression scales in the postpartum literature revealed the Postpartum Depression Screening Scale (PDSS) was best suited to detect depressive symptoms in postpartum women (Beck & Gable, 2000, 2001a, 2001b, 2003, 2005). The CES-D was the depression measure of choice in the parent studies because measures were taken during pregnancy as well as postpartum and scores could

be compared for change over time. Scores can range between 0 and 60, with a higher score representing increased depressive symptoms. A score ≥ 16 is suggested as an indicator for depressive illness and need for referral and clinical diagnosis (Yonkers & Samson, 2000).

An internal consistency reliability coefficient of 0.84 for the CES-D has been reported with use in the general population (Corcoran & Fischer, 1987) and this also falls within the same range (0.88-0.91) for samples of pregnant women (NICHD Early Child Care Research Network, 1999). An internal consistency reliability of 0.82 was noted in postpartum 106 first-time mothers, with moderate test-retest reliability (0.61-0.62 at one month postpartum) (Beeghly, Olson, Weinberg, Pierre, Downey, et al., 2003; Beeghly, et al., 2002). Sensitivity to change in depressive symptoms over time was also demonstrated in Beeghly's (2002) analysis of 106 postpartum women. Construct validity and criterion validity of the CES-D has been demonstrated both in community and clinical samples (Radloff, 1986; Rodin & Voshart, 1986). Moderate to high correlation coefficients ($r = 0.58 - 0.70$) were noted in a sample of 106 women during the first 12 months postpartum (Beeghly, et al., 2002) and a sensitivity of 60%, specificity (92%), and a positive predictive value of 53% was demonstrated in a sample of postpartum mothers in the United States with a cutoff score of 16 (Campbell & Cohn, 1991).

Objective sleep disturbance

To objectively estimate sleep quantity and disruption, participants were asked to wear a wrist actigraph (Ambulatory Monitoring, Inc., Ardsley NY) for 48 hours at each assessment. The wrist actigraph provides continuous motion data using a battery-operated wristwatch-size microprocessor that senses motion with a piezo-electric linear

accelerometer. Interpretation of motion is based on the fact that there are fewer limb movements during sleep than when awake (Hauri & Wisbey, 1992). Actigraph data were analyzed by trained research assistants blinded to depression ratings using the autoscoring program for sleep available in Action3 software (Ambulatory Monitoring, Inc., Ardsley NY). The autoscoring mechanism of the program avoids bias in scoring. Research assistants were trained by the primary investigator with regard to downloading data from the wrist actigraph into the auto-score program. No other training was required. The autoscoring algorithm yielded the following three sleep-related outcome scores for this study: 1) sleep quantity as total sleep time (TST) at night in minutes, 2) sleep disruption as the number of minutes spent awake between midnight and 6:00am (WAKE), and 3) sleep onset latency (SOL) as the number of minutes it took to fall asleep once lights were turned off as indicated by the participant pressing the event marker on the actigraph monitor. Although other studies have used sleep efficiency and the percentage of wake after sleep onset (%WASO) to objectively estimate sleep disruption, sleep onset is a necessary variable in these two measures, and was difficult to determine in this population due to multiple bed times and wake times each night. Therefore, minutes of wake time (WAKE) between midnight to 6:00 am was used to standardize the measurement of sleep disruption.

The validity of actigraphy in distinguishing sleep from wakefulness has been demonstrated in numerous populations including infants, adolescents, college students, and adults (Cole, Kripke, Gruen, Mullaney & Gillin, 1992; Hauri & Wisbey, 1992; Mullaney, Kripke & Messin, 1980; Sadeh & Acebo, 2002; Sadeh, Hauri, Kripke & Lavie, 1995; Sadeh, Sharkey & Carskadon, 1994; Webster, Kripke, Messin, Mullaney &

Wyborney, 1982). Validation for actigraphic measures is based on the current gold standard for measuring sleep states, polysomnography (PSG). Most researchers agree that actigraphic data correlate well with PSG data with correlations of .89 to .98 in normal sleep, and .78 to .88 in patients with sleep disorders (Ancoli-Israel, 2005). With correct use, the actigraph can provide reliable measures of sleep and wakefulness (Ancoli-Israel, 2005).

Perceived sleep disturbance

Subjective sleep disturbance was determined using the General Sleep Disturbance Scale (GSDS), a 21-item self-report measure (Lee, 1992) (see Appendix D). Participants were asked to rate the frequency of specific sleep problems during the past week from 0 (not at all) to 7 (every day). The seven subscales of the GSDS address problems such as sleep quality (3 items), sleep onset latency which measures difficulty falling asleep (1 item), sleep maintenance which measures mid-sleep awakening (1 item), early awakening (1 item) use of medication to promote sleep (6 items), sleep quantity (2 items) and daytime sleepiness (7 items). Scores for each subscale range from 0 to 7 with a total score ranging between 0 and 147. A higher score is indicative of increased frequency of sleep disturbance. According to the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association, 1994) a diagnosis of insomnia can be made if a person experiences symptoms of insomnia at least three times a week. Therefore, a mean score of ≥ 3 on the GSDS or any of the subscales is considered clinically significant for sleep disturbance. The GSDS has been found to have good internal consistency, with a Cronbach alpha coefficient of .88 in samples of employed women and childbearing women (Lee, 1992; Lee & DeJoseph, 1992). The Sleep Questionnaire and Assessment of

Wakefulness (SQAW) developed at Stanford University, Palo Alto, California, was used to evaluate the construct validity of the GSDS. The SQAW was initially developed as a clinical screening tool and includes 863 items including multiple-choice, dichotomous, and fill-in options (Lashley, 2004).

Daily sleep diaries

While wearing the wrist actigraph, each participant was instructed on how to record their bed times, wake times, and ratings of their sleep quality in a 48-hour sleep diary. Sleep diaries provided an overview of sleep-wake activities and patterns for the 2-day period. Reliability and validity of sleep diaries is an issue given subjective nature and bias in reporting (Lashley, 2004). However, sleep diaries are an important companion to actigraphy as the diaries are used to facilitate interpretation of the actigraphy. Sleep diaries yielded the following five self-report sleep variables: bed time, wake time, rise time, time in bed (difference between bed time and rise time), and a 5-point sleep quality rating from 1 (very poor) to 5 (very good) for each night while wearing an actigraph monitor. Overall, researchers agree that sleep diaries are reliable for collecting information about sleep-wake patterns in most subjects (Lashley, 2004).

Social support

The self-report Interpersonal Relationship Inventory (IPRI) (Tilden, Hirsch & Nelson, 1994) is comprised of three subscales, social support, reciprocity, and conflict. Only the 13-item subscale assessing social support was used in the two parent populations (Appendix E). Each item is rated on a five-point Likert scale of never (1) to always (5) or strongly disagree (1) to strongly agree (5). Scores range from 13 to 65 for

this subscale with a lower score indicative of good interpersonal relations specific to level of social support.

The IPRI was developed from qualitative (phenomenological) interview data collected from 44 respondents (Tilden, Nelson & May, 1990). The scale was validated for content by a panel of 11 experts and the 39-item version was tested with 340 students, patients, and community residents for reliability (Cronbach's alpha 0.70- 0.89) and validity. Validity testing included theory testing, contrasted groups, and multi-trait multi-method comparison. The three subscales of social support, reciprocity, and conflict demonstrated repeated internal consistency and test-retest reliability. Psychometric evaluation of the instrument over a four year period supported the internal consistency reliability and construct validity of all three subscales (Tilden, et al., 1994). In a study to determine the psychometric characteristics of the IPRI the social support and conflict subscales were shown to be valid and internally consistent (Kane & Day, 1999). The sample of 382 residents from four rural communities was predominantly female (71%) with a mean age of 44 (Kane & Day, 1999).

Perceived stress

The Perceived Stress Scale (PSS) is a 10-item self report questionnaire that provides a global measure of stress by asking the respondent to answer questions based on their experiences over the previous 4-week period (Shaw, Dimsdale & Patterson, 2000). The PSS is the only validated instrument available to assess stress appraisal (Monroe & Kelley, 1997) (Appendix G). The items assess specific stress domains of unpredictability, lack of control, burden overload, and stressful life circumstances. Responses are based on a 5-point Likert scale (0 "never" to 4 "experienced very often").

With a range of scores 0 to 40, a higher score indicates greater perceived stress (Shaw, et al., 2000).

The PSS has been widely used in the general population in a sample of 121 minority adolescent mothers and a group of 129 medically high-risk prenatal women (Chen, et al., 2000; Koniak-Griffin, Anderson, Verzemnieks & Brecht, 2000; Lobel, DeVincent, Kaminer & Meyer, 2000).

The PSS was used in a sample of Scandinavian nulliparous pregnant women (N = 476) to assess the appraisal of perceived stress and the association of stress and 27 pregnancy related symptoms from week 10 to week 36 gestation. Psychological stress contributed to the prevalence of pregnancy related symptoms including urogenital, gastrointestinal, musculoskeletal, and miscellaneous (sleep problems, fatigue). Internal reliability ranged between .85 and .92 over the pregnancy (Rodriguez, et al., 2001).

Although the PSS is unable to predict the onset of PPD, it does provide a global assessment of perceived stress which has been shown to contribute to PPD (Shaw, et al., 2000).

Maternal adjustment

Kumar and colleague's Maternal Adjustment and Maternal Attitudes (MAMA) scale includes a 12-item subscale that assesses maternal attitude toward the baby during the postpartum period (Kumar, Robson & Smith, 1984). This subscale was used to assess postpartum maternal adjustment in both samples. Please see Appendix F. Responses on the MAMA questionnaire are: 1 = never, 2 = rarely, 3 = often, and 4 = very often. To score the subscale, responses were summed and a mean score was computed. Examples of questions assessing maternal adjustment included: Have you regretted having the

baby? Have you felt disappointed about motherhood? Participants were asked to circle the appropriate word (never, rarely, often, very often) that best described how they had felt over the past month. Test-retest and split-half reliability for the attitudes toward baby subscale were 0.84 and 0.73 respectively (Kumar, et al., 1984). Concurrent reliability was obtained during instrument development.

Procedures

Table 3.1

Data Collection Times

Time 1 (Third trimester)	Time 2 (12 weeks postpartum)
Social characteristics:	Social characteristics:
Age	Employment status
Education level	
Household income	
Employment status	
Partnered	
	Postpartum characteristics:
	Breast, formula, combination feeding
Variables:	Variables:
Depressive symptoms	Depressive symptoms
Subjective sleep measures	Subjective sleep measures
Objective sleep measures	Objective sleep measures
Perceived stress	Perceived stress
Level of social support	Level of social support
	Maternal adjustment

Table 3.1 presents the data collection times for this secondary analysis. Third trimester (Time 1) data collection took place 3.1 ± 1.5 weeks prior to delivery and 12 week postpartum (Time 2) data collection took place 11.3 ± 1.0 weeks postpartum.

Data Analysis

Data analysis for this study included descriptive measures including means, standard deviations, and ranges. Outlying data were scrutinized for outliers and data were modified in order to meet assumptions for statistical analysis. Statistical significance was determined with a two-tailed alpha of $p < .05$ for correlations and differences between group means and $p < .01$ for regression analysis using SPSS 13.0. The following paragraphs provide the aims together with appropriate statistical analyses.

Aim # 1: to describe self-report depressive symptoms (Center for Epidemiologic Studies Scale for Depression, CES-D), self-report sleep (General Sleep Disturbance Scale, GSDS, total scores and subscale scores), self-report diary variables (bedtime, wake time, rise time), and objective sleep (sleep onset latency, SOL, total sleep time, TST, amount of time awake between midnight and 6:00 a.m. WAKE), in a sample of new mothers in the third trimester (Time 1) and at 12 weeks postpartum (Time 2).

Data analysis included descriptive statistics, means, standard deviations, and paired t-tests to compare group mean scores between the third trimester and 12-weeks postpartum.

Aim # 2: to describe level of social support and level of perceived stress in a sample of new mothers ($n = 161$) in the third trimester of pregnancy (Time 1) and at 12 weeks postpartum (Time 2). Aim 2 is also to describe the scores (mean $\pm$ SD) of maternal adjustment at 12 weeks postpartum.

Data analysis included descriptive statistics, means, standard deviations, and paired t-tests to compare group mean scores between the third trimester and 12-weeks postpartum.

Aim # 3: To determine the relationship between depressive symptoms and sleep disturbance in the third trimester and at 12 weeks postpartum

Pearson product moment correlations were used to examine the strength of the relationships between continuous variables of sleep and depression.

Aim # 4: To compare self-report measures of perception of sleep (GSDS total, subscales, diary) and objective (TST, WAKE) between women with and without depressive symptoms in the third trimester and to compare women with and without depressive symptoms in the third month postpartum.

Independent group t-tests and Mann-Whitney U tests were used to compare the mean subjective and objective sleep scores for the two groups of women. The two groups were categorized by their CES-D scores.

Aim # 5: To examine mean Time 2 depressive symptoms and the relationship with socioeconomic (income, education, third trimester work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables.

T-tests, One-way ANOVA, and Mann-Whitney U tests were used to test this aim.

Aim # 6: To examine the relationship between depressive symptoms and demographic (age, race, income, education, third trimester work status, 12 week postpartum work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables at 12 weeks postpartum.

A correlation matrix of the independent and dependent variables were examined to identify significantly correlated independent variables, and to check for multicollinearity among the independent variables. One-Way ANOVAs were tested for

independent variables with more than two groups (race, feeding type). A hierarchical regression model was then tested with significantly correlated demographic and perinatal variables.

Aim # 7: To examine the role of social support, perceived stress, and maternal adjustment as moderators on the relationship between sleep disturbance and depressive symptoms at 12 weeks postpartum, after controlling for third trimester depressive symptoms.

Testing Aim 7 involved multiple methodical steps. First, significantly correlated demographic, perinatal, sleep, and psychosocial variables were identified. Each block of the model was scrutinized for overall significance and individual unique contribution of the independent variables to the variance in Time 2 depression scores. Any variable not adding significant unique variance to Time 2 depression scores was not included in the final hierarchical regression model. The interaction term of sleep and depression was computed with the sleep variable that was significantly correlated with Time 2 depression scores as well as one making a unique and significant contribution to Time 2 depression score variance.

CHAPTER IV

RESULTS

Introduction

This chapter presents the results of a study that examined depressive symptoms and sleep loss in a sample of first time mothers during the third trimester (Time 1) and 12 weeks postpartum (Time 2). Chapter 3 provided detailed information on sample selection and criteria for this secondary analysis. This chapter begins with the demographic characteristics of the women who met criteria for this secondary analysis (Table 4.1). Following this, Table 4.2 presents the reliabilities of the instruments used in this study. The last few sections of this chapter present each of the aims and hypotheses with their corresponding results. Any modifications of variables in order to meet statistical testing assumptions are also provided. Due to the large number of hypotheses and statistical tests, significance was set at $p < .01$.

Table 4.1

Third Trimester and Postpartum Sample Characteristics (N = 161)

	<i>N</i>	<i>%</i>
Age (mean $\pm$ SD)		31.3 $\pm$ 5.8 years
Married or Partnered	161	100%
Income:		
$\geq$ \$60,000/year	92	57%
< \$60,000/year	69	43%
Race:		
Caucasian	84	52%
Asian	40	25%
Hispanic	19	12%
African American	8	5%
Mixed Race	10	6%
Employment Status (third trimester)		
Working	61	38%
Not Working	100	62%
Education:		
College Diploma	114	71%
No College Diploma	47	29%
Type of Delivery:		
Vaginal	118	73%
Cesarean Section	43	27%
Gender of Infant:		
Male	97	60%
Female	64	40%
Employment Status (12 weeks postpartum)		
Working	27	17%
Not Working	134	83%
Feeding Type (12 weeks postpartum)		
Breast	103	64%
Bottle	25	16%
Combination	32	20%

Table 4.1 presents the demographic, prenatal, and postpartum characteristics of the sample used in this secondary analysis.

Assessing Internal Consistency of Measures

Internal consistency speaks to how well a set of items on an instrument designed to measure the same concept, are intercorrelated (Jacobson, 2004). The most commonly reported indicator for instrument internal consistency is coefficient alpha, also known as a Cronbach α (Cronbach, 1951). Cronbach's alpha provides a quantitative assessment of the degree to which items on an instrument correlate with each other (Powers & Knapp, 1995). It is calculated from the correlations between scores on individual items within an instrument, with a value between 0 and 1 (Hulley, 2001). A value of 0.80 is preferred and considered an excellent indicator of internal consistency. A value of $\geq 0.70 - 0.79$ is deemed acceptable, and an alpha < 0.70 may indicate not all of the items on the instrument are measuring the same construct (Hulley). In general, the closer the coefficient is to 1.00 the more reliable the tool (Polit & Beck, 2004). Internal reliability consistencies were calculated for the Center for Epidemiologic Studies Depression Scale (CES-D), the General Sleep Disturbance Scale (GSDS), Tilden's Interpersonal Relationship Inventory, Cohen's Perceived Stress Scale, and the Maternal Adjustment and Maternal Attitudes subscale (MAMA). The MAMA is a 12-item subscale used to assess postpartum maternal attitude towards her infant. Cronbach's α for the 12-item subscale was poor (.54). Methodical scale reliability analyses identified four items that would increase α from 0.54 to 0.66 if deleted. Item numbers 1, 2, 7, and 10 were sequentially deleted from the subscale (please see Appendix F). Correlation between the 8-item scale and the 12-item scale was high (0.84) indicating that both scales were capturing the same construct. Therefore the 8-item subscale was used in this analysis.

The internal consistency reliabilities for all instruments used in this study are presented below in Table 4.2.

Table 4.2

Instrument Reliability Testing

Instrument	Alpha Time 1	Alpha Time 2
Center for Epidemiologic Studies Depression Scale (CES-D)	.83	.86
General Sleep Disturbance Scale (GSDS)	.77	.80
Tilden's Interpersonal Relationship Inventory	.90	.91
Cohen's Perceived Stress Scale (PSS)	.85	.86
Maternal Adjustment and Maternal Attitudes Scale (MAMA) (8-item subscale)	Not Applicable	.66

Hypothesis Testing

The following section presents the aims and hypotheses tested in this study along with supporting data.

Aim # 1 was to describe self-report depressive symptoms (Center for Epidemiologic Studies Scale for Depression, CES-D), self-report sleep (General Sleep Disturbance Scale, GSDS, total scores and subscale scores), self-report diary variables (bedtime, wake time, rise time), and objective sleep (sleep onset latency, SOL, total sleep time, TST, amount of time awake between midnight and 6:00 a.m. WAKE), in a sample of new mothers in the third trimester (Time 1) and at 12 weeks postpartum (Time 2).

Depressive symptoms were assessed with the 20-item self-report The Center for Epidemiologic Studies Depression Scale (CES-D). Because CES-D scores were not normally distributed in this sample, the CES-D scores of the nine participants whose

scores exceeded 27 at Time 1 were truncated to ≥ 27 . This resulted in a more symmetric distribution. Perceived SOL was also not normally distributed. In order to obtain a more symmetric distribution, this variable was transformed into seven categories (0 - 5, 6 - 10, 11 - 15, 16 - 20, 21 - 25, 25 - 30, and ≥ 31 minutes) from the original continuous variable of minutes from lights out to sleep. Objective actigraphic measures included total minutes of sleep time (TST) and number of minutes awake between midnight and 6:00am (WAKE). Because TST was not normally distributed in this sample, TST for two participants who exceeded 600 minutes was truncated to 600 minutes resulting in a more symmetric distribution. Self-report depression findings are presented in Table 4.3 and the subjective and objective sleep findings are presented in Table 4.4. Aim 1 tested two hypotheses which are presented below with corresponding findings.

Hypothesis 1.1

Hypothesis 1.1 states that there will be no significant difference in depressive symptoms between the third trimester and 12 weeks postpartum. Table 4.3 presents the results of the paired t-tests. There was a significant decrease in mean CES-D scores for the 161 women in the sample from third trimester (Time 1) to 12 weeks postpartum (Time 2). Therefore this hypothesis is not supported.

Table 4.4 presents a cross tabulation table of percentages of women and their depression scores. Results suggest that 28.6% ($n = 46$) of the women scored in the depressed range ($CES-D \geq 16$) at Time 1 with 32.6% ($n = 15$) continuing to experience depressive symptoms at Time 2. Alternatively, 71.4% of the women scored in the non-depressed range ($CESD \leq 15$) at Time 1 with 7% ($n = 8$) of them experiencing depressive symptoms at Time 2.

Table 4.3

A Comparison of Depressive Symptoms between Time 1 and Time 2 (N = 161)

	Time 1 Mean $\pm$ SD	Time 2 Mean $\pm$ SD	Significant Group Differences by Time (Paired <i>t</i> -test)
Center for Epidemiologic Studies Depression Scale (CES-D)	12.2 $\pm$ 7.0	8.8 $\pm$ 6.7	$t_{(160)} = 5.60^*$

* $p < .001$

Table 4.4

Depressive Symptoms at Time 1 and Time 2 (N = 161)

	CES-D $\leq$ 15 Time 2	CES-D $\geq$ 16 Time 2	Total
CESD $\leq$ 15 Time 1	n = 107 93%	n = 8 7.0%	n = 115 71.4%
CES-D $\geq$ 16 Time 1	n = 31 67.4%	n = 15 32.6%	n = 46 28.6%
Total	n = 138 85.7%	n = 23 14.3%	n = 161 100%

Hypothesis 1.2

Hypothesis 1.2 states that there will be no significant difference in subjective and objective sleep between the third trimester and 12 weeks postpartum. Table 4.5 presents the data for this hypothesis. Results from paired t-tests do not support this hypothesis. A significant improvement in total GSDS total demonstrates an improvement in sleep disturbance from the third trimester to 12 weeks postpartum. Subscale mean scores for minutes to fall asleep, ability to stay asleep, and daytime sleepiness, also improved significantly from the third trimester to 12 weeks postpartum. Although mean subscale scores for waking earlier than usual, quality of sleep, and quantity, were problematic three or more times a week, they did not reach the level of significance set *a priori* for these results. Sleep diary entries for minutes taken to fall asleep also significantly improved from the third trimester to 12 weeks postpartum ($t_{(154)} = 4.8, p < .001$). Of the two objective wrist actigraphy measures, total sleep time (TST) was reduced by approximately 10 minutes and was not statistically or clinically significant for this sample. Actigraphy measures of time awake between midnight and 06:00 a.m. (WAKE) increased by approximately 4% from the third trimester to 12 weeks postpartum ($t_{(160)} = 3.6, p < .001$).

Table 4.5

A Comparison of Sleep Disturbance between Time 1 and Time 2 (N = 161)

	Time 1 Mean $\pm$ SD	Time 2 Mean $\pm$ SD	Significant Group Differences by Time (Paired <i>t</i> -test)
<u>Subjective self-report:</u>			
GSDS Total Score	45.2 $\pm$ 15.5	38.4 $\pm$ 16.2	$t_{(160)} = 5.04^*$
Sleep Onset Latency	2.1 $\pm$ 2.1	1.2 $\pm$ 1.7	$t_{(160)} = 4.52^*$
Sleep Maintenance	6.1 $\pm$ 1.8	5.0 $\pm$ 2.6	$t_{(160)} = 5.13^*$
Early Awakening	3.1 $\pm$ 2.3	3.3 $\pm$ 2.6	
Sleep Quality	3.5 $\pm$ 1.8	3.2 $\pm$ 1.7	
Sleep Quantity	4.4 $\pm$ 2.3	4.6 $\pm$ 2.4	
Excessive Daytime Sleepiness	2.7 $\pm$ 1.2	2.1 $\pm$ 1.2	$t_{(160)} = 7.0^*$
Medications	0.75 $\pm$ 0.36	0.11 $\pm$ 0.55	
<u>Subjective sleep diary data:</u>			
Bed Time	23:1 $\pm$ 1:1	23:0 $\pm$ 1:2	
Sleep Onset Latency (mins)	2.6 $\pm$ 2.0	1.8 $\pm$ 1.9	$t_{(154)} = 4.8^*$
Wake Time	7:25 $\pm$ 1:25	7:23 $\pm$ 1:26	
Rise Time	7:55 $\pm$ 1:23	8:03 $\pm$ 1:29	
<u>Objective actigraph data:</u>			
Wake After Sleep (WAKE) (mins)	19.1 $\pm$ 13.8	23.4 $\pm$ 13.1	$t_{(160)} = 3.6^*$
Total Sleep Time (TST) (mins)	426 $\pm$ 73.0	415 $\pm$ 73.1	

* $p \leq .001$

Aim # 2 was to describe level of social support and level of perceived stress in a sample of new mothers (n = 161) in the third trimester of pregnancy (Time 1) and at 12 weeks postpartum (Time 2). Aim 2 was also to describe the scores (mean $\pm$ SD) of maternal adjustment at 12 weeks postpartum.

Hypothesis 2.1

Hypothesis 2.1 states that there will be no significant difference in level of social support and perceived stress between the third trimester and 12 weeks postpartum. Table 4.6 presents the data for this hypothesis. Results from paired t-tests do not support this hypothesis for social support. However, a significant improvement in Cohen's Perceived Stress Scale mean scores demonstrates an improvement in level of perceived stress from the third trimester to 12 weeks postpartum. ($t_{(160)} = 3.39$, $p < .001$).

Table 4.6

A Comparison of Social Support and Perceived Stress between Time 1 and Time 2

($N = 161$)

	Time 1 Mean $\pm$ SD	Time 2 Mean $\pm$ SD	Significant Group Differences by Time (Paired t -test)
Tilden's Interpersonal Relationship Inventory	57.2 $\pm$ 6.3	57.3 $\pm$ 6.7	$t_{(160)} = 0.36$
Cohen's Perceived Stress Scale (PSS)	14.71 $\pm$ 6.2	12.9 $\pm$ 6.3	$t_{(160)} = 3.39^*$
Maternal Adjustment and Maternal Attitudes Scale (MAMA)	NA	27.3 $\pm$ 2.5	NA

* $p < .001$

Aim # 3 was to determine the relationship between depressive symptoms and sleep disturbance in the third trimester and at 12 weeks postpartum. Table 4.7 presents the Pearson's product moment correlations used to examine the strength of relationships between the GSDS total and subscale scores and the continuous independent variables (objective TST, WAKE) with the continuous CES-D score as the dependent variable. For

the entire sample of new mothers, increased frequency of depressive symptoms was associated with certain aspects of sleep, but not necessarily in the hypothesized direction.

Hypothesis 3.1

Hypothesis 3.1 states that there will be a negative relationship between frequency of depressive symptoms and wake time (WAKE) during the night in the third trimester. The findings presented in Table 4.7 reject this hypothesis; there was no relationship between frequency of depressive symptoms and WAKE in the third trimester.

Hypothesis 3.2

Hypothesis 3.2 states that there will be a negative relationship between frequency of depressive symptoms and WAKE at 12 weeks postpartum. As seen in Table 4.7, there is a positive significant relationship ($r = .19$, $p \leq .01$) between frequency of depressive symptoms and WAKE at 12 weeks postpartum indicating support for this hypothesis.

Hypothesis 3.3

Hypothesis 3.3 states that there will be a negative relationship between frequency of depressive symptoms and total sleep time (TST) in the third trimester. The results in Table 4.7 reject this hypothesis; there was no relationship between frequency of depressive symptoms and TST in the third trimester.

Hypothesis 3.4

Hypothesis 3.4 states that there will be a negative relationship between frequency of depressive symptoms and TST at 12 weeks postpartum. As seen in Table 4.7, there was no relationship between frequency of depressive symptoms and TST at 12 weeks postpartum.

Hypothesis 3.5

Hypothesis 3.5 states that there will be a negative relationship between frequency of depressive symptoms and GSDS SOL or subjective diary sleep onset latency (SOL) in the third trimester. The findings presented in Table 4.7 rejects this hypothesis; there was no correlation between depressive symptoms and diary SOL in the third trimester.

However, there was a positive significant relationship between frequency of depressive symptoms and the GSDS SOL subscale in the third trimester ($r = .31, p < .01$).

Hypothesis 3.6

Hypothesis 3.6 states that there will be a negative relationship between frequency of depressive symptoms and GSDS SOL subjective diary SOL at 12 weeks postpartum. The findings presented in Table 4.7 reject this hypothesis; there was a positive significant relationship between frequency of depressive symptoms and time taken in minutes to fall asleep per mother's sleep diary ($r = .22, p < .01$) and the GSDS SOL ($r = .36, p < .01$).

Table 4.7

Pearson Correlation Coefficients of Independent Variables and CES-D Score at Time 1 and Time 2 (N = 161)

	Pearson Correlations with CES-D score in Third trimester (Time 1)	Pearson Correlations with CES-D score at 12 Weeks Postpartum (Time 2)
<u>Sleep Measures</u>		
<u>Subjective self-report:</u>		
GSDS Total Score	0.40*	0.36*
Sleep Onset Latency	0.31*	0.36*
Sleep Maintenance	0.003	-0.03
Early Awakening	0.27*	0.12
Sleep Quality	0.28*	0.20*
Sleep Quantity	0.30*	0.21*
Excessive Daytime Sleepiness	0.32*	0.41*
Medications	-0.09	0.19
<u>Subjective sleep diary data:</u>		
Bed Time	0.124	0.07
Sleep Onset Latency	0.07	0.22*
Wake Time	-0.03	0.07
Rise Time	0.032	0.13
<u>Objective actigraph data:</u>		
Wake After Sleep (WAKE)	0.14	0.19*
Total Sleep Time (TST)	-0.07	-0.07
<u>Psychosocial Measures</u>		
Third Trimester CES-D	-	0.40*
Maternal Adjustment	-	-0.43*
Social Support	-0.29*	-0.48*
Perceived Stress	0.62*	0.68*

* $p \leq .01$

Aim # 4 was to compare self-report measures of perception of sleep (GSDS total, subscales, diary) and objective (TST, WAKE) between women with ($n = 46$) and without ($n = 115$) depressive symptoms in the third trimester and women with ($n = 22$) and without ($n = 138$) depressive symptoms in the third month postpartum. The specific aim was to test four hypotheses which are presented below with the corresponding data. Independent t -tests were used to compare the mean subjective and objective sleep scores for the two groups of women. The two groups of women were categorized by their CES-D scores, with ≤ 15 (0 - 15), and ≥ 16 (16 - 60) at the third trimester (Time 1) and at the 12 week postpartum assessment (Time 2).

Hypothesis 4.1

Hypothesis 4.1 states that there will be no significant difference in subjective sleep variables (GSDS total, subscales, diary) between women with CES-D scores ≤ 15 ($n = 115$) and ≥ 16 ($n = 46$) in the third trimester. The independent t -tests presented in Table 4.8 reject this hypothesis; the two groups differed significantly on the GSDS overall total sleep disturbance score ($t_{(159)} = 3.8, p < .001$) and the subscales for sleep onset latency $t_{(159)} = 3.0$ ($p < .01$), sleep quantity $t_{(159)} = 2.7, p < .01$), and excessive daytime sleepiness $t_{(159)} = 3.0, p < .01$).

However, differences did not reach the *a priori* $p < .01$ level of significance for the remaining GSDS subscales or the subjective sleep diary entries. Given the unequal size of the two groups, the more conservative Mann-Whitney U test was performed to verify t -test findings. The GSDS total score ($p = .001$); GSDS sleep onset latency ($p = .004$), GSDS sleep quantity ($p = .008$), and GSDS excessive daytime sleepiness ($p = .007$) all suggested significant Mann-Whitney U p values. This also suggested

comparable results between the independent *t*-tests and Mann-Whitney U tests (Table 4.8).

Hypothesis 4.2

Hypothesis 4.2 states that there will be no significant difference in the objective sleep variables (TST, WAKE) between women with CES-D scores ≤ 15 and ≥ 16 in the third trimester. Although women with CES-D scores ≥ 16 slept approximately 13 minutes less than women with CES-D scores ≤ 15 in the third trimester, independent *t*-test and Mann-Whitney U did not reveal any significant differences.

Independent *t*-tests indicated women with CES-D scores ≥ 16 in the third trimester were awake approximately 5 minutes longer between midnight and 6:00 a.m. than women with CES-D scores ≤ 15 in the third trimester ($t_{(159)} = 2.2$, $p = .03$). However, statistical significance did not reach the *a priori* $p < .01$ level.

Table 4.8

Comparison of Sleep Disturbance for Mothers with CES-D ≤ 15 and CES-D ≥ 16 at

Time 1

	CES-D ≤ 15 at Time 1 (n = 115)	CES-D ≥ 16 at Time 1 (n = 46)	Significant Group Differences Independent <i>t</i> -test and <i>p</i> value	Mann- Whitney U <i>p</i> Value
<u>Subjective self-report:</u>				
GSDS Total Score	42.4 $\pm$ 14.4	52.0 $\pm$ 16.3	$t_{(159)} = 3.8$ (<.001)	.001
Sleep Onset Latency	1.75 $\pm$ 1.9	2.9 $\pm$ 2.4	$t_{(159)} = 3.0$ (< .01)	.004
Sleep Maintenance	6.1 $\pm$ 1.8	6.2 $\pm$ 1.8		
Early Awakening	2.8 $\pm$ 2.2	3.7 $\pm$ 2.4	$t_{(159)} = 2.3$ (< .05)	.034
Sleep Quality	3.3 $\pm$ 1.8	3.9 $\pm$ 1.7	$t_{(159)} = 2.1$ (.05)	.036
Sleep Quantity	4.1 $\pm$ 2.3	5.1 $\pm$ 2.0	$t_{(159)} = 2.7$ (.01)	.008
Excessive Daytime Sleepiness	2.5 $\pm$ 1.1	3.2 $\pm$ 1.3	$t_{(159)} = 3.0$ (< .01)	.007
Medications	0.10 $\pm$ 0.42	0.02 $\pm$ 0.15		
<u>Subjective sleep diary data:</u>				
Sleep Onset Latency (mins)	2.6 $\pm$ 2.0	2.6 $\pm$ 2.0		
Bed Time	23:07 $\pm$ 1:00	23:29 $\pm$ 1:23	$t_{(159)} = 1.9$ (= .064)	
Wake Time	7:26 $\pm$ 1:22	7:23 $\pm$ 1:34		
Rise Time	7:53 $\pm$ 1:19	7:59 $\pm$ 1:34		
<u>Objective actigraph data:</u>				
Wake After Sleep (mins)	17.6 $\pm$ 12.2	22.9 $\pm$ 16.7	$t_{(159)} = 2.2$ (.03)	.061
Total Sleep Time (mins)	429.4 $\pm$ 72.4	416.8 $\pm$ 74.3		

Hypothesis 4.3

Hypothesis 4.3 states that there will be no significant difference in subjective sleep variables between women with CES-D scores ≤ 15 ($n = 138$) and ≥ 16 ($n = 23$) at 12 weeks postpartum. Independent t -test findings indicated women with CES-D scores ≥ 16 at 12 weeks postpartum reported more general sleep disturbance ($t_{(159)} = 2.3$, $p = .03$) and more sleep SOL ($t_{(159)} = 2.2$, $p = .04$), significance did not reach the *a priori* $p < .01$ level of significance. The GSDS subscale score indicated women with CES-D scores ≥ 16 at 12 weeks postpartum reported significantly more daytime sleepiness than women with CES-D scores ≤ 15 at 12 weeks postpartum ($t_{(159)} = 3.01$, $p < .01$).

Hypothesis 4.4

Hypothesis 3.4 states that there will be no significant difference in objective sleep variables (TST, WAKE) between women with CES-D ≤ 15 and ≥ 16 at 12 weeks postpartum. The t -test results are presented in Table 4.9 support this hypothesis. Independent t -test findings for WAKE were significant at the .05 level, however, not at the required *a priori* .01 level and TST results indicated no significant mean differences between the two groups. However the Mann - Whitney U test for WAKE suggests women with CES-D scores ≥ 16 at 12 weeks postpartum were awake significantly more time than women with CES-D scores ≤ 15 at 12 weeks postpartum ($p = .01$).

Table 4.9

Comparison of Sleep Disturbance between Mothers with CES-D ≤ 15 and CES-D ≥ 16 at

Time 2

	CES-D ≤ 15 at Time 2 (n = 138)	CES-D ≥ 16 at Time 2 (n = 23)	Significant Group Differences Independent <i>t</i> -Test and <i>p</i> value	Mann- Whitney U <i>p</i> Value
<u>Subjective self-report:</u>				
GSDS Total Score	37.2 $\pm$ 15.3	45.4 $\pm$ 19.6	$t_{(159)} = 2.3$ (.03)	.109
Sleep Onset Latency	1.1 $\pm$ 1.5	2.0 $\pm$ 2.2	$t_{(159)} = 2.1$ (.05)	.030
Sleep Maintenance	5.1 $\pm$ 2.7	4.6 $\pm$ 2.4		
Early Awakening	3.2 $\pm$ 2.6	3.8 $\pm$ 2.6		
Sleep Quality	3.2 $\pm$ 1.7	3.4 $\pm$ 1.8		
Sleep Quantity	4.6 $\pm$ 2.4	4.9 $\pm$ 1.9		
Excessive Daytime Sleepiness	2.0 $\pm$ 1.1	2.7 $\pm$ 1.4	$t_{(159)} = 3.01$ (< .01)	.021
Medications	0.1 $\pm$ 0.5	0.3 $\pm$ 0.9		
<u>Subjective sleep diary data:</u>				
Sleep Onset Latency (mins)	1.6 $\pm$ 1.8	2.4 $\pm$ 2.2	$t_{(154)} = 1.8$ (.09)	.076
Bed Time	23:02 $\pm$ 1:14	23:11 $\pm$ 2:04		
Wake Time	7:19 $\pm$ 1:21	7:42 $\pm$ 1:52		
Rise Time	7:59 $\pm$ 1:24	8:27 $\pm$ 1:49		
<u>Objective actigraph data:</u>				
Wake After Sleep (mins)	22.3 $\pm$ 12.1	28.3 $\pm$ 14.0	$t_{(159)} = 2.2$ (.04)	.012
Total Sleep Time (mins)	417.4 $\pm$ 68.2	402.2 $\pm$ 98.84		

Aim # 5 was to examine the relationship of mean Time 2 depressive symptoms with socioeconomic (income, education, third trimester work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables.

Hypothesis 5.1

Hypothesis 5.1 states that there will be no significant difference in mean Time 2 depression scores and socioeconomic level (education level, income, Time 1 work status) or perinatal variables (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding).

Sociodemographic variables and mean Time 2 CES-D scores are presented in Table 4.10. Results indicated women with household incomes <\$60,000/year obtained significantly higher mean CES-D scores at 12 weeks postpartum than women with household incomes > \$60,000/year ($t = 2.5, p < 0.01$). Results also indicated that women without a college diploma obtained significantly higher mean CES-D scores at Time 2 than women with a college diploma ($t = 2.9, p = 0.01$). Women not working in the third trimester also scored significantly higher mean CES-D scores at 12 weeks postpartum than women with household incomes and those women working in the third trimester. However, significance levels did not reach the .01 *a priori* level ($t = 2.3, p = 0.03$). Mann-Whitney U tests confirmed t-test findings.

Table 4.10

Time 2 CES-D Mean Scores and Sociodemographic Characteristics (N = 161)

Sociodemographic characteristics	Time 2 CES-D Score mean $\pm$ SD	Univariate <i>p</i> value	Mann-Whitney U <i>p</i> value
Mother's mean (SD) age 31.3 $\pm$ 5.8		$r = -0.088$, NS	
Education			
College diploma	7.8 $\pm$ 5.9	$t = 2.9$, $p = .004$	.005
No college diploma	11.5 $\pm$ 7.8		
Income			
$\geq$ \$60,000/year	7.7 $\pm$ 6.0	$t = 2.5$, $p = .013$	.016
< \$60,000/year	10.4 $\pm$ 7.3		
Work status third trimester			
Working	7.4 $\pm$ 5.7	$t = .2.3$, $p = .025$	.047
Not working	9.8 $\pm$ 7.2		
Work status 12 weeks postpartum			
Working	8.4 $\pm$ 7.3	$t = .37$, NS	NS
Not working	8.9 $\pm$ 6.6		
Type of Delivery			
Vaginal	8.9 $\pm$ 6.8	$t = .02$, NS	NS
Cesarean Section	8.9 $\pm$ 6.7		
Gender of Infant			
Male	8.2 $\pm$ 6.6	$t = 1.5$, NS	NS
Female	9.9 $\pm$ 6.9		

NS = not significant

Note One-Way ANOVA for race and type of feeding see Table 4.12

Aim # 6 was to examine the relationship of depressive symptoms to demographic (age, race, income, education, third trimester work status, 12 week postpartum work status) and perinatal (vaginal delivery, cesarean delivery, gender of the infant, breast or formula feeding) variables at 12 weeks postpartum.

Pearson correlations were examined to determine the strength of the relationships and assess for multi-collinearity between variables. Scatter plots indicated no evidence of curvilinear relationships between any of the independent variables with the dependent variable. Categorical independent variables for race and type of feeding were dummy-coded.

Hypothesis 6.1

Hypothesis 6.1 states that there will be no significant relationship between frequency of depressive symptoms and demographic variables (age, race, income, education, third trimester work status, postpartum work status) or perinatal variables (vaginal or cesarean delivery, male or female infant, breast or formula feeding) at 12 weeks postpartum after controlling for third trimester depressive symptoms.

Table 4.11 presents a correlation matrix of the independent and dependent demographic and perinatal variables tested in Aim 6. Only significantly correlated variables were entered into the regression model. Third trimester CES-D scores, income, education level, and third trimester work status were all significantly correlated with CES-D scores at 12 weeks postpartum. Table 4.12 presents one-way ANOVA results for race and feeding type. Results indicate that neither race nor type of infant feeding was significantly correlated with CES-D scores at 12 weeks postpartum.

Table 4.11

*Correlation Matrix for Categorical Independent Variables and Dependent Variables**(N = 161)*

Pearson Correlation <i>r</i>	CES-D Time 2	CES-D Time 1	Age	Income	Education	Work Time 1	Work Time 2	Delivery	Gender
CES-D Time2	1.000	.409*	-.088	.200*	-.253*	-.168*	-.030	-.002	.119
CES-D Time 1		1.000	-.038	.190	-.260	-.088	-.125	.014	.047
Age			1.000	-.315	.549	.253	.066	.091	-.013
Income				1.000	-.327	-.340	-.154	.045	.040
Education					1.000	.333	.069	-.041	-.093
Work Time 1						1.000	.301	-.124	-.033
Work Time 2							1.000	-.008	-.059
Delivery								1.000	-.031
Gender									1.000

* $p < .05$

Table 4.12

*One-Way ANOVA for Race and Infant Feeding with Time 2 CES-D Scores**(N = 161)*

Independent Variable	<i>p</i>
<u>Race/ethnicity:</u>	
White	F = 1.51, p = .203
Asian	
African American	
Hispanic	
Mixed Race	
<u>Type of infant feeding at 12 weeks postpartum:</u>	
Breastfeeding	F = 1.44, p = .239
Formula	
Combination	

A hierarchical regression model was tested controlling for third trimester CES-D scores entered in block 1. Significantly correlated demographic variables (income, education level, third trimester work status) from Table 4.11 were entered into block 2 and results indicate that after controlling for third trimester CES-D scores, the combination of income, education, and third trimester work status accounted for an additional 3.5% of the variance in CES-D scores at 12 weeks postpartum ($F_{(3,156)} = 2.27$, $p = 0.82$) (Table 4.13). Further individual examination of these three independent variables indicated none of them added any significant unique contribution to the variance in 12 week CES-D scores (Table 4.14). Therefore, we cannot reject hypothesis 5.1, as there was no significant relationship between frequency of depressive symptoms and demographic variables or perinatal variables at 12 weeks postpartum after controlling for third trimester depressive symptoms.

Table 4.13

Hierarchical Regression Model Summary: Time 1 CES-D and Demographics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.409	.167	.162	6.153	.167	31.975	1	159	.000
2	.450	.202	.182	6.081	.035	2.272	3	156	.082

Table 4.14

Coefficients Table

Block	Variables Entered	beta	sr ²	df	F	p
1	Third Trimester CES-D	.409	.167	1, 159	31.97	.000*
2	Income	.070	.004	3, 156	.78	.379
	Education	-.112	-.01		1.95	.165
	Third Trimester work status	.075	-.005		.92	.339
3	Social Support	-.184	-.03	3, 156	8.83	.003*
	Perceived Stress	.517	.18		62.46	.000*
	Maternal Adjustment	-.043	-.00		.51	.475
4	GSDS Sleep Onset Latency	.171	.020	4, 154	6.98	.009*
	GSDS Sleep Quality	-.053	-.001		.062	.429
	GSDS Excessive Daytime Sleepiness	.082	.003		1.22	.272
	Sleep Diary Sleep Onset Latency	.022	.000		.122	.728

* p < .01

Aim # 7 was to examine the role of social support, perceived stress, and maternal adjustment as moderators on the relationship between sleep disturbance and depressive symptoms at 12 weeks postpartum, after controlling for third trimester depressive symptoms.

Hypothesis 7.1

Hypothesis 7.1 states the relationship between frequency of depressive symptoms and sleep disturbance will be influenced (or moderated) by social support, perceived stress, and maternal adjustment at 12 weeks postpartum.

In order to build a sound hierarchical multiple regression model to test this hypothesis a methodical approach was imperative. Only variables that made a significant unique contribution to 12 week postpartum depression scores were entered into the final hierarchical model. Aim 6 identified third trimester CES-D scores as significantly accounting for variance in Time 2 depression scores. The next step was to identify significant psychosocial and sleep variables for the final model.

Table 4.15 indicates level of social support, perceived stress, and maternal adjustment significantly accounted for an additional 37% of the variance in Time 2 CES-D scores after controlling for third trimester depression scores. Further examination of these three independent variables indicated maternal adjustment made no significant unique contribution to CES-D scores at 12 weeks postpartum (Table 4.14), therefore it was not entered into the final model.

Table 4.15

Hierarchical Regression Model Summary: Time 1 CES-D and Psychosocial Variables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.409 ^a	.167	.162	6.153	.167	31.975	1	159	.000
2	.734 ^b	.538	.526	4.627	.371	41.730	3	156	.000

a. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+)

b. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), adj8, tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score

Correlations between sleep disturbance and Time 2 depression scores were presented earlier in Table 4.7. Results indicated GSDS total score, GSDS SOL subscale, sleep quality subscale, and excessive daytime sleepiness subscale, and sleep diary SOL significantly correlated with CES-D score at 12 weeks postpartum. Table 4.16 presents a correlation matrix of the independent sleep and psychosocial variables to check for multicollinearity.

Table 4.16

*Correlation Matrix: Psychosocial and Sleep Variables and Time 2 CES-D Scores**(N = 156)*

Pearson Correlation <i>r</i>	CES-D Time 2	Social Support	Perceived Stress	GSDS Total Score	GSDS SOL	GSDS Sleep Quality	GSDS Excessive Daytime Sleepiness	Sleep Diary SOL
CES-D Time2	1.000	-.474*	.677*	.356*	.354*	.200*	.403*	.224*
Social Support		1.000	-.446	-.120	-.177	-.105	-.159	-.154
Perceived Stress			1.000	.381	.249	.264	.507	.144
GSDS Total Score				1.000	.442	.818	.862	.215
GSDS SOL					1.000	.308	.325	.476
GSDS Sleep Quality						1.000	.570	.143
GSDS Excessive Daytime Sleepiness							1.000	.215
Sleep Diary SOL								1.00

* $p < .05$

The GSDS total score is highly correlated with GSDS subscale scores for sleep quality and excessive daytime sleepiness. Therefore it was not entered into the regression model. The significantly correlated sleep variables of GSDS SOL, GSDS sleep quality, GSDS excessive daytime sleepiness, and sleep diary for EOL were entered into step 3 of the regression model. The combination of these four sleep variables significantly accounted for an additional 4% of the variance in Time 2 CES-D scores (Table 4.17). Upon further examination of these four independent variables individually, only GSDS SOL made a significant unique contribution to CES-D scores at 12 weeks postpartum accounting for an additional 2% of the variance in Time 2 depression scores after controlling for Time 1 depression scores (Table 4.14).

Table 4.17

*Hierarchical Regression Model Summary: Time 1 CES-D, Psychosocial, and Sleep**Variables*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.405 ^a	.164	.159	6.223	.164	30.213	1	154	.000
2	.730 ^b	.534	.524	4.679	.370	60.219	2	152	.000
3	.755 ^c	.570	.550	4.553	.036	3.132	4	148	.017

a. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+)

b. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score

c. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score, SollogT3Recode Sol Log T3 Recode 6, gsdssqual_t3 T3: GSDS sleep quality subscale, gsdssol_t3 T3: GSDS sleep onset latency subscale-initiation insomnia, gsdsseds_t3 T3: GSDS excessive daytime sleepiness subscale

Next, interaction terms were computed for GSDS SOL x social support and for GSDS SOL x perceived stress to test hypothesis 7.1. GSDS SOL was selected as the sleep variable given it significantly contributed an additional 2% of the variance in Time 2 CES-D scores after controlling for Time 1 CES-D scores (Table 4.14). Table 4.14 also identified perceived stress and social support as significantly contributing to the variance in Time 2 CES-D scores after controlling for Time 1 CES-D scores. Maternal adjustment was not identified as statistically significant and was therefore excluded from the final regression model. The final hierarchical regression model summary results are presented in Table 4.18. The interaction terms testing hypothesis 7.1 were entered into block 4 of the model were not significant, therefore we cannot accept the hypothesis. Social support and perceived stress did not moderate the relationship between sleep and depressive symptoms at 12 weeks postpartum, after controlling for Time 1 CES-D scores. The overall 4-step model accounted for 57.5% of the variance in CES-D scores at 12 weeks postpartum ($F_{(6, 154)} = 34.79, p < .001$).

Table 4.18

Final Hierarchical Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.409 ^a	.167	.162	6.153	.167	31.975	1	159	.000
2	.733 ^b	.537	.528	4.620	.369	62.533	2	157	.000
3	.754 ^c	.568	.557	4.475	.031	11.334	1	156	.001
4	.759 ^d	.575	.559	4.465	.007	1.359	2	154	.260

a. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+)

b. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score

c. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score, gsdssol_t3 T3: GSDS sleep onset latency subscale-initiation insomnia

d. Predictors: (Constant), cesd27_t0 T0: CESD Total (>27 recoded as 27+), tilden_t3 T3: Tilden's Interpersonal Relationships Inventory, stress_t3 T3: Cohen's perceived stress score, gsdssol_t3 T3: GSDS sleep onset latency subscale-initiation insomnia, solpss SOL PSS Product Term, solss SOL SS Product Term

Summary of Findings

The main findings of this secondary analysis are summarized below:

1) Demographic variables suggest that this sample of 161 first-time mothers was comparable to the general population of San Francisco, California where this study took place. Mean age of $31(\pm 5.8)$ years, 52% Caucasian, 25% Asian, 12% Hispanic, 5% African American, and 6% mixed race. Just over half 57% had a household yearly income of \$60,000 dollars a year, and 71% had finished college (Table 4.1).

2) Mean CES-D scores of all participants ($N = 161$) in the third trimester (12.2 ± 7.0) significantly decreased by 12 weeks postpartum (8.8 ± 6.7) ($t_{(160)} = 5.6$, $p < .001$) (Table 4.3).

3) Subjective sleep measured with the GSDS significantly improved for all women ($n = 161$) from the third trimester to 12 weeks postpartum. In particular, the GSDS total score and subscale scores for minutes taken to fall asleep, ability to stay

asleep, and daytime sleepiness all significantly improved. Diary entries indicated significant improvement in minutes taken to fall asleep from the third trimester to 12 weeks postpartum ($t_{(153)} = 5.0, p < .001$) (Table 4.5).

4) A significant difference was noted in mean objective actigraphy minutes spent awake between midnight to 6:00 a.m. in mothers at 12 weeks postpartum when compared with the third trimester ($t_{(159)} = 3.4, p < .001$) (Table 4.5).

5) Mean stress scores of all participants ($N = 161$) in the third trimester (14.7 ± 6.2) significantly decreased by 12 weeks postpartum (12.9 ± 6.3) ($t_{(160)} = 3.4, p < .001$) (Table 4.6).

6) A significant difference ($t_{(158)} = 3.7, p < .001$) was noted in the mean GSDS total scores between women with CES-D scores ≥ 16 ($n = 45$) and ≤ 15 ($n = 115$) in the third trimester. Women with CES-D scores ≥ 16 in the third trimester experienced more general sleep disturbance than women with CES-D scores ≤ 15 in the third trimester including increased time before falling asleep, sleep quantity, and excessive daytime sleepiness. No significant differences reaching *a priori* .01 significance levels were noted in the remaining GSDS subscales, sleep diary entries, or objective actigraph findings. Mann-Whitney U tests confirmed all independent *t*-test findings (Table 4.8).

7) Independent *t*-tests and Mann-Whitney U tests revealed no significant differences in total GSDS scores, subscale scores, sleep diary entries, or objective actigraphy results between women with CES-D scores ≥ 16 ($n = 23$) and ≤ 15 ($n = 138$) at 12 weeks postpartum (Table 4.9).

8) When entered into a regression model, sociodemographic characteristics and perinatal variables were not significant predictors of CES-D scores at 12 weeks postpartum, after controlling for Time 1 depression scores.

9) Third trimester CES-D scores significantly predicted later postpartum CES-D scores, and accounted for 16.7% of the variance in postpartum CES-D scores (Beta = .40, $F = 31.97$, $p < .001$), (Table 4.14).

10) After controlling for Time 1 CES-D scores, the combination of social support, perceived stress, and maternal adjustment significantly accounted for an additional 37% of CES-D scores at 12 weeks postpartum (Table 4.15). Perceived stress significantly accounted for 18% of the variance in Time 2 CES-D scores and social support significantly accounted for 3% of the variance in Time 2 CES-D scores. Maternal adjustment did not make any significant unique contribution to variance in Time 2 CES-D scores (Table 4.14).

11) After controlling for Time 1 CES-D scores, social support, and perceived stress, the combination of GSDS SOL, GSDS Sleep quality, GSDS daytime sleepiness, and diary SOL significantly accounted for an additional 4% of the variance in depressive symptoms at 12 weeks postpartum (Table 4.17). However, only GSDS SOL added a significant and unique contribution to Time 2 CES-D scores (2%, Table 4.14).

12) Social support and perceived stress were not identified as moderators between the relationship of sleep and depression at 12 weeks postpartum (Table 4.18).

CHAPTER V

DISCUSSION

Introduction

The pregnancy and postpartum period are joyful and exciting for most mothers. However, the transition and adaptation to a new infant can be especially difficult for first-time mothers who may have little or no past experience to draw upon. Two of the most common problems encountered by women during the pregnancy and postpartum are depressive symptoms and sleep disruption. A large percentage of women will suffer from some mood changes in the postpartum period (Wisner, Parry & Piontek, 2002b). It is also widely accepted that new mothers experience disrupted sleep (Gay, et al., 2004; Huang, et al., 2004; Lee & Zaffke, 1992; Lee, 1998; Lee, et al., 2000b; Swain, et al., 1997; Wolfson, et al., 2003). Sleep fragmentation during the third trimester is often due to discomforts associated with being pregnant (Baratte-Beebe & Lee, 1999) while sleep fragmentation during the postpartum period is most often due to infant care during the night. Historically, sleep disturbance and mood disorders have been overlooked as possible predictors of PPD. The majority of research conducted in childbearing women and depression has focused on symptoms experiences during the early postpartum period. Very few researchers have examined depressive symptoms during the pregnancy and in the twelfth week postpartum.

Given this gap in the literature, the overall purpose of this study was to describe the frequency of depressive symptoms and sleep disturbance in first-time mothers in the third trimester and at 12 weeks postpartum. A second overall purpose was to compare the sleep of women with and without depressive symptoms in the third trimester and the

sleep of women with and without depressive symptoms at 12 weeks postpartum. A final purpose was to identify whether social support, perceived stress, and maternal adjustment acted as moderators between the relationship of depressive symptoms and sleep disturbance at 12 weeks postpartum. This chapter presents the interpretations and significance of the findings, discusses implications for clinical practice, acknowledges the strengths and limitations, and presents conclusions and directions for future research.

Interpretation and Significance of Results

The purpose of this study was to describe depressive symptoms of participants ($n = 161$) in the third trimester (Time 1) and again at 12 weeks postpartum (Time 2). Although mean CES-D scores for the sample was within a healthy range, 28.6% of the participants ($n = 46$) scored ≥ 16 on the CES-D at Time 1 and 14.3% ($n = 23$) scored ≥ 16 on the CES-D at Time 2. These data support earlier findings where prevalence rates antenatal depressive symptoms of up to 50% have been suggested (Austin, 2004; Chaudron, 2003; Chen, et al., 2004; Kim, et al., 2006) and postpartum rates of 5 - 15% have been suggested (Beck & Gable, 2001b; Dobie & Walker, 1992; Gale & Harlow, 2003; Kumar & Robson, 1984; O'Hara & Swain, 1996; Wisner, et al., 2002a). Results also revealed mean CES-D scores significantly decreased from the third trimester to 12 weeks postpartum ($t_{(160)} = 5.6, p < .001$) supporting research suggesting a greater prevalence of depressive symptoms during the pregnancy than in the postpartum period (Andersson, et al., 2006).

Sociodemographic variables income, education, and work status at Time 1 were significantly correlated with Time 2 depressive symptoms. Moreover, mothers without a

college diploma ($n = 47$), obtained significantly higher mean CES-D scores at Time 2 than women with a college diploma ($n = 114$) ($t = 2.8$, $p < 0.01$). Given education is a measure of socioeconomic status, results support earlier research where lower socioeconomic standing places mothers at an increased risk for developing postpartum mood disorders (Rich-Edwards, Kleinman, Abrams, Harlow, McLaughlin, et al., 2006; Seguin, Potvin, St-Denis & Loiselle, 1999). However, a regression model with demographic (race, age, education, third trimester work status, 12 week postpartum work status) and perinatal (type of delivery, gender of infant, type of feeding) variables suggested no significant relationship with depressive symptoms in new mothers at 12 weeks postpartum.

Overall subjective mean sleep (GSDS) scores significantly decreased from Time 1 to Time 2 ($t_{(160)} = 5.04$, $p \leq .001$). Previous research suggests a high prevalence of sleep disturbance in pregnancy and especially the third trimester, due to hormonal changes, enlarged uterus, snoring, sleep apnea, and frequent urination during the night are associated with greater sleep disturbance than the postpartum period (Lee, et al., 2000c; Marchant, 1978; Mindell & Jacobson, 2000; Santiago, et al., 2001; Trakada, et al., 2003; Worth, et al., 2002).

The 161 first-time mothers in this sample experienced significantly more general sleep disturbance, trouble falling asleep, trouble staying asleep, and daytime sleepiness the late third trimester compared to sleep at 12 weeks postpartum. Sleep diary entries for time taken to fall asleep once lights were out was significantly more of a problem for women in the third trimester than at 12 weeks postpartum. These findings are reassuring and clinicians can counsel new mothers that sleep improves over time for most women.

Interestingly, time awake between midnight and 6:00 a.m. (WAKE) was significantly longer at 12 weeks postpartum than the third trimester for all participants. This may indicate that the infant is more disruptive of sleep for new mothers than their third trimester discomforts of pregnancy and future research should include measures of infant sleep and temperament.

Prenatal depressive symptoms are well documented as predictors of PPD (Beck, 2001; Chaudron, et al., 2001) and results of this study support these findings. Hierarchical linear regression identified 16.7% of the variance in Time 2 CES-D scores was accounted for by Time 1 scores. This is an important finding given many researchers exclude women with antenatal depressive symptoms in their studies of postpartum depression. The findings from this study underscore the need to include women with antenatal depression in future research in order to better understand the role of all the contributing factors in the development of postpartum depression and better generalize to the population of postpartum women.

After controlling for third trimester CES-D scores, three psychosocial variables (level of social support, perceived stress, maternal adjustment) were entered into a regression model to determine their contribution to Time 2 depressive symptomatology. All three psychosocial variables accounted for 37% of the variance in Time 2 CES-D scores after controlling for Time 1 CES-D scores. However, maternal adjustment made no unique significant contribution to Time 2 CES-D scores. Social support accounted for 3% ($\beta = -.18$, $F = 8.8$, $p < .01$) and perceived stress significantly accounted 18% ($\beta = .52$, $F = 62.5$, $p < .001$) of the variance in Time 2 CES-D scores. These results also support earlier research. A study of 385 Chinese women living in Hong Kong found that level

perceived stress accounted for 18% of the total variation of postpartum depression scores (Leung, Martinson & Arthur, 2005). Although the perceived stress findings are similar, the sample populations were ethnically and culturally diverse, limiting the comparison of the results.

A study perceived stress as a predictor of low birth weight in a sample of 865 largely low-income, pregnant, young (25% < 19 years), multiparous (56%), Brazilian women found high rates of perceived stress (25-55%) (Rondo, et al., 2003). Given Rondo (2003) studied perceived stress as a predictor of low birth weight results cannot be compared with the current secondary analysis.

Although this secondary analysis assessed perception of stress at 12 weeks postpartum, knowledge that higher levels of perceived stress are associated with postpartum depressive symptoms provides an area for further research, especially for stress reduction. Moreover, perceived stress has been associated with an increased risk of illness when coping mechanisms are absent (Cohen & Williamson, 1988). For most postpartum women, the main stressor may be the lack of sleep due to the 24-hr care needs of the new baby (Quillin, 1997). Although not statistically significant, actigraphy measure of total sleep time indicated women slept on the average 10 minutes less than in the third trimester.

After determining that there was a significant relationship between sleep and depressive symptoms in this sample of new mothers, it was important to then compare the sleep of women with ($n = 46$) and without ($n = 115$) clinically high CES-D scores in the third trimester and also women with ($n = 23$) and without ($n = 138$) depressive symptoms at 12 weeks postpartum. Given the unequal groups, Mann-Whitney U test

results were also used in conjunction with the independent t-test results. Women with CES-D scores ≥ 16 in the third trimester experienced significantly more general sleep disturbance ($t_{(159)} = 3.8, p < .001$), more time before falling asleep ($t_{(159)} = 3.0, p < .01$), poorer sleep quality ($t_{(159)} = 2.1, p = .05$), less time asleep ($t_{(159)} = 2.7, p = .01$), and more daytime sleepiness ($t_{(159)} = 3.0, p < .01$) than women with CES-D scores ≤ 15 in the third trimester. One reason for this might be that those women with depressive symptoms during the early postpartum may have dropped out of the study prior to the 3-month end point. Other considerations for the sleep findings may relate to depression having a stronger impact on sleep during pregnancy than after delivery.

Women with CES-D scores ≥ 16 at 12 weeks postpartum reported significantly more daytime sleepiness than women with CES-D scores ≤ 15 ($t_{(159)} = 3.01, p < .01$). Although significant differences were noted in subjective reports of sleep onset latency ($t_{(159)} = 2.1, p = .05$) they did not reach the .01 *a priori* significance level. Of the two objective wrist actigraphy measures, total sleep time (TST) was reduced by about 15 minutes however, this was neither statistically nor clinically significant.

Only the sample with complete data at both time points was used for this secondary analysis. The attrition rate in the first sample was 4.4% ($n = 6$) and the attrition rate in the second sample was 20.5% ($n = 15$). The sample with the higher attrition rate also had a higher proportion of women without a college education and an income less than \$60,000 per year which might explain the higher rate of attrition. Previous research has shown that low SES women are more likely to self-exclude themselves from healthcare than more affluent women (Murray, Woolgar, Murray & Cooper, 2003; Russell, 2006; Sobey, 2002).

Given the period surrounding the birth of a first child can be a particularly challenging and a stressful transition for parents (Heinicke, 1995), the final objective of this study was to determine whether social support, perceived stress, or maternal adjustment acted as moderators on the relationship between sleep disturbance and depressive symptoms at 12 weeks postpartum after controlling for Time 1 CES-D scores.

Time 1 CES-D scores were entered into block one of the model and were found to account significantly for 16.7% of the variance in Time 2 CES-D scores. As stated earlier, no demographic or perinatal variables were identified for inclusion into the final model. Perceived stress and social support significantly accounted for 37% of the variance in Time 2 CES-D scores and sleep variables accounted for an additional 3% of the variance in Time 2 CES-D scores, however, only GSDS SOL subscale score was identified for inclusion in the final model. The final model indicated that after controlling for Time 1 CES-D scores, social support, perceived stress, GSDS SOL, the interaction terms to test for social support and perceived stress as moderators on the relationship between sleep and Time 2 CES-D scores were not significant. This was surprising given perceived stress accounted for 18% of the variance in Time 2 CES-D scores.

Implications for Clinical Practice

Research suggests that first-time mothers are at greater risk of developing postpartum mood disorders than multiparous women. This maybe in part due to a lack of experience, lack of role models, or even just not knowing what lies ahead. Sleep disruption and fragmented sleep are common problems for most postpartum women given the constant demands of infant care. Nurses, nurse practitioners, midwives, and

other health care providers like childbirth educators are in unique positions to educate and counsel new mothers. The results of this study highlight several areas that provide implications for clinical practice in the care of first-time mothers.

First, 7% ($n = 8$) of women with minimal or no depressive symptoms and 32.6% ($n = 15$) of women with depressive symptoms at Time 1 scored ≥ 16 on the CES-D at Time 2. These rates strongly demonstrate the need for continued assessment of depressive symptoms well into the first postpartum year. Specific sleep disturbances reported by the 46 women who scored high on the CES-D at Time 1 were very similar to the 23 women who had CES-D ≥ 16 scores at Time 2. With sleep deprivation and fragmented sleep related to infant care during the night, daytime sleepiness is common and expected for new mothers. However, those mothers with the highest CES-D symptom scores at 12 weeks postpartum were those who reported delayed sleep onset latency, later rise times and more time awake between midnight and 6:00 a.m. For new mothers, complaints of delayed sleep onset, later rise times, and more time awake at night may be more relevant clinical screening questions to assess risk for postpartum depression, particularly for new mothers who fear social stigma associated with admitting to any type of negative affect. The antenatal and postpartum depressive symptom rates of this study compare with earlier research which further enhances the pool of evidence based research on depressive symptom rates in childbearing women. That antenatal depressive symptoms are able to predict postpartum depressive symptoms, even after demographic and perinatal variables are controlled, also supports current research findings.

Second, this study provided evidence-based information on the relationship between depressive symptoms and sleep disturbance in new mothers during the third trimester and in the twelfth week postpartum. Knowing that antenatal depressive symptoms and sleep disturbance do significantly improve postpartum in the majority of new mothers provides clinicians with information to reassure their patients. Knowing that women with depressive symptoms in the third trimester are more likely to continue experiencing symptoms into the third month postpartum than women without symptoms in the third trimester also provides valuable information to clinicians taking care of new mothers. It is important to assess depressive symptoms well into the first postpartum year.

Lastly, the results of this study highlight the strong relationship between stress and depressive symptoms. Health care providers must incorporate prenatal stress measures to identify those at greater risk. Prenatal stress may be related to low socioeconomic status, unemployment, and barriers to healthcare whereas one of the biggest postpartum stressors may be disrupted and fragmented sleep due to infant care demands (Quillin, 1997). It has been suggested that social support may act as a buffer for a person's mental health in times of high stress (Cohen & Wills, 1985).

Study Strengths and Limitations

A secondary data analysis research design is an inherent limitation of this study. The final sample (N = 161) was a combination from two research studies that had 243 potential participants. Of these potential participants, only 161 were in permanent partnered relationships and had complete data on the variables of interest which could be a potential issue in selection bias.

Historically, researchers have excluded women with antenatal depressive symptoms when studying postpartum depression. Inclusion of women with antenatal depressive symptoms is a major strength of this study. Other strengths of this study include the heterogeneous sample which consisted of a range of ages, ethnicities, and socioeconomic backgrounds. The demographic and ethnic mix of the sample was similar to the general population of San Francisco, where this study took place. Given the diverse sample, the results are generalizable to other populations of new mothers with ethnic populations similar to that of San Francisco, California. Inclusion of both subjective (GSDS, sleep diary) and objective (actigraphy) measures to assess the quality and quantity of sleep also strengthens the findings of this study. Historically researchers have used either subjective or objective measures for sleep. Very few researchers have incorporated both methods.

This study was conducted with a relatively well-educated (71%) and older (31 ± 5.8 years) sample of first-time mothers. Therefore, the results cannot be generalized to non-college educated, younger, or multiparous women. The decision to use only a self-report scale to assess depressive symptoms is another limitation of this study. Psychiatric interviews have been well established as the 'gold standard' for depression diagnosis.

Therefore, including psychiatric interviews would enhance the clinical application and strength of future studies on this topic.

A major strength of this study was the use of subjective *and* objective measures to assess sleep. However, the reliability and validity of sleep diaries is concerning to some researchers (Lashley, 2004). In particular, participants find them burdensome, participants may not keep them daily, diaries are subject to intentional and unintentional bias, and they are subjective (Lashley, 2004). Other researchers agree sleep diaries provide valuable information (Lashley, 2004). Secondly, although actigraphy was appropriately used to assess sleep and wake periods for participants in this study, many researchers consider PSG as the gold standard for sleep measurement (Lashley, 2004).

Another limitation of this study was the use of the Maternal Adjustment and Maternal Attitudes (MAMA) (Kumar, et al., 1984). This is a 12-item subscale used to assess maternal attitude toward the baby during the postpartum period. Scale reliabilities recommended removal of 4 items to increase the internal consistency from .54 to .66. The first limitation is the fact that only the 12-item subscale was used in the study, not the whole measure. It has been suggested that using only a subscale and not the whole tool limits the internal reliability of the subscale. Secondly, although the 8-item scale correlated highly with the 12-item scale ($r = 0.84$) it was not validated for use in the current sample which may have altered the psychometric properties of the instrument. Thirdly, the internal consistency of the MAMA scale to measure maternal adjustment was not optimal (.66) and may have affected the ability to measure impact of maternal adjustment in this sample of new mothers.

Conclusions and Directions for Future Research

There is a growing body of literature to support the experience of sleep disturbance and depressive symptoms for women in the weeks following childbirth. There is also a growing consensus that sleep disturbance and depressive symptoms are associated in the early postpartum period. However, little research has examined sleep and depressive symptoms and their association in women in the third trimester and into the twelfth week postpartum. Moreover, given that prenatal depression is a predictor of PPD, it is unfortunate that most researchers exclude women with prenatal depressive symptoms. In the current study some of the women scoring in the depressed range (CES-D ≥ 16) at Time 1 were scoring in the minimal or non-depressed range (CES-D ≤ 15) at Time 2, and some women with scores ≤ 15 at Time 1 were scoring ≥ 16 at Time 2. Antenatal depression has been shown to be a reliable predictor of depression in the postpartum period. However, results of the current study demonstrate the need to include women with current depressive symptoms but also to closely assess *all* women from the antenatal period through the postpartum period.

The high percentage of women (28.6%) scoring ≥ 16 on the CES-D at Time 1 lends support to previous research on depressive symptoms among women in the third trimester, where prevalence rates of up to 50% have been suggested (Austin, 2004; Chaudron, 2003; Chen, et al., 2004; Kim, et al., 2006). It has also been suggested that postpartum depressive symptoms are a continuation of pre-pregnancy prenatal symptoms for up to half of postpartum women (Chaudron, 2003).

Areas for future research identified from this study include: (a) replication in samples of younger, multiparous, socioeconomically and culturally diverse women; (b)

development and testing of prenatal interventions targeting stress identification and reduction; (c) qualitative inquiry to identify why some women's antenatal depressive symptoms improve over time and others continue to experience depressive symptoms during their postpartum recovery; and (d) although perceived stress and social support were found to be significant predictors of Time 2 depressive symptoms, marital satisfaction, partner support, infant temperament, infant sleeping patterns, and cultural variables such as postpartum rituals and gender preference will enhance future research by providing other areas for intervention.

*Identification of Relevant Relationships in the Current Secondary Analysis from the
Biopsychosocial Framework*

As stated earlier, the aims and hypotheses for this secondary analysis were formulated to examine certain relationships from within a biopsychosocial conceptual framework presented in Chapter II. Although multiple biological and psychosocial factors have been implicated in the development of postpartum depressive symptoms, this research specifically examined fragmented sleep, perceived stress, level of social support, and level of maternal adjustment and their contribution to the development of depressive symptoms in a sample of new, first-time mothers at 12 weeks postpartum. Figure 5.0 presents the same biopsychosocial framework identifying the concepts examined along with relevant findings. The statistically significant relationships between sleep, stress, and social support (psychosocial stress and coping) and development of postpartum depressive symptoms were expected given the previous literature and research in these areas. However, the relationship between maternal adjustment (transition to motherhood)

and postpartum depression was identified as a non-statistically significant predictor of postpartum depressive symptoms. Although this finding was not expected, the Alpha for the Maternal Adjustment and Maternal Attitudes Scale used to measure this construct suggested a poor internal reliability (.66) in this sample of new mothers. Future research using an alternative measure of maternal adjustment may reveal statistically significant findings.

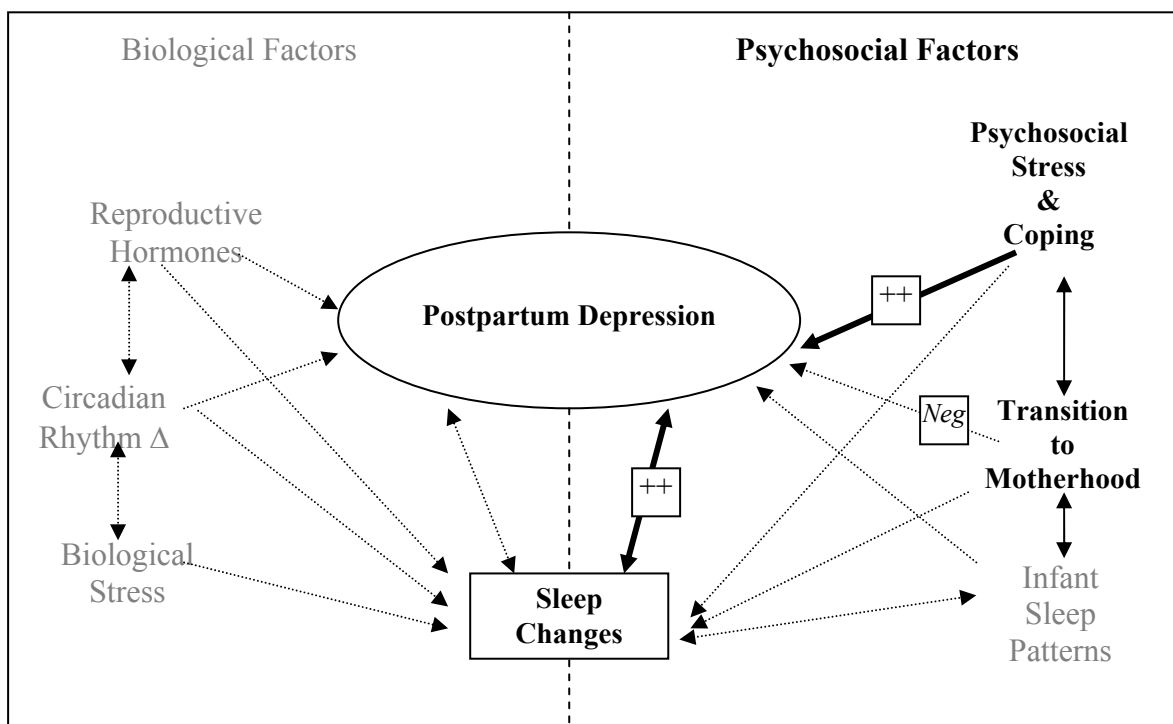


Figure 5.0. Conceptual framework identifying links between concepts from the secondary analysis

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APPENDIX A: Screening Questionnaire for Parent Study 1

Staff: _____ Screen #: _____ Study ID: _____



INITIAL SCREENING FORM

INTRODUCTION

HELLO, I'M _____ FROM THE NEW PARENT SLEEP STUDY. HOW ARE YOU DOING?
IS THIS A GOOD TIME TO TALK ABOUT THE STUDY? IT WILL TAKE 10-15 MINUTES.
[Schedule a better time if necessary and record on contact log]

BEFORE I TELL YOU MORE ABOUT THE STUDY, WOULD IT BE OKAY IF I ASK YOU A FEW
QUESTIONS TO SEE IF YOU ARE ELIGIBLE? THE QUESTIONS ARE ABOUT YOUR
PREGNANCY HISTORY AND LIVING SITUATION AND YOU CAN STOP ME AT ANY TIME OR
DECLINE TO ANSWER ANY QUESTIONS. WOULD THAT BE OK?

[Begin by discussing her current pregnancy:]

1. So how is your pregnancy going? BOY GIRL DK

(Do you know if you're having a boy or girl? Have you had any contractions yet?)

2. When are you due? ____/____/____

3. Have you been having any difficulty with this pregnancy? NO YES

If YES, explain: _____

5. How many times have you been pregnant before? _____ times

=0 – possibly eligible for NaPS, skip to #19
>0 – continue

Now I'm going to ask you about the outcomes of your previous pregnancies. *[Place X in cells]*

				1	2	3	4	5	6	7	8
Item	Preg #	Year of Preg	Volun - TAB	Tubal preg	SAB or Misca <20 wks	Misca 20+ wks	Still birth	Death 0-27d	Death 28d-1yr	Single live birth	Multiple live births
6	1st										
7	2nd										
8	3rd										
9	4th										
10	5th										
11	6th										
12	7th										
13	8th										
14	9th										
15	10th										

NaPS 16. ***[Are there any X's in columns 1-8?]***

NO – possibly eligible for NaPS1, skip to #19

YES – **INELIGIBLE** for NaPS1, continue with #17

NaPS2 17. ***[Are there any X's in columns 1-4?]***

NO – **INELIGIBLE** for NaPS2, skip to page 3 - Eligibility

YES – possibly eligible for NaPS2, continue with #18

18. ***[Are there any X's in columns 5-8?]***

NO – possibly eligible for NaPS2, continue with #19

YES – **INELIGIBLE** for NaPS2, skip to page 3 - Eligibility

19. Are you currently living with a partner?

NO – **INELIGIBLE**, skip to page 3 - Eligibility

YES – continue

20. What is your partner's first name? _____ Gender: M F

21. What is your current age? _____ years

≥18 – continue

<18 – **INELIGIBLE**, skip to page 3 - Eligibility

22. Do you work nights? *[at least 4 hrs between 12am-6am]*

NO – continue

YES – INELIGIBLE, skip to page 3 - Eligibility

[NaPS2 women skip to #27]

23. What is _____'s (partner) age? _____ years

≥18 – continue

<18 – INELIGIBLE, skip to Eligibility below

24. Does _____ (partner) work nights? *[at least 4 hrs between 12am-6am]*

NO – continue

YES – INELIGIBLE, skip to Eligibility below

25. Do you plan to have anyone help you after the baby is born? NO YES

[If YES] Who? _____

When and for how long? _____

26. *[Based on #25, is the couple planning to employ a live-in nanny?]*

NO – continue

YES – INELIGIBLE, skip to Eligibility below

27. Finally, this study involves reading and writing in English. Is that OK with you?

NO – INELIGIBLE, continue

YES – ELIGIBLE, continue

ELIGIBILITY

NaPS ELIGIBLE: Based on your answers, it seems that you are eligible for our study to help new parents sleep better. Before I tell you more about the study, would it be OK if I ask a few more questions about your background?

NaPS2 ELIGIBLE: Based on your answers, it seems that you and _____ (partner) won't be eligible for the study we presented at your childbirth class. However, we do have another sleep study that you are eligible for. This other study is a little different than the one we talked about in your childbirth class. I'll tell you more about it in a minute if you are interested, but first, would it be OK if I ask you a few more questions about your background?

NOT ELIGIBLE: It turns out that you won't be eligible for our study because _____. Even though you won't be able to participate in our study, would it be OK if I asked you just a few more questions about your background?

[If she isn't living with a partner, skip partner questions 31, 33, 35]

DEMOGRAPHICS

These questions will help us compare those who are not eligible with those who are.
OK?

28. What is your current marital status?

Single or Unmarried	1	Divorced	4
Married	2	Widowed	5
Separated	3	Domestic Partners	6

29. How long have you been _____ (answer to #28)? _____ mos / yrs

30. Do you consider yourself Hispanic or Latino? NO YES

31. How would you describe your race? _____

<i>[code her response]</i>	American Indian or Alaska Native	1
	Asian	2
	Native Hawaiian or Other Pacific Islander	3
	Black or African-American	4
	White or Caucasian	5
	More than one race	6
	Other	7

32. Do you consider your partner Hispanic or Latino? NO YES

33. How would you describe your partner's race? _____

<i>[code her response]</i>	American Indian or Alaska Native	1
	Asian	2
	Native Hawaiian or Other Pacific Islander	3
	Black or African-American	4
	White or Caucasian	5
	More than one race	6
	Other	7

34. What is the highest level of school you completed?

Grade school or less	1	Some college	5
Some high school	2	College diploma	6
High school diploma/equivalent	3	Some graduate/professional school	7
Vocational or trade school	4	Graduate or professional degree	8

35. And what is the highest level of school _____ (*partner*) completed?

Grade school or less	1	Some college	5
Some high school	2	College diploma	6
High school diploma/equivalent	3	Some graduate/professional school	7
Vocational or trade school	4	Graduate or professional degree	8

36. What is your present work situation?

Employed full-time for wage or salary	1
Employed part-time for wage or salary	2
Self-employed business	3
On Maternity Leave and returning	4

On Maternity Leave and not returning	5
Homemaker/Work without pay in a family	6
Unemployed, looking for work	7
Unemployed, not looking for work	8
Student	9
Retired	10
Unable to work because: _____	11
Other (please specify): _____	12

37. What is _____'s (*partner*) present work situation?

Employed full-time for wage or salary	1
Employed part-time for wage or salary	2
Self-employed business	3
On Paternity Leave and returning	4
On Paternity Leave and not returning	5
Homemaker/Work without pay in a family	6
Unemployed, looking for work	7
Unemployed, not looking for work	8
Student	9
Retired	10
Unable to work because: _____	11
Other (please specify): _____	12

38. How many people live in your household (including yourself)? _____

39. What was your approximate net family income from all sources, after taxes last year?

Less than \$15,000	1	\$ 90,000 to \$104,999	7
\$15,000 to \$29,999	2	\$105,000 to \$119,999	8
\$30,000 to \$44,999	3	\$120,000 to \$134,999	9
\$45,000 to \$59,999	4	\$135,000 to \$149,999	10
\$60,000 to \$74,999	5	\$150,000 or more	11
\$75,000 to \$89,999	6		

COUPLES NOT ELIGIBLE:

Thank her for answering our questions and for her interest in our study.

Refer when appropriate: www.sleepfoundation.org

UCSF Sleep Disorders Center: (415) 885-7886

COUPLES ELIGIBLE FOR NaPS:

That's all the questions I have. Now let me tell you a little more about the study. Participation in this study involves measuring your sleep and well-being at 4 different points - once before your baby is born and 3 times after your baby is born. To measure your sleep, you and your partner would wear a wristwatch device, called an actigraph, for 2-3 days. To measure your well-being, we would give you some questionnaires to fill out.

Couples in the study will also be assigned to one of two methods designed to improve their sleep. The method you are assigned will be determined randomly.

If you decide to participate in the study, we would have two meetings with you and your partner at your home before your baby is born. In the first meeting, we would review the study consent form and show you how to use the actigraphs and fill out the questionnaires. We would have a second meeting 2 days later to go over the methods to help you sleep better. Each of these meetings would take about an hour and could be scheduled at your convenience. We would also arrange to stop by a few days later to pick up the actigraphs and questionnaires. Do you have any questions so far?

After your baby is born, you would wear the actigraph and complete the questionnaires 3 more times: when your baby is 1 month old, 2 months old, and 3 months old. To make it easier for you, we would arrange times to drop off and pick up the actigraphs and questionnaires.

You'll receive \$100 after you complete the first measurement period and another \$100 at the end of the study. Do you have any questions? Do you think you and your partner would be interested in participating in this study?

WOMEN ELIGIBLE FOR NaPS2:

That's all the questions I have. Now let me tell you a little more about this other sleep study. It's similar to the one we talked about in your class except that it's only for pregnant women who have experienced a previous pregnancy loss. The purpose of this study is to better understand the sleep patterns and experiences of this group of women. Participation involves measuring your sleep and well-being for 2 days during your third trimester and again when your baby is 3 months old. To measure your sleep, we would have you wear a wristwatch device, called an actigraph. To measure your well-being, we would give you some questionnaires to fill out. We would also ask you to participate in a private and confidential interview about your experiences during your current and previous pregnancies. If you decide to participate in the study, we would set up two meetings at a location of your choice before your baby is born. Each meeting would take about an hour and could be scheduled at your convenience. At the first meeting, we would review the study consent form and show you how to use the actigraphs and fill out the questionnaires. At the second meeting, we would pick up the actigraph and questionnaires and conduct the interview. We would repeat these procedures again when your baby is 3 months old. You would receive \$150 for completing the study. Do you have any questions? Do you think you might be interested in participating in this study?

[If YES, refer her to Paulina]

<i>[Did the couple/woman agree to participate?]</i>	NO	YES	⇒	NaPS	NaPS2
<i>[If YES] Record the Study ID # here:</i>			⇒	<i>[NaPS: 001-150]</i>	<i>[NaPS2: 201-250]</i>
<i>[Date screening completed:]</i>	month day	year	⇒	<i>[Get contact info & schedule visits]</i>	

APPENDIX B: Screening Questionnaire for Parent Study 2

Staff: _____ Screening #: _____

Date: ____/____/____ Study ID #: _____

☞ Moms Sleep Study ☞

ELIGIBILITY SCREENING FORM

TO SEE IF YOU CAN BE IN THE STUDY, I HAVE A FEW QUESTIONS ABOUT YOUR HEALTH HISTORY AND LIVING SITUATION. YOU CAN STOP ME AT ANY TIME AND YOU CAN SKIP ANY QUESTION YOU DON'T WANT TO ANSWER. OK?

1. So how is your pregnancy going? BOY GIRL DK

(Do you know if you're having a boy or girl? Have you had any contractions yet?)

2. Have you been having any problems with this pregnancy? NO YES

[If YES, explain]: _____

3. When are you due? ____/____/____

4. Are you having one baby? More than one?

=1 –continue with #5
>1 – INELIGIBLE, skip to page 2 - Eligibility

5. How many times have you been pregnant before? _____ times

= 0 – skip to #7
> 0 – continue with #6

6. How many times have you given birth? _____ times

= 0 – continue with #7
> 0 – INELIGIBLE, skip to page 2 – Eligibility

7. What is your current age? _____ years

- ≥ 18 – continue with #8
< 18 – INELIGIBLE, skip to Eligibility below
8. Do you work nights? [at least 4 hrs between 12am-6am]

NO – continue with #9
YES – INELIGIBLE, skip to Eligibility below

Now I'm going to ask you some questions about your health history.

9. Have you ever been diagnosed with a sleep disorder, such as insomnia or apnea?

[If YES] Describe: _____

NO – continue with #10
YES – INELIGIBLE, skip to Eligibility below

10. Have you ever been diagnosed with depression or other mood disorder?

[If YES] Describe: _____

NO – continue with #11
YES – INELIGIBLE, skip to Eligibility below

11. Are you currently taking any medications, vitamins, or herbal supplements? NO YES

[If YES] What are you taking? What are you taking it for?

_____	_____
_____	_____
_____	_____

[Any meds for pain, sleep problems, or psychological/emotional problems?]

NO – ELIGIBLE, continue
YES – INELIGIBLE, continue

ELIGIBLE: Based on your answers, it seems that you can be in our study. Before I tell you more about the study, is it OK if I ask a few more questions about your background?

NOT ELIGIBLE: It turns out that you can't be in our study because _____. Even though you won't be able to participate in our study, is it be OK if I asked you just a few more questions about your background?

DEMOGRAPHICS

These questions will help us compare those who can be in the study with those can't. OK?

13. Are you currently in a relationship with someone? NO YES

[If YES:]

With a man or a woman? MAN WOMAN
How long have you been with him/her? _____ mos / yrs

16. Are you single or married? Which category best describes your marital status?

- | | | |
|---------------------|---|-----------------|
| Single or Unmarried | 1 | |
| Married | 2 | |
| Separated | 3 | |
| Divorced | 4 | |
| Widowed | 5 | |
| Domestic Partners | 6 | (same-sex only) |

17. Do you consider yourself Hispanic or Latino? NO YES

18. Which of the following categories best describes your race?

- | | |
|---|---|
| American Indian or Alaska Native | 1 |
| Asian | 2 |
| Native Hawaiian or Other Pacific Islander | 3 |
| Black or African-American | 4 |
| White or Caucasian | 5 |
| More than one race | 6 |
| Other, describe: _____ | 7 |

19. What language do you feel most comfortable speaking?

- | | |
|--------------|---|
| English | 1 |
| Spanish | 2 |
| Other: _____ | 3 |

20. What is the highest level of school you completed?

- | | |
|-----------------------------------|---|
| Grade school or less | 1 |
| Some high school | 2 |
| High school diploma/equivalent | 3 |
| Vocational or trade school | 4 |
| Some college | 5 |
| College diploma | 6 |
| Some graduate/professional school | 7 |
| Graduate or professional degree | 8 |

21. Are you currently working?

- | | |
|--|----|
| Employed full-time for wage or salary | 1 |
| Employed part-time for wage or salary | 2 |
| Self-employed business | 3 |
| On Maternity Leave and returning | 4 |
| On Maternity Leave and not returning | 5 |
| Homemaker/Work without pay in a family | 6 |
| Unemployed, looking for work | 7 |
| Unemployed, not looking for work | 8 |
| Student | 9 |
| Unable to work because: _____ | 10 |
| Other (please specify): _____ | 11 |

22. How many people live in your household (including yourself)? _____
23. What was your household income from all sources, after taxes last month?

[f she'd prefer to choose from a category:]

Less than \$1,000	1
\$1,000 to \$1,999	2
\$2,000 to \$2,999	3
\$3,000 or more	4

NOT ELIGIBLE

Thank her for answering our questions and for her interest in our study.

Refer when appropriate: www.sleepfoundation.org
UCSF Sleep Disorders Center: (415) 885-7886

ELIGIBLE

That was my last question. Now let me tell you a little more about the study. We would come to your home 9 times between now and when your baby is 3 months old. We would check your sleep a total of 4 times - once about a month before your due date and then 3 times after your baby is born. To measure your sleep, you would wear a small computer on your wrist, called an actigraph, for 3 days and nights in a row. We would also ask you questions about your sleep and how you are feeling.

If you decide to participate in the study, we would come to your home 3 times before your baby is born. At the first visit, we would go over the study consent form and have you start wearing the actigraph for 3 days and nights in a row. We would come back to your home 2 days later to show you the things that might help you sleep. We would come back a third time a day or two later to pick up your actigraph and to ask you some questions about your sleep and how you are feeling. Each of these meetings would take about an hour.

Do you have any questions so far?

After your baby is born, you would wear the actigraph and answer questions 3 more times: when your baby is 1 month old, 2 months old, and 3 months old. To make it easier for you, we would come to your home to bring you the actigraph and pick it up, ask you the questions, and pay you for your time.

We would also check your baby's sleep for when he/she is 2 months old. We would give you an actigraph for your baby to wear before and after his/her immunizations.

You would receive \$50 each time we check your sleep, for a total of \$200.
Do you have any questions? Do you want to participate in this study?

[If YES, proceed to contact info and schedule first visit]

[Did she agree to participate?] NO YES → [assign Study ID on p1]

APPENDIX C: The Center for Epidemiologic Studies Depression Scale

Below is a list of statements describing how people behave or feel. For each statement, please check the box which best indicates how often you felt or behaved that way during the **past week**.

	Rarely or none of the time (less than 1 day)	Some or little of the time (1-2 days)	Moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	0	1	2	3
2. I did not feel like eating; my appetite was poor.	0	1	2	3
3. I felt that I could not shake off the blues even with help from my family or friends.	0	1	2	3
4. I felt that I was just as good as other people.	0	1	2	3
5. I had trouble keeping my mind on what I was doing.	0	1	2	3
6. I felt depressed.	0	1	2	3
7. I felt that everything I did was an effort.	0	1	2	3
8. I felt hopeful about the future.	0	1	2	3
9. I thought my life had been a failure.	0	1	2	3
10. I felt fearful.	0	1	2	3
11. My sleep was restless.	0	1	2	3
12. I was happy.	0	1	2	3
13. I talked less than usual.	0	1	2	3
14. I felt lonely.	0	1	2	3
15. People were unfriendly.	0	1	2	3
16. I enjoyed life.	0	1	2	3
17. I had crying spells.	0	1	2	3
18. I felt sad.	0	1	2	3
19. I felt that people dislike me.	0	1	2	3
20. I could not get going.	0	1	2	3

APPENDIX D: General Sleep Disturbance Scale

The next questions ask about your sleep during the **PAST WEEK**. Circle one number for each item.

How many days in the <u>PAST WEEK</u> did you:	NO DAYS	EVERY DAY
1. have difficulty getting to sleep	0 1 2 3 4 5 6 7	
2. wake up during your sleep period	0 1 2 3 4 5 6 7	
3. wake up too early at the end of a sleep period	0 1 2 3 4 5 6 7	
4. feel rested upon awakening at the end of a sleep period	0 1 2 3 4 5 6 7	
5. sleep poorly	0 1 2 3 4 5 6 7	
6. feel sleepy during the day	0 1 2 3 4 5 6 7	
7. struggle to stay awake during the day	0 1 2 3 4 5 6 7	
8. feel irritable during the day	0 1 2 3 4 5 6 7	
9. feel tired or fatigued during the day	0 1 2 3 4 5 6 7	
10. feel satisfied with the quality of your sleep	0 1 2 3 4 5 6 7	
11. feel alert and energetic during the day	0 1 2 3 4 5 6 7	
12. get too much sleep	0 1 2 3 4 5 6 7	
13. get too little sleep	0 1 2 3 4 5 6 7	
14. take a nap at a scheduled time	0 1 2 3 4 5 6 7	
15. fall asleep at an unscheduled time	0 1 2 3 4 5 6 7	
16. drink an alcoholic beverage to help you get to sleep	0 1 2 3 4 5 6 7	
17. use tobacco to help you get to sleep	0 1 2 3 4 5 6 7	
18. use marijuana to help you get to sleep	0 1 2 3 4 5 6 7	
19. use an over-the-counter sleeping pill to help you get to sleep	0 1 2 3 4 5 6 7	
20. use a prescription sleeping pill to help you get to sleep	0 1 2 3 4 5 6 7	
21. use aspirin or other analgesic to help you get to sleep	0 1 2 3 4 5 6 7	

APPENDIX E: Tilden's Interpersonal Relationship Inventory

Most relationships with people we feel close to are both helpful and stressful. Below are statements that describe close personal relationships. Please read each statement and mark an **X** in the box that best fits your situation **DURING THE PAST MONTH**. There is no right or wrong answer.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1.	I know someone who makes me feel confident in myself.	1	2	3	4	5
2.	Some people I care about share similar views with me.	1	2	3	4	5
3.	There is someone I can turn to for helpful advice about a problem.	1	2	3	4	5
4.	I can talk openly about anything with at least one person I care about.	1	2	3	4	5
5.	There is someone I could go to for anything.	1	2	3	4	5
6.	I can count on a friend to make me feel better when I need it.	1	2	3	4	5
7.	It's safe for me to reveal my weaknesses to someone I know.	1	2	3	4	5
8.	Someone I care about stands by me through good times and bad times.	1	2	3	4	5
9.	I have the kind of neighbors who really help out in an emergency.	1	2	3	4	5
10.	If I need help, all I have to do is ask.	1	2	3	4	5
11.	I have enough opportunity to talk things over with people I care about.	1	2	3	4	5
12.	I have enjoyable times with people I care about.	1	2	3	4	5
13.	At least one person I care about lets me know they believe in me.	1	2	3	4	5

APPENDIX F: Maternal Adjustment and Maternal Attitudes Scale

IN THE PAST MONTH:		Not at all	A little	A lot	Very much
1.	Have you been worrying that you might not be a good mother?	1	2	3	4
2.	Have you worried about hurting your baby?	1	2	3	4
3.	Have you had enough time for yourself since you had the baby?	1	2	3	4
4.	Have you regretted having the baby?	1	2	3	4
5.	Have you felt proud of being a mother?	1	2	3	4
6.	Have you been feeling happy that you have a baby?	1	2	3	4
7.	Has the thought of having more children appealed to you?	1	2	3	4
8.	Have you felt disappointed by motherhood?	1	2	3	4
9.	Have you enjoyed caring for your baby's needs?	1	2	3	4
10.	Have you been wondering whether your baby will be healthy and normal?	1	2	3	4
11.	Has life been more difficult since the baby was born?	1	2	3	4
12.	Have you enjoyed feeding your baby?	1	2	3	4

**Highlighted items indicate questions identified by scale reliability analyses and deleted.

APPENDIX G: Perceived Stress Scale

The next questions ask about your feelings, thoughts and activities during the **LAST MONTH**.

Please **pick one answer for each question**.

	In the last month, how often have you...	Never	Almost never	Some-times	Fairly often	Very often
1.	Been upset because of something that happened unexpectedly?	1	2	3	4	5
2.	Felt that you were unable to control the important things in your life?	1	2	3	4	5
3.	Felt nervous and stressed?	1	2	3	4	5
4.	Felt confident about your ability to handle your personal problems?	1	2	3	4	5
5.	Felt that things were going your way?	1	2	3	4	5
6.	Found that you could not cope with all the things that you had to do?	1	2	3	4	5
7.	Been able to control irritations in your life?	1	2	3	4	5
8.	Felt that you were on top of things?	1	2	3	4	5
9.	Been angered because of things that happened that were outside of your control?	1	2	3	4	5
10.	Felt difficulties were piling up so high that you could not overcome them?	1	2	3	4	5

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Author Signature

Date