Photocopy Use and Authorization

In presenting this dissertation in partial fulfillment of the requirements for an advanced degree at Idaho State University, I agree that the Library shall make it freely available for inspection. I further state that permission for extensive copying of my dissertation for scholarly purposes may be granted by the Dean of the Graduate School, Dean of my academic division, or by the University Librarian. It is understood that any copying or publication of this dissertation for financial gain shall not be allowed without my written permission.

Signature _____

Date _____

Moderated Mediation Models of Maternal Perinatal Predictors

of Maternal-Infant Attachment

by

Joe Neal, M.S.

A dissertation

submitted in partial fulfillment

of the requirements for the degree of

Doctor of Philosophy in the Department of Clinical Psychology

Idaho State University

Summer 2019

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of Joe Harold Neal find it satisfactory and recommend that it be accepted.

_____

Nicki Aubuchon-Endsley,
Major Advisor

_____

Joel Bocanegra,
Committee Member

_____

Robert Rieske,
Committee Member

_____

Maria Wong,
Committee Member

_____

Jeehoon Kim,
Graduate Faculty Representative

Idaho State
UNIVERSITY
Office for Research - Research Outreach & Compliance
921 S. 8th Avenue, Stop 8046 • Pocatello, Idaho 83209-8046

February 9, 2018

Nicki Aubuchon-Endsley, PhD
Stop 8112
Psychology
Pocatello, ID 83209

RE: Your application dated 2/5/2018 regarding protocol number 4191: Infant Development and Healthy Outcomes in Mothers (Idaho Mom Study)

Dear Dr. Aubuchon-Endsley:

Your request for renewal of the protocol listed above was reviewed 4/12/2016 meeting of the Idaho State University Human Subjects Committee.

This is to confirm that your request for renewal is approved. Your request to modify the protocol by modifying data storage procedures and adding assistants Joe Neal, Jessica Riedstra, Jason Gibbs, Taylor Ramos, Anika Lovgren, Nicole Douthit, Abby Prow, Hailey Wilcox, Sierra Clayson, Reilly Sasaki, and Jennifer Hambleton has been approved via Expedited Review.

You are free to proceed with your protocol as described effective immediately. The protocol is next subject to renewal on or before 2/9/2019, unless closed before that date.

As with the initial approval, changes to the study must be promptly reported and approved. Contact Tom Bailey (208-282-2179; fax 208-282-4723; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

p.p. T Bai

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

Acknowledgments

I would like to thank Dr. Nicki Aubuchon-Endsley, my dissertation chair, for her guidance and support throughout my graduate studies at ISU. She has consistently served as an example of true professional excellence, and this project would not have been possible without her invaluable guidance. I would also like to thank my other committee members, Dr. Joel Bocanegra, Dr. Robert Rieske, Dr. Maria Wong, and Dr. Jeehoon Kim for their knowledgeable and thoughtful contributions to this project. I would also like to thank all of my lab mates in the Perinatal Psychobiology Lab. Their dedication to the IDAHO Mom Study helped make this project possible.

Last, and certainly not least, I would like to thank my family for their unconditional support. Their patience, encouragement, assistance, and devotion provided a constant reminder of why we started this journey.

Table of Contents

List of Figures

List of Tables

Moderated Mediation Models of Maternal Perinatal Predictors

of Maternal-Infant Attachment

Dissertation Abstract-Idaho State University (2019)

The present study examined maternal prenatal and postnatal depression, maternal health complications, breastfeeding frequency, postnatal maternal perception of social support, and maternal perception of mother-infant attachment. Two models were examined. Model 1 focused on prenatal depression, and Model 2 focused on prenatal to postnatal change in depressive symptomology. For Model 1, we hypothesized decreased prenatal maternal depression would be associated with increased attachment and decreased health complications, increased health complications would mediate the relationship between greater prenatal depression and lower frequency of breastfeeding, and increased postnatal social support would moderate the relationship between fewer health complications and increased breastfeeding frequency. In Model 2, we predicted increased prenatal to postnatal change in depression would be associated with decreased attachment, maternal health would moderate the relationship between depression and breastfeeding, the interaction of breastfeeding and social support would mediate the relationship between the interaction of depression and health and attachment, and social support would moderate relations between breastfeeding and attachment. Participants included 96 mothers measured longitudinally at 35±2 week's gestation and 6 months±2 weeks postpartum. There was a significant direct effect of prenatal depression on maternal-infant attachment in Model 1, such that greater prenatal depression was associated with a decreased attachment. In Model 2, social support moderated the relationship between breastfeeding and attachment, with mothers who indicated lower quality social support endorsing improved attachment scores when

breastfeeding frequency was increased. Prenatal maternal depression, postnatal maternal social support, and breastfeeding education may be targets of intervention for healthcare professionals.

Key Words: perinatal, attachment, depression, infant crying, social support, health, breastfeeding

Moderated Mediation Models of Maternal Perinatal Predictors of Maternal-Infant Attachment

Bonding, or "the formation of a mutual attachment between infant and caregiver" (Sullivan, Perry, Sloan, Kleinhaus, & Burtchen, 2011, p. 644), occurs among many species. The relationship between mother and child is bidirectional, in that it requires the mother to provide care to the infant and for the infant to respond to the mother's care in order to initiate a sequence of reciprocal responsiveness to subsequent behavioral cues. Research with animals and humans highlights the importance of a variety of factors in strengthening the bond between mother and infant. Additional research on attachment is important given that such behaviors are essential for infant survival (Ainsworth, 1989) and predict a host of salient offspring outcomes. Such outcomes include the ability to self-regulate responses to parental requests and prohibitions (Feldman, 2007), development of emotional empathy (Feldman, 2007; Feldman, Weller, Zagoory-Sharon, & Levine, 2007), and acquisition and adherence to social norms (Broad, Curley, & Keverne, 2006); however, a more comprehensive examination of perinatal biopsychosocial risk and resiliency factors in promoting maternal-infant attachment is lacking, despite the noteworthy implications that this work may have in positively shaping long-term offspring outcomes.

Therefore, the current dissertation study aims to examine the complex interrelations among the most robust maternal predictors of maternal-offspring attachment. Although it is beyond the scope of the current dissertation literature review and project, it should be noted that many infant factors influence maternal-infant attachment, including: health (Wisner et al., 2009), preterm birth (Forssas, Gissler, Sihvonen, & Hemminki, 1999; Liggins & Howie, 1972), low birth weight (Hack, Klein, & Taylor, 1995), hospital regulatory policies that restrict infant

contact with parents and caregivers (Feldman, Weller, Leckman, Kuint, & Eidelman, 1999; Gooding et al., 2011; Wigert, Berg, & Hellström, 2010), and early temperament/self-regulation (Feldman et al., 2004; Goldsmith & Alansky, 1987; Kinsey et al., 2014; Stifter & Bono, 1998; Waters, Vaughn, & Egeland, 1980).

Roots and Measures of Attachment

Developmental theories of attachment have historically focused on the relationship between mother and infant postpartum. Primarily, John Bowlby established the roots of attachment theory with psychodynamic-influenced research that focused on how childhood family experiences may result in the later development of cognitive and emotional disturbances. After completing numerous case studies with children who presented with psychopathology, Bowlby concluded that poor early interactions between mothers with parenting difficulties and their infants were the likely cause of childhood maladaptive patterns of behavior (Bretherton, 1992).

In addition, Mary Ainsworth's early exposure to security theory during her graduate studies shaped her theory of attachment to align more with principles of security theory (Bretherton, 1992). One aspect of security theory postulates that young children need a secure base established with their parents in order to successfully adjust to novel situations. Her early research supported that children without a secure base are likely to struggle with psychopathology and maladaptive coping strategies when entering unfamiliar situations (Ainsworth & Bowlby, 1991).

Eventually, Ainsworth and Bowlby collaboratively reshaped theory on how mother-infant interactions influence subsequent attachment. Bowlby's research during this time had focused on the development of personality disorders in children whose mothers separate from them at an

early age. Bowlby's conclusions, based primarily on participant observation and reviews of developmental research, supported that children must establish warm and intimate bidirectional relationships with their primary caregivers in order to develop adaptive coping strategies later in life (Bretherton, 1992). Ainsworth focused on the development of maternal-infant attachment in Uganda. Following her data-driven research on the development of proximity-promoting behaviors, she and Bowlby formed a collaborative effort to refine mother-infant attachment theory (Ainsworth & Bowlby, 1991; Bretherton, 1992).

Three primary attachment styles developed because of Bowlby and Ainsworth's combined efforts. The first, secure attachment, resulted when mothers were sensitive and responsive to infant needs. Securely attached infants were defined as less likely to cry and more likely to explore their environments. The second style, insecure attachment, resulted when mothers were less sensitive to infant cues. Insecurely attached infants were more likely to cry and less likely to explore their environment compared to securely attached infants, even when mothers attempted to comfort them. The third style, not yet-attached infants, presented with limited responsivity to their mother (Bretherton, 1992).

The theoretical contributions of Bowlby and Ainsworth have shaped the way researchers and practitioners have measured maternal-infant attachment. One of the earliest measures, the Ainsworth Strange Situation Test (ASST; Ainsworth & Bell, 1970), was developed as a controlled observational method of assessing maternal-infant attachment that balanced child exploratory behaviors with an ethological-evolutionary perspective of attachment. The ASST observation occurs in a laboratory to provide novel conditions that may elicit alarm and inhibit exploratory behaviors in less-attached infants. Contact- and proximity-seeking behaviors are noted during a series of situations in which the infant's mother and a stranger enter and exit a

room during varying times throughout the task (Ainsworth & Bell, 1970). Other observational measures, such as the naturalistic Attachment Q-Sort (Waters & Deane, 1985) involve observing a child between ages 12 to 48 months at home or daycare for one hour and sorting 100 descriptive cards to ultimately classify secure attachment styles. Researchers have developed a host of additional measures, such as the Manchester Child Attachment Story Task (MCAST; Green, Stanley, Smith, & Goldwyn, 2000) and the Child Attachment Interview (Target, Fonagy, & Shmueli-Goetz, 2003) to classify a subject's level of attachment; however, such measures are often story- or interview-based, and thus they are appropriate for toddlers and children rather than infants.

Limitations, such as the age restrictions of child-report measures (e.g., MCAST; Green et al., 2000), have led researchers to develop measures that rely on maternal self-report. Modern validated maternal self-report measures, such as the Infant Crying Questionnaire–Revised (ICQ-R; Haltigan et al., 2012), have helped clarify maternal interpretations of infant interactions. Such measures have the potential to provide a rapid assessment of mother-infant attachment and eliminate the drawbacks associated with the prolonged observation and complex coding procedures of other methods.

The efforts of Bowlby, Ainsworth, and a host of other researches demonstrates the importance of interactions between mothers and infants. Maternal sensitivity and responsivity, collectively, increase the likelihood that infants and children will develop adaptive coping strategies when adjusting to novel environmental stimuli. Correctly identifying the quality of maternal-infant interactions through validated measures may be critical when considering ways to increase positive long-term outcomes for infants. While the early research of Bowlby and Ainsworth helped establish modern standards for healthy mother-infant relationships, subsequent

research has supported a host of salient factors, beginning in utero, that have the potential to influence long-term mother and infant outcomes.

Perinatal Influences

Contributing factors toward maternal-infant attachment begin in utero. The third trimester is an especially critical time for fetal development, as this is when olfactory and auditory systems become fully functional. When these systems begin functioning, the infant experiences numerous stimuli that contribute to mother-infant attachment. It is during this time that the fetus becomes familiar with stimuli from within its environment, such as its mother's voice and substances ingested by the mother. Kisilevsky and colleagues' (2003) research supported that human fetuses prefer their mother's voice at birth because of ongoing exposure to unique characteristics of the mother's voice, such as pitch and prosody, during sensitive periods of fetal development. The fetus also begins ingesting amniotic fluids during this time by thumb sucking and practicing breathing. Due to the combination of the mother's unique scent and flavors consumed in the maternal diet, the fetus becomes akin to the mother's unique odor (Schaal, Marlier, & Soussignan, 2000). Animal research has replicated the early influence of these biopsychosocial factors, wherein different species experience an array of responses to their mother shortly after birth. Avian species, for example, undergo a process known as imprinting in which a newborn chick bonds to the first moving object that it sees (Sullivan et al., 2011).

Long-Term Outcomes

The bond between infants and parents has a major impact on infants' developmental trajectories. The long-term emotional attachment between a caregiver and infant that begins at first contact is a major factor in infant safety and wellbeing across the lifespan (Johnson, 2013). The relationship between a child and parent will lead to a bond that strengthens the capability of

the child to feel safe and protected (Benoit, 2004). When the mother and infant fail to bond or a variety of factors disrupt their bond, a multitude of negative emotional and behavioral outcomes may develop. Poor quality of early relationships, bonding, and attachment serve as risk factors for a variety of persistent and pervasive mental health problems for the developing child, including: borderline personality disorder (Nickell, Waudby, & Trull, 2002), depressive symptoms (Rapee, 1997), negative self-esteem (Hall, Peden, Rayens, & Beebe, 2004), and eating disorders (Canetti, Kanyas, Lerer, Latzer, & Bacher, 2008). Empirical evidence supports that infants who form responsive, secure attachment with their mothers over the first few months of their life tend to develop a positive self-concept and engage in more prosocial behaviors across the lifespan (Nagasawa, Okabe, Mogi, & Kikusui, 2012; Ross & Young, 2009). Early mother-infant interactions also have the potential to shape cognitive outcomes, such as acquisition of communication skills, interpretation of social stimuli (Landry, Smith, Miller-Loncar, & Swank, 1997), responses to stressful situations (Feldman, Rosenthal, & Eidelman, 2014), and overall cognitive performance and tests of academic achievement (Cogill, Caplan, Alexandra, Robson, & Kumar, 1986). Given the salience of early parental relationships in predicting long-term offspring outcomes, it is important to understand early factors which negatively and positively impact maternal-infant interactions. Therefore, the following review will address existing gaps within the attachment literature, including examination of maternal and infant factors which contribute to maternal-infant attachment, in order to inform the current dissertation study foci.

Maternal Mental Health

Maternal mental health difficulties are associated with adverse outcomes for children of mothers who experience symptoms of a variety of psychological disorders. Though extensive research has examined how maternal psychopathology predicts interactions with children

postnatally (Martini, Knappe, Beesdo-Baum, Lieb, & Witthen, 2010), relatively fewer studies examine perinatal risk. Additionally, many studies focus on diagnosed psychopathology without considering the broader spectrum of mental health disruptions that affect a large number of expectant or new mothers; however, this is a salient area of investigation given that expecting and new mothers face an extensive set of unique challenges. These challenges are especially salient for first-time mothers. While decreased feelings of distress are present shortly after their baby is born, personal well-being declines as a result of increased marital and personal stress in new mothers by the time their baby is approximately 7 months old (Miller & Sollie, 1980). A strong body of literature supports that when this distress is manifested as depression, there are significant impacts on maternal and infant health (Emmanuel & St John, 2010; Glover, 2014; Schetter & Tanner, 2012). Increased distress may account for as much as 55% of the variance in postpartum depressive symptoms, particularly when new mothers have combined chronic life stressors such as living in poverty with poor social support (Sidor, Kunz, Schweyer, Eickhorst, & Cierpka, 2011). Therefore, this review of the literature will consider depression in relation to attachment, followed by a review of the most common stressors associated with both maternal mental health and attachment (e.g., social support). These findings will inform the novel theoretical model hypothesized within the current dissertation study (see Figure 5).

Depression. One of the most studied disorders shown to disrupt maternal-infant attachment is depression. The onset of Major Depressive Disorder (MDD) is more prevalent among women during childbearing years than any other time of their lives (Weissman & Olfson, 1995). Evidence of the relation between maternal depression and child behavioral problems has historically yielded conflicting results. While some studies have supported no differences between children of depressed mothers versus healthy controls (Rogers & Forehand, 1983), other

studies have indicated that children of depressed mothers display increased levels of social maladjustment (Forehand, Lautenschlager, Faust, & Graziano, 1986). Contrarily, other evidence supports that children of depressed mothers are less likely to engage in conduct-disordered behaviors because their mothers display a muted range of affect (Hops et al., 1987). An increasing amount of evidence, however, has begun mounting which indicates that children of depressed mothers are more likely to experience harsher criticism and are less likely to develop secure attachments with their caregiver.

Field (1998) provided support that maternal depression has the potential to affect infants during the prenatal and postnatal periods. Increased severity of depression is more likely to result in an imbalance of biological markers, including lowered serotonin levels and increased levels of cortisol and norepinephrine. Field (1998) predicted that such changes may result in a chemical imbalance in the pregnant mother, which may lead to infant dysregulation because of prenatal exposure to the described imbalance. Once the child is born, the mother's overt behaviors, such as an intrusive or withdrawn interaction style, have the potential to alter the infant's arousal modulation. The interplay between alterations to the infant's regulatory systems and the mother's persistent negative affect have the potential to exacerbate an ongoing cycle of negative emotional affect between the mother and infant, thus leading to a decreased likelihood of forming a secure mother-infant bond. Such interaction indicates a need for interventions that focus on improving maternal affect (Field, 1998). Additional studies have further supported the link between maternal depression and its possible effects on infant and child developmental dysregulation.

Webster-Stratton and Hammond (1988) reported that depressed mothers were more likely to perceive their children as exhibiting conduct problems compared to non-depressed mothers. Evidence further supported that depressed mothers were more likely to engage in nattering with

their child, be more critical of their children, and report more daily spankings (Webster-Stratton & Hammond, 1988). Furthermore, perinatal maternal depression has also been linked with increased infant physiological stress (i.e., baseline cortisol levels and increased cortisol reactivity; Oberlander et al., 2008). Maternal depression worsens when expectant mothers experience comorbid physiological stress (i.e., cortisol release) and symptoms of anxiety in the prenatal or postnatal periods (Brennan et al., 2008). Electroencephalography (EEG) of infants with depressed mothers also indicates that such infants display right frontal EEG asymmetry, disorganized behaviors, and more disrupted sleep patterns (Jones, McFall, & Diego, 2004).

Taken together, since maternal perinatal depression is one of the most prominent disorders and is robustly related to attachment within an extensive body of literature, it will be considered a risk factor within the current dissertation. Many studies have examined how post-birth maternal depression may predict offspring social and emotional functioning, yet a lack of evidence exists for how maternal depression may longitudinally affect future mother-infant interactions. Animal models demonstrate the potentially adverse effects of maternal mental health difficulties and subsequent maternal health complications, but longitudinal examples are limited in human samples. Based on the dearth of literature comparing prenatal and postnatal onset across a broad range of presenting symptoms, the current study will examine effect size differences between two models (i.e., one investigating prenatal depression and one investigating the change between prenatal and postnatal depressive symptomology) using severity of depressive symptomology, as measured by the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987). Investigation of maternal health risk factors in relation to maternal-infant attachment would not be complete without consideration of the influence of maternal physical health.

Maternal Physical Health

Since mothers are most often the primary caregiver of their infants, independent of marital and occupational status, maternal health difficulties during the prenatal and postnatal periods have the potential to significantly impact their children's health (Logsdon, Wisner, & Pinto-Foltz, 2006). Similar to mental health variables, maternal physical health also serves as a protective or risk factor for maternal-infant attachment.

Medical interventions. C-sections, a surgical procedure by which infants are delivered through incisions made in the abdominal and uterine wall, are considered necessary under some conditions to protect maternal and/or infant health, but may be associated with poorer maternal-infant attachment (Strathearn, 2011). A study conducted by Pérez -Escamilla, Maulén -Radovan, and Dewey (1996) examined the relationship between C-section and breastfeeding behaviors among a sample of Mexican women. Results of the study indicated that women who receive a C-section are less likely to initiate breastfeeding in comparison to women who deliver vaginally. Prolonged hospital stays are associated with C-sections, which may account in part for increased maternal-infant separation and decreased breastfeeding time. While breastfeeding predicts attachment, studies have also supported a direct link between C-sections and risk of poor maternal-infant attachment (Sockol, Battle, Howard, & Davis, 2014; Swain et al., 2008).

C-sections have also been associated with poorer maternal and infant health, including maternal infection (Deneux-Tharaux, Carmona, Vouvier-Colle, & Bréart, 2006), ongoing postpartum maternal physical pain (Nikolajsen, Sørensen, Jensen, & Kehlet, 2004), maternal cardiac arrest (Liu et al., 2007), infant respiratory morbidity (Hansen, Wisborg, Uldbjerg, & Henriksen, 2008), and infant mortality (MacDorman, Declercq, Menacker, & Malloy, 2006). Importantly, these maternal and infant health factors may further contribute toward difficulties

with attachment (Kinsey, Baptiste-Roberts, Zhu, and Kjerulff, 2014). This is particularly problematic given that rates of C-section have increased almost 10-fold from 5% of all deliveries in the United States in 1965 (Swain et al., 2008) to as high as 36% by modern estimates (Little, Orav, Robinson, Caughey, & Jha, 2016).

Medical diagnoses. Emerging evidence also suggests that maternal thyroid disorders affect maternal health and prenatal development, both of which predict postnatal attachment. While maternal thyroid disorders may lead to increased likelihood for expectant mothers to develop depressive symptomology, increased levels of stress may lead to maternal thyroid dysfunction (Cooper & Murray, 1998). Given that studies have demonstrated that as high as 84% of women are likely to experience at least low to moderate levels of stress during pregnancy (Woods, Melville, Guo, Fan, & Gavin, 2010), the need for increased monitoring of mothers who may be at risk for thyroid problems during pregnancy is high (Haddow et al., 1999). Even among healthy mothers, the thyroid gland is likely to increase in size by 10-40% compared to pre-pregnancy gland size. This increase in size and subsequent production of the hormones thyroxine and triiodothyronine potentially put expectant mothers with iodine deficiencies at risk of developing hypothyroidism. Fluctuations in such hormones produced in the thyroid gland during pregnancy make carrying an infant a risk factor for developing complex endocrine issues for many women (Stagnaro-Green et al., 2011).

When these described effects occur, both the expectant mother and her fetus are at risk for physical and cognitive difficulties (Henrichs et al., 2010). Antibodies that are responsible for regulating thyroid function are capable of crossing the placental barrier (Haddow et al., 1999). When the expectant mother's thyroid is dysregulated, the fetus's thyroid is likely to be adversely affected due to the expectant mother's dysregulated functioning. One of the most commonly

occurring problems among infants affected prenatally by maternal thyroid problems compared to infants with mothers not affected by thyroid problems is lower cognitive capabilities (Haddow et al., 1999; Henrichs et al., 2010). Such effects may occur even when maternal thyroid problems are relatively mild (Haddow et al., 1999). The link between increased levels of stress and subsequent depressive symptomology for expectant and new mothers (Sidor et al., 2011) indicates a strong need to closely monitor mothers at risk for developing thyroid problems, as increased mental health difficulties are associated with mothers experiencing difficulty bonding with their infants. Furthermore, Cooper and Murray (1998) emphasized the need for additional investigation into how maternal mental health factors, namely depression, merit further investigation to better determine their relationship with maternal physical health outcomes. Additional maternal health diagnoses which have been associated with maternal mental health and may predict disruptions in maternal-infant attachment include hypertension (Federenko & Wadhwa, 2004), anemia (Bodnar & Wisner, 2005), diabetes (Prince et al., 2007), and bacterial vaginosis (Culhane et al., 2001).

Overall, maternal mental and physical health are related and both influence maternal-infant attachment. Existing literature suggests that other important environmental (e.g., social support) and behavioral (e.g., breastfeeding) factors influence relations between maternal health and infant attachment, though no integrated model has been created to explain such relations. Therefore, the next sections of the literature review will address these factors individually and the purpose of the dissertation will be to statistically test integrated models based on gaps in the extant literature.

Social Support

Social relationships. Social relationships are a tool that can promote disease-preventing activities (Dennis, 2003). Conversely, social isolation has been associated with increased disease morbidity (e.g., slower rates of physical healing) and mortality (Cacioppo & Hawkley, 2003). Social relationships have also been associated with increased maternal-infant attachment, with infants coming from families with low social support experiencing higher rates of anxious attachment and greater irritability (Crockenberg, 1981).

Perinatal and long-term maternal support. Numerous dimensions of social support have been identified as relevant in shaping maternal experiences, such as hands-on services (e.g., medical support), provision of information (e.g., providing expectant and new mothers with brochures on common maternal experiences), sharing of emotional experiences, and positive regard for one another (Leahy-Warren, McCarthy, & Corcoran, 2011). The benefits of social connections on behavioral outcomes have a long-standing impact on mental and physical health outcomes. In fact, programs targeted at improving familial social support in the perinatal period are associated with positive changes in attachment and health outcomes.

Small et al. (2011) reviewed the mixed results regarding outcomes of social support interventions for expectant mothers since the early-1900s. Although many of the investigated interventions targeted low-socioeconomic status (SES), single, or young mothers, the factor that was consistent across all of the interventions investigated is that they all have a similar focus on support for parents and healthy developmental outcomes for children. Maternal support factors of concern included maternal childbirth education, breastfeeding support, social connectedness (i.e., lay members within the community with whom the expectant mother may discuss postnatal problems), support for expectant mothers who are victims of intimate partner violence, and

expectant mothers struggling with symptoms of depression. Results of the review indicated that social support has the potential to increase maternal mental health and family connectedness, which may lead to better overall maternal health outcomes. The study also highlighted the need for mothers to perceive the support they receive as non-judgmental, particularly in relation struggles with intimate partner violence or mental health difficulties.

Similarly, Balaji et al. (2007) found that the qualitative nature of social relationships among sensitive populations, such as pregnant and postpartum mothers, is more indicative of future physical well-being than quantitative representations of support. While concerns about the willingness of expectant mothers to disclose mental health and domestic issues (e.g., domestic violence) have raised questions about the likelihood that mothers would reveal this information, the ongoing success of programs that allow mothers to connect with and maintain friendships with sympathetic peers highlights the benefits of support interventions on postnatal outcomes.

Mothers who receive more social support throughout pregnancy and perceive such support as higher quality are more likely to rate their labor experience more positively and deliver infants with higher Apgar scores (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993; Elsenbruch et al., 2006). Increased quantity and quality of social support also has the potential to offset disadvantages often associated with lower SES (Collins et al., 1993). A positive labor experience and healthier infant has the potential to protect mothers and infants from adverse physical and mental health consequences, such as postpartum depression (Weisman et al., 2010) and Neonatal Intensive Care Unit admission (Wisner et al., 2009). These benefits increase the possibility that mothers and infants will have more time to together to bond (Wigert et al., 2010). Ekas, Lickenbrock, and Whitman (2010) examined how social support is associated with maternal outcomes in mothers of children with autism spectrum disorders. Results indicated that

friend, partner, and family support contributed to increased maternal optimism, which in turn predicted greater likelihood of positive maternal outcomes (i.e., decreased rates of depression and parental stress). Given the higher prevalence of neurodevelopmental disorders (e.g., Autism Spectrum Disorder) in low birth weight children (Hack et al., 2009), these results further emphasize the role that social support may have on buffering against increased stress that is often associated with raising an infant that struggles with complex medical or psychological impairments.

Postnatal support may also be a protective factor against adverse developmental outcomes in infants and toddlers. Lyons-Ruth, Connell, Grunebaum, and Botein (1990) examined the effects of a well-established 18-month in-home social support service (low=9-month involvement, high=18-month involvement) for 31 underserved, low-income families who were referred for services by educational (e.g., Head Start Programs), health (e.g., pediatric clinics), and social service (e.g., State Department of Protective Services) agencies. Families did not meet exclusionary criteria due to a documented history of child maltreatment, current maternal depression, or previous maternal psychiatric hospitalization. The four goals of the in-home support program included: 1) increasing family competence of community resources that provide financial, health, social, and educational support, 2) fostering a trusting relationship within the family, 3) increasing maternal social networking opportunities via monthly interaction with a social worker or attendance of weekly parenting groups, and 4) workers modeling positive maternal-infant interaction with a focus on the maternal roles of infant emotional support and teacher. Infants of depressed mothers who received treatment displayed significantly higher levels of attachment to their mothers and cognitive functioning when compared to economically-similar controls. The duration mothers were involved in services was positively correlated with

maternal-infant involvement. The authors concluded that increased social support for mothers with a history of psychiatric difficulties has the potential to protect against maternal-infant attachment difficulties.

Social support theory and perinatal factors. The manner by which parental social relationships affect infant outcomes has historically focused on both mental and physical health factors. While stress and coping (Cohen & Wills, 1985) and relational regulation theory (Lakey & Orehek, 2011) support that meaningful social relationships have the potential to protect one from adverse mental health difficulties, these theories may not account for the physical health conditions or complications associated with pregnancy.

The life-span perspective of social support (Uchino, 2009) accounts for factors of received versus perceived support as well as ways by which social support may promote physical well-being. Since pregnant mothers with increased psychological distress may be susceptible to more health complications throughout the duration of and following pregnancy than women who experiencing less psychological distress (Beydoun & Saftlas, 2008; Cooper & Murray, 1998; Gupta et al., 2007), social support may have the potential to buffer against subsequent mother-infant attachment difficulties that new mothers may experience as a result of problematic maternal health conditions.

Taken together, social support is associated with both maternal mental and physical health, which are predictors of maternal-infant attachment quality. In particular, social support may interact with maternal physical health conditions (Uchino, 2009) such that increased social support may buffer the relations between poor maternal health and maternal-infant attachment difficulties long term. Therefore, the current dissertation study will investigate whether social support moderates relations between physical health factors to predict attachment. Another

salient factor to consider, similarly related to maternal health and maternal-infant attachment, is breastfeeding.

Breastfeeding

Breastfeeding predicts securely-attached mother-infant relationships (Bretherton, 1992). Numerous outcomes have been associated with the bond that develops between mother and infant when the mother engages in breastfeeding. Breastfeeding within the first 2 hours after giving birth has been associated with increased maternal sensitivity to infant needs (Johnson, 2013). While skin-to-skin contact has similarly been associated with maternal-infant attachment, the suckling that occurs during breastfeeding may increase attachment, even in the absence of skin-to-skin contact (Widström et al., 1990). Breastfeeding has also been associated with an exponential increase in mother-infant eye gaze, increased maternal affection, increased maternal attraction to the infant, decreased maternal stress, decreased postpartum depressive symptoms, and increased modulation of the maternal nervous system (Johnson, 2013). According to the American Academy of Pediatrics (AAP), breastfeeding should be the exclusive source of nutrients for infants for the first 6 months postpartum and should continue until the infant is at least 1 year of age (Eidelman et al., 2012).

Mothers who breastfeed their infants are more likely to experience improvements in mood and increased desirability to be more engaged during social interactions (Feldman & Eidelman, 2003). Due to the increased likelihood that mothers with improved affect are more likely to feel positive about their infants, breastfeeding's potential reciprocal benefits for mother and baby are likely to facilitate maternal-infant attachment (Feldman & Eidelman, 2003). Mothers who initiate physical interactions with their infants early in infant development are also more likely to see adaptive outcomes as their infant continues growing (Cattaneo et al., 1998).

For example, early and prolonged skin-to-skin contact between mother and infant has been associated with better regulation of infant body temperature (Johnson, 2013), improved infant oxygen saturation (Hunt, 2008), increased alertness and social engagement with their caregiver, improved development of motor skills, and continued increased cognitive development through the 6-month postpartum period (Johnson, 2013). This early and prolonged skin-to-skin contact also influences parental factors that further benefit the relationship between mother and infant. Examples of such benefits include increased likelihood that mothers feel more positive toward their infant, demonstrate more overt positive affect, are less likely to experience symptoms of depression and anxiety, feel more positive about their interactions with their infant, and are more alert to infant cues for care (Feldman, Eidelman, Sirota, & Weller, 2002). Such relations occur in mothers of healthy infants. Mothers of healthy infants who experience decreased proximity and increased separation are more likely to have increased preoccupation with thoughts of disrupted infant well-being, increased symptoms of maternal depression and anxiety, and an overall decrease in behaviors exhibited toward the infant that are commonly associated with more secure attachment (Feldman et al., 1999). Taken together, the proximity that infants and mothers have to one another through breastfeeding increases the likelihood that mothers and infants will develop a stronger attachment to one another due to parent- and infant-specific protective factors. The biological (e.g., Johnson, 2013) and emotional (e.g., Feldman et al., 2002) factors associated with breastfeeding support it as a strong predictor of maternal-infant attachment.

Thus far, empirical evidence supports the relationships between maternal mental health, maternal social support, maternal physical health, and breastfeeding as potentially fostering or hindering maternal-infant attachment; however, no existing model of such relations exists in the empirical literature. Questions remain as to how mental health factors have the potential to

influence physical health, but strong social support appears to interact with depressed affect to influence maternal physical health outcomes (Lyons-Ruth et al., 1990). What appears clearer is the positive association between good maternal health and increased likelihood of breastfeeding (Forster, McLachlan, & Lumley, 2006). For the cited reasons, it appears likely that a more comprehensive model of maternal-infant attachment would include the interaction of maternal depression and social support influencing maternal physical health outcomes, which in turn influences the likelihood of breastfeeding, and collectively predicts maternal-infant attachment. Therefore, the final section of the current review will address the contemporary construct of attachment and will support the use of the current outcome measure.

Maternal Attachment

Maternal sensitivity. Maternal sensitivity, or a mother's ability to attend to and respond in ways that are well-matched to her infant's signals for attention (Leerkes, Weaver, & O'Brien, 2012), has historically been considered an important step toward developing secure mother-infant attachments. Specific brain circuits have the potential to shape the thoughts and behaviors new mothers will develop for responding to infant signals. Animal models have demonstrated differences in how biological processes have the potential to influence maternal responsivity. For instance, hormones such as prolactin (Lucas, Ormandy, Binart, Bridges, & Kelly, 1998; Shingo et al., 2003) and oxytocin (Kendrick, Keverne, & Baldwin, 1987; Nagasawa et al., 2012; Ross & Young, 2009) have been associated with increases in adaptive maternal behaviors as well as decreases in avoidance and hostility toward one's infant for decades. Several areas of the brain, including the hypothalamus, midbrain, and limbic system have been supported to act together to form an intricate network that is activated when hormones are released following infant crying. This neural network is associated with a range of executive functions, such as attention,

empathy, and emotion regulation, which are likely to influence whether a mother will bond with her infant. Mothers who deliver vaginally are similarly more likely to be responsive to their infant due to alterations in neurohormonal events in the brain following the biological process. Mothers who deliver infants by C-section do not experience the same biological processes due to the lack of vagino-cervical stimulation that occurs during vaginal childbirth (Swain et al., 2008).

Infant crying. Some researchers view crying as a way of eliciting the need for proximity to an infant's caregiver from an evolutionary standpoint (Hofer, 2002). Human infants have evolved to use crying as a form of expression. Evidence of infant-caregiver interaction in indigenous and hunter-gatherer tribes indicates that infants who are in closer contact with their mothers are more likely to have their cry responded to in less than 1 minute compared to an average latency of 5 to 30 minutes in Western cultures (Murray, 1979). Similarly, infants in constant contact with caregivers in hunter-gatherer societies are also more likely to have their cries responded to as a result of non-verbal indicators, such as facial expressions and body movements, rather than parents in Western societies who are more likely to rely on infant crying to signal the need to attend to their child (Murray, 1979).

Westernized culture has adapted maternal sensitivity to infant crying into two classifications of beliefs: infant-oriented versus parent-oriented beliefs. Parents who identify more with infant-oriented beliefs are much more likely to interpret their infant's crying as a signal of distress that is in need of caregiver attention. Conversely, mothers who view crying from a parent-oriented point of view are more likely to view crying as a form of coercive behavior on the part of the infant (Haltigan et al., 2012). Infant-oriented mothers are more likely to respond to their infant faster than parent-oriented mothers. While such factors have important implications for parental interpretation of infant signals and subsequent responses, predictive

properties of measures that assess for parental interpretation of infant crying are not currently well-established. Given that maternal sensitivity to infant cues is a core feature of maternal-infant attachment (Field, 1998), maternal misinterpretation of infant crying has the potential to decrease the likelihood that mothers and infants will form a secure attachment. Moreover, existing measures investigate maternal attachment as a product of maternal perceptions of infant crying behavior. A relatively novel, yet validated measure, the ICQ-R, will be utilized within the current dissertation study for this purpose.

Proposed Study

The current study hopes to address gaps in the existing literature by understanding the relationship among factors associated with maternal-infant attachment, which has the potential to inform intervention approaches for mothers who may be at risk of experiencing difficulty bonding with their infant. Numerous factors interact with maternal-infant attachment, yet a more comprehensive model of attachment, including important mediators or moderators, does not currently exist. Similarly, how maternal mental health difficulties during the perinatal period affect maternal-infant bonding has been scarcely investigated (McFarland et al., 2015). Thus, the purpose of the proposed study is to investigate relationships among mental health, physical health, social support, breastfeeding behaviors, and perceived attachment in the perinatal period to assist with determining the optimal modality and timing of interventions targeting mothers who may experience difficulties bonding with their infants.

Maternal perinatal depression adversely predicts maternal-infant bonding (Martini et al., 2010). Similarly, maternal mental health difficulties have the potential to lead to a host of problematic maternal physical health conditions (e.g., Field, 1998). Maternal physical health difficulties also have the potential to exacerbate maternal mental health problems (e.g., Cooper &

Murray, 1998). Social support is one possible moderating factor between maternal physical health factors and postnatal attachment (e.g., Cacioppo & Hawkley, 2003). Poor maternal health factors are associated with decreased likelihood of breastfeeding (Li et al., 2013), which increases the likelihood that mothers will develop poorer attachments with their infants (Broad et al., 2006; Liu et al., 2014). Based on these individual relationships, the proposed study will investigate two larger models of associations of maternal depression with infant attachment at different timelines during pregnancy. In the first model, the association between prenatal depressive symptomology and postnatal infant attachment will be examined as mediated by maternal physical health and breastfeeding behaviors, with the relationship between postnatal maternal physical health and breastfeeding duration moderated by maternal social support (see Figure 11). The second model will test the association in the change between prenatal to postnatal depressive symptomology and postnatal infant attachment as mediated by breastfeeding duration, with the relationship prenatal to postnatal depressive symptomology change and breastfeeding duration being moderated by postnatal physical health complications and the relationship between breastfeeding duration and maternal-infant attachment being moderated by perceived quality of postnatal social support. Two separate models will be tested, which include the ten hypotheses below. The first will consider maternal prenatal depression in the model (i.e., Hypotheses 1a-1e) and the second will evaluate the change in maternal prenatal versus 6-month postnatal depressive symptomology (i.e., Hypotheses 2a-2e).

Hypotheses

Hypothesis 1a. Controlling for maternal health, maternal satisfaction with social support, breastfeeding frequency, and the interaction between maternal health and satisfaction with social support, fewer symptoms of prenatal maternal depression, as measured by lower scores on the

EPDS, will be associated with greater maternal-infant attachment, as measured by higher attachment scores on the ICQ-R, in the model (see Figure 1).

Figure 1. Proposed Prenatal Depression Model

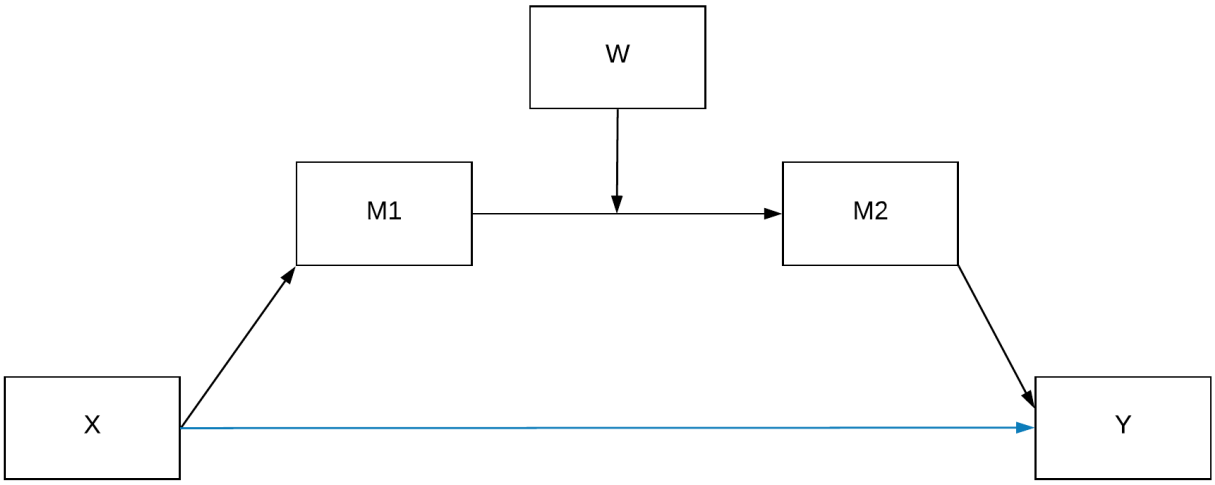

Figure 1. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Hypothesis 1b. Fewer symptoms of prenatal maternal depression, as measured by lower scores on the EPDS, will be associated with fewer maternal physical health complications, as measured by the 6-month Postnatal Session Screener, in the model (see Figure 2).

Figure 2. Proposed Prenatal Depression Model

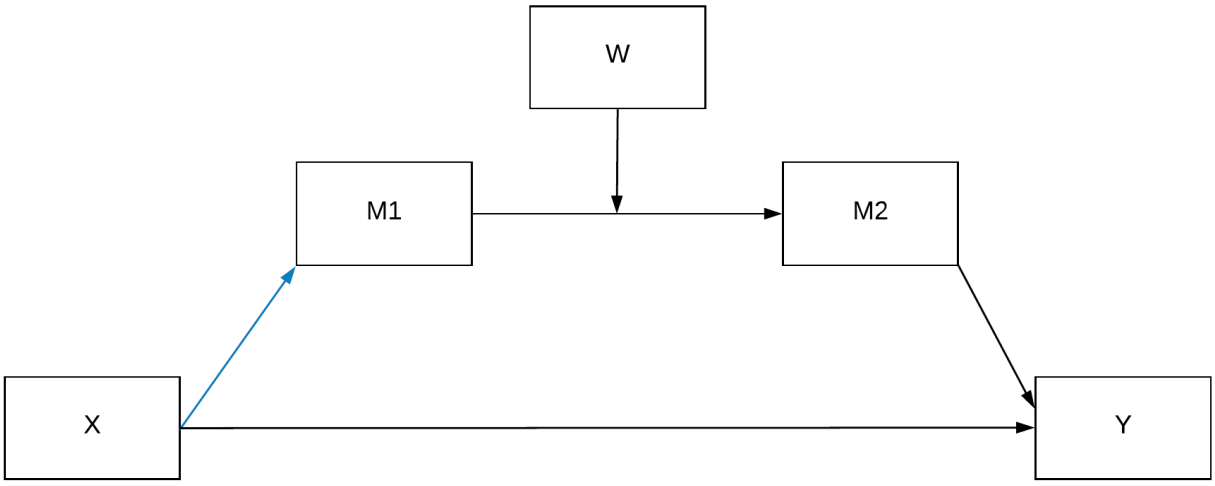

Figure 2. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Hypothesis 1c. Controlling for prenatal depression, postnatal maternal perceptions of social support, as measured by the SSQ-6, will moderate relations between maternal physical health and maternal breastfeeding frequency in the model (see Figure 3). In other words, mothers who endorse greater dissatisfaction with current social support (as indicated by the average rating across social support items) will have stronger relationships with more physical health complications (as indicated by presence of maternal physical health complications during labor, delivery, and/or post-delivery) and decreased frequency of feedings at 6 months postpartum. The interaction between maternal physical health and postnatal maternal social support (as measured by the SSQ-6) will mediate relations between greater prenatal maternal depression and less frequent breastfeeding (as measured by the 6-Month Infant Dietary Questionnaire) in the model.

Figure 3. Proposed Prenatal Depression Model

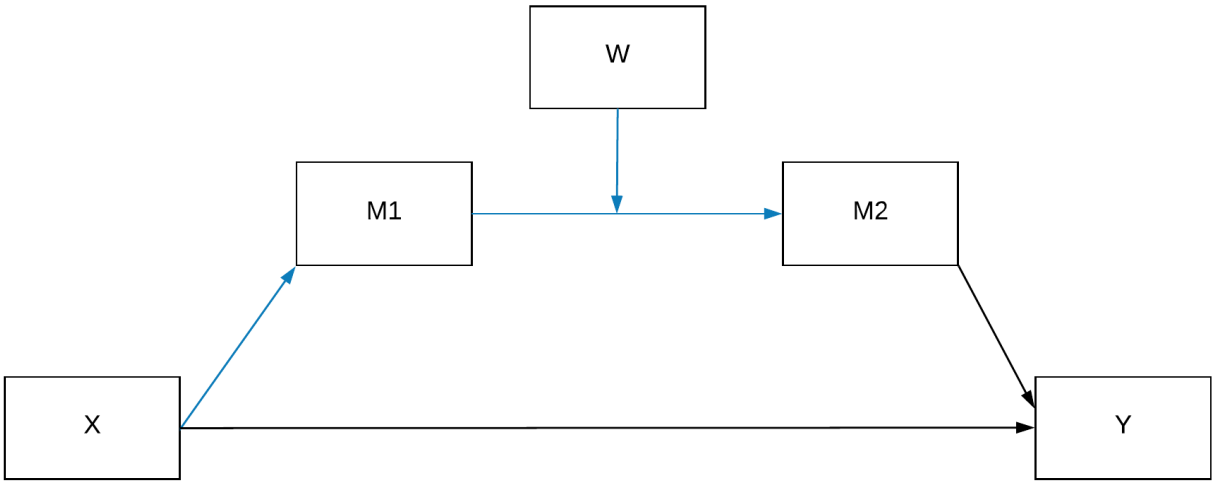

Figure 3. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Hypothesis 1d. Controlling for prenatal depression, breastfeeding will mediate relations between the interaction between maternal physical health and postnatal social support and maternal-infant attachment in the model (see Figure 4). For mothers who endorse greater dissatisfaction with current social support (as indicated by the average rating across social support items), they will have stronger relationships with more physical health complications (as indicated by presence of maternal physical health complications during labor, delivery, and/or post-delivery) and decreased frequency of feedings at 6 months postpartum, which will predict poorer maternal-infant attachment.

Figure 4. Proposed Prenatal Depression Model

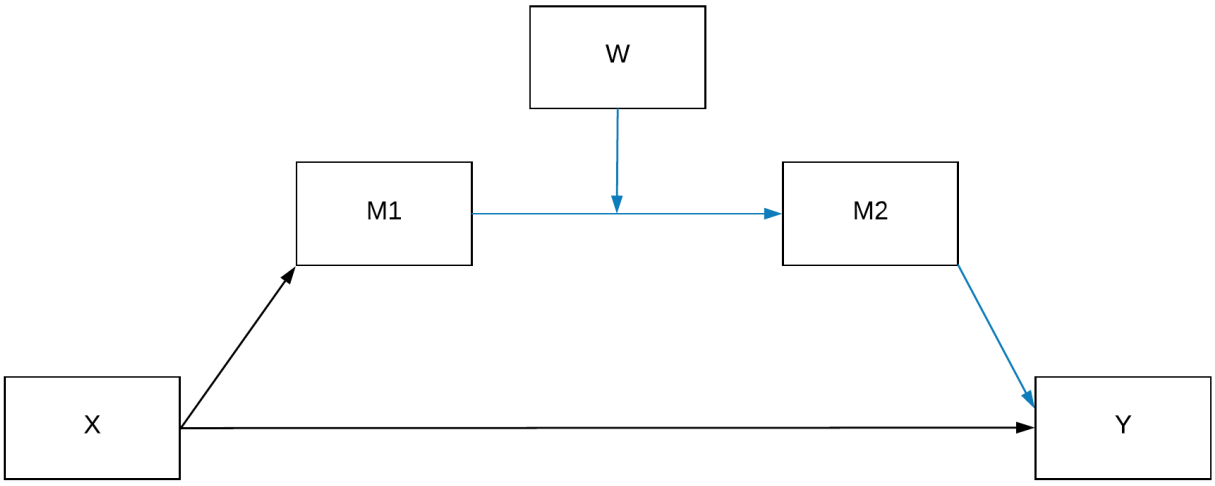

Figure 4. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Hypothesis 1e. The overall model will explain a statistically significant amount of variance in maternal-infant attachment (see Figure 5).

Figure 5. Proposed Prenatal Depression Model

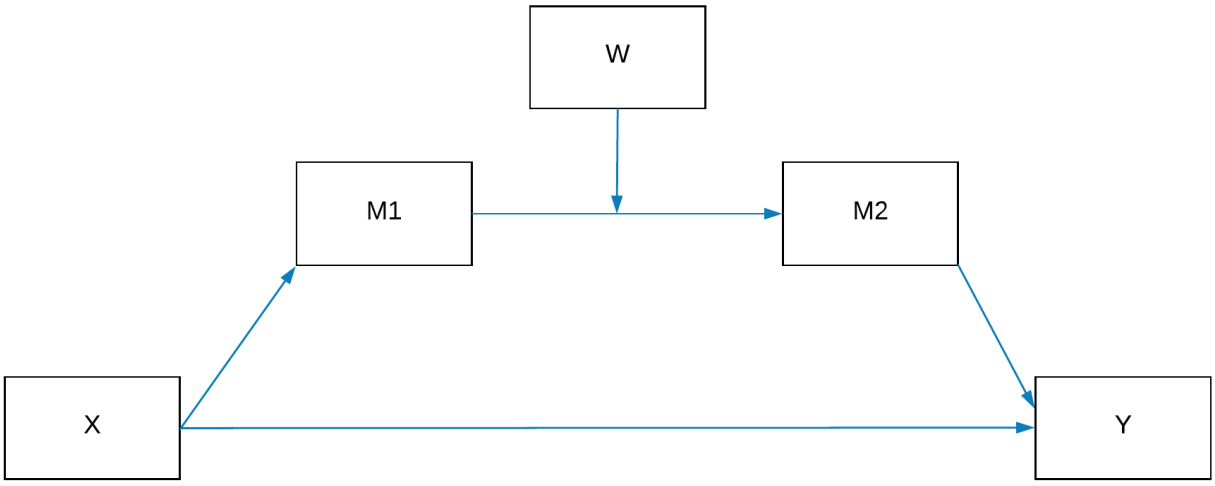

Figure 5. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Hypothesis 2a. Controlling for maternal health, breastfeeding frequency, maternal satisfaction with social support, the interaction between depression and maternal health, and the interaction between breastfeeding and satisfaction with social support, fewer symptoms of maternal depression, as measured by the prenatal to postnatal change in EPDS depressive symptomology, will be associated with greater maternal-infant attachment, as measured by higher attachment scores on the ICQ-R, in the model (see Figure 6).

Figure 6. Proposed Prenatal to Postnatal Depression Change Model

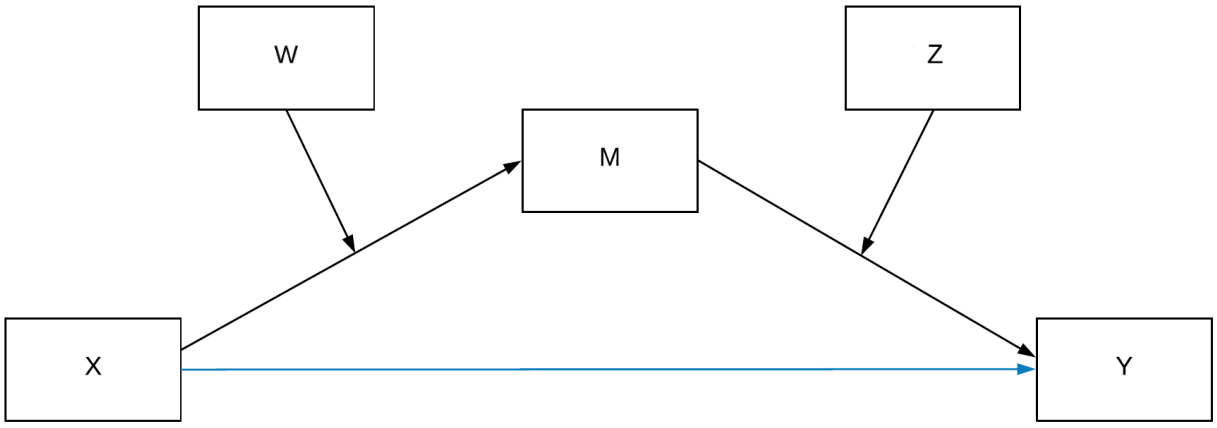

Figure 6. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Hypothesis 2b. Postnatal (i.e., 6-month postpartum) maternal physical health complications will moderate relations between prenatal to postnatal change in EPDS depressive symptomology and breastfeeding frequency in the model (see Figure 7). In other words, for mothers with more physical health problems (as indicated by labor, delivery, and post-delivery health complications), those who endorse greater increases in depressive symptoms from the prenatal to postnatal period will breastfeed less frequently at 6 months postpartum.

Figure 7. Proposed Prenatal to Postnatal Depression Change Model

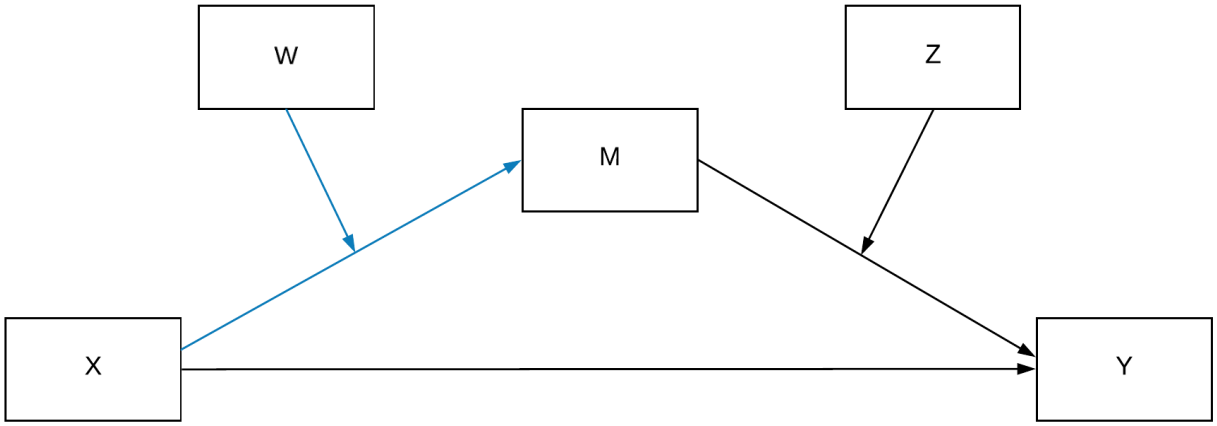

Figure 7. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Hypothesis 2c. Controlling for prenatal to postnatal depressive symptomology, postnatal health complications, and the interaction between maternal depression and health, postnatal maternal social support will moderate relations between breastfeeding frequency and maternal-infant attachment (see Figure 8). For mothers who endorse increased satisfaction with current social support, they will have stronger relations between more frequent 6-month postnatal breastfeeding and greater maternal-infant attachment.

Figure 8. Proposed Prenatal to Postnatal Depression Change Model

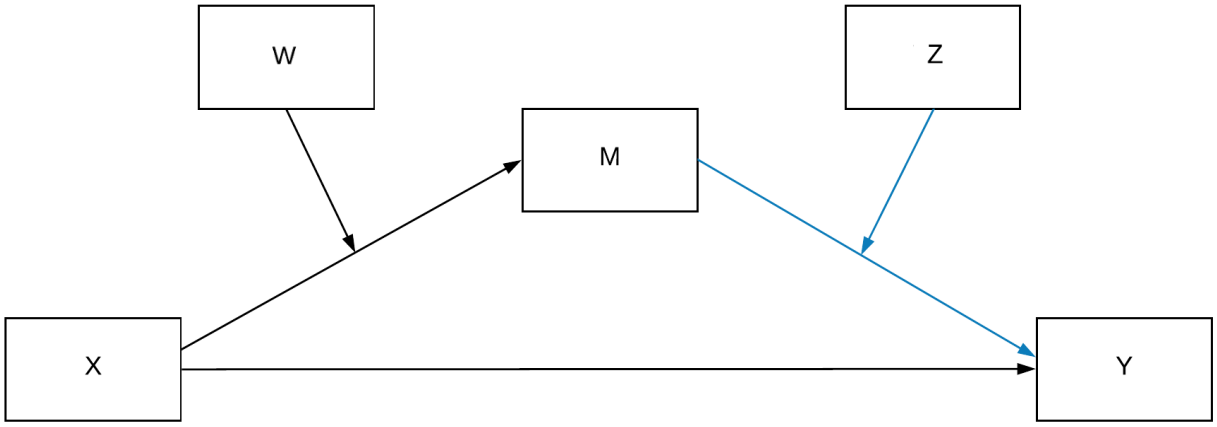

Figure 8. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Hypothesis 2d. The conditional indirect effect will be statistically significant such that the interaction between postpartum maternal breastfeeding frequency and maternal social support (as measured by the SSQ-6) will mediate relations between the interaction between maternal depression change and maternal physical health and maternal-infant attachment in the model (see Figure 9). In other words, for mothers with more physical health problems, those who endorse greater increases in depressive symptoms from the prenatal to postnatal period will breastfeed less frequently at 6 months postpartum, which will interact with maternal social support such that for mothers who endorse increased satisfaction with current social support, more frequent 6-month postnatal breastfeeding will predict greater maternal-infant attachment.

Figure 9. Proposed Prenatal to Postnatal Depression Change Model

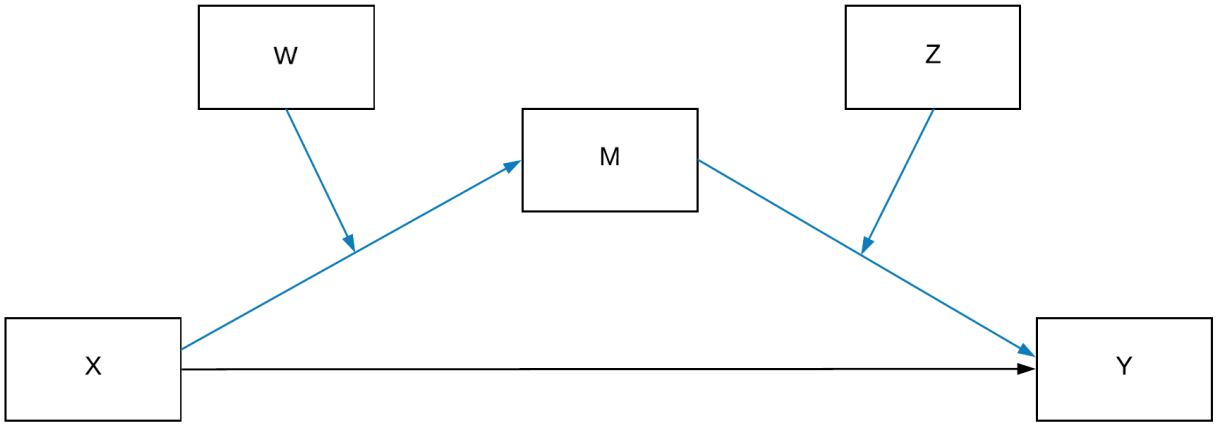

Figure 9. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Hypothesis 2e. The overall model will explain a statistically significant amount of variance in maternal-infant attachment (see Figure 10).

Figure 10. Proposed Prenatal to Postnatal Depression Change Model

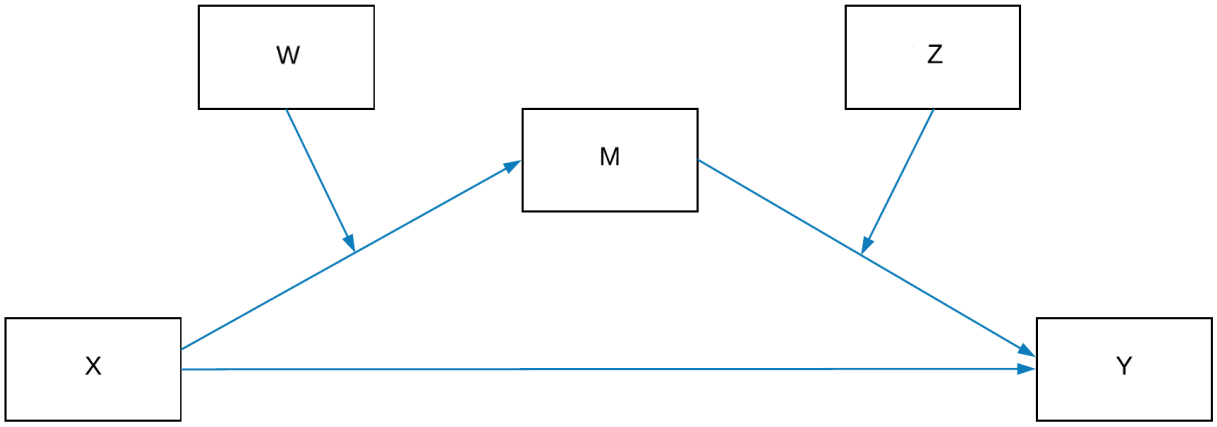

Figure 10. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Methods

Procedure

Recruitment. The Idaho State University (ISU) Human Subjects Committee approved the parent study on February 13, 2016 for use with a perinatal population throughout southeastern Idaho. Participants took part in the Infant Development and Healthy Outcomes in Mothers (IDAHO Mom) Study as part of a longitudinal project investigating relations among perinatal maternal health and infant development. Investigators utilized a variety of recruitment techniques, including flyers posted in the offices of pediatric providers, Facebook advertisements, ISU campus bulletin boards, and news advertisements. Potential participants typically contacted graduate and undergraduate research assistants (GRAs or URAs) by telephone, text, or e-mail to express interest in the study. GRAs or URAs then provided a brief overview of the study (i.e., description of participant benefits, potential risks to mother and

infant, financial compensation, rights as a research participant, and time requirements) and asked for oral consent to complete a brief screening questionnaire that assessed for participant study eligibility.

Eligibility. Participants were informed that they were allowed to withdraw consent at any time and that they may skip questions they did not want to answer without penalty. Questions assessed for study exclusionary criteria, which included expectant mothers who were minors (<18 years old) or a higher risk pregnancy due to advanced age (>35 years old), mothers expecting more than one child, current use of illicit recreational substances (e.g., marijuana, heroin, etc.), excessive alcohol use during pregnancy (>40 drinks), chronic and/or severe physical or mental health diagnoses (e.g., HIV/AIDS, hepatitis, psychotic disorders, diabetes mellitus, etc.), and current use of medications classified under categories D and X (e.g., lorazepam, warfarin, etc.) by the FDA. RAs invited interested expectant mothers who did not meet exclusionary criteria and expressed further interest to participate in the prenatal phase of the study.

Prenatal session. The prenatal session (at 35±2 weeks gestation) began by GRAs completing informed consent with expectant mothers. The informed consent included a description of study purpose, procedures, risks and benefits, alternatives to participation, and financial compensation. Following informed consent, GRAs began the interview by updating participant contact information. GRAs then interviewed the participants using the M.I.N.I. International Neuropsychiatric Interview, Version 6.0.0 (M.I.N.I.) for the DSM-IV, which also included the Dysthymia Module from the M.I.N.I., Version 5.0.0. A Timeline Followback interview followed completion of the M.I.N.I., which assessed for maternal caffeine, alcohol, tobacco, medication, and illicit substance use, as well as secondhand smoke exposure

frequencies and amounts. URAs then completed a brief interview that included confirmation of information assessed during initial phone screening, Pregnancy Context, Ethnicity and Race, and SES measures. GRAs and URAs also collected maternal anthropometric measurements that assessed the expectant mother's weight, height, and abdominal circumference. Participants then completed computer-guided self-report measures in Media Lab, which included: the Perceived Stress Scale (PSS), Dietary Screener Questionnaire (DSQ), Eating Behavior Questionnaire (EBQ), Edinburgh Perinatal Depression Scale (EPDS), Perinatal Anxiety Screening Scale (PASS), Perinatal OCD Scale – Prenatal (POCS), Severity of Violence Against Women Scale (SVAWS), Trauma History Questionnaire (THQ), Domain-Specific Risk Taking Scale (DOSPERT), and the Infant Crying Questionnaire-Revised (ICQ-R).

Upon completion of self-report questionnaires, URAs flagged critical items and notified the GRAs and/or the Principal Investigator to review those items with the participant. When applicable, GRAs provided the participant with a community resource list so that they could seek assistance with items that posed a risk of harm to self or others, impairment in functioning, exposure to domestic violence, or significant psychological distress. URAs reviewed the 3-day saliva sample procedures with the participants and gave them $30 financial compensation through cash or Walmart gift cards for completion of the prenatal session. Participants could then earn an additional $5 per day (potential compensation of up to $15) for successful completion of four saliva samples per day (i.e., immediately upon waking up in the morning, 30 minutes after waking, 45 minutes after waking, and right before going to bed). RAs sent automated text messages through Boomerang to consenting participants to remind them of anticipated collection times over the course of the 3 collection days. Participants then scheduled a 6-month postnatal session.

Postnatal session. The postnatal session (at the infant's 6-month birthday±2 weeks) began by having the participant and her infant engage in four video-recorded behavioral tasks, including: a caregiving task, a free-play interaction during which the mother was asked to complete a 6-month Infant Health and Sleep Questionnaire, an orientation task of the infant playing with blocks (taken from the Laboratory Temperament Assessment Battery or Lab-TAB; Goldsmith & Rothbart, 1996), and observed responses of mother and infant during a gentle infant arm restraint task (also taken from Lab-TAB). After completion of the 20-minute behavioral tasks, the mother and her infant completed additional anthropometry measurements that assessed maternal and infant weight, height/length, and abdominal circumference. Following the measurements, GRAs began interviewing the mother by administering the M.I.N.I., Timeline Followback interview, additional items not completed during the free-play task on the Infant Health and Sleep Questionnaire, and a postnatal screening questionnaire that consisted of questions regarding the mother's and infant's health and experiences during and following labor and delivery. After completion of the postnatal screening questionnaires, mothers completed a series of computer-guided self-reports that included the PSS, DSQ, EBQ, EPDS, PASS, POCS, ICQ-R, Infant Dietary and Breastfeeding Questionnaire, Infant Behavior Questionnaire-Revised (IBQ-R), the Duke University Religion Index (DUREL), Social Support Questionnaire 6 (SSQ6), and the Yale-Brown Obsessive-Compulsive Scale – Self-Report Version (Y-BOCS).

Participants

Participants consisted of expectant mothers recruited throughout southeastern Idaho whose due date corresponded with the self-reported day of last menstrual period, consistent with obstetrical health providers. The 6-month follow-up session occurred based on confirmed birth date of infants during anticipated 1-month and/or 5-month postpartum follow-up telephone calls,

during which time the mother confirmed her baby's name and gender. The number of interested expectant mothers excluded from the study included 382 mothers, of whom 72 were ineligible, 131 declined to participate after being contacted, and 179 were unreachable by telephone or email. One hundred and twenty-five expectant mothers completed the prenatal session, of whom 96 completed the 6-month postnatal session. For this dissertation project, I began contributing to data collection on March 4, 2017 and completed data collection for 37 of the 221 sessions, including 11 prenatal and 26 postnatal sessions.

Measures

Although the IDAHO Mom Study employs an array of measures to assess for psychological and physical health factors in infant and mother, as described above, the current proposed dissertation will only utilize the following measures to test the outlined hypotheses:

Edinburgh Postnatal Depression Scale (EPDS). The EPDS (see Appendix A) is a 10-item self-report measure used as a brief indicator of depressive symptomology in perinatal women (Cox et al., 1987). The measure assesses for depressive symptomology that is less likely to be associated with somatic symptoms of depression that commonly occur due to the natural physiological changes associated with childbearing. Scores range from 0 to 30, with higher scores indicating a greater severity of depressive symptomology. Researchers have demonstrated that the EPDS has excellent psychometric properties, including good sensitivity (0.86) and specificity (0.78) for individuals who meet research-supported diagnostic criteria for depression. The measure maintains a high internal consistency with a Cronbach's alpha of 0.88 and a split-half reliability of 0.88.

Social Support Questionnaire 6 (SSQ6). The SSQ6 (see Appendix B) is a 6-item self-report measure used as a brief indicator of social support (I. Sarason, B. Sarason, Shearin, &

Pierce, 1987). Three samples were used to norm the measure. The first consisted of 182 undergraduate students of whom 76 were tested once and 106 were retested for test-retest reliability, the second of 217 undergraduate students enrolled in an Introductory Psychology class who completed the SSQ and three additional measures of social support, and the third of 146 participants similar to the second sample who completed the SSQ and two additional measures of social support.

Six items are used in the IDAHO Mom Study to assess for the total number of support individuals (between 1 to 9), defined as people who the individual can count on when facing challenging situations, as well as how satisfied the person is with the quality of his or her current level of support in each of the 6 described situations on a 6-point scale (e.g., *very dissatisfied* (1) to *very satisfied* (6); I. Sarason et al., 1987). Internal consistency reliability of items for the number of supports and the satisfaction of support one currently, as rated on the SSQ6, has ranged between alpha coefficients of 0.90 and 0.93 (I. Sarason et al., 1987). Postnatal participant-rated satisfaction with current levels of social support, as indicated by the average of satisfaction of supports across the six items, will serve as a moderator of postnatal physical health factors in the first model and a moderator of breastfeeding duration in the second model. The Principal Investigator added the SSQ6 to the 6-month postnatal session of the IDAHO Mom study on December 3, 2015, after the study was already in progress. RAs collected SSQ6 data for all participants, meaning that missing data will not be a factor in the present dissertation analyses. The latter part of the six items on the SSQ-6, which inquires how satisfied the respondent is with the quality of social support they receive, will be averaged (range of averaged scores from 1 to 6) to represent postnatal maternal social support in the present study.

6-Month Postnatal Session Screener. The 6-Month Postnatal Session Screener (see Appendix C) is a 32-item self-report measure that assesses for numerous physical, psychological, and living condition factors that may have affected labor, delivery, and recovery following childbirth. This measure will be used in the present study to assess for total symptom count of endorsed maternal health factors that may have affected post-birth mother-infant experiences, including C-section delivery; complications associated with labor or delivery (e.g., preterm labor or fetal distress); use of additional interventions (e.g., stripping membranes or episiotomy); other surgeries during labor or delivery aside from a C-section (e.g., hysterectomy or tubal ligation); or a diagnosis of gestational or type 2 diabetes, high blood pressure, pre-eclampsia, or toxemia, hyper/hypothyroidism or any other type of thyroid disorder, group b strep, anemia, asthma, or an infection (e.g., bacterial vaginosis or urinary tract infection).

6-Month Infant Dietary Questionnaire. The 6-Month Infant Dietary Questionnaire (see Appendix D) is a 7-item self-report questionnaire that assesses for infant dietary information since the birth of the child. This questionnaire includes items based on the CDC's Infant Feeding Practices Study II (IFPS II; Fein et al., 2008). The sample for the CDC's Infant Feeding Practices Study II consisted of longitudinal data collected by mail from 500,000 households, of whom 4,900 were pregnant and 2,000 maintained enrollment through their infant's first year. The 6-Month Infant Dietary Questionnaire contains questions that assess for rates of breastfeeding, bottle feeding, and current foods commonly fed to the infant. It also assesses for any maternal complications and potential difficulties associated with different modes of feeding (e.g., baby no longer or never initiated breastfeeding due to difficulties with mother expressing enough milk). Mothers respond to whether they currently breastfeed or how many days, weeks, or months they breastfed. In the current study, the 6-Month Infant Dietary Questionnaire will assess for

breastfeeding. Specifically, the daily frequency of breastfeeding at 6 months postpartum will serve as an indicator of breastfeeding behaviors.

Infant Crying Questionnaire–Revised (ICQ-R). The ICQ-R (see Appendix E) is a 31-item self-report measure used for assessing maternal perceptions of infant crying behavior (Haltigan et al., 2012). The sample upon which the measure was normed consisted of 259 first-time mothers and their infants. Two of the participants did not complete the ICQ, thus resulting in a sample of 257 mother-infant dyads. The ICQ-R consists of prenatal (ICQ-R-Pre) and postnatal versions (ICQ-R-Post), which assess for perceptions prior to birth of the infant compared to attitudes about crying following delivery of infant and how maternal response to crying may influence infant development. Items range from *never* (1) to *always* (5) on a 5-point Likert-type scale. The ICQ-R is a consolidated version of the 43-item Infant Crying Questionnaire (ICQ). The ICQ contains 43 items and consists of six subscales, including three infant-oriented (Attachment, Crying as Communication, and Positive Adjustment) and three parent-oriented (Minimization, Spoiling, and Parent Esteem) subscales. Exploratory factor analysis on the ICQ determined factor structure (Haltigan et al., 2012). Investigators used maximum likelihood estimation and a *Promax* (oblique) rotation. Item loading was set to a value of .32 or higher and the factor solution was set to an upper boundary of six factors based on the previous validation of the original six ICQ subscales. Analysis of the factor structure resulted in the elimination of seven of the original items (5 cross-loading and 2 non-loading). After the investigators deleted these items, only one item loaded onto the Parent Esteem factor; thus, they subsequently removed the Parent Esteem factor. Haltigan et al. (2012) then conducted two additional sets of analyses with the intent of eliminating low-loading and cross-loading items. Following these sets of analyses, the authors deleted one cross-loading and three low-loading

items, resulting in 31 total items. The ICQ-R therefore consists of five subscales, including two infant-oriented subscales (Attachment and Crying as Communication) and three parent-oriented subscales (Minimization, Directive Control, and Spoiling).

Attachment contains eight total items and measures maternal desire to be emotionally close to one's baby to make him or her feel safe. Attachment items include: 1) wanting baby to know they can rely on mother for help, 2) wanting baby to feel secure, 3) wanting baby to feel better, 4) wanting baby to feel safe, 5) wanting to comfort baby, 6) wanting baby to feel safe and secure, 7) wanting baby to feel like they can rely on mother, and 8) wanting baby to feel like they care about how mother feels. Minimization assesses for maternal attitudes that one's baby is crying for attention. Directive Control is associated with maternal attitudes that parents should teach their infants to control their emotions. Crying as Communication measures maternal attitudes that infants are crying because they are trying to express a need to the mother. Spoiling measures maternal perception that responding too much to infant crying may result in the infant becoming dependent upon maternal response to infant signals. Investigation of the factor structure of the prenatal and postnatal versions of the ICQ-R demonstrated that the five subscales had adequate to high internal consistency with Cronbach's alpha ranging from .70 (Spoiling) to .83 (Attachment). Higher scores indicate increased infant- (e.g., Want to make my baby feel safe.) or parent-oriented (e.g., Want baby to stop b/c I can't get anything else done) attitudes. The present study will utilize the total score on the postnatal Attachment scale as an index of postnatal mother-infant attachment.

Hollingshead Four-Factor Index of Socioeconomic Status. The Hollingshead Four-Factor Index of Socioeconomic Status (see Appendix F) is a 12-item self-report questionnaire that assesses for factors that may affect the perception of social status or class in relation to

others within society. The current four-factor index is an elaboration of the two-educational and occupational factor index (Hollingshead, 1975). The original two-factor index was deemed to be outdated due to the limited list of occupations and because family status was primarily based on the head of household. The four-factor scale was validated by using the National Opinion Research Center's data on occupations and occupation group as well as educational and occupational data from the 1970 United States Census (Hollingshead, 1975). The current four factors include marital status, education, occupation, and biological sex. These factors include questions that assess for information such as total number of people in the home, yearly household income, and maternal/paternal education status. Marital status is associated with family status, but it is more likely to be stable versus factors such as education. Education is a reflection of overall acquired knowledge, which is likely to indicate a higher likelihood that one will gain employment in a socially desirable occupation. While occupation may be less stable during early adulthood, it is likely to stabilize by the time one reaches their thirties. Maintaining an occupation indicates that one possesses the necessary skills to maintain positions within society. Sex is consistent across the lifespan, but is often indicative of the roles to which one commonly ascribes in the society in which they live (Hollingshead, 1975).

Each of the four described domains are a reflection of unique elements within each factor. Marital status takes into account the current status of the individual or individuals being assessed (e.g., married and both partners working, divorced with one partner working and the other receiving financial support, retired from the work force, etc.). The educational factor contains seven scaled categories of completed education, ranging from a less than seventh grade education (score of 1) to a person that has completed graduate professional training (score of 7). The occupational factor rates individuals based on scale of 1 to 9, with a score of 1 indicating

farm labor or a service worker (e.g., attendant or produce sorters) and a score of 9 indicating business executives or proprietors of large businesses (e.g., aeronautical engineers and attorneys). The total score ranges between 8 and 66, with higher scores indicating higher status within society. Combining the four factors results in a total score. The total score of the interviewee produces the single-parent household total score, whereas two-parent households are computed by averaging the total score of the two parents. The current study will consider the Hollingshead Four-Factor Index of Socioeconomic Status as a potential control for SES (Hollingshead, 1975). SES will be compared to independent (IV) and the dependent (DV) variables included in the model using a series of Pearson correlations (marital status and occupation) and analysis of variances (ANOVA; education, SES, and parity) to determine if it is significantly correlated with any of them. If the described potential covariate does not significantly correlate with the IVs or DV, it will not be included in the model.

Pregnancy Context. The Pregnancy Context questionnaire is a 42-item self-report questionnaire that assesses for factors associated with current pregnancy (see Appendix G). It contains questions related to conception, prenatal care, past pregnancies, maternal health, relationship status, and current living conditions. The Pregnancy Context questionnaire will assess for parity in the current study. Parity is an important covariate to consider when evaluating maternal experiences during labor and delivery, as women giving birth for the first time are more likely to experience more complications during labor and delivery compared to women who have previously given birth (Collins et al., 1993). Many of the questions in the Pregnancy Context questionnaire were from the Pregnancy Risk Assessment Monitoring System (PRAMS; Robbins et al., 2014). The PRAMS is the product of a research project between the Division of Reproductive Health, the Center for Disease Control, and state departments of health. The most

recent version of the PRAMS includes 52 items that assess for maternal and infant factors that may provide indicators for infant health outcomes. Question 16 (“So overall, you have given birth to how many children?”) will be used as the assessment of parity in the present study.

Statistical Analyses

Figure 11. Proposed Prenatal Depression Model

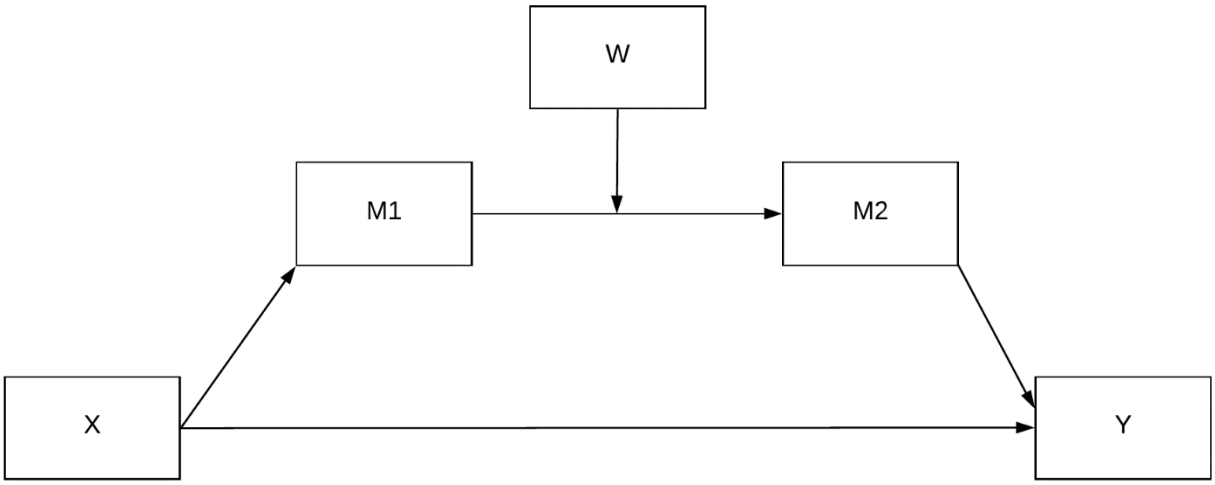

Figure 11. In this model, maternal prenatal depression is X, postnatal maternal physical health is M_1, breastfeeding is M_2, postnatal social support is W, and maternal-infant attachment is Y.

Figure 12. Proposed Prenatal to Postnatal Depression Change Model

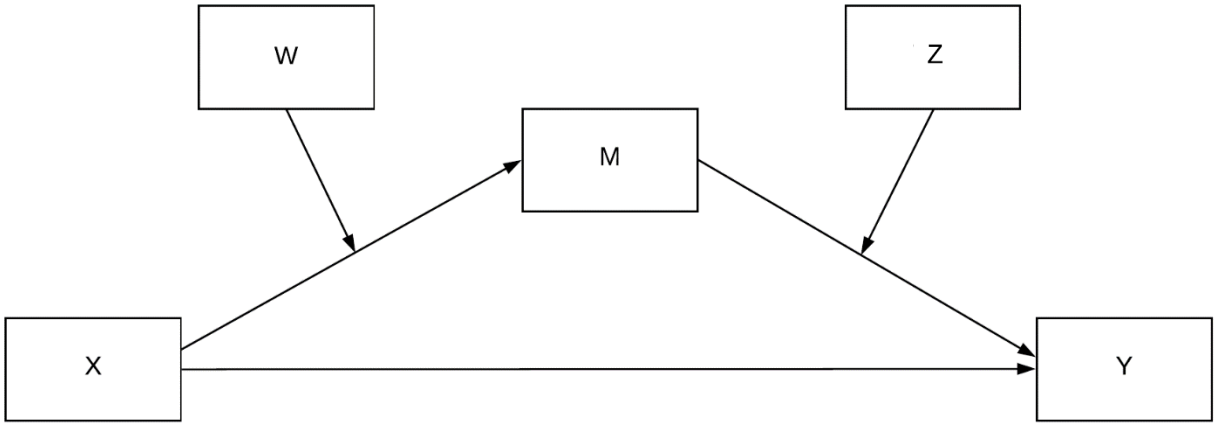

Figure 12. In this model, maternal prenatal to postnatal change in depression is X, postnatal maternal physical health is W, breastfeeding is M, social support is Z, and maternal-infant attachment is Y.

Regression Assumptions

Prior to completing the proposed analyses, univariate normality of the data was assessed by examining missing responses, skewness, kurtosis, outliers, and range restriction. The evaluation of missing data occurred on a case-by-case basis, depending on type of data that is missing. The only missing data in the present study relied on a single observation (e.g., presence or absence of breastfeeding), and different methods of handing missing data were considered prior to completing final analyses (see Results section for specific details about how missing data was handled).

Model Testing

Moderated mediation analyses for proposed prenatal and postnatal mental health difficulties utilized Hayes' (2017) PROCESS macro, version 3. Version 3 of PROCESS was required because the proposed analysis requires a combination of models 6 and 8 to test the

moderation of the direct effect between maternal depression and attachment as well as the moderation of the indirect path due to the serial mediation among maternal mental health, physical health, breastfeeding, and attachment. Two models, one with depression measured prenatally (see Figure 11) and one with a prenatal to postnatal depression score change (see Figure 12) were estimated, testing the above 10 hypotheses. The product of coefficients approach was computed in Model 1, through which the indirect effect of X on Y was calculated based on the product of the paths between X (prenatal maternal depression) and M1 (postnatal maternal physical health), M1 (postnatal maternal physical health) and M2 (breastfeeding duration) moderated by W (postnatal social support), and M2 (breastfeeding duration) and Y (postnatal attachment; see Figure 11). Similarly, the product of coefficients approach was also computed in Model 2, through which the indirect effect of X on Y is calculated based on the product of the paths between X (prenatal to postnatal maternal depression change) and M (breastfeeding duration) moderated by W (postnatal maternal physical health) and M (breastfeeding duration) and Y (postnatal attachment) moderated by Z (postnatal social support; see Figure 12). A 95% confidence interval was used to test the significance of the indirect effect. Given the continuous nature of all variables being tested, PROCESS was a good method to use due to the sampling methods involved in bootstrapping, which is the method used for this type of analysis. A bootstrapped sample in which the data was sampled with replacement approximately 5,000 times was used in the analyses. This method sampled using existing variability within the data. Biased-corrected 95% confidence intervals were obtained by this sampling and resampling method. Biased-corrected 95% confidence intervals adjusted the endpoints of the confidence intervals. This method is considered more accurate than percentile intervals due to this adjustment. If the intervals contained 0, the null was retained, indicating that the indirect effect of X on Y was not

significant at a *p*-value less or equal to 0.05. The analyses tested the indirect effect of X on Y through the described moderators, effects that were conditional upon the described mediators in the proposed models. The "index of moderated mediation" and "index of moderated moderated mediation" were used to measure the overall model effects for Models 1 and 2, respectively. As described above, if the confidence intervals for these indices contain 0, this indicates that the overall model is not significant (Hayes, 2017).

Results

Regression Assumptions

Prior to completing the proposed analyses, univariate normality of the data was assessed by examining missing responses, skewness, kurtosis, outliers, and range restriction. Preliminary analyses of the data indicated that four of the 96 participants did not provide a response to the item on the 6-Month Infant Dietary Questionnaire that gauged maternal breastfeeding frequency. No other values were missing from the dataset; however, three of the 92 mothers who provided a numeric response for total number of infant feedings per day listed a range of values (e.g., "8 to 10 times a day"). When participants provided a range of total feedings per day, the average of the provided range was computed as the participant's final answer (e.g., the average of 8 and 10 yields a final participant response of 9 feedings per day). Little's Missing Completely at Random (MCAR) test was then computed to determine whether the missing data was supported as missing at random. Results (χ^2=9.072, df=4, *p*=.059) were not significant, which supported that the missing values were missing at random. Therefore, the four missing values were imputed using the expectation maximization method. Expectation maximization was a good method because it produces maximum likelihood estimates through expectation (E) and maximization (M) steps. The E step obtains iterations of missing cases one-by-one by estimating missing

values based on other variables that are present in the model, and then the M step in the same iteration computes parameters (e.g., variances and covariances) based on the likelihood computed during the E step. This process continues until the covariance matrices converge (Graham, 2009). While listwise deletion was a viable option due to the small number of missing values in the present study, Graham (2009) recommended the use of data imputation even if listwise deletion may result in only a marginal loss of power.

Casewise diagnostics revealed no outliers (±3 *SD*). The attachment variable had a substantial negative skew, the social support variable had a severe negative skew, and the EPDS prenatal depression variable had a moderate positive skew based on initial computed values and a review of frequency histograms (e.g., view of distribution on frequency histogram for EPDS data indicated the above interpretation; see Appendix H for skewness and kurtosis values of skewed variables prior to data transformation). According to Muthén and Kaplan (1985), any skewness or kurtosis values less than -2.00 or greater than 2.00 are likely to distort results of analyses (e.g., distortions of standard errors). Therefore, these variables were transformed using a reflected natural logarithm transformation for attachment, reflected and inverse transformation for social support, and square root transformation for prenatal depression prior to subsequent analyses (see Appendix I for skewness and kurtosis values after data transformation; Tabahnick & Fidell, 2013). Skewness and kurtosis values indicated data transformation assisted with normalizing the data. Remaining regression assumptions tested following transformation included using residual plots to test for homoscedasticity and normality of residuals, frequency histograms to test for normality of distribution, and scatterplots to assess for the absence of range restriction and to support linearity. None of these assumptions were violated, and reflected

variables were reflected again prior to final analyses to provide accurate interpretation for directions of effect.

Since preliminary analyses indicated that data imputation was an acceptable method to use based on the type of missing data, subsequent results were interpreted based on the sample of 96 participants to maintain maximum power. A more thorough estimate of the data was also provided, as models 1 and 2 for the current primary hypotheses were tested with 96 participants (missing data imputed) and 92 participants (removal of participants from the dataset who did not provide maternal breastfeeding information on the 6-Month Infant Dietary Questionnaire) to provide an indication of whether data imputation significantly affected the interpretation of results.

Descriptive Statistics

Imputed sample of 96 participants. The majority of participants in the sample of 96 mothers identified as European-American (81%), married (84%), employed (59%), and multiparous (59%). The average maternal age was 27.22 years (*SD*=3.99 years; range=18-36 years at 6-month postnatal follow-up). The sample was also well-educated, with the largest percentage of mothers identifying as educated with a 4-year college or university degree (39%). The modal family income was between $50,000-$74,999 per year (29%). Most mothers planned their pregnancy (70%; see Appendix J).

Based on the raw scores reported by participants, the average depressive symptomology score, as measured by the EPDS, was 4.89 (*SD*=3.91) out of a possible 30. The average prenatal to postnatal difference in depressive symptomology, as measured by the difference between the prenatal and 6-month postnatal responses on the EPDS, was 0.07 (*SD*=3.52), which indicated a slight decrease in the average symptomology of maternal depression postnatally from prenatal

symptomology. Based on preliminary analyses of the means of prenatal and postnatal EPDS scores, and recommended use of absolute values for such scores, postnatal was subtracted from prenatal to provide a positive mean difference (Vickers, 2001). The average maternal postnatal ICQ-R attachment scale score was 37.71 (*SD*=2.95) out of a possible score of 40 points. Participants reported an average postnatal social support satisfaction score, as measured by the SSQ-6, of 5.41 (*SD*=0.91) out of a possible 6 points. Mothers also reported an average of 2.04 (*SD*=1.49) postnatal maternal health complications and an average of 4.68 (*SD*=3.69) infant feedings per day at 6 months postpartum. Approximately 69% of mothers in the imputed sample continued feeding their infants through their 6-month postnatal session. Descriptive statistics for the sample of 92 participants were comparable to the imputed sample of 96 participants (see Appendix J).

Correlations

Computation of univariate Pearson correlations between predictor variables (prenatal depressive symptomology, prenatal to postnatal change in depressive symptomology, postnatal maternal health, breastfeeding frequency 6 months postpartum, and postnatal maternal social support), the dependent variable (attachment), and potential covariates (parity and socioeconomic status) indicated only one significant relationship between one set of variables. Parity was significantly related to maternal breastfeeding frequency at 6 months postpartum (Pearson r=0.277, p<0.01). Since none of the potential covariates significantly correlated with both predictor and outcome variables, they were not included in the model analyses.

Primary Analyses

Hypothesis 1a. *Controlling for maternal health, maternal satisfaction with social support, breastfeeding frequency, and the interaction between maternal health and satisfaction*

with social support, fewer symptoms of prenatal maternal depression, as measured by lower scores on the EPDS, will be associated with greater maternal-infant attachment, as measured by higher attachment scores on the ICQ-R, in the model.

Participant results. Using the full sample of participants, prenatal maternal depression was negatively related to maternal-infant attachment (*b*=-0.085, *t*[93]=-2.391, *SE*=0.036, *p*=0.019; see Appendix K) such that mothers who endorsed less depressive symptoms had higher attachment scores. The sample of 92 participants produced comparable results (see Appendix L).

Hypothesis 1b. *Fewer symptoms of prenatal maternal depression, as measured by lower scores on the EPDS, will be associated with fewer maternal physical health complications, as measured by the 6-month Postnatal Session Screener, in the model.*

Participant results. Using the imputed sample, maternal depression was not associated with postnatal maternal health complications (*b*=-0.010, *t*[94]=-0.062, *SE*=0.157, *p*=0.950; see Appendix K). The sample of 92, similarly, did not support the hypothesized relationship (see Appendix L).

Hypothesis 1c. *Controlling for prenatal depression, postnatal maternal perceptions of social support, as measured by the SSQ-6, will moderate relations between maternal physical health and maternal breastfeeding frequency in the model. In other words, mothers who endorse greater dissatisfaction with current social support (as indicated by the average rating across social support items) will have stronger relationships with more physical health complications (as indicated by presence of maternal physical health complications during labor, delivery, and/or post-delivery) and decreased frequency of feedings at 6 months postpartum. The interaction between maternal physical health and postnatal maternal social support (as measured by the SSQ-6) will mediate relations between greater prenatal maternal depression*

and less frequent breastfeeding (as measured by the 6-Month Infant Dietary Questionnaire) in the model.

Participant results. The interaction between maternal physical health and postnatal social support was not significantly related to breastfeeding (b=1.546, t[92]=1.462, SE=1.058, p=0.147; see Appendix K). The interaction between maternal physical health and social support also did not mediate relations between prenatal maternal depression and breastfeeding in the imputed sample of 96 mothers. The data supported this conclusion regardless of whether mean-centered transformed values of social support were one standard deviation below the mean (-0.253; CI=-0.277 to 0.116), at the mean (0.000; CI=-0.110 to 0.058), or at the highest level of social support (0.243; CI=-0.136 to 0.173), per examination of the conditional indirect effect. Comparable results were supported with the sample of 92 participants (see Appendix L).

Hypothesis 1d. *Controlling for prenatal depression, breastfeeding will mediate relations between the interaction between maternal physical health and postnatal social support and maternal-infant attachment in the model. For mothers who endorse greater dissatisfaction with current social support (as indicated by the average rating across social support items), they will have stronger relationships with more physical health complications (as indicated by presence of maternal physical health complications during labor, delivery, and/or post-delivery) and decreased frequency of feedings at 6 months postpartum, which will predict poorer maternal-infant attachment.*

Participant results. In the imputed sample, breastfeeding did not mediate relations between the interaction between maternal physical health and postnatal maternal satisfaction of social support and maternal-infant attachment (b=0.003, t[93]=0.261, SE=0.009, p=0.795; see Appendix K). The data supported this conclusion regardless of whether mean-centered

transformed values of social support were one standard deviation below the mean (-0.253; *CI*=-0.015 to 0.008), at the mean (0.000; *CI*=-0.006 to 0.006), or at the highest level of social support (0.243; *CI*=-0.007 to 0.011), per examination of the conditional indirect effect. The sample of 92 mothers did not support breastfeeding as mediating relations between the interaction between postnatal maternal physical health complications and postnatal maternal satisfaction of social support and maternal-infant attachment (see Appendix L).

Hypothesis 1e. *The overall model will explain a statistically significant amount of variance in maternal-infant attachment.*

Participant results. The "index of moderated mediation" was used to test the proposed overall conceptual model for the imputed sample of 96 mothers. The 95% Bias Corrected confidence intervals (CIs) included zero (Index=<0.001; 95% CI=-0.005 to 0.005), which indicated the "index of moderated mediation" was not significant.

Hypothesis 2a. *Controlling for maternal health, breastfeeding frequency, maternal satisfaction with social support, the interaction between depression and maternal health, and the interaction between breastfeeding and satisfaction with social support, fewer symptoms of maternal depression, as measured by the prenatal to postnatal change in EPDS depressive symptomology, will be associated with greater maternal-infant attachment, as measured by higher attachment scores on the ICQ-R, in the model.*

Participant results. Using the full sample of participants, prenatal to postnatal change in maternal depression was not associated with maternal-infant attachment (*b*=-0.003, *t*[91]=-0.330, *SE*=0.010, *p*=0.742; see Appendix M). Similar results were produced with the sample of 92 mothers (see Appendix N).

Hypothesis 2b. *Postnatal (i.e., 6-month postpartum) maternal physical health complications will moderate relations between prenatal to postnatal change in EPDS depressive symptomology and breastfeeding frequency in the model. In other words, for mothers with more physical health problems (as indicated by labor, delivery, and post-delivery health complications), those who endorse greater increases in depressive symptoms from the prenatal to postnatal period will breastfeed less frequently at 6 months postpartum.*

Participant results. Using the sample of 96 mothers, postnatal maternal physical health did not moderate relations between prenatal to postnatal change in EPDS depressive symptomology and 6-month breastfeeding frequency (*b*=-0.002, *t*[92]=-0.030, *SE*=0.073, *p*=0.976; see Appendix M). The smaller sample of 92 mothers, comparably, did not support the proposed hypothesis (See Appendix N).

Hypothesis 2c. *Controlling for prenatal to postnatal depressive symptomology, postnatal health complications, and the interaction between maternal depression and health, postnatal maternal social support will moderate relations between breastfeeding frequency and maternal-infant attachment. For mothers who endorse increased satisfaction with current social support, they will have stronger relations between more frequent 6-month postnatal breastfeeding and greater maternal-infant attachment.*

Participant results. The interaction between breastfeeding frequency and satisfaction with social support (*b*=-0.081, *t*[91]=-2.252, *SE*=0.036, *p*=0.027) was significantly related to maternal-infant attachment (see Appendix M). Follow-up tests of the interaction (i.e., simple slopes analysis) were performed using the non-transformed data to provide more interpretable results. Model results computed using the raw data were consistent with the results of the transformed data (see Appendices O and P).

Results of the mean centered simple slopes analysis of the raw data indicated that when maternal satisfaction with social support was one standard deviation below the mean (4.50, or participants endorsing being "a little satisfied" with the quality of received social support at 6 months postpartum; b=0.279, t[91]=-2.454, p=0.016), one additional breastfeeding session per day at 6 months postpartum increased maternal-infant attachment by 0.279 points. When mothers had average social support (5.41, or participants endorsing being "fairly satisfied" with the quality of received social support at 6 months postpartum; b=0.062, t[91]=0.757, p=0.451) or social support at the sample's maximum value (6.00, or participants endorsing being "very satisfied" with the quality of received social support at 6 month postpartum; b=-0.078, t[91]=-0.746, p=0.458), there was no relationship between breastfeeding frequency and attachment (see Appendix O). The 96 mothers in the study, overall, endorsed high levels of social support, with 11 mothers reporting social support satisfaction scores at or below 4.50, 47 mothers endorsing a score between 4.51 and 5.99, and 38 mothers reporting a social support satisfaction score of 6.00. The Johnson-Neyman technique for identifying regions of significance indicated that when mothers endorsed social support values of 4.918 or lower (n=16; proximally "fairly satisfied" with received social support at 6 months postpartum), 6-month breastfeeding frequency and attachment are significantly related. Results also produced 30 mothers reporting a breastfeeding frequency at or below 0.99, 50 mothers endorsing a breastfeeding frequency between 1.00 and 8.42, and 16 mothers reporting a breastfeeding frequency at or above 8.43. The sample of 92 mothers also supported the findings of the sample of 96 mothers (see Appendices N, Q, and R).

Hypothesis 2d. *The conditional indirect effect will be statistically significant such that the interaction between postpartum maternal breastfeeding frequency and maternal social support (as measured by the SSQ-6) will mediate relations between the interaction between*

maternal depression change and maternal physical health and maternal-infant attachment in the model. In other words, for mothers with more physical health problems, those who endorse greater increases in depressive symptoms from the prenatal to postnatal period will breastfeed less frequently at 6 months postpartum, which will interact with maternal social support such that for mothers who endorse increased satisfaction with current social support, more frequent 6-month postnatal breastfeeding will predict greater maternal-infant attachment.

Participant results. The conditional indirect effect between prenatal to postnatal change in maternal depressive symptomology and postnatal maternal perceptions of mother-infant attachment was assessed by mean centering all variables included in the interaction terms, including change in depression, health, breastfeeding frequency, and social support. Mean centering provided easy reference values for each predictor, thus increasing the interpretability of the analyzed model (Shieh, 2011). Results indicated that all CIs included zero (see Appendix S) in the sample of 96 participants, which indicated that the conditional indirect effect was not statistically significant. Comparably, the sample of 92 mothers produced similar results (see Appendix T).

Hypothesis 2e. *The overall model will explain a statistically significant amount of variance in maternal-infant attachment.*

Participant results. The "index of moderated moderated mediation" was used to test the proposed overall conceptual model for the sample containing 96 participants. The CIs included zero (Index=<0.001; 95% CI=-0.015 to 0.013), which indicated the "index of moderated moderated mediation" was not significant.

Discussion

Study Findings

Descriptive statistics. While the average maternal age was 27.22 in the present sample, this is not surprising given that women are waiting until later in life to have their first child than they were several decades ago; for example, the average maternal age for first-time mothers was 21.40 in 1970, whereas the average age had increased to 25 years as of 2006 (Mathews & Hamilton, 2009). Additionally, current sample exclusion criteria included a maternal age under 18 based on unique perinatal concerns associated with teen pregnancy; as such, this may have led to a relatively greater mean age at pregnancy. The high level of average education in the present sample may have also played a role, as mothers who have 12 or more years or education are more likely to delay their first birth than their less-educated peers (Heck, Schoendorf, Ventura, & Kiely, 1997). It is possible that limited sample variability (e.g., similar ethnicity, high level of education, and relationship status) also contributed to non-significant results. Especially noteworthy with the present sample was that 84% of participants identified as married; this may have played a major role in final analyses, particularly since previous research has supported marriage as a contributing factor toward increased mother-infant attachment beyond other demographic variables (e.g., education or maternal age; Rosenkrantz Aronson & Huston, 2004). Married mothers may also benefit from more positive infant outcomes, as previous research has supported that marriage is robustly related to decreased risk of infant mortality and full-term birth (Shah, Zao, & Ali, 2011). Interestingly, 83% of mothers in the imputed sample of 96 mothers endorsed an average social support satisfaction score of 5.00 or higher (out of a possible 6.00), indicating a high level of satisfaction with the quality of postnatal social support that

participants were receiving at 6 months postpartum. Similarly, 95% of mothers endorsed a perceived mother-infant attachment score of 32 or higher (with a possible range of 8 to 40).

Correlation with covariates. Neither SES nor parity were significantly correlated with postnatal maternal-infant attachment. Collins and colleagues (1993) indicated that higher quality of social support may buffer against SES factors. Since higher levels of social support interacting with higher levels of breastfeeding was significantly related to increased attachment, this finding supports that social support may be a more robust predictor of attachment outcomes than SES, which may at least partially explain the null findings with regard to covariates. Limited sample variability in parity may have limited findings in the present study, particularly given that most mothers in the imputed sample had 2 or fewer children (84%), with the modal number of moms indicating their current pregnancy was their first (39%; see Appendix J).

As previously noted, parity was significantly related to 6-month postpartum breastfeeding frequency such that greater parity led to more frequent breastfeeding with the current sample. This is consistent with previous research that has suggested that breastfeeding support should target primiparous mothers, as they are more likely to experience delays in breastfeeding initiation and earlier cessation than multiparous mothers (Hackman, Schaefer, Beiler, Rose, & Paul, 2015). Findings in the present study are also somewhat paradoxical, given the large number of first-time mothers who participated (41%) and the high percentage of mothers still breastfeeding through 6 months postpartum (69%). However, increased quality of social support was a significant moderator of breastfeeding behaviors in the present study, and the current sample overwhelmingly reported they were receiving high quality social support.

While mothers who have previously given birth are more likely to have fewer complications during labor and delivery than first-time mothers (Collins et al., 1993), postnatal

maternal health was not significantly related to breastfeeding frequency at 6 months postpartum in the present sample. It is possible that limited variability in existing maternal health problems may have affected this outcome in the present study, as mothers who were at an increased risk of complications during labor or delivery were excluded from the present study (e.g., mothers older than 35 years, expecting more than one child, taking category C or X medications, or with preexisting severe/chronic physical health diagnoses such as diabetes or hepatitis). Alternatively, limited variability in breastfeeding behaviors could have been a factor. Since the majority of mothers continued breastfeeding through 6 months postpartum, this offered additional support that the present sample of women was healthy. Existing literature supports that mothers who are at risk of not initiating or ceasing breastfeeding are likely to be overweight, have preexisting medical conditions, or increased labor and delivery complications (Guelinckx, Devlieger, Beckers, & Vansant, 2008; Kitsantas & Pawloski, 2010); in fact, mothers who are overweight or obese prior to pregnancy have evidenced an 11% increased risk of cessation of breastfeeding per month compared to women whose body weight is within normal limits (Kitsantas & Pawloski, 2010).

One additional noteworthy factor is that community samples, such as the samples in the present study, may merit additional considerations for clarifying maternal health conditions that may put mothers and infant at risk for bonding difficulties. The PRAMS (Robbins et al., 2014) accounts for a multitude of maternal health conditions, including type I or II diabetes, hypertension, gestational diabetes, asthma, anemia, heart problems, epilepsy, thyroid problems, polycystic ovarian syndrome, the flu, substance use, sexually transmitted diseases, and cancer. The 2016 Idaho Pregnancy and Risk Assessment Tracking System's (PRATS) annual report (PRATS, 2018) also accounts for how often mothers exercise for 30 minutes or more per day

during their final trimester of pregnancy. While total count of dichotomous yes/no categories of health complications were used in the present study, the categories of symptoms may not have accounted for the array of health conditions that may be most salient when considering maternal-infant attachment.

Hypothesis 1a (Controlling for maternal health, maternal satisfaction with social support, breastfeeding frequency, and the interaction between maternal health and satisfaction with social support, fewer symptoms of prenatal maternal depression will be associated with greater maternal-infant attachment). A strong body of literature indicates that prenatal maternal depression has the potential to decrease maternal-infant bonding (e.g., Lefkovics, Baji, & Rigó, 2014; McFarland et al., 2011). Increased prenatal maternal depressive symptomology, in the present study, was associated with maternal perceptions of poorer infant attachment. This indicates that mothers who experience an increase in prenatal depressive symptomology may be particularly at risk of developing poorer attachments with their infants; in fact, additional follow-up analyses with untransformed data indicated that when controlling for other variables, a one unit increase in maternal prenatal depressive symptomology resulted in a 0.182 point decrease in postnatal maternal-infant attachment (results with the sample of 92 mothers similarly supported these findings; see Appendices U and V, respectively). This outcome offers additional support to the findings of Field (1998), such that infants of mothers who experience prenatal maternal depression may be at an increased risk of developmental dysregulation. As previously described, the bidirectional relationship between mother and child involves the mother to providing care to the infant, the infant responding to the mother's care, and the continued sequence of reciprocal responsiveness to subsequent behavioral cues (Sullivan et al., 2011). When maternal perception is negatively skewed due to depressive symptomology,

mothers may be less vigilant, less sensitive to infant needs, and more controlling (Fox & Gelfand, 1994), which could lead to reciprocal negative feedback loop. Overall, current study findings replicated existing literature using a longitudinal community sample from rural Idaho using the ICQ-R (Haltigan et al., 2012), a relatively novel measure of mother self-reported perceptions of maternal-infant attachment.

According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association [APA], 2013), the 12-month prevalence of Major Depressive Disorder in the United States is approximately 7%, with 18- to 29-year-old individuals being 3 times more likely to experience a major depressive episode than people who are 60 years or older. Similarly, between 3% and 6% of women will experience an onset of major depressive symptoms during the perinatal period, with 50% of cases occurring prior to delivery (APA, 2013). Roughly 11% of participants obtained a prenatal score of 10 or higher on the EPDS, with 8% of mothers scoring 12 or higher. Cox and colleagues (1987) recommended a cutoff score of 12 for the EPDS, with speculation that a score of 10 may be appropriate if primary care workers routinely used the scale. While the cited *DSM*-5 information indicates as many as 6% of expectant and new mothers meeting threshold for a major depressive episode during the perinatal period (APA, 2013), additional available evidence suggests that as many as 13% of women may experience a new episode of major or minor depression prenatally, while 19% of new mothers may experience a new episode of major or minor depression postnatally (Gavin et al., 2005). When using the recommended EPDS cutoff score of 12, in the present prenatal sample (8%), women primarily within the age range most susceptible to a major depressive disorder endorsed relatively low incidence of clinically elevated depressive symptoms compared to other samples of women who have endorsed depressive symptomology (13%;

Gavin et al., 2005). Given that the present sample had subclinical levels of depression, yet demonstrated a significant relation between prenatal depression and postnatal perception of attachment, this provides evidence that healthcare providers may need to use conservative estimates when assessing for perinatal depressive symptomology and/or the effects that these symptoms have on maternal-infant relationships.

Hypothesis 1b (Fewer symptoms of prenatal maternal depression will be associated with fewer maternal physical health complications). Contrary to hypotheses, mothers who endorsed increased prenatal depressive symptomology did not experience significantly more postnatal health complications. One potential explanation could be the method by which postnatal health complications were measured. Participants responded to a series of 6 yes/no inquiries that provided markers for maternal health complications, including whether mothers: 1) experienced complications during labor, 2) experienced complications during delivery, 3) delivered by C-section, 4) required interventions during labor and delivery, 5) experienced complications post-delivery, or 6) had surgeries aside from a C-section. Dichotomous endorsement of such items that were added to achieve a total number of health complications (range of scores from 0 to 6) may have led to limited differentiation among possible complications that mothers could have experienced (e.g., tubal ligation vs. hysterectomy). Therefore, these conditions likely varied in severity and the degree to which prenatal depression and related affective, cognitive, and behavioral changes during pregnancy may impact perinatal/postnatal health.

Hypothesis 1c (Controlling for prenatal depression, postnatal maternal perceptions of social support will moderate relations between maternal physical health and maternal breastfeeding frequency in the model). Postnatal social support did not moderate the

relationship between maternal health complications and breastfeeding. Since specific medical interventions, namely C-sections, have been associated with decreased likelihood of mothers initiating breastfeeding (Pérez-Escamilla et al., 1996), consolidating labor, delivery, and postnatal complications into dichotomous yes/no categories and adding them to define the current study variable possibly led to limited understanding of the severity and chronicity of health complications mothers experienced and, therefore, the subsequent relation between physical health and breastfeeding behaviors. While the main effect of physical health was not significant, potentially as a result of limited variability in conditions endorsed (e.g., categorical rather than individually), the distribution of social support may have further contributed toward non-significant interaction effect findings.

Social support had a severe negative skew, which indicated that the majority of participants were satisfied with their quality of received social support at 6 months postpartum. An overall lack of variability in both maternal health complications and social support potentially limited results that may have been seen in a community sample of mothers with greater variability in social support and other key variables. Alternatively, the interaction between maternal health complications and postnatal social support may not be related to breastfeeding outcomes (see Future Directions for recommendations on how to test these hypotheses regarding null findings).

Hypothesis 1d (Controlling for prenatal depression, breastfeeding will mediate relations between the interaction between maternal physical health and postnatal social support and maternal-infant attachment in the model). The paths between the interaction between physical health and social support, breastfeeding, and maternal-infant attachment in

Model 1 were not significant. These non-significant findings may have been due to several factors.

The findings between the interaction and the mediator could be due to the limited variability of the present data. Previous studies have supported social support programs as a potential moderator of relations between adverse perinatal physical health complications and maternal-infant attachment; for example, even when mothers and their children have experienced adverse conditions, such as being the victim of physical violence or coming from a low SES background, stronger social support has been associated with favorable perceptions of maternal-infant attachment (e.g., Cacioppo & Hawkley, 2003; Uchino, 2009). Contrary to current study hypotheses, this moderated relationship was not supported. As previously described, it is possible that the measure of maternal health did not accurately represent variations in participant health complications; as such, the relationship between postnatal maternal health, social support, and subsequent breastfeeding behaviors may not have been fully captured in the proposed prenatal depression model (Model 1). The high level of self-reported quality of postnatal social support may have also played a factor, as the majority of mothers ranked their satisfaction with current social support as very high. One final consideration, as previously noted, is that postnatal social support may not moderate the relationship between postnatal maternal health and breastfeeding behaviors.

The lack of a significant relationship between breastfeeding and mother-infant attachment was particularly unexpected. Since breastfeeding has been associated with secure mother-infant relationships (Bretherton, 1992) and increased maternal sensitivity (Johnson, 2013), a significant association between breastfeeding and self-reported maternal-infant attachment was anticipated in the present study. The lack of significant findings may have been due to the abovementioned

limited variability in breastfeeding duration and attachment in the present sample. Additionally, this may also be attributed to the myriad reasons why women cease breastfeeding, which may not all be related to maternal-infant attachment. For example, common reasons mothers discontinue breastfeeding during the first year postnatally include maternal perception that breastmilk alone does not satisfy their baby (Li, Fein, Chen, & Grummer-Strawn, 2008), inconvenience or fatigue associated with breastfeeding (Brown, Dodds, Legge, Bryanton, & Semenic, 2014), maternal anxiety surrounding breastfeeding abilities or milk supply (Gatti, 2008), or returning to school or work by or before 12 weeks postpartum (Taveras et al., 2003). Johnson (2013) highlighted how breastfeeding as early as within the first 2 hours postnatally may lead to increased maternal sensitivity, meaning that even if mothers did not continue breastfeeding through 6 months postpartum that they may have developed a comparably high level of maternal sensitivity to mothers who engaged in breastfeeding though the 6-month postnatal session if they endorsed ever breastfeeding their infant.

Hypothesis 1e (The overall model will explain a statistically significant amount of variance in maternal-infant attachment). Model 1 was not statistically significant. In addition to many of the individual pieces of the model being non-significant, which may have been related to limited variability of certain variables in the current sample, another possible explanation is that the present model did not fully capture the complex relationship among the outlined study variables. The association between maternal depressive symptomology and maternal physical health highlights an example of how such relationships may be more complex than modeled with the current study variables. While adverse maternal mental health has been associated with a host of poor postnatal maternal health outcomes (e.g., Federenko & Wadhwa, 2004; Sidor at al., 2011; Woods et al., 2010), maternal pre-pregnancy and prenatal health may

just as likely influence prenatal maternal mental health (e.g., Henrichs et al., 2010); for example, women who are overweight or obese prior to pregnancy are at an increased risk of developing antenatal or postnatal depression compared to their normal-weight peers (Guelinckx et al., 2008). Additionally, the proposed association among the study variables captured in this relatively novel model of maternal-infant attachment may not exist. Inclusion of the aforementioned pre-pregnancy variables in more comprehensive longitudinal models may clarify the timing and nature of factors that most robustly influence maternal-infant attachment.

One final factor worth noting is that regardless of whether the analysis of Model 1 included the imputed sample of 96 mothers or the 92 mothers who provided complete responses, the previously mentioned results were consistent.

Hypothesis 2a (Controlling for maternal health, breastfeeding frequency, maternal satisfaction with social support, the interaction between depression and maternal health, and the interaction between breastfeeding and satisfaction with social support, fewer symptoms of maternal depression will be associated with greater maternal-infant attachment). The average prenatal to postnatal change (-0.07 [*SD*=3.52]) indicated an overall non-significant minor decrease in depressive symptomology from the third trimester of pregnancy to six months postpartum. This overall minimal change between prenatal and postnatal depressive symptoms may have contributed toward non-significant findings.

Within existing literature, prenatal depressive symptomology has been robustly associated with increased likelihood of regulatory system dysfunction in infants (Field, 1998), and postnatal depression is often correlated with increased likelihood that mothers will perceive their children as having a conduct disorder and report decreased attachment by or before the time their child is 8 years old (Webster-Stratton & Hammond, 1988). The present study's results

indicated that mothers' shift in prenatal to postnatal depressive symptomology was unrelated to perceptions of bonding with their infants. While these results were contrary to anticipated results, it is worth noting that many of the previously described studies that supported a significant change in maternal depressive symptomology used cross-sectional data or low cutoff scores on measures used to assess maternal depression (e.g., Stratton & Hammond, 1988).

Mothers in the present sample had lower incidence of postnatal depression than other community samples (Gavin et al., 2005) and exhibited a high prevalence of breastfeeding, which may have presented as a postnatal protective factor against depression. Alternatively, expectant mothers may be more at risk for increased levels of perinatal depression during the latter stages of pregnancy than they are postnatally. This explanation would be consistent with previously cited evidence that symptoms of postnatal depression may begin prior to giving birth (APA, 2013) as well as evidence that first-time mothers, in particular, are likely to exhibit an increase in depressive symptomology from the third trimester of pregnancy until the postnatal period (Figueiredo & Conde, 2011). The small decrease in prenatal to postnatal change in depressive symptomology in the present sample may support this hypothesis, as increased prenatal maternal depression was significantly associated with decreased mother perceptions of maternal-infant attachment in Model 1, but Model 2 did not indicate a significant relationship between prenatal to postnatal change in depression and maternal-infant attachment (see Future Directions for recommendations on how to clarify the relations between antenatal depression, postnatal depression, and maternal-infant attachment).

Hypothesis 2b (Postnatal maternal physical health complications will moderate relations between prenatal to postnatal change in EPDS depressive symptomology and breastfeeding frequency in the model). The null interactive relationship between changes in

depression and physical health difficulties in reference to breastfeeding frequency may be due to several factors. The lack of a relationship between prenatal to postnatal changes in depressive symptomology at different values of postnatal maternal health complications may be due to the combined limited variance among both change in depression and maternal health complications. The present sample was relatively healthy, in terms of both physical and mental health factors. Exclusionary criteria, in particular, is one likely reason such relations are not present in the current study. The hypothesized moderating effect of maternal health complications may also not be significantly related to breastfeeding outcomes. There may also be another variable not accounted for in the present study that attenuates relations between perinatal maternal health complications and breastfeeding frequency, such as access to healthcare or prenatal and postnatal self-care or education materials. Previous research, for example, has indicated that racial/ethnic disparities (Hogan, Njoroge, Durant, & Ferre, 2001; Shi, Stevens, Wulu Jr, Politzer, & Xu, 2004) and rurality (Nesbitt, Connell, Hart, & Rosenblatt, 1990) may be adversely related to access of healthcare for expectant and new mothers. These differences are evident, even when mothers may have access to low- or no-cost essential health services (Joseph, Liston, Dodds, Dahlgren, & Allen, 2007). Utilizing such services may increase maternal likelihood of breastfeeding, as community-based health and counseling programs have previously been associated with increased breastfeeding initiation and duration (Olson, Haider, Vangjel, Bolton, & Gold, 2010).

Hypothesis 2c (Controlling for prenatal to postnatal depressive symptomology, postnatal health complications, and the interaction between maternal depression and health, postnatal maternal social support will moderate relations between breastfeeding frequency and maternal-infant attachment). The interaction between breastfeeding and postnatal satisfaction with social support, as hypothesized, was significantly related to maternal

perceptions of postnatal mother-infant attachment. Greater breastfeeding frequency was related to higher attachment scores, but only when mothers endorsed lower-perceived quality of social support. When mothers perceived that their social support was one standard deviation below the sample average, increasing breastfeeding frequency resulted in a statistically significant improvement in perceived postnatal attachment. This provides additional evidence on the importance of monitoring social support (e.g., Collins et al., 1993) and provides support that mothers who endorse lower satisfaction with social support may strengthen their self-reported bond with their infant by continuing breastfeeding through or beyond 6 months postpartum. Such behaviors may provide the added benefit of offsetting other potentially adverse mother-infant experiences. If institutional or healthcare professionals provide additional education and resources that encourage social support and breastfeeding, this may assist in reducing associations between breastfeeding difficulties, poor satisfaction with social support, and poor maternal-infant attachment.

Hypotheses 2d (The conditional indirect effect will be statistically significant such that the interaction between postpartum maternal breastfeeding frequency and maternal social support will mediate relations between the interaction between maternal depression change and maternal physical health and maternal-infant attachment in the model) and 2e (The overall model will explain a statistically significant amount of variance in maternal-infant attachment). The conditional indirect effect was not statistically significant; similarly, Model 2 overall was not statistically significant. As highlighted in the study findings of Model 1, it is possible that Model 2 did not capture the complex relations among study variables. Given the complexity among the variables examined, a more dynamic or bidirectional relationship may exist among several of the outlined variables; for example, as previously described, there may be

a bidirectional relationship between prenatal or postnatal maternal physical and mental health (e.g., Henrichs et al., 2010).

As emphasized in the discussion of Model 1, proposed associations in Model 2 produced consistent results between the imputed sample of 96 mothers and the sample of 92 mothers. These results provide further support that data imputation likely did not skew the results for the sample of 96 mothers.

Practical Implications

Factors that may influence maternal-infant attachment, such as prenatal and postpartum depression, were examined to determine how such elements were related to the development of maternal-infant bonds. The inclusion of multiple salient mediators and moderators of maternal-infant attachment analyzed simultaneously helped to clarify potential relations among established variables that healthcare and community providers may target to increase maternal-infant attachment.

Namely, in Model 1, prenatal mental health significantly predicted greater attachment difficulties, whereas a change from prenatal to postnatal depressive symptomology in Model 2 did not indicate a similar relationship between depression and maternal-infant attachment. While some evidence supports that depressive symptomology is likely to be more prevalent in the postnatal than the antenatal period (Gavin et al., 2005), the average difference scores for the imputed sample of 96 moms (0.07) indicated minimal change between the prenatal and postnatal periods, with mothers, on average, endorsing higher depression scores in the third trimester of the prenatal period. One reason this may have occurred is due to the relatively low levels of depression endorsed by mothers in the present sample. Since the majority of women endorsed relatively low symptoms of depression, this may have resulted in limited variability of reported

prenatal and postnatal symptom change. The use of difference scores may have also limited study findings. Research has suggested that difference scores may be lower in reliability than the use of pre- and post- scores in isolation (Rogosa & Willett, 1983). Alternative ways of measuring change across time, such as a repeated measures design, may have better captured the relation between depression and maternal-infant attachment over time.

Support of a robust direct effect of prenatal maternal depression on attachment in Model 1, despite consideration of social support, physical health, or breastfeeding, demonstrated the need for prevention/intervention programs to emphasize prenatal maternal mental health. A reduction in depressive symptomology may bolster maternal-infant attachment above and beyond other risk variables. Particularly, in rural or impoverished areas, where resources may be more limited, the focus on mental health could offer a more practical solution for mothers at risk of developing a weaker bond with their infants. Utilization of community healthcare centers may assist primary providers in under-resourced areas with the dissemination of services, particularly when mothers may be at an increased risk of prenatal or postnatal health complications (Joseph et al., 2007; Shi et al., 2004). Since almost 70% of women do not receive adequate interventions to address depressive symptoms during pregnancy (Flynn, Blow, & Marcus, 2006), and because not all treatment modalities will be well-received by subsets of women (O'Mahen & Flynn, 2008), commencement of earlier interventions to combat times during which expectant mothers are at risk of developing depressive symptomology is critical. This finding is particularly salient, given that the present community sample exhibited subclinical levels of depressive symptomology, yet a significant relation was still found between prenatal depression and postnatal maternal perception infant attachment. This could indicate that healthcare providers may lower the threshold when screening for depression, as the presence of even mild

symptomology could negatively impact maternal-infant attachment. Further work is needed in this area to explicate the relation among these variables and integrate theoretical and empirical findings to improve depression screening.

Early interventions may decrease difficulties that mothers have bonding with their infants, and therefore improve maternal perceptions of mother-infant bonding. This improved perception may further strengthen the mother-infant bond and lead to positive long-term infant and childhood outcomes, such as increases in behavioral and emotion regulation. If mothers were to experience a decrease in depressive symptomology early in pregnancy, they may be more likely to establish a secure maternal-infant bond and avoid previously described adverse mother and infant outcomes.

The average satisfaction of postnatal social support that mothers in the present sample endorsed was quite high (5.41 out of 6), indicating that the majority of mothers were satisfied with their quality of received social support at 6 months postpartum. Since breastfeeding and social support interacted to predict increased participant perceptions of maternal-infant bonding in Model 2, this provides support that expectant mothers may benefit when physicians or other healthcare professionals provide expectant and new mothers with information on community resources that can provide new mothers with additional support. Consistent with previously cited literature (Collins et al., 1993; Elsenbruch et al., 2006), healthcare providers should focus on monitoring and recommending resources for improving expectant mothers' self-rated quality of social support. Since greater social support has the potential to offset the deleterious effects of lower-frequency breastfeeding on attachment, providers should screen for social support and breastfeeding intentions to better assess risk for poor attachment. Early provision of social

support resources and interventions to increase the likelihood of breastfeeding may improve maternal-infant attachment.

Study Strengths

A primary strength of the present study is its longitudinal design. Longitudinal studies provide the ability to view trends over time due to repeated observations, thus making it more likely that researchers can establish a more specified sequence of effects on attachment (Caruana, Roman, Hernández-Sánchez, & Solli, 2015). The current study involved a total sample of 125 mother-infant dyads during their third trimester of pregnancy, of whom 96 participants returned at 6-months postpartum to report on perinatal mother and infant experiences. While attrition is common with longitudinal studies, the study maintained the majority of participants (77%), which provided sufficient power for the present investigation. Many studies that investigate mother-infant outcomes involve small numbers of participants, making this sample of 96 mothers a major strength.

Another major strength was that the study investigated maternal-infant attachment with a multifaceted model that encompassed factors previously associated with maternal-infant attachment, yet not considered concurrently. Although the overall models did not significantly predict maternal-infant attachment, the inclusion of longitudinal variables provided a more extensive review than many of the previously cited cross-sectional studies. Viewing the variables in a complete model rather than in isolation provided clarity on how the identified variables may be related to one another. For example, seeing the effects of the interaction of social support and breastfeeding on maternal-infant attachment indicates that future studies should assess the same relationship to see if results are replicated, while simultaneously investigating how this relationship may be related to prenatal and postnatal maternal physical and mental health.

Given that mothers provided responses during their final trimester of pregnancy as well as 6-months postpartum, this allowed for a comparison between maternal prenatal and prenatal to postnatal change in depressive symptoms. Use of this method provided a unique contribution to the existing literature by investigating how the timing of perinatal maternal depression may be associated with other examined variables. Given the bidirectional relationship between some mother and infant factors that influence maternal-infant attachment (e.g., Field, 1998), determining the timeline during which mothers and infants may be most at risk for future attachment difficulties would assist healthcare professionals by identifying specific times during which the implementation of specific interventions are most likely to increase healthy mother and infant outcomes. The present study indicated that prenatal maternal depressive symptomology, even at subclinical levels, is significantly related to maternal-infant attachment. This provides support that early screening for depressive symptomology may assist healthcare providers with identifying mother-infant dyads who may benefit from maternal psychological interventions.

Finally, the measures used were theoretically and psychometrically sound and the statistical analyses used allowed for correcting of biases. While the ICQ-R, by comparison to some of the other measures, may be a relatively novel indicator of attachment since it relies on self-reported maternal perception of attachment (compared to the established behavioral-based ASST [Ainsworth & Bell, 1970]), it has been demonstrated as a psychometrically sound measure of both prenatal and postnatal maternal-infant attachment. The significant relations between maternal-infant attachment and other study variables in the present study offers further support of the ICQ-R's attachment scale as a valid indicator of maternal-infant attachment. Continued development and validation of such self-report measures offers promise for healthcare

professionals looking to rapidly screen mothers who may be at risk for attachment difficulties. Use of the PROCESS macro to investigate the relation among the measured variables provided additional strength for the findings, as PROCESS uses a bias-corrected bootstrapping method for investigation of the conditional effects. This method was robust against non-normality, as it adjusted the intervals based on the skew of the sample's distribution.

Study Limitations

Several important limitations were likely to contribute toward the described results. The present study's measure of maternal health complications posed one such limitation. As previously described, adding responses to the dichotomous yes/no responses to categories of perinatal maternal health complications (e.g., "Did you have any surgery aside from a C-section [tubal ligation, hysterectomy, uterine embolization]?") potentially limited the breadth of health complications some mothers may have endorsed if they had not been limited by the yes/no nature of categorized health conditions. Considering alternative ways of quantifying the breadth, severity, and functional implications of maternal health complications may be salient, particularly given the minimal to severe complications that mothers who experience similar health conditions or undergo similar medical procedures may experience. One potential way of representing maternal severity of complications may include total number of days mothers spend in the hospital after delivery.

Given the salience of early breastfeeding practices on maternal sensitivity to infant needs (Johnson, 2013), relying on breastfeeding frequency at 6-months postpartum may have limited the salience of other important breastfeeding behaviors that promote mother-infant attachment. Including breastfeeding frequency and duration would have provided a more accurate depiction of breastfeeding practices and potentially led to different outcomes. Accounting for other

breastfeeding practices, such as pumping, may also elucidate additional factors that may be associated with mother-infant bonding.

Descriptive statistics revealed that the sample of participants was relatively homogenous with regard to sociodemographic descriptors. The majority of participants identified as European-American, married, and well-educated. Similarly, the vast majority of mothers in the sample also identified as satisfied with current social support and endorsed relatively low levels of depressive symptomology. The present sample may be representative of a rural Idaho sample, but it may not generalize to urban or more diverse areas of the United States.

Exclusionary criteria prevented mothers who were below 18 years of age or above age 35, expected more than one child, used illicit substances or excessive alcohol during their current pregnancy, took category D or X medications, or had a severe and/or chronic physical or mental health diagnosis from participating in the present study. These described exclusionary criteria potentially eliminated expectant mothers and infants who may be most at risk of difficulties establishing a secure maternal-infant bond. Such participants may be most in need of preventative health services.

The lengthy duration between retrospective prenatal and postnatal sessions may have attenuated the salience and subsequent self-report of maternal experiences across their pregnancy. Participants went approximately 7 months between their prenatal and 6-month postnatal sessions. A longer duration between retrospective self-report measures may have contributed to poorer recall of experiences on self-report measures. Additionally, expectant and new mothers are a specialized population who contend with a host of challenges that regularly accompany new motherhood, such as breastfeeding and sleep deprivation or fatigue (Barkin &

Wisner, 2013; Brown et al., 2014). These challenges may also impact the quality of retrospective report.

Finally, difference scores used as the indicator of maternal depressive symptomology in Model 2 may have contributed toward null findings. As previously described, repeated measures of depression may have offered a more reliable indicator than difference scores. Use of repeated measures would allow investigators to determine not only the degree of change over time, but also how factors vary among individual participants. Another potential alternative could be to employ Structural Equation Modeling (SEM) or other comparable methods of analyses (Locascio & Atri, 2011). Use of an SEM design could capture complex relations among variables, such as a potential bidirectional relationship between depression and maternal health.

Future Directions

This study aimed to expand upon existing literature in several ways and supported the need for further development of theoretical models of maternal-infant attachment. The proposed study utilized a novel, validated measure of maternal perceptions of attachment based on mothers' interpretation of responses to infant affect. Continued use of the ICQ-R would increase confidence in utilizing maternal self-report as an outcome measure of maternal-infant attachment; however, it would also be worth having observational coders determine whether maternal perceptions provide an accurate representation of infant attachment. Future longitudinal studies should use behavioral measures, such as the ASST (Ainsworth & Bell, 1970), to assess levels of attachment to determine whether maternal perception correlates with infant/child perceptions and interactions. Inclusion of behavioral measures in conjunction with the presently utilized maternal self-report may clarify the efficacy of the relatively novel ICQ-R. Similarly, longer-term examination of maternal perceptions of attachment may result in increased sample

variability and clarify the relations among variables that affect maternal-infant bonding. This could also help clarify how and if maternal perceptions of attachment differ exclusively from the effects of perinatal depression.

The ASST investigates attachment relationships between mothers and their 9- to 18-month-old infants (Ainsworth & Bell, 1970). Infants older than 6 months, such as those within the target age range of the ASST, are likely to exhibit increased social and emotional responses, which could result in reciprocal responses from mothers. Identifying progressive variations in maternal perceptions of bonding may clarify the time during which mothers may be most at risk of experiencing a perceived rupture in infant bonding.

Prenatal and postnatal mental health factors should also be measured in multiple ways. The present study used difference scores; as previously mentioned, some research has suggested that differences scores may be less ideal than pre- and post- scores in isolation (Rogosa & Willett, 1983). Future studies should test this hypothesis by examining differences of effect by utilizing methods that researchers have supported as alternatives with fewer psychometric concerns. Early and increased frequency of maternal reports could allow for alternative measures of depressive symptomology. This would allow for use of a repeated measures design or other appropriately supported statistical techniques that may increase study reliability.

Including comprehensive measures of breastfeeding could also improve future studies. The present study used frequency at 6 months postpartum as the representation of breastfeeding behavior. Other studies have measured breastfeeding duration and breast pump use (e.g., IFPS II; Fein et al., 2008). Measuring and contrasting modalities of breastfeeding behaviors across time would help clarify which feeding methods may facilitate mother-infant attachment as well as future mother/child outcomes. Additionally, assessing for breastfeeding duration and frequency

as well as why mothers cease breastfeeding would help clarify factors that may be indicative of future attachment difficulties.

Physical health should be examined in a multitude of ways to determine how health factors may put mothers and their infants at an increased risk for bonding difficulties. Factoring maternal pre-pregnancy health conditions could clarify relations among variables that are associated with maternal-infant attachment, particularly given the previously outlined support for maternal pre-pregnancy obesity and subsequent perinatal health and infant bonding complications. Questionnaires that account for a variety of health conditions across time could assist healthcare providers with identifying mothers and infants who are at an increased risk of adverse health and developmental outcomes. Previously described, the PRAMS (Robbins et al., 2014) accounts for an array of maternal health conditions, such as hypertension, polycystic ovarian syndrome, and sexually transmitted diseases. Researchers could consider these factors individually and in combination to determine which health factors are most closely related to maternal-infant attachment. Some of the described factors, such as type I or II diabetes, may occur pre-pregnancy, while others, such as gestational diabetes, are more salient during or after pregnancy. Identifying specific health conditions that may place mothers and infant most at risk for poor bonding would highlight times during which health conditions warrant close monitoring and assist medical providers by pinpointing times during which interventions may be most effective. Furthermore, given the previously described challenges of mothers from rural areas or members of an ethnic minority (e.g., Hogan et al., 2001), investigation of maternal access and utilization of preventative or aftercare services may help clarify the relationship between maternal health and mother-infant attachment Nesbitt et al., 1990).

Increased sociodemographic variability would enhance the generalizability of future studies. While the present study may have strong implications for a subset of the population (namely, southeastern Idaho), investigation of how women who identify as more culturally diverse would provide clarification on how factors related to maternal-infant attachment may be targeted through specific interventions. Inclusion of mothers who have complex physical and mental health conditions would help clarify target populations for intervention. Longitudinal investigation of variables that range from pre-pregnancy through 12 months postpartum with heterogeneous samples could help clarify the relations among maternal health or environmental factors and attachment.

The addition of other variables would help clarify the complex relations of factors supported as related to maternal-infant attachment. As previously mentioned, increased maternal weight has been associated with decreased likelihood of breastfeeding (Oddy et al., 2006). Other maternal medical factors that may shape mother-infant attachment include poor prenatal healthcare (Alexander & Kotelchuck, 2001; Kost et al., 1998) previous perinatal loss (Côté-Arsenault & Mahlangu, 1999; Tsartsara & Johnson, 2006), high or low body mass index (Sebire et al., 2001; Yu et al., 2013), and hypertension (Boney, Verma, Tucker, & Vohr, 2005). Similarly, spirituality (Corrigan, McCorkle, Schell, & Kidder, 2003; Stifoss-Hanssen, 1999) and religious practices (Corrigan et al., 2003) may influence mother-infant relationships by providing structure for how family members support one another (Mahoney, Pargament, A. Murray-Swank, & N. Murray-Swank, 2003). Investigating differences in maternal health and social variables may clarify which factors may be the most salient predictors of maternal-infant attachment. Given the supported connection between parity, health complications, and breastfeeding initiation/cessation, parity may serve as a moderating variable. Future studies

should investigate this to determine the association between parity and other outlined variables of interest.

Finally, the present study focused primarily on maternal factors that influence maternal-infant attachment. Inclusion of infant variables may provide insight into maternal-infant bonding difficulties. Several infant variables have been supported as potential targets of intervention to increase maternal-infant attachment. Examples include infant temperament (Egeland & Farber, 1984) and infant health problems or early placements in the neonatal intensive care unit (Franklin, 2006).

Conclusion

The present study served to inform the understanding of factors currently supported as related to maternal-infant attachment; specifically, this project sought to elucidate the relationship between perinatal maternal depression, postnatal maternal physical health, breastfeeding behaviors, postnatal maternal social support, and postnatal maternal perception of infant attachment. While previous research has indicated that these variables are associated with one another, this is the first study, to our knowledge, that has attempted to theorize and build more complex moderated mediation models designed to test how these variables collectively may be related using longitudinal data.

Significant relations were found between prenatal depressive symptomology and postnatal maternal perceptions of mother-infant attachment. The interaction between breastfeeding and postnatal maternal social support was significantly related to perceptions of maternal-infant attachment; in particular, mothers who endorsed poorer quality postnatal social support saw significant improvements in their perceptions of maternal-infant attachment as breastfeeding frequency increased at 6-months postpartum. These findings support existing

evidence of how increased perinatal depressive symptomology (Field, 1998) and poorer quality social support (Small et al., 2011) are associated with decreased maternal-infant attachment.

A lack of significant relations among other variables may be because the measures utilized did not allocate for the array of health conditions mothers may have endorsed (e.g., categories of health conditions rather than accounting for unique, individualized variations) or because the relatively homogenous sample of participants shared similar demographics (e.g., predominantly well-educated, European-American women). The hypothesized relations among study variables may not have best captured the complex relationships among the examined variables. Alternatively, the proposed relations among the included variables may not exist. Major strengths of the project included the use of robust statistical methods and supported measures, whereas project limitations included factors such as strict exclusionary criteria and limited, nested categories of perinatal health complications. Future projects should continue building on the present study by decreasing the duration between participant sessions, including behavioral measures of maternal-infant attachment, investigating relations among study variables with more diverse samples, and taking into account additional variables, such as complex pre-existing maternal health conditions, that may be related to maternal-infant attachment.

References

Ainsworth, M. S. (1989). Attachments beyond infancy. *American Psychologist*, *44*(4), 709-716.

Ainsworth, M. D., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behavior of one-year-olds in a strange situation. *Child Development*. *41*(1), 49-67. http://dx.doi.org/10.2307/1127388

Ainsworth, M. S., & Bowlby, J. (1991). An ethological approach to personality development. *American Psychologist*, *46*(4), 333-341. http://dx.doi.org/10.1037/0003-066X.46.4.333

Alexander, G. R., & Kotelchuck, M. (2001). Assessing the role and effectiveness of prenatal care: History, challenges, and directions for future research. *Public Health Reports*, *116*(4), 306-316. https://doi.org/10.1093/phr/116.4.306

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Barkin, J. L., & Wisner, K. L. (2013). The role of maternal self-care in new motherhood. *Midwifery*, *29*(9), 1050-1055. https://doi.org/10.1016/j.midw.2012.10.001

Balaji, A. B., Claussen, A. H., Smith, D. C., Visser, S. N., Morales, M. J., & Perou, R. (2007). Social support networks and maternal mental health and well-being. *Journal of Women's Health*, *16*(10), 1386-1396. doi:10.1089/jwh.2007.cdc10

Benoit, D. (2004). Infant-parent attachment: Definition, types, antecedents, measurement and outcome. *Paediatrics & Child Health*, *9*(8), 541-545. https://doi.org/10.1093/pch/9.8.541

Beydoun, H., & Saftlas, A. F. (2008). Physical and mental health outcomes of prenatal maternal stress in human and animal studies: A review of recent evidence. *Paediatric and Perinatal Epidemiology*, *22*(5), 438-466. doi:10.1111/j.1365-3016.2008.00951.x

Bodnar, L. M., & Wisner, K. L. (2005). Nutrition and depression: Implications for improving mental health among childbearing-aged women. *Biological Psychiatry, 58*(9), 679-685. https://doi.org/10.1016/j.biopsych.2005.05.009

Boney, C. M., Verma, A., Tucker, R., & Vohr, B. R. (2005). Metabolic syndrome in childhood: Association with birth weight, maternal obesity, and gestational diabetes mellitus. *Pediatrics, 115*(3), e290-e296. doi:10.1542/peds.2004-1808

Brennan, P. A., Pargas, R., Walker, E. F., Green, P., Jeffrey Newport, D., & Stowe, Z. (2008). Maternal depression and infant cortisol: Influences of timing, comorbidity and treatment. *Journal of Child Psychology and Psychiatry, 49*(10), 1099-1107. doi:10.1111/j.1469-7610.2008.01914.x

Bretherton, I. (1992). The origins of attachment theory: John Bowlby and Mary Ainsworth. *Developmental Psychology, 28*(5), 759-775. http://dx.doi.org/10.1037/0012-1649.28.5.759

Broad, K. D., Curley, J. P., & Keverne, E. B. (2006). Mother–infant bonding and the evolution of mammalian social relationships. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, *361*(1476), 2199-2214. doi:10.1098/rstb.2006.1940

Brown, C. R., Dodds, L., Legge, A., Bryanton, J., & Semenic, S. (2014). Factors influencing the reasons why mothers stop breastfeeding. *Canadian Journal of Public Health, 105*(3), e179-e185. https://doi.org/10.17269/cjph.105.4244

Cacioppo, J. T., & Hawkley, L. C. (2003). Social isolation and health, with an emphasis on underlying mechanisms. *Perspectives in Biology and Medicine, 46*(3), S39-S52.

Canetti, L., Kanyas, K., Lerer, B., Latzer, Y., & Bachar, E. (2008). Anorexia nervosa and parental bonding: The contribution of parent–grandparent relationships to eating disorder psychopathology. *Journal of Clinical Psychology*, *64*(6), 703-716.doi:10.1002/jclp.20482

Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease, 7*(11), E537-E540. doi:10.3978/j.issn.2072-1439.2015.10.63

Cattaneo, A., Davanzo, R., Worku, B., Surjono, A., Echeverria, M., Bedri, A., ... & Quintero, S. (1998). Kangaroo mother care for low birthweight infants: A randomized controlled trial in different settings. *Acta Paediatrica*, *87*(9), 976-985. doi:10.1111/j.1651-2227.1998.tb01769.x

Cogill, S. R., Caplan, H. L., Alexandra, H., Robson, K. M., & Kumar, R. (1986). Impact of maternal postnatal depression on cognitive development of young children. *British Medical Journal*, *292*(6529), 1165-1167. https://doi.org/10.1136/bmj.292.6529.1165

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, *98*(2), 310-357. http://dx.doi.org/10.1037/0033-2909.98.2.310

Collins, N. L., Dunkel-Schetter, C., Lobel, M., & Scrimshaw, S. C. (1993). Social support in pregnancy: Psychosocial correlates of birth outcomes and postpartum depression. *Journal of Personality and Social Psychology*, *65*(6), 1243-1258. http://dx.doi.org/10.1037/0022-3514.65.6.1243

Cooper, P. J., & Murray, L. (1998). Postnatal depression. *BMJ : British Medical Journal*, *316*(7148), 1884–1886.

Corrigan, P., McCorkle, B., Schell, B., & Kidder, K. (2003). Religion and spirituality in the lives of people with serious mental illness. *Community Mental Health Journal, 39*(6), 487-499. https://doi.org/10.1023/b:comh.0000003010.44413.37

Cŏté-Arsenault, D., & Mahlangu, N. (1999). Impact of perinatal loss on the subsequent pregnancy and self: Women's experiences. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *28*(3), 274-282. doi:http://dx.doi.org/10.1111/j.1552-6909.1999.tb01992.x

Cox, J. L., Holden, J. M., & Sagovsky, R. (1987). Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *The British Journal of Psychiatry*, *150*(6), 782-786. https://doi.org/10.1192/bjp.150.6.782

Crockenberg, S. B. (1981). Infant irritability, mother responsiveness, and social support influences on the security of infant-mother attachment. *Child Development*, *52*(3) 857-865. doi:10.2307/1129087

Culhane, J. F., Rauh, V., McCollum, K. F., Hogan, V. K., Agnew, K., & Wadhwa, P. D. (2001). Maternal stress is associated with bacterial vaginosis in human pregnancy. *Maternal and Child Health Journal*, *5*(2), 127-134. https://doi.org/10.1023/A:1011305300690

Deneux-Tharaux, C., Carmona, E., Bouvier-Colle, M. H., & Bréart, G. (2006). Postpartum maternal mortality and cesarean delivery. *Obstetrics & Gynecology*, *108*(3, Part 1), 541-548. doi:10.1097/01.aog.0000233154.62729.24

Dennis, C. L. (2003). Peer support within a health care context: A concept analysis. *International Journal of Nursing Studies*, *40*(3), 321-332. https://doi.org/10.1016/S0020-7489(02)00092-5

Eidelman, A. I., Schanler, R. J., Johnston, M., Landers, S., Noble, L., Szucs, K., & Viehmann, L. (2012). Breastfeeding and the use of human milk. *Pediatrics, 129*(3), e827-e841. doi:10.1542/peds.2004-2491

Egeland, B., & Farber, E. A. (1984). Infant-mother attachment: Factors related to its development and changes over time. *Child Development*, 753-771. doi:10.2307/1130127

Ekas, N. V., Lickenbrock, D. M., & Whitman, T. L. (2010). Optimism, social support, and well-being in mothers of children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *40*(10), 1274-1284. https://doi.org/10.1007/s10803-010-0986-y

Elsenbruch, S., Benson, S., Rücke, M., Rose, M., Dudenhausen, J., Pincus-Knackstedt, M. K., ... & Arck, P. C. (2006). Social support during pregnancy: Effects on maternal depressive symptoms, smoking and pregnancy outcome. *Human Reproduction*, *22*(3), 869-877. https://doi.org/10.1093/humrep/del432

Emmanuel, E., & St John, W. (2010). Maternal distress: A concept analysis. *Journal of Advanced Nursing, 66*(9), 2104-2115. https://doi.org/10.1111/j.1365-2648.2010.05371.x

Federenko, I. S., & Wadhwa, P. D. (2004). Women's mental health during pregnancy influences fetal and infant developmental and health outcomes. *CNS Spectrums, 9*(3), 198-206. https://doi.org/10.1017/S1092852900008993

Fein, S. B., Labiner-Wolfe, J., Shealy, K. R., Li, R., Chen, J., & Grummer-Strawn, L. M. (2008). Infant feeding practices study II: Study methods. *Pediatrics*, *122*(Supplement 2), S28-S35.

Feldman, R. (2007). Parent–infant synchrony: Biological foundations and developmental outcomes. *Current Directions in Psychological Science, 16*(6), 340-345. doi:10.1111/j.1467-8721.2007.00532.x

Feldman, R., & Eidelman, A. I. (2003). Direct and indirect effects of breast milk on the neurobehavioral and cognitive development of premature infants. *Developmental Psychobiology, 43*(2), 109-119. doi:10.1002/dev.10126

Feldman, R., Eidelman, A. I., Sirota, L., & Weller, A. (2002). Comparison of skin-to-skin (kangaroo) and traditional care: Parenting outcomes and preterm infant development. *Pediatrics, 110*(1), 16-26. doi:10.1542/peds.110.1.16

Feldman, R., Rosenthal, Z., & Eidelman, A. I. (2014). Maternal-preterm skin-to-skin contact enhances child physiologic organization and cognitive control across the first 10 years of life. *Biological Psychiatry, 75*(1), 56-64. https://doi.org/10.1016/j.biopsych.2013.08.012

Feldman, R., Weller, A., Leckman, J. F., Kuint, J., & Eidelman, A. I. (1999). The nature of the mother's tie to her infant: Maternal bonding under conditions of proximity, separation, and potential loss. *Journal of Child Psychology and Psychiatry, 40*(6), 929-939. doi:10.1017/S0021963099004308

Feldman, R., Weller, A., Zagoory-Sharon, O., & Levine, A. (2007). Evidence for a neuroendocrinological foundation of human affiliation: Plasma oxytocin levels across pregnancy and the postpartum period predict mother-infant bonding. *Psychological Science, 18*(11), 965-970. doi:10.1111/j.1467-9280.2007.02010.x

Field, T. (1998). Maternal depression effects on infants and early interventions. *Preventive Medicine, 27*(2), 200-203. https://doi.org/10.1006/pmed.1998.0293

Figueiredo, B., & Conde, A. (2011). Anxiety and depression symptoms in women and men from early pregnancy to 3-months postpartum: Parity differences and effects. *Journal of Affective Disorders*, *132*(1-2), 146-157. https://doi.org/10.1016/j.jad.2011.02.007

Flynn, H. A., Blow, F. C., & Marcus, S. M. (2006). Rates and predictors of depression treatment among pregnant women in hospital-affiliated obstetrics practices. *General Hospital Psychiatry*, *28*(4), 289-295. https://doi.org/10.1016/j.genhosppsych.2006.04.002

Forehand, R., Lautenschlager, G. J., Faust, J., & Graziano, W. G. (1986). Parent perceptions and parent-child interactions in clinic-referred children: A preliminary investigation of the effects of maternal depressive moods. *Behaviour Research and Therapy*, *24*(1), 73-75. https://doi.org/10.1016/0005-7967(86)90152-x

Forssas, E., Gissler, M., Sihvonen, M., & Hemminki, E. (1999). Maternal predictors of perinatal mortality: The role of birthweight. *International Journal of Epidemiology*, *28*(3), 475-478. https://doi.org/10.1093/ije/28.3.475

Forster, D. A., McLachlan, H. L., & Lumley, J. (2006). Factors associated with breastfeeding at six months postpartum in a group of Australian women. *International Breastfeeding Journal*, *1*(18), 1-12. https://doi.org/10.1186/1746-4358-1-18

Fox, C. R., & Gelfand, D. M. (1994). Maternal depressed mood and stress as related to vigilance, self-efficacy and mother-child interactions. *Early Development and Parenting*, *3*(4), 233-243. https://doi.org/10.1002/edp.2430030406

Franklin, C. (2006). The neonatal nurse's role in parental attachment in the NICU. *Critical Care Nursing Quarterly*, *29*(1), 81-85.

Gatti, L. (2008). Maternal perceptions of insufficient milk supply in breastfeeding. *Journal of Nursing Scholarship*, *40*(4), 355-363. https://doi.org/10.1111/j.1547-5069.2008.00234.x

Gavin, N. I., Gaynes, B. N., Lohr, K. N., Meltzer-Brody, S., Gartlehner, G., & Swinson, T. (2005). Perinatal depression: A systematic review of prevalence and incidence. *Obstetrics & Gynecology*, *106*(5), 1071-1083. doi:10.1097/01.AOG.0000183597.31630.db

Glover, V. (2014). Maternal depression, anxiety and stress during pregnancy and child outcome; what needs to be done. *Best Practice & Research Clinical Obstetrics & Gynaecology*, *28*(1), 25-35. https://doi.org/10.1016/j.bpobgyn.2013.08.017

Goldsmith, H., & Rothbart, M. K. (1996). Prelocomotor and locomotor laboratory temperament assessment battery (Lab-TAB; version 3.0, technical manual). *Madison: University of Wisconsin, Department of Psychology*.

Gooding, J. S., Cooper, L. G., Blaine, A. I., Franck, L. S., Howse, J. L., & Berns, S. D. (2011). Family support and family-centered care in the neonatal intensive care unit: Origins, advances, impact. *Seminars in Perinatology*, *35*(1), 20-28. https://doi.org/10.1053/j.semperi.2010.10.004

Guelinckx, I., Devlieger, R., Beckers, K., & Vansant, G. (2008). Maternal obesity: Pregnancy complications, gestational weight gain and nutrition. *Obesity Reviews*, *9*(2), 140-150. https://doi.org/10.1111/j.1467-789X.2007.00464.x

Gupta, S., Agarwal, A., Banerjee, J., & Alvarez, J. G. (2007). The role of oxidative stress in spontaneous abortion and recurrent pregnancy loss: A systematic review. *Obstetrical & Gynecological Survey*, *62*(5), 335-347. doi:10.1097/01.ogx.0000261644.89300.df

Hack, M., Klein, N. K., & Taylor, H. G. (1995). Long-term developmental outcomes of low birth weight infants. *The Future of Children*, 176-196. doi:10.2307/1602514

Hack, M., Taylor, H. G., Schluchter, M., Andreias, L., Drotar, D., & Klein, N. (2009). Behavioral outcomes of extremely low birth weight children at age 8 years. *Journal of Developmental and Behavioral Pediatrics, 30*(2), 122-130. doi:10.1097/DBP.0b013e31819e6a16

Hackman, N. M., Schaefer, E. W., Beiler, J. S., Rose, C. M., & Paul, I. M. (2015). Breastfeeding outcome comparison by parity. *Breastfeeding Medicine, 10*(3), 156-162. doi: 10.1089/bfm.2014.0119

Haddow, J. E., Palomaki, G. E., Allan, W. C., Williams, J. R., Knight, G. J., Gagnon, J., ... & Faix, J. D. (1999). Maternal thyroid deficiency during pregnancy and subsequent neuropsychological development of the child. *New England Journal of Medicine, 341*(8), 549-555. doi:10.1056/NEJM199908193410801

Hall, L. A., Peden, A. R., Rayens, M. K., & Beebe, L. H. (2004). Parental bonding: A key factor for mental health of college women. *Issues in Mental Health Nursing, 25*(3), 277-292. http://dx.doi.org/10.1080/01612840490274787

Haltigan, J. D., Leerkes, E. M., Burney, R. V., O'Brien, M., Supple, A. J., & Calkins, S. D. (2012). The infant crying questionnaire: Initial factor structure and validation. *Infant Behavior and Development, 35*(4), 876-883. https://doi.org/10.1016/j.infbeh.2012.06.001

Hansen, A. K., Wisborg, K., Uldbjerg, N., & Henriksen, T. B. (2008). Risk of respiratory morbidity in term infants delivered by elective caesarean section: Cohort study. *British Medical Journal, 336*(7635), 85–87. http://doi.org/10.1136/bmj.39405.539282.BE

Hayes, A. F. (2017). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). New York, NY: The Guilford Press.

Heck, K. E., Schoendorf, K. C., Ventura, S. J., & Kiely, J. L. (1997). Delayed childbearing by education level in the United States, 1969–1994. *Maternal and Child Health Journal*, *1*(2), 81-88. https://doi.org/10.1023/A:1026218322723

Henrichs, J., Bongers-Schokking, J. J., Schenk, J. J., Ghassabian, A., Schmidt, H. G., Visser, T. J., ... & Visser, W. (2010). Maternal thyroid function during early pregnancy and cognitive functioning in early childhood: The generation R study. *The Journal of Clinical Endocrinology & Metabolism*, *95*(9), 4227-4234. https://doi.org/10.1210/jc.2010-0415

Hofer, M. A. (2002). Unexplained infant crying: An evolutionary perspective. *Acta Paediatrica*, *91*(5), 491-496. doi:10.1111/j.1651-2227.2002.tb03262.x

Hogan, V. K., Njoroge, T., Durant, T. M., & Ferre, C. D. (2001). Commentary: Eliminating disparities in perinatal outcomes—lessons learned. *Maternal and Child Health Journal*, *5*(2), 135-140. https://doi.org/10.1023/A:1011357317528

Hollingshead, A. B. (1975). Four factor index of social status. Unpublished manuscript. Department of Sociology, Yale University, New Haven, Connecticut.

Hops, H., Biglan, A., Sherman, L., Arthur, J., Friedman, L., & Osteen, V. (1987). Home observations of family interactions of depressed women. *Journal of Consulting and Clinical Psychology*, *55*(3), 341-346. http://dx.doi.org/10.1037/0022-006X.55.3.341

Hunt, F. (2008). The importance of kangaroo care on infant oxygen saturation levels and bonding. *Journal of Neonatal Nursing*, *14*(2), 47-51. https://doi.org/10.1016/j.jnn.2007.12.003

Johnson, K. (2013). Maternal-infant bonding: A review of literature. *International Journal of Childbirth Education*, *28*(3), 17-22.

Jones, N. A., McFall, B. A., & Diego, M. A. (2004). Patterns of brain electrical activity in infants of depressed mothers who breastfeed and bottle feed: The mediating role of infant temperament. *Biological Psychology*, *67*(1), 103-124. https://doi.org/10.1016/j.biopsycho.2004.03.010

Joseph, K. S., Liston, R. M., Dodds, L., Dahlgren, L., & Allen, A. C. (2007). Socioeconomic status and perinatal outcomes in a setting with universal access to essential health care services. *CMAJ*, *177*(6), 583-590. https://doi.org/10.1503/cmaj.061198

Kendrick, K. M., Keverne, E. B., & Baldwin, B. A. (1987). Intracerebroventricular oxytocin stimulates maternal behaviour in the sheep. *Neuroendocrinology*, *46*(1), 56-61. https://doi.org/10.1159/000124796

Kinsey, C. B., Baptiste-Roberts, K., Zhu, J., & Kjerulff, K. H. (2014). Birth-related, psychosocial, and emotional correlates of positive maternal-infant bonding in a cohort of first-time mothers. *Midwifery*, *30*(5), e188-e194. https://doi.org/10.1016/j.midw.2014.02.006

Kisilevsky, B. S., Hains, S. M., Lee, K., Xie, X., Huang, H., Ye, H. H., ... & Wang, Z. (2003). Effects of experience on fetal voice recognition. *Psychological Science, 14*(3), 220-224. doi:10.1111/1467-9280.02435

Kitsantas, P., & Pawloski, L. R. (2010). Maternal obesity, health status during pregnancy, and breastfeeding initiation and duration. *The Journal of Maternal-Fetal & Neonatal Medicine*, *23*(2), 135-141. https://doi.org/10.3109/14767050903118270

Kost, K., Landry, D. J., & Darroch, J. E. (1998). Predicting maternal behaviors during pregnancy: Does intention status matter? *Family Planning Perspectives*, *30*(2), 79-88. doi:10.2307/2991664

Lakey, B., & Orehek, E. (2011). Relational regulation theory: A new approach to explain the link between perceived social support and mental health. *Psychological Review, 118*(3), 482-495. doi: 10.1037/a0023477

Landry, S. H., Smith, K. E., Miller-Loncar, C. L., & Swank, P. R. (1997). Predicting cognitive-language and social growth curves from early maternal behaviors in children at varying degrees of biological risk. *Developmental Psychology*, *33*(6), 1040-1053. http://dx.doi.org/10.1037/0012-1649.33.6.1040

Lecrubier, Y., Sheehan, D. V., Weiller, E., Amorim, P., Bonora, I., Sheehan, K. H., ... & Dunbar, G. C. (1997). The Mini International Neuropsychiatric Interview (MINI). A short diagnostic structured interview: Reliability and validity according to the CIDI. *European Psychiatry*, *12*(5), 224-231. https://doi.org/10.1016/S0924-9338(97)83296-8

Lefkovics, E., Baji, I., & Rigó, J. (2014). Impact of maternal depression on pregnancies and on early attachment. *Infant Mental Health Journal*, *35*(4), 354-365. https://doi.org/10.1002/imhj.21450

Leerkes, E. M., Weaver, J. M., & O'Brien, M. (2012). Differentiating maternal sensitivity to infant distress and non-distress. *Parenting: Science and Practice*, *12*, 175-184. http://dx.doi.org/10.1080/15295192.2012.683353

Leahy-Warren, P., McCarthy, G., & Corcoran, P. (2011). Postnatal depression in first-time mothers: Prevalence and relationships between functional and structural social support at 6 and 12 weeks postpartum. *Archives of Psychiatric Nursing*, *25*(3), 174-184. https://doi.org/10.1016/j.apnu.2010.08.005

Li, R., Fein, S. B., Chen, J., & Grummer-Strawn, L. M. (2008). Why mothers stop breastfeeding: Mothers' self-reported reasons for stopping during the first year. *Pediatrics, 122*(Suppl. 2), S69-S76. doi:10.1542/peds.2008-1315i

Li, N., Liu, E., Guo, J., Pan, L., Li, B., Wang, P., ... & Hou, L. (2013). Maternal prepregnancy body mass index and gestational weight gain on pregnancy outcomes. *PLOS ONE, 8*(12). doi:10.1371/journal.pone.0082310. https://doi.org/10.1371/journal.pone.0082310

Liggins, G. C., & Howie, R. N. (1972). A controlled trial of antepartum glucocorticoid treatment for prevention of the respiratory distress syndrome in premature infants. *Pediatrics, 50*(4), 515-525.

Little, S. E., Orav, E. J., Robinson, J. N., Caughey, A. B., & Jha, A. K. (2016). The relationship between variations in cesarean delivery and regional health care use in the United States. *American Journal of Obstetrics and Gynecology*, *214*(6), 735-e1-8. https://doi.org/10.1016/j.ajog.2015.12.023

Liu, J., Leung, P., & Yang, A. (2014). Breastfeeding and active bonding protects against children's internalizing behavior problems. *Nutrients*, *6*(1), 76-89. Doi:10.3390/nu6010076

Liu, S., Liston, R. M., Joseph, K. S., Heaman, M., Sauve, R., & Kramer, M. S. (2007). Maternal mortality and severe morbidity associated with low-risk planned cesarean delivery versus planned vaginal delivery at term. *Canadian Medical Association Journal*, *176*(4), 455-460. doi:10.1503/cmaj.060870

Locascio, J. J., & Atri, A. (2011). An overview of longitudinal data analysis methods for neurological research. *Dementia and Geriatric Cognitive Disorders Extra*, *1*(1), 330-357. doi:10.1159/000330228

Logsdon, M. C., Wisner, K. L., & Pinto-Foltz, M. D. (2006). The impact of postpartum depression on mothering. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 35*(5), 652-658. doi:10.1111/j.1552-6909.2006.00087.x

Lucas, B. K., Ormandy, C. J., Binart, N., Bridges, R. S., & Kelly, P. A. (1998). Null mutation of the prolactin receptor gene produces a defect in maternal behavior. *Endocrinology*, *139*(10), 4102-4107. https://doi.org/10.1210/endo.139.10.6243

Lyons-Ruth, K., Connell, D. B., Grunebaum, H. U., & Botein, S. (1990). Infants at social risk: Maternal depression and family support services as mediators of infant development and security of attachment. *Child Development*, *61*(1), 85-98. doi:10.1111/j.1467-8624.1990.tb02762.x

MacDorman, M. F., Declercq, E., Menacker, F., & Malloy, M. H. (2006). Infant and neonatal mortality for primary cesarean and vaginal births to women with "no indicated risk," United States, 1998–2001 birth cohorts. *Birth, 33*(3), 175-182. doi:10.1111/j.1523-536X.2006.00102.x

Mahoney, A., Pargament, K. I., Murray-Swank, A., & Murray-Swank, N. (2003). Religion and the sanctification of family relationships. *Review of Religious Research*, 220-236. doi:10.2307/3512384

Martini, J., Knappe, S., Beesdo-Baum, K., Lieb, R., & Wittchen, H. U. (2010). Anxiety disorders before birth and self-perceived distress during pregnancy: Associations with maternal depression and obstetric, neonatal and early childhood outcomes. *Early Human Development, 86*(5), 305-310. https://doi.org/10.1016/j.earlhumdev.2010.04.004

Mathews, T. J., & Hamilton, B. E. (2009). *Delayed childbearing: More women are having their first child later in life* (NCHS Data Brief No. 21). Retrieved from Centers for Disease Control and Prevention website: https://stacks.cdc.gov/view/cdc/5468

McFarland, J., Salisbury, A. L., Battle, C. L., Hawes, K., Halloran, K., & Lester, B. M. (2011). Major depressive disorder during pregnancy and emotional attachment to the fetus. *Archives of Women's Mental Health*, *14*(5), 425-434. doi:10.1007/s00737-011-0237-z

Miller, B. C., & Sollie, D. L. (1980). Normal stresses during the transition to parenthood. *Family Relations*, *29*, 459-465. doi:10.2307/584459

Murray, A. D. (1979). Infant crying as an elicitor of parental behavior: An examination of two models. *Psychological Bulletin*, *86*(1), 191-215. http://dx.doi.org/10.1037/0033-2909.86.1.191

Muthén, B., & Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology*, *38*(2), 171-189. https://doi.org/10.1111/j.2044-8317.1985.tb00832.x

Nagasawa, M., Okabe, S., Mogi, K., & Kikusui, T. (2012). Oxytocin and mutual communication in mother-infant bonding. *Frontiers in Human Neuroscience*, *6*(31). doi:10.3389/fnhum.2012.00031

Nesbitt, T. S., Connell, F. A., Hart, L. G., & Rosenblatt, R. A. (1990). Access to obstetric care in rural areas: Effect on birth outcomes. *American Journal of Public Health*, *80*(7), 814-818. doi:10.2105/AJPH.80.7.814

Nickell, A. D., Waudby, C. J., & Trull, T. J. (2002). Attachment, parental bonding and borderline personality disorder features in young adults. *Journal of Personality Disorders*, *16*(2), 148-159. https://doi.org/10.1521/pedi.16.2.148.22544

Nikolajsen, L., Sørensen, H. C., Jensen, T. S., & Kehlet, H. (2004). Chronic pain following caesarean section. *Acta Anaesthesiologica Scandinavica*, *48*(1), 111-116. doi:10.1111/j.1399-6576.2004.00271.x

Oberlander, T. F., Weinberg, J., Papsdorf, M., Grunau, R., Misri, S., & Devlin, A. M. (2008). Prenatal exposure to maternal depression, neonatal methylation of human glucocorticoid receptor gene (NR3C1) and infant cortisol stress responses. *Epigenetics, 3*(2), 97-106. http://dx.doi.org/10.4161/epi.3.2.6034

Oddy, W. H., Li, J., Landsborough, L., Kendall, G. E., Henderson, S., & Downie, J. (2006). The association of maternal overweight and obesity with breastfeeding duration. *The Journal of Pediatrics, 149*(2), 185-191. https://doi.org/10.1186/1471-2393-7-9

Olson, B. H., Haider, S. J., Vangjel, L., Bolton, T. A., & Gold, J. G. (2010). A quasi-experimental evaluation of a breastfeeding support program for low income women in Michigan. *Maternal and Child Health Journal, 14*(1), 86-93. https://doi.org/10.1007/s10995-008-0430-5

O'Mahen, H. A., & Flynn, H. A. (2008). Preferences and perceived barriers to treatment for depression during the perinatal period. *Journal of Women's Health, 17*(8), 1301-1309. https://doi.org/10.1089/jwh.2007.0631

Pérez-Escamilla, R., Maulén-Radovan, I., & Dewey, K. G. (1996). The association between cesarean delivery and breast-feeding outcomes among Mexican women. *American Journal of Public Health, 86*(6), 832-836.

Results From the 2016 Pregnancy Risk Assessment Tracking System (PRATS) Annual Report. (2018). Boise: Idaho Department of Health and Welfare, Division of Public Health, Bureau of Vital Records and Health Statistics. Retrieved from http://healthandwelfare.idaho.gov/Portals/0/Health/Statistics/Prats/2016PRATSAnnualReport.pdf

Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Phillips, M. R., & Rahman, A. (2007). No health without mental health. *The Lancet*, *370*(9590), 859-877. https://doi.org/10.1016/S0140-6736(07)61238-0

Rapee, R. M. (1997). Potential role of childrearing practices in the development of anxiety and depression. *Clinical Psychology Review*, *17*(1), 47-67. https://doi.org/10.1016/S0272-7358(96)00040-2

Robbins, C. L., Zapata, L., Farr, S. L., Kroelinger, C. D., Morrow, B., Ahluwalia, I. B., ... & Williams, L. (2014). Core state preconception health indicators--Pregnancy Risk Assessment Monitoring System and Behavioral Risk Factor Surveillance System, 2009.

Rogers, T. R., & Forehand, R. (1983). The role of parent depression in interactions between mothers and their clinic-referred children. *Cognitive Therapy and Research*, *7*(4), 315-324. https://doi.org/10.1007/BF01177554

Rogosa, D. R., & Willett, J. B. (1983). Demonstrating the reliability the difference score in the measurement of change. *Journal of Educational Measurement*, *20*(4), 335-343. https://doi.org/10.1111/j.1745-3984.1983.tb00211.x

Rosenkrantz Aronson, S., & Huston, A. C. (2004). The mother-infant relationship in single, cohabiting, and married families: A case for marriage? *Journal of Family Psychology*, *18*(1), 5-18. http://dx.doi.org/10.1037/0893-3200.18.1.5

Ross, H. E., & Young, L. J. (2009). Oxytocin and the neural mechanisms regulating social cognition and affiliative behavior. *Frontiers in Neuroendocrinology*, *30*(4), 534-547. https://doi.org/10.1016/j.yfrne.2009.05.004

Sarason, I. G., Sarason, B. R., Shearin, E. N., & Pierce, G. R. (1987). A brief measure of social support: Practical and theoretical implications. *Journal of Social and Personal Relationships*, *4*(4), 497-510.

Schaal, B., Marlier, L., & Soussignan, R. (2000). Human foetuses learn odours from their pregnant mother's diet. *Chemical Senses*, *25*(6), 729-737. https://doi.org/10.1093/chemse/25.6.729

Schetter, C. D., & Tanner, L. (2012). Anxiety, depression and stress in pregnancy: Implications for mothers, children, research, and practice. *Current opinion in psychiatry*, *25*(2), 141-148. doi:10.1097/YCO.0b013e3283503680

Sebire, N. J., Jolly, M., Harris, J. P., Wadsworth, J., Joffe, M., Beard, R. W., ... & Robinson, S. (2001). Maternal obesity and pregnancy outcome: A study of 287 213 pregnancies in London. *International Journal of Obesity*, *25*(8), 1175-1182.

Shi, L., Stevens, G. D., Wulu Jr, J. T., Politzer, R. M., & Xu, J. (2004). America's Health Centers: Reducing racial and ethnic disparities in perinatal care and birth outcomes. *Health Services Research*, *39*(6p1), 1881-1902. doi:10.1111/j.1475-6773.2004.00323.x

Shieh, G. (2011). Clarifying the role of mean centring in multicollinearity of interaction effects. *British Journal of Mathematical and Statistical Psychology*, *64*(3), 462-477. https://doi.org/10.1111/j.2044-8317.2010.02002.x

Shingo, T., Gregg, C., Enwere, E., Fujikawa, H., Hassam, R., Geary, C., ... & Weiss, S. (2003). Pregnancy-stimulated neurogenesis in the adult female forebrain mediated by prolactin. *Science*, *299*(5603), 117-120.

Sidor, A., Kunz, E., Schweyer, D., Eickhorst, A., & Cierpka, M. (2011). Links between maternal postpartum depressive symptoms, maternal distress, infant gender and sensitivity in a high-risk population. *Child and Adolescent Psychiatry and Mental Health, 5*(1), 1-7. https://doi.org/10.1186/1753-2000-5-7

Small, R., Taft, A. J., & Brown, S. J. (2011). The power of social connection and support in improving health: Lessons from social support interventions with childbearing women. *BioMed Central Public Health, 11*. doi:10.1186/1471-2458-11-S5-S4.

Sockol, L. E., Battle, C. L., Howard, M., & Davis, T. (2014). Correlates of impaired mother-infant bonding in a partial hospital program for perinatal women. *Archives of Women's Mental Health*, *17*(5), 465-469. https://doi.org/10.1007/s00737-014-0419-6

Stagnaro-Green, A., Abalovich, M., Alexander, E., Azizi, F., Mestman, J., Negro, R., ... & Wiersinga, W. (2011). Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and postpartum. *Thyroid*, *21*(10), 1081-1125. https://doi.org/10.1089/thy.2011.0087

Stifoss-Hanssen, H. (1999). Religion and spirituality: What a European ear hears. *The International Journal for the Psychology of Religion*, *9*(1), 25-33. http://dx.doi.org/10.1207/s15327582ijpr0901_4

Strathearn, L. (2011). Maternal neglect: Oxytocin, dopamine and the neurobiology of attachment. *Journal of Neuroendocrinology*, *23*(11), 1054-1065. doi:10.1111/j.1365-2826.2011.02228.x

Sullivan, R., Perry, R., Sloan, A., Kleinhaus, K., & Burtchen, N. (2011). Infant bonding and attachment to the caregiver: Insights from basic and clinical science. *Clinics in Perinatology, 38*(4), 643-655. https://doi.org/10.1016/j.clp.2011.08.011

Swain, J. E., Tasgin, E., Mayes, L. C., Feldman, R., Todd Constable, R., & Leckman, J. F. (2008). Maternal brain response to own baby-cry is affected by cesarean section delivery. *Journal of Child Psychology and Psychiatry, 49*(10), 1042-1052. doi:10.1111/j.1469-7610.2008.01963.x

Tabahnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed.). Upper Saddle River, New Jersey: Pearson.

Target, M., Fonagy, P., & Shmueli-Goetz, Y. (2003). Attachment representations in school-age children: The development of the Child Attachment Interview (CAI). *Journal of Child Psychotherapy*, *29*(2), 171-186. doi:10.1080/0075417031000138433

Taveras, E. M., Capra, A. M., Braveman, P. A., Jensvold, N. G., Escobar, G. J., & Lieu, T. A. (2003). Clinician support and psychosocial risk factors associated with breastfeeding discontinuation. *PEDIATRICS, 112*(1), 108-115.

Tsartsara, E., & Johnson, M. P. (2006). The impact of miscarriage on women's pregnancy-specific anxiety and feelings of prenatal maternal–fetal attachment during the course of a subsequent pregnancy: An exploratory follow-up study. *Journal of Psychosomatic Obstetrics & Gynecology*, *27*(3), 173-182. http://dx.doi.org/10.1080/01674820600646198

Uchino, B. N. (2009). Understanding the links between social support and physical health: A life-span perspective with emphasis on the separability of perceived and received support. *Perspectives on Psychological Science*, *4*(3), 236-255. https://doi.org/10.1111/j.1745-6924.2009.01122.x

Vickers, A. J. (2001). The use of percentage change from baseline as an outcome in a controlled trial is statistically inefficient: A simulation study. *BMC Medical Research Methodology, 1*(1), 1-6. https://doi.org/10.1186/1471-2288-1-6

Webster-Stratton, C., & Hammond, M. (1988). Maternal depression and its relationship to life stress, perceptions of child behavior problems, parenting behaviors, and child conduct problems. *Journal of Abnormal Child Psychology, 16*(3), 299-315. https://doi.org/10.1007/BF00913802

Weissman, M. M., & Olfson, M. (1995). Depression in women: Implications for health care research. *Science, 269*(5225), 799-801. doi:10.1126/science.7638596

Weisman, O., Granat, A., Gilboa-Schechtman, E., Singer, M., Gordon, I., Azulay, H., ... & Feldman, R. (2010). The experience of labor, maternal perception of the infant, and the mother's postpartum mood in a low-risk community cohort. *Archives of Women's Mental Health, 13*(6), 505-513. https://doi.org/10.1007/s00737-010-0169-z

Widström, A. M., Wahlberg, V., Matthiesen, A. S., Eneroth, P., Uvnäs-Moberg, K., Werner, S., & Winberg, J. (1990). Short-term effects of early suckling and touch of the nipple on maternal behaviour. *Early Human Development, 21*(3), 153-163. https://doi.org/10.1016/0378-3782(90)90114-x

Wigert, H., Berg, M., & Hellström, A. L. (2010). Parental presence when their child is in neonatal intensive care. *Scandinavian Journal of Caring Sciences, 24*(1), 139-146. doi:10.1111/j.1471-6712.2009.00697.x

Wisner, K. L., Sit, D. K., Hanusa, B. H., Moses-Kolko, E. L., Bogen, D. L., Hunker, D. F., ... & Singer, L. T. (2009). Major depression and antidepressant treatment: Impact on pregnancy and neonatal outcomes. *American Journal of Psychiatry*, *166*(5), 557-566. https://doi.org/10.1176/appi.focus.10.1.67

Woods, S. M., Melville, J. L., Guo, Y., Fan, M.-Y., & Gavin, A. (2010). Psychosocial stress during pregnancy. *American Journal of Obstetrics and Gynecology*, *202*(1), 61.e1–61.e7. http://doi.org/10.1016/j.ajog.2009.07.041

Yu, Z., Han, S., Zhu, J., Sun, X., Ji, C., & Guo, X. (2013). Pre-pregnancy body mass index in relation to infant birth weight and offspring overweight/obesity: A systematic review and meta-analysis. *PloS ONE, 8*(4), 1-11. doi:10.1371/ journal.pone.0061627

Appendix A

Edinburgh Postnatal Depression Scale[1] (EPDS)

Name: _____ Address: _____

Your Date of Birth: _____ _____

Baby's Date of Birth: _____ Phone: _____

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt **IN THE PAST 7 DAYS**, not just how you feel today.

Here is an example, already completed.

I have felt happy:
- ☐ Yes, all the time
- ☒ Yes, most of the time
- ☐ No, not very often
- ☐ No, not at all

This would mean: "I have felt happy most of the time" during the past week. Please complete the other questions in the same way.

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - ☐ As much as I always could
   - ☐ Not quite so much now
   - ☐ Definitely not so much now
   - ☐ Not at all

2. I have looked forward with enjoyment to things
   - ☐ As much as I ever did
   - ☐ Rather less than I used to
   - ☐ Definitely less than I used to
   - ☐ Hardly at all

*3. I have blamed myself unnecessarily when things went wrong
   - ☐ Yes, most of the time
   - ☐ Yes, some of the time
   - ☐ Not very often
   - ☐ No, never

4. I have been anxious or worried for no good reason
   - ☐ No, not at all
   - ☐ Hardly ever
   - ☐ Yes, sometimes
   - ☐ Yes, very often

*5 I have felt scared or panicky for no very good reason
   - ☐ Yes, quite a lot
   - ☐ Yes, sometimes
   - ☐ No, not much
   - ☐ No, not at all

*6. Things have been getting on top of me
   - ☐ Yes, most of the time I haven't been able to cope at all
   - ☐ Yes, sometimes I haven't been coping as well as usual
   - ☐ No, most of the time I have coped quite well
   - ☐ No, I have been coping as well as ever

*7 I have been so unhappy that I have had difficulty sleeping
   - ☐ Yes, most of the time
   - ☐ Yes, sometimes
   - ☐ Not very often
   - ☐ No, not at all

*8 I have felt sad or miserable
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Not very often
   - ☐ No, not at all

*9 I have been so unhappy that I have been crying
   - ☐ Yes, most of the time
   - ☐ Yes, quite often
   - ☐ Only occasionally
   - ☐ No, never

*10 The thought of harming myself has occurred to me
   - ☐ Yes, quite often
   - ☐ Sometimes
   - ☐ Hardly ever
   - ☐ Never

Administered/Reviewed by _____ Date _____

[1]Source: Cox, J.L., Holden, J.M., and Sagovsky, R. 1987. Detection of postnatal depression: Development of the 10-item Edinburgh Postnatal Depression Scale. *British Journal of Psychiatry* 150:782-786 .

[2]Source: K. L. Wisner, B. L. Parry, C. M. Piontek, Postpartum Depression N Engl J Med vol. 347, No 3, July 18, 2002, 194-199

Appendix B

Social Support Questionnaire 6 (SSQ6)

Instructions:

The following questions ask about people in your life who provide you with help or support. Each question has two parts. For the first part, list all the people you know, excluding yourself, whom you can count on for help or support in the manner described. Give the person's initials and their relationship to you (see example). Do not list more than one person next to each of the number beneath the question.

For the second part, circle how satisfied you are with the overall support you have.

If you have no support for a question, check the words "No one," but still rate your level of satisfaction. Do not list more than nine persons per question.

Please answer all questions as best you can. All your answer will be kept confidential.

Example:

Who do you know whom you can trust with information that could get you in trouble?

No one	1) T.N. (brother)	4) T.N. (father)	7)
	2) L.M. (friend)	5) L.M. (employer)	8)
	3) R.S. (friend)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

1. Whom can you really count on to be dependable when you need help?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

2. Whom can you really count on to help you feel more relaxed when you are under pressure or tense?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

3. Who accepts you totally, including both your worst and your best points?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

4. Whom can you really count on to care about you, regardless of what is happening to you?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

5. Whom can you really count on to help you feel better when you are feeing generally down-in-the-dumps?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

6. Whom can you count on to console you when you are very upset?

No one	1)	4)	7)
	2)	5)	8)
	3)	6)	9)

How Satisfied?

6 – very satisfied	5 – fairly satisfied	4 – a little satisfied	3 – a little dissatisfied	2 – fairly dissastified	1 – very dissastified

Appendix C

Postnatal Session Screener

STATUS: ____eligible ____ineligible

1. Date:_____

2. Administered By:_____

(To be separated from interview after completed)

Name: _____ Date: _____

How are you doing? How is your baby doing? Since we last spoke, has anything changed with the following:

3. Have you moved? ____ No ____ Yes

3a. If yes, explain?

_____
_____

(*Write new address in "Current Address" space).*

4. Do you plan to move anytime in the near future? ____ No ____ Yes

4a. If yes, explain?

_____

5. Verify **Current Address**: _____
_____
_____

(IF RELEVANT) Future Address: _____
_____

Future Home Phone Number: _____

6. Subject Day Phone #: _____ (Best time to call: _____)

7. Evening Phone #: _____ (Best time to call: _____)

8. Email: _____

9. How best to leave a message:
_____

10. Did you have any complications during labor? ____ No ____ Yes
10a. If yes, please explain:
_____
_____
____

11. Any complications during delivery? ____ No ____ Yes
11a. If yes, explain:
_____
_____
____

12a. How did you deliver? Vaginally ____ Planned C-section ____ Emergency C-section ____

12b. Where did you deliver? Home____Portneuf____Bingham Memorial____
Other (Please List)_____

13. Did you have to take any medications during labor/delivery? Common medications may include (1) prostaglandin gel to soften the cervix, (2) a cervical ripening agent and/or labor/contraction-inducing agent such as Pitocin; (3) pain medication in the form of a narcotic, epidural, or spinal block/anesthesia; (4) an anti-nausea medication given orally or by IV such as promethazine; or (5) an antacid such as Bicitra.

1. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		
1=Steroid 2=Insulin 3=Antidepressant 4=Antibiotic 5=Opiate or Pain Med 6=Other	Date Stopped: Dosage: Reason Taken:	

2. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		
1=Steroid 2=Insulin 3=Antidepressant 4=Antibiotic 5=Opiate or Pain Med 6=Other	Date Stopped: Dosage: Reason Taken:	

3. Medication Name	Medication Information

4. Medication Name	Medication Information

	Date Started:	Notes:
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

	Date Started:	Notes:
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

14. Were any interventions needed during labor/delivery (e.g., stripping membranes, flipping baby, episiotomy)?
14a. If yes, explain:
_____
_____
____
15. Any complications post-delivery? ____ No ____ Yes
15a. If yes, explain:
_____
_____
____

16. Did you have to take any medications post-delivery? Common medications may include (1) pitocin or another medication to ensure uterine contraction and reduce blood loss following delivery, (2) pain medication like Ibuprofen or Tylenol, (3) an anti-nausea medication given orally or by IV such as promethazine, (4) an antacid such as Bicitra, (5) a stool softener like Colace or laxative like fiber, or (6) pain-relieving gel for hemorrhoids or the perineum.

1. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

2. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

3. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type	Date Stopped:	
1=Steroid 2=Insulin 3=Antidepressant 4=Antibiotic 5=Opiate or Pain Med 6=Other	Dosage: Reason Taken:	

4. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type	Date Stopped:	
1=Steroid 2=Insulin 3=Antidepressant 4=Antibiotic 5=Opiate or Pain Med 6=Other	Dosage: Reason Taken:	

17. Did you have any surgery aside from a C-section (tubal ligation, hysterectomy, uterine embolization)? ____ No ____ Yes

17a. If yes, explain:

_____

_____

____

18. Did your Baby have any complications (e.g., fetal distress, meconium exposure, asphyxia, shoulder dystocia, or umbilical cord issues)? ____ No ____ Yes

18a. If yes, explain:

_____

_____

____

19. What was your baby's birth date/gestational age at delivery?

_____

20. What was your baby's length and weight at delivery (**add percentiles, if known**)?

Length _____%ile _____ inches Weight _____%ile _____ lbs.

21. Since your prenatal session, has there been any change in your medications (started/stopped) other than what we discussed surrounding labor/delivery? This includes vitamins/supplements.

1. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		

2. Medication Name	Medication Information	
	Date Started:	Notes:
Medication Type		

	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

3. Medication Name	Medication Information	
		Notes:
	Date Started:	
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

4. Medication Name	Medication Information	
		Notes:
	Date Started:	
Medication Type		
	Date Stopped:	
1=Steroid		
2=Insulin	Dosage:	
3=Antidepressant		
4=Antibiotic	Reason Taken:	
5=Opiate or Pain Med		
6=Other		

22. What was your approximate weight when admitted to the hospital for delivery? _____lbs.

23. What was your approximate weight as soon as measured after delivery (at home or in hospital)? _____lbs.

23a. Approximately how postpartum were you when this measure was taken? _____

24. Were any of the following conditions diagnosed at any point during your pregnancy or since?

24a. Gestational or Type II Diabetes: ____ yes ____ no

24b. High Blood Pressure, Pre-eclampsia, or Toxemia: ____ yes ____ no

24c. Hyper/hypothyroidism or any other type of thyroid disorder: ____ yes ____ no

24d. Group B Strep: ____ yes ____ no

24e. Anemia: ____ yes ____ no

24f. Asthma: ____ yes ____ no

24g. An infection (e.g., Bacterial Vaginosis, Yeast Infection, Trichomoniasis, Urinary Tract Infection, or Chlamydia)

25. Have you **ever** been diagnosed with a physical illness, such as HIV, AIDS, Heart Disease, Herpes, Hepatitis, or Seizures? ____ yes ____no

25a. If yes, list physical illnesses:_____

26. Have you been diagnosed with a psychological disorder since your prenatal session: _____ yes _____ no
If yes,
describe:_____

26a. Check if one of the categories below:

Bipolar disorder	____ Yes	____ No
Schizophrenia	____ Yes	____ No
Schizoaffective disorder	____ Yes	____ No
Psychosis	____ Yes	____ No

Was the Idaho Department of Health and Welfare involved in your labor/delivery or do you anticipate them being involved in the future? ____ Yes ____ No

How so?

_____

DEMOGRAPHICS UPDATE:

Now, I would like to review some of the information you shared about your family, work status and living arrangements and see if anything has changed.

27. Has your relationship with your partner changed at all? _____ No _____ Yes
27a. If yes, describe:

_____
____
_____
____

Code change in status
1. single _____ 2. married _____ 3. divorced _____ 4. widowed _____ 5. separated _____ 6. committed relationship _____ 7. Other (Describe) _____

28. Has anything about your living conditions changed since your prenatal session?
_____ No _____ Yes
***(If Yes there is a change, circle appropriate code)*:**

Code new living arrangement
_____ Rent an apt. _____ Live with relatives (***If Yes ask, "Do you pay rent? _____Yes _____ No)*** _____ Own condo _____ Own house _____ rent house _____ Other _____

29. Number of people living in the house ____ # Total ____# Adults ____# Children

30. Are you working? _____ No _____ Yes
30a. **If yes:** What is your occupation? _____

31. Are you in school? _____ No _____ Yes

32. What is the total income in your household from all sources over the last year?

<$5,000	1
$5,000 to $9,999	2
$10,000 to $19,999	3
$20,000 to $29,999	4
$30,000 to $39,999	5
$40,000 to $49,999	6
$50,000 to $74,999	7
$75,000 to $99,999	8
≥ $100,000	9

Thanks so much for your time!

Appendix D

6-Month Infant Dietary Questionnaire

---

1. **Since we last saw you** on _____ (date of last session), how have you fed your baby? (Please circle yes or no)

   Formula: yes no

   Breastfeeding: yes no

   Other food **not** including meat (e.g., infant snacks, meals, or other solids): yes no

   Other foods including meat (e.g., pureed meats, infant dinner, other meat products) yes no

---

2. **If you have fed your baby formula since we last saw you:**
   a. How old was you baby when you this began? _____months _____weeks _____days
   b. What kind of formula (or non-breast milk) do you use?

      _____

      i. Is this iron fortified? (circle:) yes no
      ii. Is this DHA or other supplemented? (circle:) yes no
      iii. Is this special diet formula (e.g., lactose free)? (circle:) yes no
   c. Presently, for how many feedings a day do you use formula? _____Feedings per day

---

3. **If you have breastfed your baby since we last saw you:**
   a. Are you currently breastfeeding your baby? (circle:) yes no
      i. If no, for how long did you breastfeed you baby? ____months ____weeks ____days
   b. Are you having or did you have any difficulty with breastfeeding? (circle:) yes no

      If yes, was this due to (Check all that apply):

      - Difficulties for you (e.g., not expressing enough milk, soreness, or fatigue)

- Difficulties for baby (e.g., latching, inability to suck properly, not obtaining enough milk, or not interested in feeding)
- Time management (e.g., returning to work and unable to pump)
- Insufficient environment (e.g., discomfort feeding in public or around others in the home)
- Other (please explain):

  _____

c. Presently, for how many feedings a day do you breastfeed? _____Feedings per day

---

4. **If you have fed your baby other food <u>not including</u> meat since we last saw you:**
   a. How old was your baby when this began? ____months _____weeks _____days
   b. Presently, for how may feedings a day do you use other foods not including meat products? _____ Feedings per day

---

5. **If you have fed your baby other food <u>including</u> meat since we last saw you:**
   a. How old was your baby when this began? ____months _____weeks ____days
   b. Presently, for how many feedings a day does your baby eat pureed meats, infant dinners, or other meat products? _____months _____weeks _____days

---

6. **What kinds of foods does your baby take now?** Please **circle** all that apply **AND** estimate the number of feedings your baby had per week for each category.

a. baby cereal: *example: Gerber rice or grain cereal*	**YES NO**	**____(#servings/week)**
b. cereal: example cheerios/oatmeal (not infant)	**YES NO**	**____(#servings/week)**
c. cow's milk	**YES NO (whole, 2%, 1%, or skim)**	**____(#servings/week)**
d. mashed table food	**YES NO**	**____(#servings/week)**
e. infant fruit	**YES NO**	**____(#servings/week)**
f. infant vegetables	**YES NO**	**____(#servings/week)**
g. baby meat	**YES NO**	**____(#servings/week)**
h. infant "dinners"	**YES NO**	**____(#servings/week)**
i. infant juice	**YES NO**	**____(#servings/week)**
j. regular juice/juice drinks	**YES NO**	**____(#servings/week)**

k. infant desserts	**YES NO**	**____(#servings/week)**
l. other homemade puree/ground baby food	**YES NO**	**____(#servings/week)**
m. other foods (please list **AND** include # of servings/week in parentheses): _____ _____ _____	**YES NO**	**____(#servings/week)**

7. **Do you give your baby any supplements?** (circle:) yes no

If yes, please list all that apply:

_____

_____

_____

_____

Appendix E

6-Month ICQ-R

We are interested in how parents think and feel when their babies cry. Please circle how often you tend to think or feel this way when your baby cries on a 5-point scale, where 1=never and 5=always.

When my baby cries:	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
1. I want my baby to know he/she can rely on me to help.	1	2	3	4	5
2. I want to make my baby stop quickly because crying is a nuisance.	1	2	3	4	5
3. I want to make my baby feel secure/cared for.	1	2	3	4	5
4. I want to make my baby stop so others aren't disturbed.	1	2	3	4	5
5. I let my baby cry it out so s/he doesn't get too dependent on me.	1	2	3	4	5
6. I want to make my baby feel better because it makes me feel like a good parent.	1	2	3	4	5
7. I will just remind myself babies don't have feelings.	1	2	3	4	5
8. I want my baby to stop crying because I'm not sure I know the right way to respond.	1	2	3	4	5
9. I think my baby is trying to tell me something.	1	2	3	4	5
10. I know it's for a physical reason like needing to be fed, changed, or take a nap and not for an emotional reason like feeling sad or afraid.	1	2	3	4	5
11. I want to make my baby stop crying because it shows people I'm a good parent.	1	2	3	4	5
12. I think my baby just wants attention.	1	2	3	4	5
13. I think my baby is trying to communicate with me.	1	2	3	4	5
14. I think my baby is trying to control or manipulate me.	1	2	3	4	5
15. I want to make my baby feel better.	1	2	3	4	5
16. I want my baby to stop because can't get anything else done.	1	2	3	4	5

17. I want to make my baby feel safe.	1	2	3	4	5
18. I want my baby to stop because crying doesn't accomplish anything.	1	2	3	4	5
19. I want to comfort my baby.	1	2	3	4	5
20. I think my baby is crying for a reason.	1	2	3	4	5
21. I let my baby cry it out so he/she doesn't get spoiled.	1	2	3	4	5

We also want to know why parents decide how to respond when their babies cry. Please circle how often you have felt or thought the following things when you respond to your baby's cries on a 5-point scale, where 1=never and 5=always.

The way I respond when my baby cries:	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
1. Can spoil my baby.	1	2	3	4	5
2. Can affect how my baby feels about him/herself in the future.	1	2	3	4	5
3. Teaches my baby about emotions (like how to show them appropriately).	1	2	3	4	5
4. Lets my baby know that I am in charge.	1	2	3	4	5
5. Helps my baby learn how to cope with emotions.	1	2	3	4	5
6. Shows what a good parent I am.	1	2	3	4	5
7. Makes my baby feel safe and secure.	1	2	3	4	5
8. Can affect how my baby feels about me in the future.	1	2	3	4	5
9. Lets my baby know that it is okay to be upset.	1	2	3	4	5
10. Lets my baby know that there is no good reason to cry.	1	2	3	4	5
11. Makes my baby feel like he/she can rely on me.	1	2	3	4	5
12. Helps me get on with other things.	1	2	3	4	5
13. Helps my baby move on to more important things like learning and exploring.	1	2	3	4	5
14. Is more important to me than my baby.	1	2	3	4	5
15. Makes my baby feel like I care about he/she feels.	1	2	3	4	5
16. Teaches my baby that it is just not okay to throw a fit.	1	2	3	4	5
17. Teaches my baby to control his/her emotions.	1	2	3	4	5

18. Makes my baby feel confident.	1	2	3	4	5
19. Helps my baby move on to having fun.	1	2	3	4	5
20. Teaches my baby that crying doesn't get you what you want.	1	2	3	4	5
21. Teachers my baby how to get along with other people.	1	2	3	4	5
22. Has no effect long term effect on my baby.	1	2	3	4	5

Additionally, we are interested in how mothers feel when their babies cry. Please circle how often you feel these ways when your baby cries on a 5-point scale, where 1=never and 5=always.

When my baby cries:	**Never**	**Rarely**	**Sometimes**	**Often**	**Always**
1. I feel sad for my baby.	1	2	3	4	5
2. I feel irritated by the sound.	1	2	3	4	5
3. I feel anxious; like nothing I do will help.	1	2	3	4	5
4. I feel annoyed that my baby is pulling me away from other things.	1	2	3	4	5
5. I feel nervous that I won't know how to respond.	1	2	3	4	5
6. I feel sorry for my baby.	1	2	3	4	5
7. I feel worried that others will think I am a bad parent.	1	2	3	4	5
8. I feel concerned for my baby.	1	2	3	4	5
9. I feel worried for my baby- about what my baby might want or need.	1	2	3	4	5
10. I feel worried for me that my baby might keep crying for a while.	1	2	3	4	5
11. I feel a strong desire to make my baby feel better.	1	2	3	4	5
12. I feel amused that my baby is upset.	1	2	3	4	5
13. I feel sad for myself because I have to deal with it.	1	2	3	4	5
14. I feel angry at the situation or person that upset my baby.	1	2	3	4	5
15. I feel angry at my baby.	1	2	3	4	5
16. I feel like it's funny.	1	2	3	4	5
17. I feel frustrated with my baby for not calming down.	1	2	3	4	5
18. I feel like laughing.	1	2	3	4	5
19. I feel annoyed at my baby for over-reacting.	1	2	3	4	5
20. I feel protective of my baby.	1	2	3	4	5

Appendix F

ID#_____ Date: _____

SES

1. How many people live in your household? (Including you) | | |

2. Who supports or contributes to the household? **Check all that apply.**
(Ask separately for a to d. For b to d, individual need not be living in household.)

Individual	Check if contributing*
a) Subject	
b) Baby's Father	
c) Subject's Partner Who is Not Child's Father	
d) Other Adult (if more then one, choose the one making the largest contribution)	

*Write N/A for categories in which no such person exists.

3. Apart from you, who contributes the most money to the child's household? (Select only one)

Baby's Father	1
Subject's Partner Who is Not Child's Father	2
Other Adult	3
No Other Contributors	4

4. What is the total income in your household from all sources over the last year?

<$5,000	1
$5,000 to $9,999	2
$10,000 to $19,999	3
$20,000 to $29,999	4
$30,000 to $39,999	5
$40,000 to $49,999	6
$50,000 to $74,999	7
$75,000 to $99,999	8
≥ $100,000	9

ID#_____ Date: _____

If baby's father does <u>not</u> contribute to household ask the following question.

5. What is the total income of the baby's father from all sources over the last year?

<$5,000	1
$5,000 to $9,999	2
$10,000 to $19,999	3
$20,000 to $29,999	4
$30,000 to $39,999	5
$40,000 to $49,999	6
$50,000 to $74,999	7
$75,000 to $99,999	8
≥ $100,000	9

6. Does the household income stay the same month to month? Yes [1] No [2]

Note: Complete questions 7, 8 and 9 for the subject, the baby's father, and the adult contributing the most money to the household (if this is not the baby's father). If there are no contributing adults (answer to question 3 is 4), complete only for the subject and baby's father.

Assign Educational Scale Score As Follows:

1 = Less than seventh grade
2 = Junior high school (7th to 9th grade)
3 = Partial high school (10th to 12th grade)
4 = High school degree (including GED)
5 = Partial college (minimum 1 year) or other specialized or technical training
6 = Standard college or university degree
7 = Graduate training with degree

7. What is the highest grade _____ has completed?
(Ask separately for a, b and c. Circle the answer below, and then assign Educational Scale Score.)

a) Subject 1-6 7 8 9 10 11 HS 1 2 3 4 BA/BS MA/MS PhD/MD ☐

b) Baby's Father 1-6 7 8 9 10 11 HS 1 2 3 4 BA/BS MA/MS PhD/MD ☐

c) Contributing Adult 1-6 7 8 9 10 11 HS 1 2 3 4 BA/BS MA/MS PhD/MD ☐

ID#_____ Date: _____

Assign Occupational Scale Score as Follows
Refer to Full Occupational List if Needed. If unable to decide between 2 levels, score lowest level.
0 = Homemaker / housewife
1 = Welfare recipient; unemployed; farm laborer; menial service worker
2 = Unskilled workers
3 = Machine operators and semiskilled workers
4 = Smaller business owners; skilled manual workers, craftsmen; tenant farmers
5 = Clerical and sales workers, small farm and business owners (up to 2 employees)
6 = Technicians, semi-professionals, small business owners (up to 5 employees)
7 = Medium-small business owners (up to 20 employees), farm owners, managers, minor professionals
8 = Administrators, lesser professionals, proprietors of medium-sized businesses
9 = Higher executives, proprietors of large businesses, major professionals

8. What is _____'s usual occupation?
(Ask separately for a, b and c. Record in the space provided and then assign Occupational Scale Score.)

a) Subject _____ ☐

b) Baby's Father _____ ☐

c) Contributing adult _____ ☐

9. Is _____ currently working? (*Ask separately for a, b and c.*)

	Yes	No
a) Subject	1	2
b) Baby's Father	1	2
c) Contributing Adult	1	2

If subject is not currently working, ask the following question.

10. Have you ever held a job? ___ Yes (1) ___ No (2)

If yes, what kind of work? _____

_____

When did you last work? _____

If baby's father is not currently working, ask the following question.

11. Has he ever held a job? ___ Yes (1) ___ No (2)

ID#_____ Date: _____

If yes, what kind of work? _____

_____

When did he last work? _____

12. Is _____ currently in school? (*Ask separately for a and b.*)

	Yes	No
a) Subject	1	2
b) Baby's Father	1	2
c) Contributing Adult	1	2

Appendix G

Pregnancy Context

Subject ID#: _____ Date: _____ Session: _____

PREGNANCY CONTEXT

SUBJECT DOB:_____ AGE:_____

I would also like to ask you some questions about your pregnancy and behaviors and feeling during your pregnancy.

How was your due date established?
By your Last Menstrual Period? **__Yes __No**
By 1st Trimester Ultrasound (up to 12 weeks)? **__Yes __No**
By 2nd Trimester Ultrasound (up to 28 weeks)? **__Yes __No**
Other
Describe:_____

1. When was you last menstrual period? _____ (date)
2. How exact is that date?_____
   Were you keeping track of your menstrual period? ___Yes ___No
   Explanation: _____
3. When did you first find out that you were pregnant? _____ (date or weeks gestation)
4. How did you find out that you were pregnant?
   _____
5. Was your pregnancy planned? ___Yes ___No
6. Did you have any trouble conceiving?
   ____ No
   ____ Yes, but no treatment
   ____ Yes, received fertility treatment
7. If yes, how long were you trying to conceive?
   _____
8. If received fertility treatment, please describe: _____
9. When was your first prenatal exam? _____ (if date, then calculate # weeks pregnant after interview and fill in here) _____
10. Is this your first pregnancy? _____Yes _____No
11. How many pregnancies have you had **(including this one)**? _____ (#)

Note: If this is mother's first pregnancy, Skip to Questions 19

Of these previous pregnancies…

12. Did any result in full term deliveries? ___Yes ___No
13. Did any result in preterm deliveries? ___Yes ___No
    If yes, how may? _____
14. Were any of these miscarriages or stillbirths? ___Yes ___No
15. Were any of these elective abortions? ___Yes ___No

If yes, how many?_____

16. So overall, you have given birth to how many children? _____(# live births or N/A)
17. Approximately, how many weeks gestation were you for each of your previous pregnancies resulting in live births?
    Pregnancy 1:_____
    Pregnancy 2:_____
    Pregnancy 3:_____
    Pregnancy 4:_____
    Pregnancy 5:_____
    Pregnancy 6:_____
18. How old were you when your first child was born? _____ **(record Age) N/A**

(Fill In: How old will mother be when baby is born? _____ (Calculate from due date)

19. Have you had any of the following symptoms during this pregnancy?
    a. Severe morning sickness _____Yes _____No
    b. Any morning sickness _____ Yes _____No
       If yes, to a or b, for how many weeks? _____
       When during pregnancy _____ (date) to _____ (date)
       If yes to a or b, please describe
       _____
       _____
    c. High blood pressure _____Yes_____No
    d. Bleeding/spotting _____Yes_____No
       If yes, please describe
       _____
       _____
    e. Infection (Bacterial Vaginosis, Yeast Infection, Trichomoniasis, Urinary Tract Infection, or Chlamydia) _____Yes _____No
       If yes, please describe
       _____
       _____
    f. Anything else?
       If yes, please describe
       _____
       _____
20. Has the pregnancy affected your eating habits? _____Yes _____No
    If yes, please describe
    _____
    _____
21. Has the pregnancy affected your stress level? _____Yes _____No
    If yes, please describe
    _____
    _____
22. Have any significant or important events or changes happened to your during this pregnancy or 3 months before this pregnancy? ____Yes ____No

If yes, what happened?

_____

_____

23. How did you feel when you found out you were pregnant with this baby?
(open-ended, write verbatim)

_____

_____

24. How are you feeling about the pregnancy now?
(open-ended, write verbatim)

_____

_____

25. Were you using birth control at the time you became pregnant?
___Yes, but not regularly (a:Type_____)
___Yes, much have failed (b.Type_____)
___No, but not trying to conceive
___No, trying to conceive
26. At any time during this pregnancy, did you consider abortion or adoption? (Note: If mother has responded that she was pleased to pregnant, say "I know you said you were pleased to be pregnant but…." _____Yes _____No
27. Are you planning to have a C-section? _____Yes _____No
IF YES: What is the reason for the planned C-section?

_____

_____

If pregnant previously: Have you ever had a C-section? ___Yes ___No
IF YES: What was the reason for the C-section?

_____

28. *If pregnant previously*: Did you have any complications with your prior pregnancies or deliveries?
___yes ___no
If yes, explain:

_____

_____

29. *If other children*: Were/are there any medical or developmental problems with any of your children?
___yes ___no
30. What is your current marital status?
    1. Single
    2. Married
    3. Divorced
    4. Widowed
    5. Separated
    6. Committed relationship
    7. Engaged
31. What is your current relationship with this baby's father?
___We are married ___(how long-specify months or years)

___We are divorced/separated ___(how long married, how long divorced/separated-months years)
___We are living together but not married ____(how long together-specify months/years)
___We are no longer involved with each other romantically_____
___We are no longer involved with each other romantically_____
Probe for reason-e.g broke up,_____
When did relationship end? _____ months prior
Are you currently involved other than romantically (e.g., does he share responsibility for previous children?)

32. **(If known)** how old is baby's father? ___ years ___Not sure of father
33. **(If known)** Does baby's father smoke currently? ___Yes ___No
Approximately how many cigarettes per day?_____
(If not smoking currently, ask next question; otherwise skip to Questions 35)
34. **(If known)** has baby's father ever smoked regularly? ___Yes ___No
(If yes) Approximately how many cigarettes per day? _____
35. **(If father is not current partner)**, is there another man in your life right now?
___Yes
___No
If yes, how long have you been together? _____(months) **N/A**
36. ***Note: If first birth, skip this)*** Now, can you tell me about each of your children. I would like to know their ages and whether the child lives with you now.
(List children and include any deceased children).

Child's Age	Does Child Live with You? Y/N

Living Arrangements
Now I'd like to get to know something about your household.

37. What are your current living arrangements?
___ rent an apt.
___ live with relatives (***If Yes ask, "Do you pay rent? ___ Yes ____No***)
___ own condo
___ own house
___ rent house
___ other _____

37a. If live with relatives, do you live in a:
___apartment
___ house or condo

37b. If living in apartment, how many units are in your apt building?
_____ (3units) or _____unsure
If unsure: Can you estimate the number of units?
___<to 5 units
___6-10 units

___ 11-15 units
___ 16-20 units
___ 21-25 units
___ >25

38. Have you moved at any time during this pregnancy? __No __Yes
    If yes, how many times?_____
    If yes, explain? _____
39. Do you plan to move anytime in the near future (e.g., after baby comes)? ___No
    ___Yes
    If yes, explain? _____
40. Who live in the house/apartment with you?
    Number of adults: ___
    Number of children: ___
41. Does anyone else in the household smoke? _____Yes _____No
42. Please list for me who smokes and how much they smoke per day? N/A

Who Smokes	How much do they smoke on average each day?

Appendix H

Table 1

Skewness and Kurtosis Prior to Data Transformation

	Skewness	*SE*	Kurtosis	*SE*
Attachment	-1.719	0.246	2.609	0.488
Social Support	-2.540	0.246	7.684	0.488
Prenatal EPDS	1.157	0.246	1.124	0.488

Note. These values correspond with the three initially non-normally distributed variables for Model 1 and Model 2. The above depicts non-transformed values for skewness and kurtosis and their respective standard errors.

Appendix I

Table 2

Skewness and Kurtosis After Data Transformation

	Skewness	*SE*	Kurtosis	*SE*
Attachment	0.453	0.246	-0.885	0.488
Social Support	-0.637	0.246	-0.865	0.488
Prenatal EPDS	-0.213	0.246	0.052	0.488

Note. These values correspond with the three initially non-normally distributed variables for Model 1 and Model 2. The above depicts transformed values for skewness and kurtosis and their respective standard errors. Transformations included a reflected natural logarithm transformation (attachment), reflected and inverse transformation (social support), and square root transformation (prenatal EPDS).

Appendix J

Table 3

Maternal Sociodemographic Descriptives at 6-Month Postpartum Session

	n=96	*n=92*
Race	**N / %**	**N / %**
Asian	1 / 1	1 / 1
Hispanic/Latino	4 / 4	4 / 4
Multiracial	12 / 13	12 / 13
Other	1 / 1	0 / 0
White/European-American	78 / 81	75 / 82
Relationship Status		
Committed Relationship	3 / 3	3 / 3
Divorced	1 / 1	1 / 1
Engaged	2 / 2	2 / 2
Married	81 / 85	78 / 85
Single	9 / 9	8 / 9
Highest Level of Education		
Junior High School	1 / 1	1 / 1
Partial High School	2 / 2	2 / 2
High School Diploma/GED	14 / 15	14 / 15
Partial College/Technical Degree	32 / 33	30 / 33
BA/BS University Degree	37 / 39	36 / 39
Graduate Training with Degree	10 / 10	9 / 10
Total Household Income		
<$5,000	1 / 1	1 / 1
$5,000-9,999	2 / 2	2 / 2
$10,000-19,999	14 / 15	14 / 15
$20,000-29,999	17 / 18	16 / 17
$30,000-39,999	12 / 13	12 / 13
$40,000-49,999	9 / 9	8 / 9
$50,000-74,999	28 / 29	26 / 28
$75,000-99,999	7 / 7	7 / 8
≥$100,000	6 / 6	6 / 7
Number of Other Children		
0 Children	39 / 41	38 / 41
1 Child	29 / 30	27 / 29
2 Children	12 / 13	12 / 13
3 Children	6 / 6	6 / 7
4 Children	3 / 3	2 / 2
5 Children	5 / 5	5 / 6
6 Children	1 / 1	1 / 1
8 Children	1 / 1	1 / 1

Note. For the sample of 96, 14% of women identified as Hispanic, but 69% of them were multiracial and coded as such. One mother, classified as "Other," identified as Chilean. In the sample of 92, 14% also identified as Hispanic, and 69% of them were also multiracial.

Appendix K

Table 4

Model 1: Moderated Mediation Transformed Data with 96 Participants

	b	*SE*	*t*	*p*
$X \rightarrow M_1$	0.010	0.157	0.062	0.950
$M_1 \rightarrow M_2$	0.008	0.258	0.031	0.976
$M_1*W \rightarrow M_2$	1.546	1.058	1.462	0.147
$M_2 \rightarrow Y$	0.003	0.009	0.261	0.795
$X \rightarrow Y$	-0.085	0.036	-2.391	0.019*

Note. In this model, maternal prenatal depression is the primary predictor (X), postnatal maternal physical health is the first mediator (M_1) between X and the second mediator, breastfeeding frequency is the second mediator (M_2) between M_1 and Y, postnatal social support is the moderator between M_1 and M_2 (W), and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 11 for the full model.

*$p<0.05$.

Appendix L

Table 5

Model 1: Moderated Mediation Transformed Data with 92 Participants

	b	*SE*	*t*	*p*
$X \rightarrow M_1$	-0.012	0.163	-0.076	0.940
$M_1 \rightarrow M_2$	0.015	0.267	0.056	0.956
$M_1*W \rightarrow M_2$	1.689	1.131	1.493	0.139
$M_2 \rightarrow Y$	0.003	0.010	0.268	0.789
$X \rightarrow Y$	-0.075	0.037	-2.020	0.047*

Note. In this model, maternal prenatal depression is the primary predictor (X), postnatal maternal physical health is the first mediator (M_1) between X and the second mediator, breastfeeding frequency is the second mediator (M_2) between M_1 and Y, postnatal social support is the moderator between M_1 and M_2 (W), and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 11 for the full model.

*$p<0.05$.

Appendix M

Table 6

Model 2: Moderated Moderated Mediation Transformed Data with 96 Participants

	b	*SE*	*t*	*p*
X → M	-0.146	0.111	-1.315	0.192
X*W → M	-0.002	0.073	-0.030	0.976
M → Y	0.001	0.010	0.113	0.910
M*Z → Y	-0.081	0.036	-2.252	0.027*
X → Y	-0.003	0.010	-0.330	0.742

Note. In this model, maternal prenatal to postnatal change in depression is the primary predictor (X), breastfeeding frequency is the mediator (M) between X and Y, postnatal maternal physical health is the moderator (W) between X and M, postnatal social support is the moderator (Z) between M and Y, and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 12 for the full model.

*$p<0.05$.

Appendix N

Table 7

Model 2: Moderated Moderated Mediation Transformed Data with 92 Participants

	b	*SE*	*t*	*p*
X → M	-0.145	0.116	-1.252	0.214
X*W → M	-0.002	0.075	-0.031	0.976
M → Y	<-0.001	0.010	-0.036	0.971
M*Z → Y	-0.078	0.036	-2.170	0.033*
X → Y	-0.001	0.010	-0.127	0.899

Note. In this model, maternal prenatal to postnatal change in depression is the primary predictor (X), breastfeeding frequency is the mediator (M) between X and Y, postnatal maternal physical health is the moderator (W) between X and M, postnatal social support is the moderator (Z) between M and Y, and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 12 for the full model.

*p<0.05.

Appendix O

Table 8

Model 2: Moderated Moderated Mediation Non-Transformed Data with 96 Participants

	b	*SE*	*t*	*p*
X → M	-0.146	0.111	-1.315	0.192
X*W → M	-0.002	0.073	-0.030	0.976
M → Y	0.062	0.082	0.757	0.451
M*Z → Y	-0.238	0.097	-2.464	0.016*
X → Y	-0.044	0.088	-0.492	0.624

Note. In this model, maternal prenatal to postnatal change in depression is the primary predictor (X), breastfeeding frequency is the mediator (M) between X and Y, postnatal maternal physical health is the moderator (W) between X and M, postnatal social support is the moderator (Z) between M and Y, and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 12 for the full model.

*$p<0.05$.

Appendix P

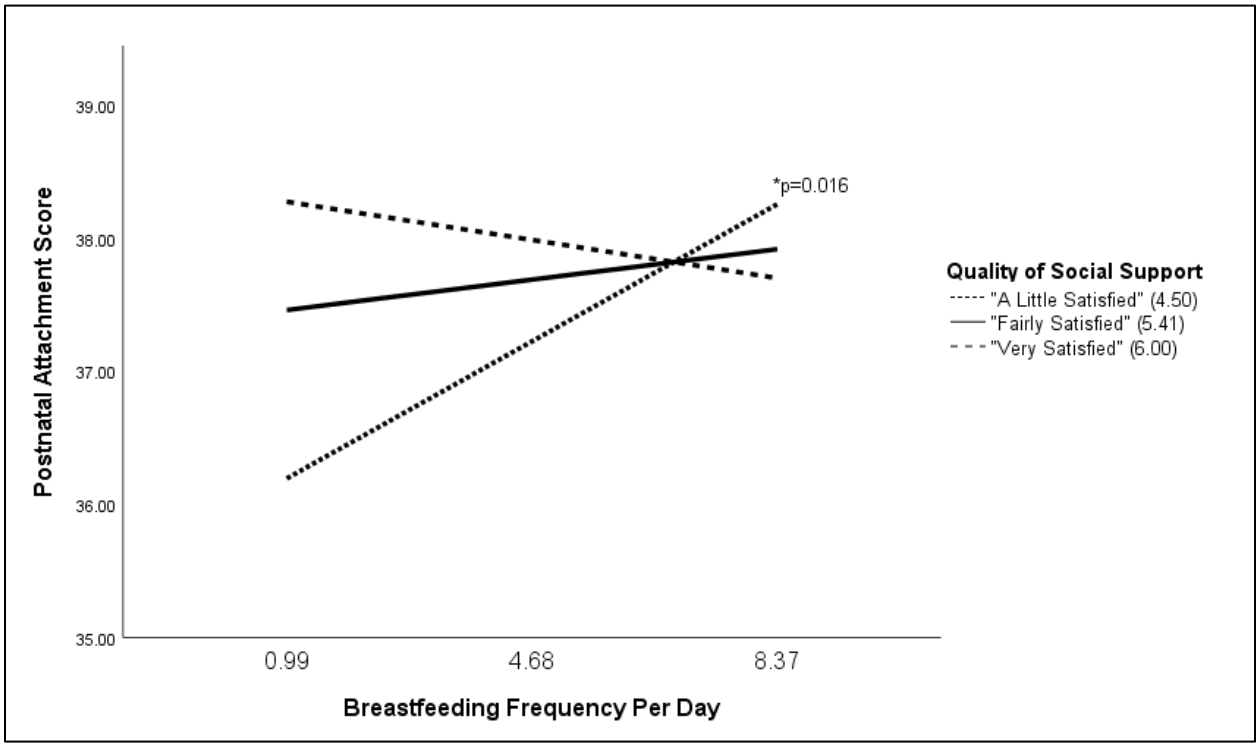

Figure 13. SIMPLE SLOPES ANALYSIS WITH 96 PARTICIPANTS. The above figure depicts the interaction between breastfeeding frequency and satisfaction with social support (SSQ-6) to explain postnatal maternal-infant attachment (ICQ-R) in Model 2 for the sample of 96 participants using the raw data. Note that values in the above figure reflect one standard deviation below the mean (0.99), the mean (4.68), and one standard deviation above the mean (8.37) for breastfeeding frequency. The sample also produced 30 mothers reporting a breastfeeding frequency at or below 0.99, 50 mothers endorsing a breastfeeding frequency between 1.00 and 8.36, and 16 mothers reporting a breastfeeding frequency at or above 8.37. The values for satisfaction with social support reflect one standard deviation below the mean (4.50), the mean (5.41), and the maximum value (6.00) of 6 points. For those with social support satisfaction levels at one standard deviation below the mean (4.50; p=0.016), the positive slope of relations between breastfeeding frequency and postnatal maternal-infant attachment significantly differed from 0. Those relations were not significant for mothers with social support satisfaction levels at the mean (5.41; p=0.451) and at the maximum level of social support (6.00; p=0.458). The sample of 96 mothers produced 11 mothers reporting social support satisfaction scores at or below 4.50, 47 mothers endorsing a social support satisfaction score between 4.51 and 5.99, and 38 mothers reporting a social support satisfaction score of 6.00. See Figure 12 for the full model.

Appendix Q

Table 9

Model 2: Moderated Moderated Mediation Non-Transformed Data with 92 Participants

	b	*SE*	*t*	*p*
X → M	-0.145	0.116	-1.252	0.214
X*W → M	-0.002	0.075	-0.031	0.976
M → Y	0.039	0.083	0.470	0.640
M*Z → Y	-0.256	0.097	-2.646	0.010*
X → Y	-0.039	0.089	-0.439	0.662

Note. In this model, maternal prenatal to postnatal change in depression is the primary predictor (X), breastfeeding frequency is the mediator (M) between X and Y, postnatal maternal physical health is the moderator (W) between X and M, postnatal social support is the moderator (Z) between M and Y, and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 12 for the full model.

*$p<0.05$.

Appendix R

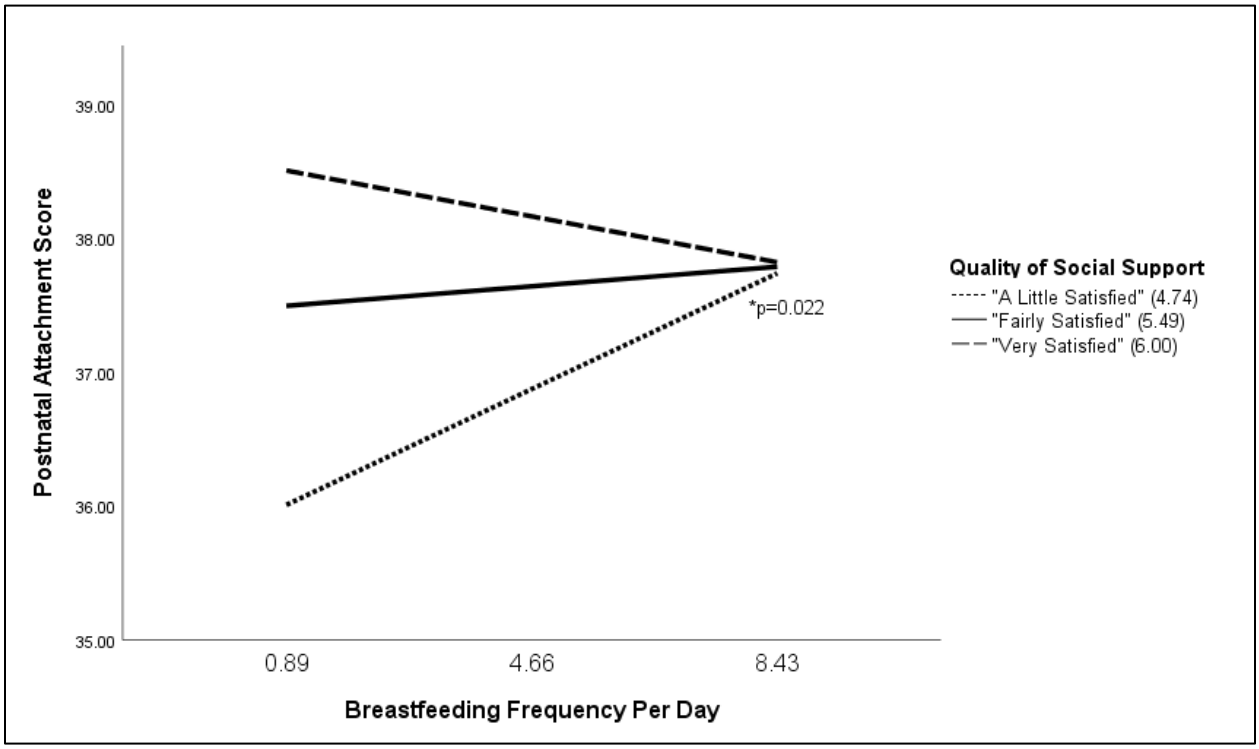

Figure 14. SIMPLE SLOPES ANALYSIS WITH 92 PARTICIPANTS. The above figure depicts the interaction between breastfeeding frequency and satisfaction with social support (SSQ-6) to explain postnatal maternal-infant attachment (ICQ-R) in Model 2 for the sample of 92 participants using the raw data. Note that values in the above figure reflect one standard deviation below the mean (0.89), the mean (4.66), and one standard deviation above the mean (8.43) for breastfeeding frequency. The sample also produced 30 mothers reporting a breastfeeding frequency at or below 0.89, 46 mothers endorsing a breastfeeding frequency between 0.90 and 8.42, and 16 mothers reporting a breastfeeding frequency at or above 8.43. The values for satisfaction with social support reflect one standard deviation below the mean (4.74), the mean (5.49), and the maximum value (6.00) of 6 points. For those with social support satisfaction levels at one standard deviation below the mean (4.74; p=0.022), the positive slope relations between breastfeeding frequency and postnatal maternal-infant attachment significantly differed from 0. Those relations were not significant for mothers with social support satisfaction levels at the mean (5.49; p=0.640) and at the maximum level of social support (6.00; p=0.384). The sample of 92 mothers produced 10 mothers reporting social support satisfaction scores at or below 4.74, 45 mothers endorsing social support satisfaction scores between 4.75 and 5.99, and 37 mothers reporting social support satisfaction scores of 6.00. See Figure 12 for the full model.

Appendix S

Table 10

Model 2: Conditional Indirect Effects of X on Y Transformed Data with 96 Participants

Health	Support	Effect	*SE*	LCI	UCI
-1.486	-0.253	-0.003	0.005	-0.015	0.004
-1.486	0.000	<-0.001	0.002	-0.005	0.004
-1.486	0.243	0.003	0.004	-0.004	0.014
0.000	-0.253	-0.003	0.003	-0.011	0.002
0.000	0.000	<-0.001	0.002	-0.004	0.004
0.000	0.243	0.003	0.003	-0.002	0.011
1.486	-0.253	-0.003	0.004	-0.013	0.004
1.486	0.000	<-0.001	0.002	-0.004	0.004
1.486	0.243	0.003	0.004	-0.003	0.013

Note. Health = one standard deviation below the mean (-1.486; low), the mean (0.00; average), and one standard deviation above the mean (1.486; high) for postnatal maternal health complications (first moderator); Support = one standard deviation below the mean (-0.253; low), the mean (0.00; average), and at the maximum score (0.243; high) for postnatal maternal perception of quality of social support (second moderator); Effect = the indirect effect of X on Y at combinations of low, average, and high values of the moderators; *SE* = standard error; LCI = lower confidence interval; UCI = upper confidence interval. When confidence intervals include 0, results are not statistically significant. See Figure 12 for the full model.

Appendix T

Table 11

Model 2: Conditional Indirect Effects of X on Y Transformed Data with 92 Participants

Health	Support	Effect	*SE*	LCI	UCI
-1.496	-0.240	-0.003	0.004	-0.014	0.003
-1.496	0.000	<-0.001	0.002	-0.004	0.005
-1.496	0.230	0.003	0.004	-0.004	0.014
0.000	-0.240	-0.003	0.003	-0.011	0.002
0.000	0.000	<-0.001	0.002	-0.004	0.004
0.000	0.230	0.003	0.003	-0.002	0.011
1.496	-0.240	-0.003	0.004	-0.013	0.003
1.496	0.000	<-0.001	0.002	-0.004	0.005
1.496	0.230	0.003	0.004	-0.003	0.013

Note. Health = one standard deviation below the mean (-1.496; low), the mean (0.00; average), and one standard deviation above the mean (1.496; high) for postnatal maternal health complications (first moderator); Support = one standard deviation below the mean (-0.240; low), the mean (0.00; average), and at the maximum score (0.230; high) for postnatal maternal perception of quality of social support (second moderator); Effect = the indirect effect of X on Y at combinations of low, average, and high values of the moderators; *SE* = standard error; LCI = lower confidence interval; UCI = upper confidence interval. When confidence intervals contain 0, results are not statistically significant. See Figure 12 for the full model.

Appendix U

Table 12

Model 1: Moderated Mediation Non-Transformed Data with 96 Participants

	b	*SE*	*t*	*p*
$X \rightarrow M_1$	0.010	0.039	0.026	0.980
$M_1 \rightarrow M_2$	-1.436	2.001	-0.716	0.476
$M_1*W \rightarrow M_2$	0.373	0.356	1.049	0.297
$M_2 \rightarrow Y$	0.044	0.082	0.535	0.594
$X \rightarrow Y$	-0.182	0.078	-2.348	0.021*

Note. In this model, maternal prenatal depression is the primary predictor (X), postnatal maternal physical health is the first mediator (M_1) between X and the second mediator, breastfeeding frequency is the second mediator (M_2) between M_1 and Y, postnatal social support is the moderator between M_1 and M_2 (W), and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 11 for the full model.

*$p<0.05$.

Appendix V

Table 13

Model 1: Moderated Mediation Non-Transformed Data with 92 Participants

	b	*SE*	*t*	*p*
$X \rightarrow M_1$	-0.006	0.040	-0.138	0.891
$M_1 \rightarrow M_2$	-1.628	2.167	-0.751	0.454
$M_1*W \rightarrow M_2$	0.468	0.385	1.213	0.228
$M_2 \rightarrow Y$	0.045	0.084	0.540	0.591
$X \rightarrow Y$	-0.172	0.080	-2.134	0.036*

Note. In this model, maternal prenatal depression is the primary predictor (X), postnatal maternal physical health is the first mediator (M_1) between X and the second mediator, breastfeeding frequency is the second mediator (M_2) between M_1 and Y, postnatal social support is the moderator between M_1 and M_2 (W), and postnatal maternal-infant attachment is the outcome variable (Y). See Figure 11 for the full model.

*$p<0.05$.