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The Role of Maternal Depression, Anxiety, Stress, and Psychosocial Factors on Neonatal Outcomes using a Resilience Framework

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By

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B.S., Cornell University, 2002

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An abstract of a dissertation submitted to the Faculty of the James T. Laney School of Graduate Studies of Emory University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Psychology
2014

ABSTRACT

The transition to motherhood has been suggested to be a fundamentally profound period for women, their families, and their babies. Extant literature has suggested a widely established relationship between maternal distress (e.g., maternal depression, anxiety, stress) and adverse child behavioral, cognitive, and emotional outcomes at varying stages across development. The current study utilizes a resilience framework to better understand if neonatal development is buffered against the negative effects of maternal distress through the psychosocial factors of social support and coping. The longitudinal study evaluated maternal distress and psychosocial factors of pregnant women (n=73) during the second and third trimester and conducted neonatal behavioral assessments of their babies at birth and four weeks after birth. A conditional process model for moderation using regression analysis revealed partial support for the central hypothesis. Coping styles including high cognitive approach and low cognitive avoidance as well as high social support appeared to attenuate the impact of maternal distress on neonatal development. Methodological issues including significant attrition and increased likelihood of women endorsing higher distress to remain in the study are discussed. Future studies should expand on the current findings to better understand with specificity the aspects of psychosocial and physiological factors that contribute to improved birth outcomes and adaptive neonatal development in the presence of maternal distress.

Key words: maternal distress, perceived stress, stress, pregnancy, depression, anxiety, coping, social support, neonatal outcomes, resilience, Neonatal Behavioral Assessment Scale, African-American women, Hispanic women

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The mechanisms linking maternal distress during pregnancy to child outcomes remain unclear (DiPietro, Hilton, Hawkins, Costigan, & Pressman, 2002; Goodman, Rouse, Long, Ji, & Brand, 2011). Studies attempting to understand the impact of maternal distress on fetal and postnatal development are regularly reported in the scientific literature (Sameroff, Seifer, Zax, & Garmezy, 1982; Sandman, Davis, Buss, & Glynn, 2011). Maternal factors theorized to affect perinatal outcome include stressful life events (e.g., death of a family member), natural disasters, depression, anxiety, and high-risk pregnancy complications (e.g., preeclampsia, inadequate prenatal care) (Schetter & Tanner, 2012). For the current study, maternal distress will be defined as self-reported maternal depression, anxiety, and perceived stress (DiPietro, 2012; Schetter & Tanner, 2012). Numerous studies have reported that maternal distress can have adverse effects on infant and child behavior (Field, Diego, & Hernandez-Reif, 2006; Lester, Emory, Hoffman, & Eitzman, 1976; Schetter & Tanner, 2012).

The aim of this introduction is to outline conceptual and empirical background concerning the relationship between maternal distress and pregnancy outcome. Prevalence of each maternal distress type (e.g., depression, anxiety, stress) will be presented as well as a brief empirical and conceptual review of maternal distress transmission. The paper will also review resilience and psychosocial factors such as maternal coping and social support that may mitigate adverse perinatal outcomes. The discussion will continue with a description of methods used to assess neonatal behavior.

Finally, a proposed model for the current study will be discussed as well as the current study hypothesis.

Broadly, the link between prenatal maternal mood and neonatal behavior is widely cited (Schetter & Tanner, 2012; Van den Bergh, Mulder, Mennes, & Glover, 2005). A majority of extant literature has suggested that maternal distress is associated with adverse child behavioral and cognitive outcomes beginning in the neonatal period until adolescence (Brennan et al., 2000; Field et al., 2006; Grace, Evindar, & Stewart, 2003; Murray et al., 2011; O'Donnell, O'Connor, & Glover, 2009; Van den Bergh & Marcoen, 2004; Van den Bergh et al., 2005). Infants of depressed mothers have been shown to have poor neurobehavioral functioning (Campbell & Cohn, 1991), greater fussiness and less consolability (Whiffen & Gotlib, 1989; Zuckerman, Bauchner, Parker, & Cabral, 1990), and greater incidence of prematurity and low birth weight (Field et al., 2004). Additionally, maternal depression has been associated with higher obstetric complications (Sameroff et al., 1982).

There have been some exceptions in the literature (DiPietro, Novak, Costigan, Atella, & Reusing, 2006; Laplante, Brunet, Schmitz, Ciampi, & King, 2008) that suggest that maternal distress may not always predict negative neonatal outcome. Specifically, DiPietro et al. (2010), reported that prenatal distress was associated with accelerated neural maturation in neonates. Additionally, another study by DiPietro (2006) revealed that a small amount (5-7%) of the variance in optimal motor development scores of 2 year olds was explained by increased maternal distress (pregnancy anxiety, nonspecific stress, depressive symptoms).

The current study attempted to utilize aspects of theories of resilience to investigate under what conditions neonatal development might be buffered from the potentially deleterious effects of maternal distress (Finney, Mitchell, Cronkite, & Moos, 1984; Lakey & Cohen, 2000). For the current study, maternal social support and coping were selected as psychosocial factors that might predict resilience. Later in the introduction, the extensive theoretical framework and extant literature about maternal social support and coping will be discussed. The primary study hypothesis suggests that maternal coping and maternal social support will moderate the effect of prenatal maternal distress on neonatal outcomes.

Maternal Distress Prevalence

Prenatal depression has been estimated to affect 10-25% (J. Evans, Heron, Francomb, Oke, & Golding, 2001; N. I. Gavin et al., 2005; Grace et al., 2003; Skouteris, Wertheim, Rallis, Milgrom, & Paxton, 2009) of pregnant women. Approximately 5-13% of pregnant women have episodes of major depression (N. I. Gavin et al., 2005; Leight, Fitelson, Weston, & Wisner, 2010). Anxiety prevalence rates have been estimated between 6-15%; similar to depression, anxiety prevalence estimates vary due to differences in instrument choice, criterion used, etc. (Heron, O'Connor, Evans, Golding, & Glover, 2004).

National study samples have suggested that approximately 60% of individuals with major depression also meet criteria for an anxiety disorder (S. Goldstein, Halbreich, Asnis, Endicott, & et al., 1987). Prenatal depression is also often comorbid with prenatal anxiety (Da Costa, Larouche, Dritsa, & Brender, 2000; Field et al., 2006). One study of prenatal anxiety and prenatal depression revealed high correlations during both the second (r=0.71) and third (r=0.66) trimesters (O'Connor, Heron, & Glover, 2002). Another study

suggested that pregnant women comorbid for depression and anxiety had significantly higher salivary cortisol than controls or individuals with only one of these diagnoses (L. Evans, Myers, & Monk, 2008).

Impact of Maternal Distress on Neonatal and Child Development

Prenatal maternal distress (depression, anxiety, stress) has been linked to negative neonatal and child outcomes (Lancaster et al., 2010; Van den Bergh et al., 2005). Notably, data suggesting that prenatal maternal distress relates to adverse neonatal outcomes remain significant, even after controlling for numerous postnatal influences including anxiety, depression, and stressful life events (Bergman, Sarkar, O'Connor, Modi, & Glover, 2007; O'Connor et al., 2002; O'Connor, Heron, Golding, Glover, & the, 2003; Pacheco & Figueiredo, 2012). Prenatal depression has specifically been associated with an increased risk of neonatal intensive care unit (NICU) admissions, use of epidural analgesia and operative deliveries (Chung, Lau, Yip, Chiu, & Lee, 2001). Babies of depressed mothers have been shown to weigh less, be born earlier, and have lower APGARs (quick assessment of infant health immediately after birth) than babies of non-depressed mothers (Nylen, O'Hara, & Engeldinger, 2012). Maternal depression that persists after the first six months of an infant's life has been associated with lower scores on motor development measures and physical growth measures (i.e., weight) (Field, 1995) while after the first year of life infants of depressed mothers smile less and demonstrate less exploratory behaviors (Bendell et al., 1994).

Antenatal anxiety reported in the second and third trimester has been associated with parent reported behavioral and emotional problems at four years of age, independent

of postnatal depression, after controlling for smoking, alcohol use, birth weight, gestational age, maternal age, child sex, and socioeconomic status (O'Connor et al., 2002). Studies also suggest that a combination of high maternal depression and high maternal anxiety compromise maternal emotional responsivity and infant socioemotional functioning (Harville et al., 2007). Relatively high levels of maternal anxiety and depression have resulted in reduced birth weight, smaller head size (an early measure of infant brain development), and obstetric complications (Alder, Fink, Bitzer, Hösli, & Holzgreve, 2007; Hellhammer, Wüst, & Kudielka, 2009). One study prospectively linked maternal anxiety during the early part of the second trimester to depressive symptoms reported by 14-15 year-old females (Van den Bergh, Van Calster, Smits, Van Huffel, & Lagae, 2008). Pregnancy specific anxiety has been associated with temperament and attention regulation problems for 2-year-old children (Gutteling et al., 2005). It has been further suggested that among all the distress types discussed, pregnancy anxiety in particular has the "most potent maternal risk factors for adverse maternal and child outcomes" (Schetter & Tanner, 2012, p. 141). Schetter and Tanner (2012) highlight that maternal anxiety and depression are differentially associated with certain birth outcomes. Specifically, prenatal maternal depression is more likely to be associated with low birth weight and slower fetal growth (Alder et al., 2007; Goedhart et al., 2010) while prenatal maternal anxiety is more likely to be associated with pre-term birth (Schetter & Tanner, 2012).

Maternal psychological stress is significantly associated with indicators of fetal neurobehavioral maturation and reactivity (DiPietro et al., 2002; Monk et al., 2000; Wadhwa, 2005). While animal studies also support the hypothesis that stressful environments during pregnancy are associated with adverse perinatal outcomes (Istvan,

1986; Maccari et al., 2003; Van den Bergh et al., 2005), some authors suggest that experimental stress models used in animal studies do not precisely mirror what occurs in humans (DiPietro et al., 2006). In humans, perceived stress reported by mothers has been associated with adverse outcomes including child behavioral problems at 2 years of age (Gutteling et al., 2005) and Attention-Deficit/Hyperactivity Disorder (ADHD) at 7-8 years of age (Rodriguez & Bohlin, 2005). Prenatal stress (as indexed by stressful life events) has been shown to account for 17% of the variance in child cognitive development abilities scores assessed at 14 and 19 months of age (Bergman et al., 2007).

Authors have suggested that there is "remarkably convergent empirical evidence" regarding how pregnancy specific anxiety effects pre-term birth and more broadly gestation age at birth for studies of diverse populations (Schetter & Glynn, 2011). Pregnancy anxiety has been defined as fears that related to the pregnancy such as fears about the health and well being of one's baby, of hospital and health care experiences during pregnancy, and of the childbirth process and parenting afterwards (Schetter & Tanner, 2012). Evidence suggests a stronger contribution depressive symptoms to slower fetal growth and low birth weight than anxiety (Alder et al., 2007; Goedhart et al., 2010). Chronic stress has been suggested to be a "robust" predictor or birth weight. In a study using multidimensional modeling that evaluated the following predictors: state anxiety, pregnancy anxiety, and perceived stress, pregnancy anxiety was the only significant predictor after medical and demographic risks were controlled (Roesch, Schetter, Woo, & Hobel, 2004). A recent review suggested that the most substantial effects were found between stress indexed by major life events (e.g., death of a family member) and pre-term birth, especially when the stressful life event (s) occurred earlier in pregnancy (Schetter &

Glynn, 2011). Although these are not the outcomes evaluated in the current study, it is notable that pregnancy anxiety may have a differential impact to birth outcomes than maternal depression. This is significant because of the comorbidity of both types of distress. When reviewing the literature it appears that different researchers evaluate the impact of maternal depression versus those who investigate the impact of maternal anxiety and maternal stress. This becomes important due to observations that some studies do not adequately control for the type of distress that is not central to the research question. And for those, who seek to evaluate both in the same study, they may not be adequately controlled. Some studies have specifically shown that if anxiety and stress are considered together (versus just anxiety alone), they both are associated with low birth weight (Copper et al., 1996; Lobel, Dunkel-Schetter, & Scrimshaw, 1992); these authors note that some studies that are published do not control for depression (e.g., Fields et al. (2003)) so it is difficult to make a definitive conclusion about the independent effects of anxiety or stress, above and beyond maternal depression (Alder et al., 2007).

Overall, the literature indicates that maternal stress is associated with negative pregnancy outcomes independent of other biomedical and sociodemographic risk factors (Dunkel-Schetter, Wadhwa, & Stanton, 2000) with some exceptions noted, such as the DiPietro studies discussed earlier (DiPietro et al., 2010; DiPietro et al., 2006). However, a substantial literature has shown that, in addition to negatively impacting neonatal and child behavior, maternal depression also negatively impacts the woman, her romantic/marital partner, and social relationships (Hedegaard, Henriksen, Sabroe, & Secher, 1993; O'Leary, Christian, & Mendell, 1994). Hammen (2005) has cited shortcomings in the maternal depression literature including an overreliance on cross

sectional studies and a lack of attention to mediators and moderators in the risk process. The current study seeks to add the existing literature by using a longitudinal design, conducting moderational analysis, and focusing on a resilience framework (versus a deficit model).

Maternal Distress and Gestational Timing

A systematic review suggested that maternal depression rates were highest in the second and third trimesters (versus the first trimester) (Bennett, Einarson, Taddio, Koren, & Einarson, 2004). Prenatal depression scores have been shown to be statistically higher in the third trimester compared to the second trimester using the Beck Depression Inventory, second edition (BDI-II) (Skouteris et al., 2009); interestingly the largest increase in depression scores were among the pregnant women who were in the severely depressed category earlier in pregnancy. A few studies have noted that self-reported depression is linked to higher basal cortisol in both the second and third trimesters of pregnancy (Field et al., 2004; Lundy et al., 1999; Peoples, 1997).

Hedegaard et al. (1993) suggest that distress during the third trimester of pregnancy has a higher association with preterm birth than distress during the first trimester.

Anxiety research assessing the state and trait components of anxiety reported that the level of anxiety was less in the third trimester versus the second trimester for a group of highly educated women in their early 30s who planned their pregnancy (Skouteris et al., 2009). Some researchers have noted a U shaped relationships with anxiety rates reported as higher in the first and third trimester compared to the second trimester (Lee et al.,

2007). Teixeira (2009) further clarified that anxiety had a U curve (with the second trimester having the lowest scores); additionally first time mothers had higher anxiety scores in the 1st (vs. third) trimester while the opposite was true for women who had at least one child previous to the study.

Examples include schizophrenia being associated with maternal distress exposure during the first trimester (Khashan, Abel, McNamee, & et al., 2008) and autism being associated with exposure late in gestation (Kinney, Miller, Crowley, Huang, & Gerber, 2008); notably these outcomes are often related to maternal exposure to significant life events (death, stroke, cancer, etc.) and natural disaster (s). In the current literature, the effects of gestational timing of stress are still obscure (Van den Bergh et al., 2005).

Chronicity, severity, and timing of maternal depression are important considerations when attempting to better understand how a mother's depressive mood and history of depressive mood/episodes impact neonatal, infant, and child development (Brennan et al., 2000; Goodman et al., 2011)The current study will be able to add to the literature by assessing the impact of maternal distress during the second versus the third trimester on neonatal development.

Theories of Maternal Distress Transmission

Maternal distress (depression, anxiety, stress) impacts neonatal development through interactions between a number of dynamic factors (Barker, 2002). The current discussion will focus on maternal transmission during gestation. Many authors have suggested fetal programming as a conceptual way to understand the transmission of maternal distress to her offspring. Fetal programming describes the process in which the fetus changes due to changes to its immediate environment (Glover, O'Connor, & O'Donnell,

2010). The fetal programming hypothesis was initially suggested by authors who were trying to better understand individuals who develop coronary heart disease as a result of maternal stress exposure (Barker, 2002).

Hypothesized mechanisms of maternal distress transmission during gestation include theories which suggest that maternal distress 1) impacts gene expression during pregnancy which may lead to an altered placental phenotype 2) causes infant dysregulation as a result of prenatal exposure 3) impacts the transport of stress-related neurohormones to the fetus via the placenta 4) leads to changes in blood flow which impact the amount of nutrients and oxygen that the fetus receives and 5) alters the fetal hypothalamic-pituitary-adrenal (HPA) axis (DiPietro, 2004; Field, 1995; Goodman & Gotlib, 1999; Van den Bergh et al., 2005).

HPA Axis

HPA axis abnormalities have been speculated to play a critical role in development of depression including symptom presentation, persistence, and recurrence. There have been mixed results from animal studies implicating the directionality and type of influence that alterations to the HPA axis (O'Donnell et al., 2009). Maternal stress and anxiety have been inconsistently associated with elevated maternal cortisol (O'Donnell et al., 2009). One confounder that has been cited is the dampening of the HPA axis responsiveness in late pregnancy (O'Donnell et al., 2009). In the past decade, the fetal programming hypothesis has been expanded to include pathways beyond the HPA axis. It is further suggested that fetal programming of the HPA axis, limbic system, and prefrontal cortex help to explain how prenatal anxiety and stress lead to regulation problems in children (Van den Bergh et

al., 2005). Animal and human studies suggest that non-optimal fetal development occurs when the fetus is exposed to maternal stress which is associated with excessive amounts of glucocorticoids (compared to a typically developing fetus) (Kapoor, Dunn, Kostaki, Andrews, & Matthews, 2006).

A recent review highlighted that maternal prenatal anxiety impacts the HPA through both the limbic system and also the prefrontal cortex (Huizink, Mulder, & Buitelaar, 2004; Van den Bergh et al., 2005). Another potential mechanism through which maternal prenatal anxiety might impact fetal development is through the release of epinephrine and norepinephrine (Istvan, 1986). Antenatal anxiety is a risk factor for greater fetal activity during gestation (DiPietro et al., 2002).

Increased secretion of cortisol in depression is widely held to be a central physiological response to psychosocial stress (Arborelius, Owens, Plotsky, & Nemeroff, 1999; Dinan, 1994). However, there is limited conclusive data on the neuroendocrine correlates of exposure to naturally occurring stressors and their association with depressive reactions. Generally, there is disagreement about cortisol being an established biological marker for mental illness, despite being often cited theoretically (Bernal, Trimble, Burlew, & Leong, 2003; DiPietro, 2012; Hammen, 2005; Young, Lopez, Murphy-Weinberg, Watson, & Akil, 2000). It has also been suggested that high levels of stress hormones may also lead to decreased uterine blood flow and possibly the induction of preterm labor (Van den Bergh et al., 2005).

Prenatal anxiety and depression

One study hypothesized that prenatal anxiety and depression, although highly correlated, have independent components that impact child behavior and emotional

problems (O'Connor et al., 2002). Recent studies have assessed pregnancy specific anxiety (e.g., anxiety specifically experienced during pregnancy, childbirth, and hospitalization) versus trait aspects of anxiety in general populations (Van den Bergh et al., 2005). More consistent findings have been found when pregnancy specific anxiety is evaluated versus other types of anxiety (Schetter & Tanner, 2012). Overall, despite the numerous theoretical assumptions, especially biological ones, there has been limited support in human studies for specific mechanisms which connect maternal prenatal distress to adverse neonatal and child outcomes (Van den Bergh et al., 2008).

Many of the studies discussed above have evaluated anxiety, depression, and perceived stress measures separately, sometimes controlling for the other variables. This enables specific analysis based on a certain type of maternal distress. However, due to the high correlations (O'Connor et al., 2002) between the maternal distress measures the current study plans to use a novel approach by combining the maternal distress measures into a global or latent measure.

The current study is novel since unlike previous studies hypothesizes that maternal anxiety, depression, and stress can be conceptualized using a global prenatal maternal distress construct guided by research.

Proposed model, potential mechanisms, and protective factors

In addition to characteristics of distress symptomatology, other psychological and psychosocial factors are implicated when attempting to understand the impact of maternal prenatal distress on children. For example, the extant prenatal depression literature suggests that other important risk factors associated with depression include major life

events, low social support, depression history, and low self-esteem (Milgrom et al., 2008; O'hara & Swain, 1996). In general, many comprehensive models of depression include all or most of the following elements: biological, developmental, psychological, and sociodemographic factors with mutual influences among the variables and between depression and the antecedent variables (Hammen, 2005); this model can be broadly applied to prenatal distress. The current study will add to the literature by utilizing theories that focus on maternal distress while also incorporating the association with psychosocial variables that may attenuate the effect of maternal depression on neonatal development.

Although the extant literature has suggested numerous negative outcomes associated with maternal distress during pregnancy, many researchers have highlighted that findings should be interpreted with caution based on correlational and related analysis that do not imply causation (Brennan et al., 2000). This suggests the need for prospective studies utilizing analysis that help bolster causal hypothesis. For the current study, coping style and social support have been selected as factors which potentially moderate the role of maternal distress (depression, anxiety, and stress) on neonatal development. These two constructs have been chosen due to the strong theoretical framework that connects both as well as the notion they are non-pathology related psychological constructs that fit well into a resilience framework (Lazarus, 1993; Lazarus & Folkman, 1984). Resilience has been defined as a defense mechanism, which enables people to thrive in the face of adversity (Davydov, Stewart, Ritchie, & Chaudieu, 2010). Additionally, there is research linking these psychosocial factors to favorable birth outcomes (Razurel, Kaiser, Sellenet, & Epiney, 2013). Southwick et al. (2005) specifically highlight active coping style and social support

as two of the five psychosocial factors associated with resilience to stress and stress induced depression; the other three are positive emotions, cognitive flexibility, and meaning.

Psychosocial Factors: Coping and Social Support

Lazarus and Folkman (1984) initially defined coping as the constantly changing ensemble of cognitive and behavioral efforts made to handle specific demands (internal and/or external) perceived by the individual as consuming or exceeding his/her resources. Three important aspects of coping include coping strategies, coping appraisals, and coping resources (Lazarus & Folkman, 1984). Active coping (seeking social support, adopting a fighting spirit, reframing stressors in a positive light) has also been associated with improved well-being and fewer psychological symptoms in depressed adults (Fondacaro & Moos, 1989). Coping strategies have been defined as either problem-focused (strategies which alter the source of distress and/or the psychological stress) or emotional-focused (strategies that impact the way we attend to and interpret a stressor, strategies which minimize distress caused by a stressful event). Emotional-focused coping has been further sub-divided into avoidant coping (i.e., wishful thinking) and emotional approach coping (i.e., positive re-appraisal, emotional expressions) (Lazarus, 1993; Lazarus & Folkman, 1984). For example, depression has been associated with a passive (e.g., avoidance, emotion-focused) versus active (approach, problem-focused) coping style (Billings & Moos, 1984; Da Costa et al., 2000; Southwick et al., 2005). Coping has been further specified as the process of altering circumstances and/or how they are interpreted to make them appear more favorable (Lazarus, 1993).

Lazarus (1993) highlights that coping is a highly contextual process (versus a stable personality trait or style) that changes over time and in various settings. Coping is further specified as a person's ongoing efforts in thought and action to manage specific demands appraised as taxing or overwhelming (Lazarus, 1993). Coping impacts psychological stress via appraisal (Lazarus, 1993). Appraisal is the process that (cognitively) mediates or actively negotiates 1) "the demands, constraints, and resources of the environment and, 2) the goal hierarchy and personal beliefs of the individual" (Lazarus, 1993, p. 6).

Many studies have specifically assessed coping of depressed and non-depressed pregnant women (de Tychey et al., 2005). Non-adaptive coping strategies utilized by depressed pregnant women have included denial, behavioral disengagement, self-blame, and substance use. One study suggested that non-depressed women had coping styles that focused on acceptance whereas depressed woman had coping styles focused on distancing, blame, and denial (de Tychey et al., 2005). The current study hopes to add to the literature by providing information on coping types that are related to maternal distress and neonatal outcome. Two different models have been proposed to explain how coping specifically impacts maternal depression. The direct effects model suggests that coping has an independent relationship on depression (when also taking stress into account). The moderating effects model suggests that coping resources and coping strategies either buffer or exacerbate the relationship between stress and negative outcomes (Finney et al., 1984). The moderating effects model will be investigated in detail in the current study.

There is empirical support for both the direct effects model and the stress buffer moderation model of coping in pregnant women (Pakenham, Smith, & Rattan, 2007). Studies using the stress buffering effects theoretical model show that coping resources and

adaptive coping strategies buffer individuals against the negative effects of high stress (Finney et al., 1984). Studies of the stress exacerbation effects model suggest that avoidant coping has negative effects for those with high stress (Pakenham, 1999). Adaptive coping, operationalized as seeking social support, adopting a fighting spirit, and positively reframing stressors has also been associated with fewer psychological symptoms and an increased ability to manage stressful situations (Fondacaro & Moos, 1989; Valentiner, Holahan, & Moos, 1994).

In a typically developing pregnancy, emotion-focused coping has been suggested to be favored by first time mothers in the early stages of pregnancy (Huizink, Robles de Medina, Mulder, Visser, & Buitelaar, 2002). More specifically, the study demonstrated that emotion-focused coping was higher in the first part of the second trimester (15-17 weeks) as compared to the later part of the second (27-28 weeks) and last part of the third trimester (37-38 weeks) (Huizink et al., 2002). In this study, emotion-focused coping referred to regulating affect regarding stressful situations (e.g., positive reappraisal, expressing feeling towards others) while problem-focused coping is focused on alleviating the situation (e.g., planning, information seeking) (Huizink et al., 2002). Lazarus and Folkman (1984) underscore that coping types do not solely enhance or impede the impact of stress and do not necessarily act independently.

In a review of psychoneuroendocrine processes in human pregnancy, Wadhwa (2005) postulated that individual differences in maternal stress appraisals exert a larger impact on maternal systems than exposure to stressful events. Appraisal theorists, Lazarus and Folkman (1984), defined primary appraisal (e.g., determining if the situation has relevance for personal well-being) and secondary appraisal (e.g., focusing on ways of

coping as well as utilizing personal and environmental resources). For the current study, secondary appraisal as indexed by coping and social support will be assessed.

One theoretical model suggests that social support reduces the effects of stress on health, potentially acting as a stress buffer via the supportive actions of others (Lakey & Cohen, 2000). There is strong evidence the benefits of social support on psychological well-being (Kessler & McLeod, 1985). For example, one study utilized structural equation modeling to show that women who perceived greater available support delivered babies with significantly higher rates of fetal growth (birth weight adjusted based on length of gestation). Moreover, the magnitude of the independent effect of social support on fetal growth was larger than other risk factors evaluated (Feldman, Dunkel-Schetter, Sandman, & Wadhwa, 2000; Wadhwa, 2005). Four type of social support have been suggested by researchers including emotional (physical expressions of caring), informational (advice or guidance), instrumental (tangible goods or assistance with tasks), and esteem (expressions of confidence or encouragement) (as cited in Razurel et al., 2013, p. 75). Lazarus and Folkman (1984) suggested a high overlap between the concepts of stress and anxiety; specifically that anxiety is a product of stress. Further they suggest that while stress is a part of the human condition; coping is what makes a difference in adaptation outcome.

Social support has also been associated with positive outcomes following stressors for non-pregnant adults (Resick, 2001). For the current study, a working hypothesis is that coping style and social support will buffer the impact of maternal distress on neonatal development. It has been suggested that non-pregnant women experiencing unipolar depression were exposed to more stress and also generate stressful conditions in their interpersonal relationships (Hammen, 1991). Numerous authors have suggested the need

for greater consistency in the definition of social support across studies (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993; Razurel et al., 2013). Collins et al. (1993) also suggest that there should be more studies examining the impact of social support on psychological health in addition to physical health outcomes. Social support has been conceptualized as a physiological buffer against potentially pathogenic influence of stressful events via the HPA axis, immune system, and sympathetic nervous system (Hennessy, Kaiser, & Sachser, 2009).

Three different perspectives on social support research have been outlined by Lakey and Cohen (2000) including the stress and coping perspective (social support contributes to health by protecting people from the adverse effects of stress), the social constructionist perspective (social support promotes health by promoting self-esteem and self-regulation, regardless of the presence of stress), and the relationship perspective (the health effect of social support cannot be separated from relationship processes that often co-occur with support such as companionship, intimacy, low social conflict). Specifically, lack of partner support (compared to other types of support) has shown a strong association with increased depressive symptomatology (Glazier, Elgar, Goel, & Holzapfel, 2004). Stated differently, depressed women have been shown to have smaller social support networks and reported being less satisfied with support from social networks (Nylen et al., 2012). Social support has been posited to buffer infants from the deleterious effects of maternal depression (Nylen et al., 2012).

It has been suggested that the effects of social support may be more evident among women who experience high levels of environmental stress (S. Cohen & Wills, 1985). Notably, in a study of how social support in pregnancy relates to birth outcomes, various

social support constructs (material aid, assistance with tasks, advice, listening ear) were not correlated (Collins et al., 1993). The potential power of the current study is that a predictive model will be used that will include women of different ranges of distress. Studies of pregnant women have broadly suggested that lower scores on self-report and structured clinical interviews of social support are linked to depressive symptoms during pregnancy using (Barnet, Joffe, Duggan, Wilson, & Repke, 1996; Collins et al., 1993; Cutrona, 1984; McKee, Cunningham, Jankowski, & Zayas, 2001; Spoozak, Gotman, Smith, Belanger, & Yonkers, 2009). Notably, partner relationship accounted for 73.5-75% of the variance in maternal stress (Bergman et al., 2007). This further supports the idea that certain psychosocial factors such as partner support or lack thereof can have a significant impact on maternal distress and consequently child development.

Studies of women of varying socioeconomic status have suggested that women with more network resources delivered babies with higher birth weight and women who received more support had fewer difficulties in labor (Collins et al., 1993). It has been suggested that social support (like many concepts) should be conceptualized as a multidimensional construct (Collins et al., 1993). Ethnic differences in social support have been suggested in the literature. Notably, Jesse et al. (2005) demonstrated that among women with high scores on a depression measure, pregnant African American had higher scores on social support measures that Caucasian women. Additionally, pregnant African American women are less likely to be married compared to Caucasian (Dole et al., 2004) which is similar to the current study in which a higher percentage African American women were unmarried/unpartnered compared to ethnic groups.

Resilience, Risk, and Protective Factors

Resilience has been conceptualized in a variety of different ways. One prominent definition comes from Masten and Powell (2003). "Resilience refers to patterns of positive adaptation in the context of significant risk or adversity" (Masten & Powell, 2003, p. 4). Numerous authors have highlighted that resilience is not an innate trait and is rather a process or a phenomenon (Luthar & Cicchetti, 2000; Masten & Powell, 2003). They instructed researchers that it is most appropriate to identify "a resilient pattern" or note that a "person shows the features of resilience." (pg.4) (Masten & Powell, 2003).

Resilience broadly refers to a dynamic process encompassing positive adaptation within the context of significant adversity although there is little consensus on the definition (Luthar, Cicchetti, & Becker, 2000). Two major approaches to resilience research have emerged when investigating child development. The variable-focused approach examines the links among competence, adversity, and other protective factors which describe differences among individual children and the nature of their relationship and environments in which they live. Person-focused approaches focus on identifying people who meet definitional criteria for resilience, studied by investigators, particularly in comparison to maladaptive individuals who have similar levels of risk or adversity but who display markedly different outcomes. Masten and Powell's (2003) studies suggest that more resources such as parenting, intellectual skills, or social support can offset negative risk/adversity when evaluating childhood outcomes. Variable-focused analysis has repeatedly suggested that children's intellectual functioning moderated the association between childhood adversity and conduct, in both cross sectional and longitudinal studies (Masten et al., 1999). The person-focused approach is less sensitive than variable-focused

strategies for identifying processes that are naturally occurring, and therefore a variable-focused approach was used in the current study (Masten et al., 1999).

The current study will be utilizing a variable-focused resilience model by using multivariate statistics to test for linkages among measures of the degree of risk or more specifically the risk of distress (Masten, 2001). A resilience model challenges models which focus on negative assumptions or deficit focused models. This is particularly helpful when attempting to understanding the notion of adversity. Studies suggest looking at resilience with the lens of ordinariness versus it being something remarkable (Masten, 2001). A criterion for studying resilience that has been suggested is specifying the threat to development, the criteria by which adaptation is judged to be successful, and the feature of the individual or the environment that may help to explain resilient outcomes (Masten et al., 1999). For the current study, the threat is maternal distress.

Protective factors are those variables that buffer children from adversity. Examples of protective factors include individual factors, such as positive temperament, the child's intellectual capacity, and social competence; family or interpersonal factors such as secure attachments to caregivers, caring adults and strong relationships with others, and cultural, ethnic or community factors such as living in a supportive, safe, close-knit community (Gewirtz & Edleson, 2007). For the current study, maternal coping and maternal social support during pregnancy are posited to serve as protective factors which will help to explain adaptive neonatal outcome in the face of prenatal maternal distress. The current study adds to the literature by examining the influence of maternal psychosocial factors on the relationship between maternal distress and neonatal outcome (Schetter & Tanner, 2012). The proposed conceptual model for this study appears in Figure 1.

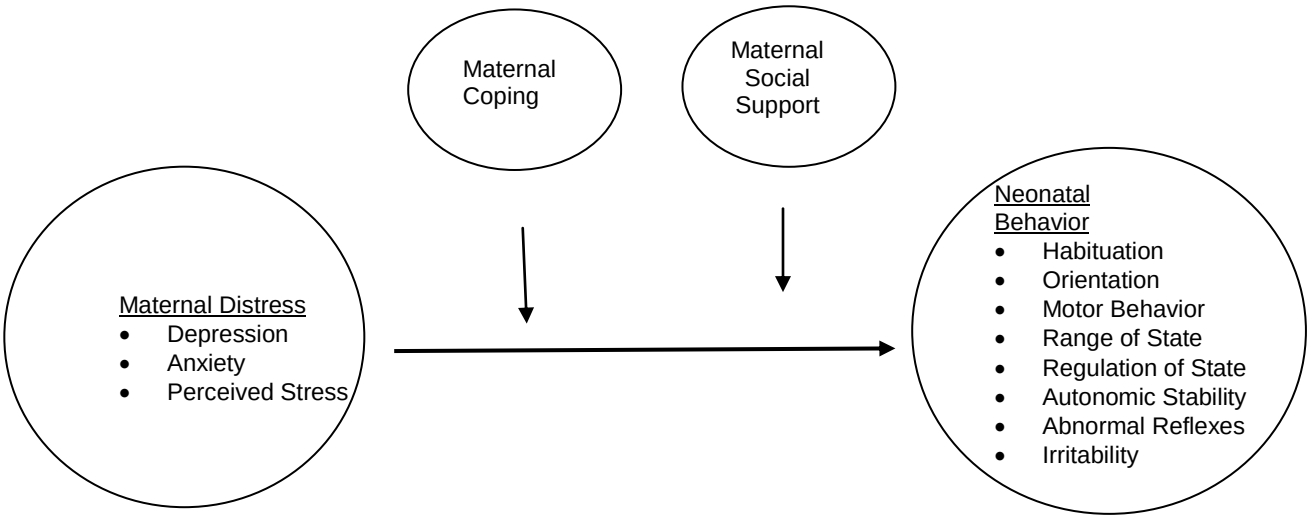


Figure 1. Psychosocial model of prenatal maternal depression affecting neonatal development.

Infant Assessments as Outcome Measures

The current study focused on the effect of maternal distress on infant development during the neonatal period between birth and the first 28 days of life. Assessments of infant behavioral outcomes have been used as a means of identifying at-risk infants (Lipkin & Schertz; Stern, 2006). Behavioral milestones during the first few months of life, in developmental order, include the infants ability to 1) organize his/her autonomic/physiologic behavior (e.g., stabilizing breathing), 2) regulate motor behavior, 3) regulate states or modulate states of consciousness (e.g., predictable sleep wake cycle), and 4) regulate social behavior (Osofsky & Fitzgerald, 2000).

The Brazelton Neonatal Behavioral Assessment Scale (NBAS) was the primary outcome measure for the current study (Brazelton & Nugent, 1995). The NBAS has been

used for over 25 years to describe the responses of the newborn to his or her extrauterine environment (Brazelton & Nugent, 1995; Osofsky & Fitzgerald, 2000). The overarching goal of the NBAS is to describe the infant's adaptation and development, particularly the ability to self-regulate over a period of time (Osofsky & Fitzgerald, 2000). It has been suggested that the NBAS is an index for potential consequences of prenatal exposure (Goodman et al., 2011). For example, fetal movement and heart rate assessed at 36 weeks gestational age has been associated with the scores of newborn scores on the NBAS irritability scale (DiPietro et al., 2002).

In terms of predictive validity, neonatal measures of "self-regulation" behavior have been suggested to be the best predictor of infant development and intelligence (Goodman et al., 2011). Canals et el. (2011) demonstrated that the NBAS self-regulation behaviors predict verbal and total intelligence at 6 years old. One highly replicated finding (effect sizes between 0.22-0.6) relating maternal distress and neonatal behavior suggest that higher prenatal maternal depression scores are associated with less optimal NBAS orientation/social-interactive scales (Goodman et al., 2011; Hernandez-Reif, Field, Diego, & Ruddock, 2006; Lundy et al., 1999) as shown in Table 1 below. Interestingly, the attentional orienting/social interacting, has been suggested to serve as a distress regulator during the first year of life (Harman, Rothbart, & Posner, 1997).

High maternal depression scores are also associated with lower NBAS motor tone cluster scores, greater irritability, and lower activity levels (as cited in Lundy et al., 1999, p. 120) as well as the NBAS attentiveness cluster (Hernandez-Reif et al., 2006). High levels of maternal prenatal anxiety correlate with lower scores on the NBAS orientation cluster (Brouwers, van Baar, & Pop, 2001; Field et al., 2003). Additionally, babies of pregnant

women who endorse high scores on both maternal depression and maternal anxiety measures have less optimal NBAS scores on the decreased/lower motor tone and activity clusters (Field et al., 2001; Lundy et al., 1999). A study of African American pregnant who were pregnant with their first child suggested that prenatal anxiety positively correlated with the NBAS habituation subscale while prenatal anxiety negatively correlated to the NBAS Range of States subscale (Oyemade et al., 1994).

TABLE 1. *Effect Sizes for Associations Between Antenatal Depression and Less Optimal Brazelton Neonatal Behavior Assessment Scale (NBAS) Score*

Authors & Year	Hab[a]	Or[b]	Mot[c]	RoS[d]	RegoS[e]	AS[f]	Refl[g]
Field et al. (2001)							
Depressed-Withdrawn[h]	0.48***	0.59***	0.65***	0.59***	0.30	0.47***	0.05
Depressed-Intrusive	0.36***	0.31**	0.47***	0.22	0.12	0.27	0.12
Field et al. (2004)	0.23*	0.30**	0.26*	0.21*	0.09	0.24*	0.00
Diego et al. (2005)	0.28*	0.35*	0.29*	0.19	0.24	0.14	0.14
Hernandez-Reif et al. (2006)	0.03	0.22*	UR[i]	UR	0.19	UR	UR
Jones et al. (1998)	UR	0.33**	UR	UR	0.39***	UR	UR
Lundy et al. (1999)	0.12	0.60***	0.07	−0.26	0.08	0.16	0.44***

[a]Habituation [b]Orientation [c]Motor System [d]Range of State [e]Regulation of State [f]Autonomic Stability [g]Reflexes
[h]In this paper, the depressed group was further characterized as either withdrawn or intrusive and the associations with NBAS were examined separately for each group.
[i]Unreported.
*$p < .05$. **$p < .01$. ***$p < .001$.

Note. Effect Sizes for Associations Between Antenatal Depression and Less Optimal Brazelton Neonatal Behavior Assessment Scale (NBAS) Score. Reprinted from "Deconstructing antenatal depression: What is it that matters for neonatal behavioral functioning?" by Goodman, S.H., Rouse, M.H., Long, Q., Ji, S., Brand, S.R., 2011, *Infant Mental Health Journal, 32 (3),* p. 341. Copyright 2011 by the Michigan Association for Infant Mental Health. Permission Granted.

Demographic Considerations

Data collected from a national US community sample, the National Comorbidity Survey (NCS), suggested that the prevalence of depression in Hispanic women is greater

than African American women, regardless of age (Blazer, Kessler, McGonagle, & Swartz, 1994). Evidence has been shown that African Americans endorse more somatic symptoms related to anxiety than Caucasian women (Heurtin-Roberts, Snowden, & Miller, 1997). Regarding pregnancy outcomes, it has been well established that African American women have higher prevalence of preterm births and babies of low birth weight compared to other ethnic groups (Field, Diego, Hernandez-Reif, et al., 2009; Ventura, Martin, Curtin, Mathews, & Park, 2000). Regarding the current study, there have been numerous studies that have specifically investigated low-income women that are also African American (similar to the current study) and found results that mirror well established findings (Field et al., 2001; Field et al., 1988). However, past studies have provided limited information concerning what it is phenomenologically distinct about being African American that might contribute to adverse birth and neonatal outcomes. Data has also suggested that African American and Asian/Pacifica Islanders are at increased risk for antenatal depression compared to non-Hispanic White women (A. R. Gavin et al., 2011).

Quite a few studies have suggested that adults of lower SES have higher cortisol secretion (Kapuku, Treiber, & Davis, 2002; Steptoe et al., 2003). One study of depression during pregnancy and postpartum found that the prevalence of depression in a sample of economically impoverished women to be twice that of middle class pregnant women (Hobfoll, Ritter, Lavin, Hulsizer, & Cameron, 1995). Moreover, this study and others have specifically suggested that low SES is a major risk factor for depression (Belle, 1990; Bruce, Takeuchi, & Leaf, 1991; Hobfoll et al., 1995; Riolo, Nguyen, Greden, & King, 2005).

Interestingly, in a study that compared African American women and Caucasian women of similar SES, there were no significant differences in prenatal depression

prevalence. Some studies have suggested that when SES and other relevant demographic differences are controlled, many previously noted associations between race and depression disappear (Jesse et al., 2005). Alternatively, it is possible that past studies have not properly included the appropriate psychosocial factors to capture racial differences in symptom endorsement, or intensity of maternal distress symptoms.

Notably, most of the women in DiPietro's studies had the following characteristics: 1) highly educated, 2) financially stable, 3) Caucasian, 4) early 30s in age, 5) non-complicated pregnancies, and 5) did not meet clinical criteria for anxiety or depression (DiPietro et al., 2010; DiPietro et al., 2006). DiPietro (2012) cautions that it may be difficult to generalize findings from her studies to women who face chronic stressors based on socioeconomic status (SES) and/or women that meet clinical criteria for depression or anxiety.

Recent studies have attempted to discern psychosocial differences between racial groups that may contribute to preterm birth. In these studies, African Americans were at higher risk of preterm birth if they used avoidant coping strategies or reported racial discrimination. In contrast, psychosocial factors that contributed to higher risk of preterm birth for Caucasian women included high counts of life events and the absence of a romantic partner (Dole et al., 2004). Notably, pregnant women in different ethnic groups also differed in SES, education level, age, and prevalence of being married (Dole et al., 2004). The current study adds to the literature by utilizing a population of low-income women primarily of African American and Hispanic descent. However, extreme caution will be used in interpreting the results according to ethnic differences since this was not

one of the major theoretical underpinnings guiding the analysis and choice of psychosocial factors for the current study.

Current Issues and Gaps in Literature

Hammen (2005) has also highlighted two important methodological issues in the literature about depression and stress which can be extended to the current topic of maternal distress: 1) attempting to insure that stress is not confounded with the outcome and 2) the idea that stressfulness (or distress) is understood from the vantage point of the individual's circumstances. This highlights the importance of the current study which assesses neonatal outcomes assessed by trained observers versus relying on maternal reports of infant behavior (DiPietro, 2012). When conceptualizing stress, it is also important to consider its impact in terms of an individual threshold or along a continuum. Overall, the extant literature warrants further research due to the following gaps in the literature 1) the almost exclusive use of a deficit framework that focuses on adverse effects of maternal distress on neonatal and child development and 2) consideration of psychosocial factors such as social support and coping to specifically predict observable neonatal outcome that is not based on maternal reports.

The Current Study

The overarching study purposes are two-fold. The first study purpose (which relates to hypothesis 1 below) is to replicate the findings of numerous previous studies which have stated that maternal distress (depression, anxiety, perceived stress) is highly correlated with adverse neonatal outcomes (Field, Diego, & Hernandez-Reif, 2009; Field et al., 2001; Goodman et al., 2011; Hernandez-Reif et al., 2006; Lundy et al., 1999).

The second study purpose (which relates to hypothesis 3 and 4 below) is to utilize a resilience framework to add to the literature my investigating if there are maternal psychosocial factors which buffer babies from the potentially negative effects of prenatal maternal distress. Specifically the current study hypothesizes that maternal social support and adaptive coping types will buffer the neonate from the negative impact of maternal distress early on in life. The current study hopes to add to the literature by using objective information about birth outcomes versus solely relying on self-report information from caregivers. Additionally, the current study anticipates that by shifting the focus from a deficit framework, research can more comprehensively understand the phenomena beyond viewing maternal distress from a negative, problem focused lens. This may potentially help contribute to outcome research for pregnant women who experience distress. The current study utilizes a theoretical framework based on empirical literature to influence the development of the study hypothesis. The current study hypotheses are as follows:

Hypothesis 1: Prenatal maternal self-reported distress (depression, anxiety, and perceived stress) will be negatively associated with neonatal outcomes (e.g., NBAS behavioral cluster scores at birth and one month of age).

Hypothesis 2: A global or latent measure of maternal distress will statistically represent the four maternal distress measures (i.e., scores on two depression measures, one anxiety measure, and perceived stress scale detailed in the Methods section) investigated in the current study.

Hypothesis 3: Prenatal maternal social support will moderate the relationship between prenatal maternal distress and neonatal outcomes.

Hypothesis 4: Prenatal adaptive maternal coping which uses cognitive or behavioral styles will moderate the relationship between prenatal maternal distress and neonatal outcomes.

Method

Research Procedure Overview

The current study was a part of a larger study funded by the National Institute of Mental Health (NIMH). The larger investigated maternal psychopathology, maternal psychotropic medication usage as well as fetal and neonatal development. Participants were recruited via flyers, advertisements, and word of mouth from the Psychiatry Obstetrics Consultation/Liaison Service at Grady Memorial Hospital, a public hospital in Atlanta, Georgia. Participants were assessed at four time points: second trimester of pregnancy (26-28 weeks gestation), third trimester of pregnancy (32-34 weeks of gestation), the birth of their child (40 weeks gestation, even in instances where the child was born prior to 40 weeks) and four weeks after the birth of their child (four weeks after 40 weeks gestation). All participants were paid between $25.00 and $35.00 per visit (depending on the length of the study protocol for the visit) plus a transportation subsidy ($2-$5). The transportation subsidy varied based on the participant's mode of transportation (the train subsidy was $2 while $5 was given if the participant parked in the lot).

Inclusion/Exclusion Criteria. Women were eligible to participate if they were between the ages of 18-45 and the gestational age (determined via ultrasound examination) of their fetus at recruitment for the first visit was less than 26 weeks and less than 32 weeks for the second visit. Participants were only eligible to enter the study while there were pregnant and the gestational age of their fetus was less than 32 weeks. Pregnant women were eligible to participate if they did not have any psychiatric diagnosis

with one exception. Participants were able to participate if they had the psychiatric diagnosis of Major Depressive Disorder (MDD).

Women were excluded based on the following criteria: 1) if they were carrying more than one fetus, 2) if the fetus had serious abnormalities (as seen on an ultrasound exam), 3) if the pregnancy had medical complications (e.g., maternal diabetes, hypertension, placenta previa), 4) if the mother was prescribed medication other than prenatal vitamins or antidepressants, 5) if the mother gave birth at a hospital or other location beside Grady Memorial Hospital, 6) if the mother had a psychiatric condition such as bipolar disorder or schizophrenia, and lastly 7) if the mother was actively utilizing psychotherapy/counseling services prior to being enrolled in the current study.

Informed Consent. Once potential participants had been identified, they were informed of the study and asked if they wished to participate. Recruitment entailed describing the general goals of the study, the psychometric assessments, and data to be gathered from the participants, their fetuses, and their babies once they were born. The degree of commitment expected from each participant was explained and coordinated accordingly. The study was approved by the Human Subjects Institutional Review Board at Emory University. Each aspect of the written informed consent document was presented to potential participants. Women who voluntarily agreed to participate signed the informed consent, provided demographic information, and then completed the first maternal psychiatric assessment. Each mother received a photocopy of the informed consent document.

Ethical Consideration for Human Subjects. The protocol utilized for this study was developed by the principal investigator (PI), Dr. Eugene Emory, and colleagues based

on their previous pilot investigations of normal prenatal brain/behavioral relationships. The protocol also received full approval of the Emory University School of Medicine's Institutional Review Board and the data were collected according to the approved National Institute of Mental Health (NIMH) protocol. Additionally, Emory University's Legal Department, the Obstetrics and Gynecology (OB/GYN) Department of Grady Memorial Hospital, and the Human Subjects Review Committee were consulted to establish a procedure to safeguard the health and well-being of the mother and the fetus. A medical doctor board certified in maternal-fetal medicine who was also a research perinatologist reviewed all ultrasound data for clinical abnormality. In the case of abnormal findings, participants were referred to their OB/GYN physician.

Participants

Participants self-reported their demographic information (age, race, highest education level, yearly income, occupation, marital status, number of children) and additional information (medical history, psychiatric history, substance abuse history, etc.). All participants resided in the Atlanta, Georgia metropolitan region.

The sample consisted of 84 women and their babies (42 male and 38 females). The average participant age was 23.51 (SD=5.068), 90% of the pregnant women were under the age of 30. Racially, the sample was primarily African American (84.5%); the rest of the sample was Hispanic (10.7%), Caucasian (1.2%), and Other (3.6%). The sample was comprised of women whose socioeconomic class was lower to lower/middle income (23.9% and 39.4% respectively) using the Hollingshead Four Factor Index of Social Status. About one-fourth of participant's socioeconomic class was middle income (26.8%) while remaining participants were upper-middle (5.6%) and upper income (4.2%). Three-

fourths (75.0%) of study participants were single women while 21.4% were married or partnered. More than half of the study participants (46.4%) began the study with at least one child while 46.4% were pregnant with their first child. More demographic data is detailed on Table 2.

Design

The current study was a longitudinal, repeated measure within-subject (multiple subjects) design. The larger study had one control group which consisted of pregnant women who did not meet criteria for any psychiatric diagnosis and who were not taking prescription psychotropic medication. In addition, /there were two experimental groups: 1) pregnant women who met criteria for Major Depressive Disorder (MDD) and who were not taking psychotropic medications and 2) pregnant women who met criteria for MDD and were taking prescribed psychotropic medication. The current study included women who did and did not meet MDD criteria. Women who took psychotropic medications (while being recruited for the study and during) were not included in the study.

Measures

Maternal Measures.

The Beck Depression Inventory-II (BDI-II; Beck, 1996). The BDI-II is administered to individuals 13 years and older. The BDI-II consists of 21 items scored on a four-point Likert scale, ranging from not present (0) to severe (3). Items address the presence or absence and severity of physical symptoms, behaviors, thoughts, and feelings associated with depression that the participant may have experienced in the last two weeks. The BDI-II has previously been used to study the relationship of maternal depression and psychosocial stress during pregnancy (Seguin, Potvin, St-Denis, & Loiselle, 1995).

Generally the psychometric properties of the BDI-II are quite sound with coefficient alpha estimates of reliability for outpatients of 0.92 and was 0.93 for the nonclinical sample. The one-week test-retest reliability coefficient was quite high at 0.93 (Beck, 1996; Grant et al., 2004). Total scores on the BDI-II indicate the presence of symptoms are categorized as none (0-9), mild (10-19), moderate (20-29) and severe (30-39).

The Beck Anxiety Inventory (BAI; Beck, 1990). The BAI consists of 21 items scored on a four-point Likert scale that measures the severity of anxiety related in adults and adolescents in the previous month. The BAI has high reliabilities and coefficient alpha, typically above 0.90. Similarly, internal consistency reliability coefficients are excellent, ranging between 0.85 and 0.94 (D. S. Goldstein & McEwen, 2002). The BAI is scored on the same range as the BDI-II and therefore lends itself more easily to a comparison of the severity of anxious to depressive symptoms. Total scores of the BAI indicate the presence of symptoms are categorized as none (0-9), mild (10-19), moderate (20-29) and severe (30-39).

The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20 item screening tool for assessing clinically significant psychological distress experienced in the previous week. The CES-D items reflect depressive symptoms associated with MDD including depressive mood, feelings of guilt, feelings of worthlessness, psychomotor retardation, loss of appetite, and sleep disturbance. CES-D internal consistency reliability ranges from 0.84 to 0.90. The CES-D has also been shown to be reliable measure for assessing number, type and duration of depressive symptoms across race, gender and age categories. The cutoff score of 16 or greater is suggestive of clinical depression.

The Perceived Stress Scale (PSS; S. Cohen, Kamarck, & Mermelstein, 1983). The PSS is a 14-item instrument that was used to assess the degree to which adults perceive their lives as burdensome, uncontrollable, and unpredictable. The PSS is a global measure of perceived stress that assesses the degree to which a person appraises their life as stressful (S. Cohen et al., 1983; S. Cohen & Williamson, 1988) and has been validated in obstetric populations (Kalra, Einarson, Karaskov, Van Uum, & Koren, 2007). The higher the degree and longer the duration of self-perceived stress, the higher the risk factor for a clinical psychiatric disorder. The reliability and validity are usually greater than 0.85. Cohen (1983) describes using the sample mean to suggest clinically significant groups.

The Coping Responses Inventory (CRI; Moos, 1993). is 48-item self-report questionnaire that aggregates participant responses into eight clusters (logistic analysis, positive reappraisal, seeking guidance/support, problem solving, cognitive avoidance, acceptance or resignation, seeking alternative rewards, and emotional discharge). Individuals select and describe a recent stressful event and use a four-point Likert scale ranging from "not at all" to "fairly often" to rate their use of different strategies for coping with the predicament. The CRI yields scales that measure the respondent's propensity toward "Approach Coping Responses" and "Avoidance Coping Responses" in either the cognitive or behavioral domain. The CRI has been used widely to study coping in diverse populations. Approach coping is predominately active and entails operations such as logical analysis, positive reappraisal, seeking assistance from others, and problem solving. Avoidance coping is primarily passive and includes factors such as cognitive avoidance, acceptance or resignation, seeking distractions, and emotional discharge. Broadly

approach coping is noted to be similar to problem-focused coping, while avoidance coping is similar to emotion-focused coping (Billings & Moos, 1984).

Maternal Fetal Attachment Scale (MFAS: Cranley, 1981). The MFAS is a 23 item self-report measure with five Likert scale options ranging from 1 (definitely no) to 5 (definitely yes). High total scores indicate high levels of maternal fetal attachment. Sample items include "I talk to my unborn baby" and "I can hardly wait to hold the baby." The MFAS yields five subscales: role taking, differentiation of self from the fetus, interaction with the fetus, attributing characteristics to the fetus, and giving of self. The Cronbach alpha for the MFAS is 0.85 (Cranley, 1981). To assess social support for the current study, the five items related to support from family and a mate/long term partner will be utilized. Sample items include "My family supports this pregnancy" and "My family will help in the caregiving of this baby".

Illicit Drug Urine Screen. All participating women provided urine samples at each visit across the study (n = 4) in order to determine the presence of several classes of illicit drugs including opioids, barbiturates, stimulants, and marijuana. Notably, studying the effects of illicit drugs on fetal/infant development was not one of the goals of the project. For the overarching study, the plan was to exclude women from the study who tested positive for illicit drug use and recruit a replacement. Women who tested positive for drug use were included in the analysis. Analysis was performed to see if there were differences between babies of women who screened positive for illicit drug use and women who tested negative for drug use.

Socioeconomic Status (SES). For the current study the Hollingshead Four-Factor Index of Social Status (Hollingshed; Hollingshead, 1975) was utilized. The Hollingshead is a

scale that determines SES by generating a composite score based on a weighted calculation using participant's occupation and education information. Composite scores are used to determine if participants fall in one of five Hollingshead social status classes which include 1) lower, 2) lower-middle, 3) middle, 4) upper-middle, and 5) upper.

Infant Measure

The Brazelton Neonatal Behavioral Assessment Scale (NBAS; Brazelton & Nugent, 1995). The NBAS was administered prior to each newborn's discharge from the hospital between 12 and 24 hours after birth and four weeks after birth. Trained research personnel were "blind" to group assignment. The seven summary scores suggested by (Brazelton, Nugent, & Lester, 1987) will be adopted: 1) Habituation, 2) Orientation, 3) Motor Behavior; 4) Range of State, 5) Regulation of State, 6) Autonomic Stability, 7) Abnormal Reflexes. Conceptually, the NBAS will serve as a global measure of elicited newborn behavior. The NBAS is recommended to be used from birth to the third month of infant life. Based on the suggestion of Goodman (2011), the supplemental subscale of Irritability was included in the current study based on combining NBAS items related to peak of excitement, rapidity of buildup, and irritability per Kaye (1978). NBAS clusters have been rescored to indicate that higher scores indicate optimal performance (Brazelton & Nugent, 2011; Tronick, 2007).

Procedure

Once pregnant women completed the recruitment process, were determined to be eligible, and agreed to participate, they were assigned a participant identification number. Thereafter, participants were reminded via telephone and by postal mail of upcoming appointments several days/weeks prior to their visit. To reduce attrition, phone reminders

were conducted by live study members versus a recorded message. Additionally, where logistically possible, study personnel that initially made contact with participants were followed throughout the study, especially for the first two study visits. The highest attrition was observed between visit 2 and visit 3.

The first visit occurred between the 26th and 28th week of pregnancy and the second visit occurred between 32 and 34 week of pregnancy. The third visit occurred at the hospital after the mother birthed her baby. The fourth visit occurred after delivery, approximately four weeks (28 days) after birth. At each visit, each mother was administered various psychometric instruments (see above), a salvia sample was taken, and then participants received payment for participation. Additionally, at the first and second visit, which both occurred while participants were pregnant, ultrasounds were also conducted. Ultrasound results (fetal monitoring) were not utilized for the current study. During the third and fourth visit, the NBAS was administered and infant saliva samples were also taken. A summary of the procedure for each visit is described below.

Visit 1. 26-28 weeks, second trimester. The details of the study were explained to the participant and women who agreed to participate signed the informed consent, provided demographic information, and completed maternal self-report assessments consisting of the BDI-II, BAI, CES-D, PSS, MFAS, and CRI. Next, participants were asked to provide a salivary cortisol sample and take a urinary drug screen prior to the start of the fetal monitoring session. Twenty minutes after fetal monitoring the mother was asked to provide another saliva sample and received $25.00 for participation.

Visit 2. 32-34 weeks. The procedure for the second visit was almost parallel to that of the first. Participants were asked to complete the BDI-II, BAI, CES-D, PSS, and MFAS.

Urinary drug screens and salivary cortisol samples were taken prior to the start of the fetal monitoring session. Another salivary cortisol sample was taken 20 minutes after completion of the fetal assessment and the participant received $25.00 for her participation.

Visit 3. Baby birth (greater than 35 weeks gestation). Daily contact with the Grady Hospital Maternal/Fetal Unit was made to ensure notice of delivery. Study research assistants rotated weekends to ensure delivery day data collection. Post-delivery assessments were conducted within 24 hours of birth. The exact time when the neonate was assessed depended on whether he/she resided in the newborn nursery or the mother's hospital room, as those residing in the nursery allowed for easier access and earlier evaluation. The post-delivery evaluation consisted of documenting obstetrical and postnatal complications, measuring maternal psychiatric symptoms with the BDI-II, BAI, CES-D, and PSS, as well as gathering maternal saliva samples and obtaining a urine sample for drug screening. Additionally newborn salivary cortisol samples were collected before and after the NBAS administration. Mothers received $35.00 for their participation plus a transportation subsidy.

Visit 4. One month after birth. Near the end of the first postnatal month, mothers were reminded of their upcoming one-month postpartum examination by both a telephone call and letter. Mother and infant were evaluated by separate RAs to ensure "blinded" observations. During the one-month visit the NBAS was administered and neonate saliva samples were collected before and after the NBAS administration. Mothers completed BDI-II, BAI, CES-D, and PSS. Additionally, maternal saliva and urine was collected. Mothers then received $35.00 for her participation plus a transportation subsidy.

Data Analysis

All statistical analyses were performed using SPSS for Windows version 21.0 statistical software. The PROCESS macro was installed in the SPSS program due to its capability to statistically account for small sample size using a conditional process analysis for moderation (Preacher & Hayes, 2004). The PROCESS model is appropriate for the current study because it statistically enables power to be maximized. This is achieved in the PROCESS macro through application of a bootstrapping method that yields more accurate estimates of the standard error used in calculating confidence intervals and tests of statistical hypothesis. The recommended 10,000 bootstrapped resample method via the PROCESS macro was used to estimate the 95% bias corrected and accelerated confidence intervals (Preacher & Hayes, 2004). The PROCESS model requires specification of moderating paths and does not estimate all possible bivariate associations and interactions. The model tested one independent variable (maternal distress score), one dependent variable (NBAS cluster score), and two moderating variable (MFAS Social Support cluster and CRI cluster), moderating the path between the independent and dependent variables as well as relevant covariates (See Figure 2 and 3). The unique variance explained by each moderator/interaction as well as the joint variance explained is reported. For this study, separate analyses were conducted for each independent and dependent variable. The α level used in the study was 0.05 while α level 0.01 was also reported.

Conceptual Diagram

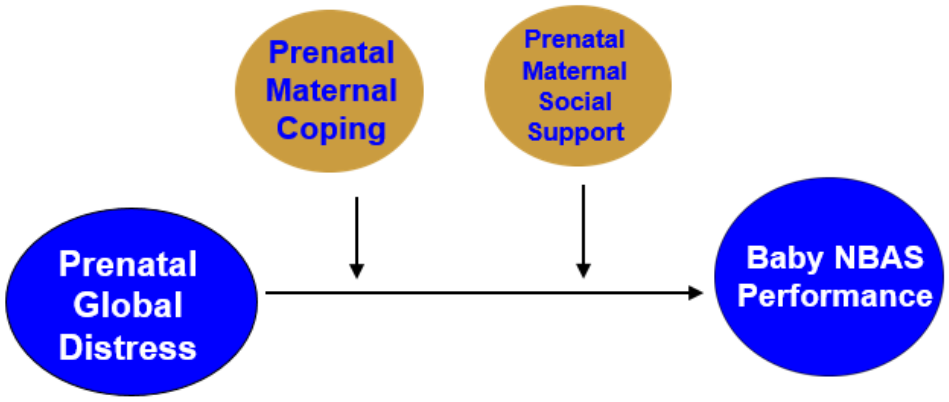
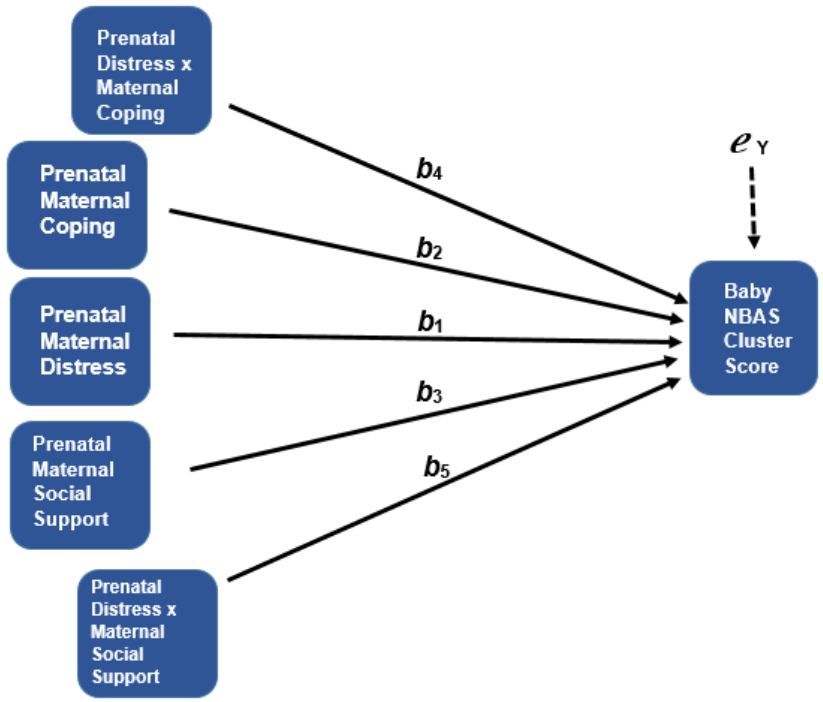


Figure 2. *Conceptual diagram of the additive moderation model for the current study.* Adapted from Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York: Guilford Press.



Conditional effect of X on Y=b_1+ b_4M + b_5W

Figure 3. *Statistical diagram of the additive moderation model for the current study.* Adapted from Hayes, A. F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. New York: Guilford Press.

Results

Descriptive Information

Table 4 depicts the birth characteristics of neonates. Notably, 20% of the sample was born premature.

Preliminary Analysis

Based on previous literature (O'Connor et al., 2002) suggesting high correlations between depression and anxiety, Pearson product-moment correlations were computed for the maternal distress measures used in the current study. Significant correlations were found among all the distress measures with the highest correlations between the two depression measures, BDI-II and CES-D, at both the second and thirdtrimesters ($r=0.798$, $p=0.743$, respectively). Due to the high correlations at birth and four weeks after birth (see Table 7 and 8), it was appropriate to attempt to combine them into a global variable describing maternal psychological distress. A principal component analysis was executed to determine the weights of each individual distress measure which comprised the global maternal distress measure at the second and third trimester; see Table 9 for a list of the factor loadings.

Based on demographic confounders/covariates suggested in extant literature, preliminary analysis were conducted using t-test, correlational analysis, or ANOVA (as appropriate) to asses if there was a significant difference in Brazelton cluster scores or distress measures based on the following variables: race, parity, socioeconomic status, and age. Significant findings are described in Table 11-18 including the respective covariates used for analysis. Due to existing issues with sample size, when conducting the regression analysis, only instances in which a covariate was significant were used in order to

maximize the degrees of freedom. Additionally, calculations suggested that there was not a significant difference in Brazelton scores for babies born full-term versus those born preterm/premature (less than 37 weeks). It must be noted that there was significant missing data regarding the gestational age at birth for the babies in the current study, thus, the results should be interpreted with extreme caution. In terms of the association of prematurity and maternal distress, third trimester maternal perceived stress scores were higher for babies not born preterm, t (50) =2.00, $p<0.05$. No statistical difference (using a t-test) was noted in maternal distress or NBAS cluster scores based on maternal substance use.

Assessments of normality were also completed for the psychosocial factors assessing coping and social support using the one-sample Kolmogorov-Smirnov (K-S) test. Neither the coping measure nor thesocial support (subscale of the MFAS measure) violate normality. Additionally, the outcome measure, NBAS cluster scores, was normally distributed. Lastly, suitable internal consistency (calculated with Cronbach alpha) for the Brazelton and distress measures were found.

Tests of Hypotheses

Hypothesis 1. The hypothesis that maternal distress scores would be correlated with NBAS scores, was assessed using a correlational analysis. At birth, NBAS motor and autonomic cluster scores were correlated with 2nd trimester maternal anxiety. Specifically, 2nd trimester maternal anxiety was negatively correlated with NBAS motor behavior cluster scores, r (68) =-0.28, p=0.021. In other words, babies of mothers who scored higher on the BAI measure had lower scores on the NBAS motor behavior cluster. Conversely, higher scores on maternal anxiety measures during the second trimester were associated

with higher scores on the NBAS autonomic system cluster r (65) =0.26, p=0.036. Additionally, at birth, third trimester maternal perceived stress was positively associated with NBAS State Regulation scores, r (44) = 0.366, p=0.012.

At 4 weeks after birth, second trimester maternal depression assessed by the BDI-II was negatively associated with the NBAS Irritability cluster, r (36) =-0.333, p=0.041. Second trimester maternal perceived stress was negatively associated with NBAS Social Interaction/Orientation cluster, r (50) =-0.277, p=0.047. Additionally, 4 weeks after birth, third trimester maternal perceived stress was negatively associated with the NBAS Abnormal Reflex cluster scores, r (56) =-0.280, p=0.033. See Table 8 for the complete correlational tables between maternal distress measures and NBAS cluster scores.

Hypothesis 2. Principal component analysis was utilized to determine if the 2nd and 3rd trimester global maternal distress measures were associated with NBAS cluster scores at birth and 4 weeks after birth. Analysis revealed that the first principal component of the 2nd trimester global distress measure explained 66.47% of the variance. In the 3rd trimester, the first principal component explained 63.83% of the variance in the global distress measure. There were no significant correlations between the global distress measures and NBAS scores at birth. Four weeks after birth, global maternal distress during the second trimester was negatively associated with NBAS Irritability cluster scores. When evaluating the correlation of the NBAS cluster score with the global maternal distress score, second trimester maternal distress was negatively associated with the NBAS Irritability cluster (r=-0.349, p=0.040). The correlations for both 2nd and 3rd trimester global maternal distress measures and the NBAS clusters is presented in Table 10.

Hypothesis 3 and 4. The study hypothesis posited that maternal distress would predict neonatal outcomes and be moderated by maternal social support and/or maternal coping response. The model examined one independent variable (maternal global distress), one dependent variable (NBAS cluster), two moderating variables (maternal social support and maternal coping), and statistically appropriate covariates (either number of children/parity, socioeconomic status, maternal age, or race). Separate analysis were conducted for each dependent variable/outcome variable and Coping Resources Inventory (CRI) cluster. Moderators included maternal social support and maternal coping reported during the second trimester. The analysis using the PROCESS macro revealed several significant findings (see tables 11-18) which have been separated by NBAS cluster scores predicted at birth and those assessed four weeks after birth. Table 11-18 also specifies (under the title "Statistical Controls") the demographic variable(s) which were being controlled for each significant regression model. To avoid high collinearity with the interaction term, the variables global maternal distress and maternal social support) were centered and an interaction term between maternal 2nd trimester global distress and maternal social support was created.

Predicting NBAS Scores at Birth. Second trimester maternal social support moderated the effect of maternal distress on NBAS Autonomic Stability, $\Delta R^2 = 0.1573$, ΔF (1, 49) = 9.9528, $p = .0027$; b = 0.0292, $t(56) = 3.1548$, $p = .0027$, and the interaction accounted for 15.73% of the variance in the NBAS Autonomic Stability cluster score. Figure 5 illustrates the interaction. Higher NBAS cluster scores indicate more optimal performance (Brazelton & Nugent, 2011; Tronick, 2007). More detailed information about the regression model including regression estimates appear in Table 11.

Second trimester maternal cognitive approach moderated the effect of maternal distress on birth NBAS Habituation and the interaction accounted for 11.99 % of the variance in NBAS Habituation at birth, ΔR^2 =0.1199 , F (1, 27) = 6.8404, p = .0144 ; b = -0.0033, t(36) = -2.6154 , p = 0.0144 (as illustrated in Figure 6). Similarly, second trimester maternal cognitive avoidance moderated the effect of maternal distress on birth NBAS Habituation, ΔR^2 =0.1083, F (1, 27) = 5.4317, p =0.275; b =-0.0030, t (36) =-2.3306, p = 0.275, and the interaction accounted for 10.83% of the variance in NBAS Habituation(see figure 7).

Four weeks after birth, second trimester social support moderated the effect of maternal distress on NBAS motor development, ΔR^2 = 0.0590, F (1, 50) = 4.2141, p = 0.0453.; b =0.0076, t (57) =2.0528, p = 0.0453, and the interaction accounted for 5.9% of the variance in NBAS motor development. As illustrated in Figure 8, babies of mother's with high levels of maternal distress had higher NBAS Motor scores when maternal social support was the highest.

Additionally, four weeks after birth, 2nd trimester maternal social support moderated the effect of maternal distress on NBAS State Organization scores in four different models which separately contained each maternal coping style (cognitive avoidance, cognitive approach, behavioral avoidance, behavioral approach) as detailed in Tables 16-18 (p<0.05). Figure 8-11 illustrate the interaction terms which suggest that babies of mother's with high levels of maternal distress had higher NBAS Motor scores for mother's with high social support.

Predicting NBAS Scores Four Weeks after Birth

Due to large amount of missing MFAS social support during the third trimester, MFAS social support during the second trimester was utilized for all the analysis. Notably, the two social support measures were statistically correlated, r (71) =0.529, p=.000 and were not significantly different from each other, t (73) =-0.235, p=0.815. The main model is significant which indicates that the predictors (2nd trimester global distress, 2nd trimester social support from the MFAS scale, number of children, 2nd trimester CRI Cognitive Avoidance) in the main model statistically predict neonate scores on the NBAS Irritability scale (summation of scores on the peak of excitement, rapidity of buildup, and irritability); based on the significant main model we can interpret the interaction. Specifically, the interaction of 2nd trimester global distress and 2nd trimester CRI Cognitive Avoidance was significant. To better understand this it helps to look at varying levels of CRI Cognitive Avoidance. A similar trend happens at each level of CRI Cognitive Avoidance (low, medium, high), the slope/effect of Global Distress predicting NBAS Irritability becomes more positive as there is an increase in 2nd trimester MFAS Social Support. In other words, higher amount of maternal social support is associated with a relatively more positive ability of 2nd trimester global distress to predict NBAS Irritability.

Additional Analysis

Regarding demographic differences, ANOVA, F (3, 102)=3.761, *p*=0.013 revealed that African American women (M=23.25) had significantly higher scores than Hispanic women (16.74) and Caucasian women (M=16.00), respectively) on perceived stress scores during the third trimester. Additionally, women who described being racially/ethnically Other, had higher scores on the NBAS Habituation scores at birth, F (2, 39)=3.939, p=0.028.

Additionally, positive correlations were found between global maternal distress and Hollingshead SES scores at the second (r=0.642, p=.001) and third trimesters (r=0.269, p=.023).

Regarding, maternal distress timing, women reported higher scores in the second trimester than the third trimester on the BDI-II, t (130) =4.709, *p*=.000 , as well as the CES-D, t(108)=2.719, *p*=.008 while the same profile was approaching significance for the BAI, t(131)=1.800, *p*=0.074.

Discussion

The first goal of the current study was to investigate prenatal maternal social support and maternal coping styles as moderators of the ability of prenatal maternal distress to predict neonatal outcomes as assessed by the widely used Neonatal Behavioral Assessment Scale (NBAS). The first study hypothesis was partially supported. Prenatal maternal social support attenuated the negative impact of prenatal maternal distress as it predicted babies autonomic stability NBAS cluster score at birth as well as motor development and state organization four weeks after birth. Figure 12 provides a simple illustration of the significant findings. Specifically, mothers with high scores on the prenatal social support measure and high global distress had babies with higher autonomic stability NBAS cluster scores at birth. Similarly, mothers with high scores on the prenatal social support score and high global distress had babies at birth with higher motor development NBAS cluster scores. At four weeks after birth, mothers with higher scores on prenatal social support and high distress had babies with higher state organization in four different models that separately included each type of cognitive style (i.e., cognitive approach, cognitive avoidance, behavioral approach, behavioral avoidance).

Support for the unique hypothesis proposed by this study also encouraged the utilization of a resilience framework in research attempting to understand the impact of maternal distress on birth and neonatal outcomes. One possible explanation is that babies of mother's who reported more social support actually had more individuals that interacted with the baby which may have contributed to babies having higher scores on the autonomic stability items (e.g., tremulousness, startles, lability of skin color) of maternal distress or the quality of social relationships helped buffer mother's as stressful situations arose. Additionally, findings from the current study contrasted findings by another with a similar population (minority, low SES, public hospital in large city) that correlated anxiety scores with the NBAS habituation cluster (Oyemade et al., 1994).

Prenatal cognitive approach and cognitive avoidance maternal coping styles attenuated the negative impact of prenatal maternal distress on the habituation NBAS cluster scores at birth. Mothers with higher scores on cognitive approach and cognitive avoidance and high global distress had babies with higher NBAS habituation clusters. It was predicted that since high cognitive approach and lower cognitive avoidance (i.e., wishful thinking) are separately both adaptive coping styles they would contribute to more optimal scores. Habituation has been described as the ability not to respond to an environmental stimuli that is either disrupting the babies' state organization or not providing functional significance (Tronick et al., 1976).

In the current study, maternal distress was operationalized as a combination of self-report measures assessing symptoms associated with anxiety, depression, and perceived stress separately during the second and third trimesters of pregnancy. This global or latent measure of maternal distress appeared to adequately encompass the distress of mother's

during pregnancy. Expectedly, the current study findings were consistent with extant literature associating maternal distress with adverse neonatal outcomes (Field, Diego, & Hernandez-Reif, 2010; Goodman et al., 2011; Van den Bergh et al., 2005).

In the current study, there were more instances of social support (compared to coping style) being a moderator of the ability of global maternal distress to predict the performance of babies as assessed by the NBAS. This is in line with extant literature that states that social support positively affects psychological well-being (Kessler & McLeod, 1985; Lakey & Cohen, 2000).

There was partial support for adaptive coping (either via cognitive or behavioral approach) moderating the relationship between maternal distress and neonatal outcomes (Finney et al., 1984). Findings concerning cognitive avoidance and cognitive approach styles endorsed by mothers in the current study lent support to Lazarus and Folkman (1984) theory suggesting that coping makes a difference in the adaption outcome of a stressor such as maternal distress. Additionally, the moderating effects model which included the buffering of maternal distress by psychosocial factors was supported by the current findings (Finney et al., 1984; Holmbeck, 1997). Specifically, the current study lent support for the moderating effects model suggested by Finney (1984) which suggest that coping strategies buffer the relationship between stress and negative outcomes.

As cited in the introduction, when attempting to understand the relationship between maternal distress and neonatal outcomes, many researchers have focused on obtaining theoretical support for physiological mechanisms of impact. While many researchers have theorized about the psychosocial pathways linking social support and physical health, far less research has focused on obtaining support for psychosocial

mechanisms between maternal distress and neonatal outcome. Additionally, there has been mixed support for physiological pathways centered on the HPA axis (Bernal et al., 2003; Hammen, 2005; Young et al., 2000). Due to the notable impact that pregnancy has on an individual's life, psychosocial resources may be more heavily relied on during pregnancy than other times in an adult's life. This is evident in past research that has suggested that first time mothers have more anxiety during the third trimester than women who have at least one child (Wartella et al., 2003). Overall, the current study found partial evidence of social support attenuating the impact of maternal distress on neonatal outcome.

In contrast to other studies, the current study did not support maternal depression associations with neonatal outcomes as strongly as many other studies (Diego, Field, & Hernandez-Reif, 2005; Field et al., 2004; Goodman et al., 2011). Notably, some researchers with alternate findings utilized structured interviews in addition to self-report measures to assess depression (Goodman et al., 2011). The current study solely used self-reported measures of distress. Also many other studies utilized univariate analysis while the current study utilized both univariate and multivariate analysis. Lastly, the current study had covariates that were differentially used depending on the association with NBAS clusters.

The current study found more support for maternal anxiety and perceived stress being associated with NBAS scores at birth and four weeks after birth than for depression being associated with these outcomes. It is suggested that maybe the specific aspect of depression most related to anxiety would be related to NBAS if the data were re-analyzed. This could either mean an item analysis or drawing on extant literature that suggest physiological arousal symptoms associated with anxiety that are also on a depression

inventory. Additionally, it may be possible to use a general distress factor that has been suggested to be present in both the Beck Depression Inventory, second edition and the Beck Anxiety Inventory (BAI) in clinical and non-clinical populations (Clark, Steer, & Beck, 1994).

Consistent with extant literature, maternal distress as indexed by depression and anxiety was higher during the second trimester than the third trimester (Bennett et al., 2004). Although this contrasted other findings (Lee et al., 2007; Skouteris et al., 2009). Interestingly, SES during the third trimester positively correlated with distress scores. Additional analysis would have to be conducted to understand this finding.

Findings from the study enabled conclusions to be drawn about the study sample which were primarily single African-American pregnant women who were in the low-middle SES or lower. Specifically, study findings showed support for social support having promise as a factor that buffers babies from the potentially negative outcomes of maternal distress. Unlike other studies which have shown that social support conceptualized as support from a romantic partner (Bergman et al., 2007), the current findings suggest that support besides that from a romantic partner is an important factor for this population. Additionally, in this sample support was provided for emotion-focused coping as an additional component that works with social support to regulate babies' exposed to a distressed maternal environment prenatally (Lazarus, 1993; Lazarus & Folkman, 1984).

Also, in this sample there were more instances of maternal anxiety and perceived stress being correlated with neonatal outcomes as compared to the impact of maternal distress in this sample. Future studies should ascertain if maternal anxiety predicts pre-

term birth in this sample which has a high incidence of preterm birth and low birth weight babies in the United States (Schetter & Glynn, 2011; Ventura et al., 2000).

Strengths

Strengths of the current study included utilizing a longitudinal study design that was able to assess maternal distress at different pregnancy trimesters and neonatal outcomes at two time points. Assessing two points during the neonatal period supports the use of a developmental framework which is appropriate for the rapid changes that occur during the neonatal period. The study also utilized statistically indicated covariates in the analysis rather than controlling for all demographic information. Another strength of the current study was the utilization of a global distress measure that could be assessed in relation to neonatal outcome. Another notable strength of the current study was the utilization of theoretical framework to generate hypothesis. Lastly, the resilience framework was useful for understanding how babies are buffered/protected in the presence of mother's experiencing distress during pregnancy.

Limitations

The current study and associated findings are negatively impacted by numerous limitations. One notable methodological limitation was the small sample size which limits statistical power in multivariate analyses. There was significant attrition between study entry and the end of the study; there was a sharp decline in participants between the 3rd trimester and birth. Although the PROCESS macro is particularly valuable for studies with small sample size, it is preferable to have more individuals to ascertain findings. Additionally, it would have been ideal to have study participants that represented more variability in demographic variables that have been shown in the literature to be important

in this research area, including history of clinical anxiety and depression, race, SES, and age. This specifically could help clarify the current study finding which suggested racial differences in the endorsement of perceived stress symptoms and babies' performance on the NBAS Habituation cluster.

Women with higher distress levels were more likely to be retained, therefore, it is possible that the significant interactions are more applicable to women who report high distress versus those who report low or no distress. Attrition also contributed to not being able to use maternal social support scores obtained during the third trimester of pregnancy. This might have explained why there appeared to be more robust moderational effects found during the second trimester than during the third trimester.

As studies have noted, broad-based anxiety measures are less likely to indicate how anxiety experiences are typical versus unexpected during the unique period of pregnancy. As has been the trend in the recent past, future studies should use a pregnancy specific anxiety measure (Gutteling et al., 2005). Pregnancy anxiety has been defined as fears that relate to the pregnancy such as fears about the health and well-being of one's baby, of hospital and health care experiences during pregnancy, and of the childbirth process and parenting afterwards (Schetter & Tanner, 2012). The study was also impacted by the type of information that could be used from the social support measure, since it was part of a larger measure assessing a different construct (maternal fetal attachment). As mentioned, a measure of social support which assesses the different facets of social support would be most helpful.

Clinical Implications

Due to the limitations of the current study highlighted above, it is suggested that more research be conducted to verify the current findings before their use in clinical settings, not only in terms of replication but also to add specificity to the current findings. Withstanding the stated limitations, the current study suggested that coping style could be a specific target of prenatal interventions for women who report prenatal distress. Also, the current findings suggest that prenatal interventions that target social support are potentially important during the second trimester of pregnancy. The measure used in the current study focused on social support appraised by the mother concerning her family and mate which appears to belong in the categories of emotional and esteem related social support (Razurel et al., 2013). Regarding a possible intervention, one recent study found a yoga intervention was better than a social support intervention in reducing prenatal depression, anxiety, and cortisol. Notably, this study seemed to have a non-specific conceptualization of social support; social support was conceptualized as support provided via a leaderless verbal discussion group that met once weekly for 12 weeks (Field, Diego, Delgado, & Medina, 2013). However, more information on the specific aspects or type of social support that attenuate the impact of maternal distress could be useful in planning future intervention studies.

Future Directions

Based on the finding that women who reported more distress remained in the study, it is suggested that future studies using a convenience sample consider employing methods to increase study completion for women with lower distress. This may include study personnel highlighting to all women the benefit of their information for larger research questions regardless of their current symptoms. Future studies that seek to expound on

racial differences in maternal distress and/or birth/neonatal outcomes should also seek to utilize measures indicated in the literature to better understand distress. For instance, it has been recommended that stress for minority groups also includes assessment of racial discrimination (Schetter & Tanner, 2012).

It is notable that the social support measure used for the current study was a subset of a larger scale assessing maternal fetal attachment. It is suggested that future studies consider using a social support measure that is specific to period of pregnancy and provides additional detail about the aspects of social support which moderate the relationship between maternal distress and neonatal outcome. Types of social support that have been suggested in the literature include emotional (physical expressions of caring), informational (advice or guidance), instrumental (tangible goods or assistance with tasks), and esteem (expressions of confidence or encouragement) (Razurel et al., 2013).

Future studies should seek to utilize a psychosocial framework in combination with physiological theories to better understand the mechanisms of maternal distress that impact birth, neonatal, and lifelong outcomes. The current study evaluated the impact of secondary appraisal by assessing the moderating effects of coping and social support. Future studies should also include primary appraisal which considers how meaning impacts how distress impacts outcomes (Lazarus & Folkman, 1984; Southwick et al., 2005).

Conclusions

Numerous existing studies have highlighted the deleterious impact of prenatal maternal distress on neonatal and child outcomes. The current study contributed to the extant literature by highlighting how the psychosocial factors of maternal coping and social support during pregnancy impact neonatal outcomes and buffer some babies of mothers

experiencing significant distress. The resilience framework may better identify aspects to include in interventions for pregnant women experiencing high levels of distress. The current study also lent support for distress being conceptualized generally using distress that may be common to stress, anxiety, and depression. Further the current study suggested that it is best that prenatal maternal distress is understood specify in the context of pregnancy specific distress. Contrary to past findings, the current study suggested there may be racial differences in the way mother's report distress over the course of pregnancy. This study further lends support to research utilizing a theoretical framework to guide hypothesis and study methodologies. Most importantly, the current study provided support for a variable focused resilience model utilizing naturally occurring resilience that is present for pregnant women experiencing significant distress.

Tables

List of Figures

Figure 11. Four weeks post birth NBAS State Regulation Regressed on 2nd trimester global distress. Interaction: global distress x maternal behavioral avoidance

Figure 12. Simplified summary of significant interaction findings related to resilience/stress buffering hypothesis

Table 2

Participant Demographics

	M (SD) / % (n)
Age	23.51 (5.07)
Race/Ethnicity (self-identified)	
African American	84.5% (71)
Hispanic	10.7% (9)
Caucasian	1.2% (1)
Other	3.6% (3)
Relationship Status	
Single	67.9% (57)
Married	8.3% (7)
Separated	2.4% (2)
Partnered	11.9% (10)
Hollingshead SES Class	
Lower	20.2% (17)
Lower-Middle	33.3% (28)
Middle	22.6% (19)
Upper-Middle	4.8% (4)
Upper	3.6% (3)
Number of Children at Beginning of Study	
No Children	46.4% (39)
One or More Children	53.6% (45)

Table 3

Means and Standard Deviations of Prenatal Maternal Distress

	Time 1 second Trimester			Time 2 third Trimester		
	M	**SD**	**n**	**M**	**SD**	**n**
BDI-II (0-63)	14.54	9.69	81	11.64	9.20	73
BAI (0-63)	9.77	8.08	81	9.72	8.55	73
CES-D (0-60)	15.41	9.66	80	14.13	10.01	72
PSS (0-56)	24.00	8.73	77	23.61	8.76	66

Note: Range of possible scores on each instrument shown in parentheses.

Table 4

Birth Characteristics of Neonates

	M (SD) / % (n)
Gestational Age at Birth (weeks)	38.38 (2.35); [Range 28.57 – 41.14]
Sex of Fetus/Baby	
Female	45.2% (38)
Male	50.0% (42)
Babies' Gestational Age at Birth	
Less than 31 weeks	3.8% (2)
31 -34 weeks	1.9% (1)
35-36 weeks	7.6% (4)
37 weeks	7.6% (4)
Greater than 37 weeks	77.9% (41)

Table 5

Means and Standard Deviations of Neonatal Outcomes: Neonatal Behavioral Assessment Cluster/Count Scores

	Time 3 *Birth*			Time 4 *4 Weeks After Birth*		
	M	**SD**	**n**	**M**	**SD**	**n**
Habituation	3.56	1.38	42	3.88	1.86	31
Social Interaction/ Orientation	5.85	1.01	53	6.02	1.32	57
Motor Behavior	4.94	0.67	71	5.33	0.53	73
Range of State	3.28	1.02	46	3.08	1.04	39
Regulation of State	5.68	1.49	60	4.65	1.20	72
Autonomous Stability	5.25	1.26	68	5.76	1.16	70
Abnormal Reflexes (Count)	4.91	2.63	70	4.47	2.61	72
Irritability	3.47	1.00	46	3.10	0.93	39

Table 6

Means and Standard Deviations of Coping Resource Inventory (Time 1) and MFAS Social Support (Time 1 and Time 2)

	Time 1 Second Trimester			Time 2 Third Trimester		
	M	**SD**	**n**	**M**	**SD**	**n**
MFAS Social Support	2.91	0.68	78	2.86	0.51	37
CRI Cognitive Approach	48.85	8.81	74	----------		
CRI Cognitive Avoidance	52.86	8.44	74	----------		
CRI Behavioral Approach	49.14	8.23	74	----------		
CRI Behavioral Avoidance	55.45	7.82	74	----------		

Note: MFAS=Maternal Fetal Attachment Scale, CRI=Coping Resource Inventory

Table 7

*Pearson Product-Moment Correlations of Maternal Distress and Neonatal Outcomes at **Birth***

		T1 BDI-II	T2 BDI-II	T1 CESD	T2 CESD	T1 BAI	T2 BAI	T1 PSS	T2 PSS
1.	NBAS Habituation	0.061	0.008	-0.065	0.017	-0.114	0.040	0.041	0.039
2.	NBAS Orientation	-0.017	-0.072	-0.183	-0.073	0.098	-0.084	0.091	-0.019
3.	NBAS Motor Behavior	0.000	0.059	-0.083	0.102	**-0.276****	-0.137	-0.177	0.072
4.	NBAS Range of State	0.154	0.043	0.064	0.120	0.072	0.150	-0.071	-0.059
5.	NBAS Regulation of State	-0.063	-0.025	-0.035	-0.041	0.024	-0.117	0.085	**0.366****
6.	NBAS Autonomic Stability	-0.047	0.133	0.038	-0.014	**0.257****	0.094	0.058	-0.174
7.	NBSA Abnormal Reflex	0.031	-0.052	0.006	-0.126	0.093	-0.050	**-0.212***	-0.187
8.	NBAS Irritability	0.132	-0.050	-0.065	0.020	0.093	-0.003	-0.167	-0.070

Note: ** = p <.05, *=p <0.10

BDI-II=Beck Depression Inventory-second edition, BAI=Beck Anxiety Inventory, CESD= Center for Epidemiologic Studies Depression Scale, PSS=Perceived Stress Scale, NBAS=Neonatal Behavioral Assessment Scale, T1=second Trimester, T2=third Trimester

Table 8

*Pearson Product-Moment Correlations of Maternal Distress and Neonatal Outcomes **Four Weeks** after Birth*

	T1 BDI-II	T2 BDI-II	T1 CESD	T2 CESD	T1 BAI	T2 BAI	T1 PSS	T2 PSS
1. NBAS Habituation	0.111	-0.199	0.061	-0.128	0.120	-0.106	-0.011	0.171
2. NBAS Orientation	-0.029	-0.129	-0.082	-0.081	-0.085	-0.271	**-0.277****	0.141
3. NBAS Motor Behavior	-0.164	-0.090	-0.059	-0.015	-0.173	-0.111	-0.025	0.078
4. NBAS Range of State	0.042	0.205	0.017	0.261	0.172	0.240	0.272	0.345
5. NBAS Regulation of State	-0.096	-0.028	-0.014	-0.012	-0.161	0.022	0.012	0.006
6. NBAS Autonomic Stability	0.025	0.006	0.063	0.203	0.008	0.024	**-0.214***	0.212
7. NBSA Abnormal Reflex	-0.021	0.008	-0.028	-0.163	-0.001	0.001	-0.062	-**0.280****
8. NBAS Irritability	**-0.333****	-0.050	-0.194	0.188	**-0.288***	0.171	-0.055	0.153

Note: ** = p <.05, *=p <0.10;

BDI-II=Beck Depression Inventory-second edition, BAI=Beck Anxiety Inventory, CESD= Center for Epidemiologic Studies Depression Scale, PSS=Perceived Stress Scale, NBAS=Neonatal Behavioral Assessment Scale, T1=second Trimester, T2=third Trimester

Table 9

Factor Loadings of Global Maternal Distress Measures using Principal Component Analysis

	T1 (second Trimester)	T2 (third Trimester)
BDI-II	0.891	0.877
CES-D	0.905	0.884
BAI	0.742	0.750
PSS	0.703	0.662

Note: BDI-II=Beck Depression Inventory-second edition, BAI=Beck Anxiety Inventory, CESD= Center for Epidemiologic Studies Depression Scale, PSS=Perceived Stress Scale, NBAS=Neonatal Behavioral Assessment Scale

Table 10

Pearson Product-Moment Correlations of Global Maternal Distress and Neonatal Outcomes

BIRTH

NBAS Cluster	**2nd trimester Global Distress**	**3rd trimester Global Distress**
Habituation	-0.029	0.021
Orientation	-0.008	-0.048
Motor Behavior	-0.076	0.050
State Organization	0.068	0.110
Regulation of State	-0.019	0.085
Autonomic Stability	0.087	0.041
Abnormal Reflex	-0.013	-0.099
Irritability	-0.039	-0.015

FOUR WEEKS AFTER BIRTH

NBAS Cluster	**2nd trimester Global Distress**	**3rd trimester Global Distress**
Habituation	0.084	-0.026
Orientation	-0.090	-0.197
Motor Behavior	-0.169	0.058
State Organization	0.117	0.254
Regulation of State	-0.134	0.047
Autonomic Stability	0.092	0.131
Abnormal Reflex	-0.066	-0.146
Irritability	-0.349**	0.026

Note: ** = p <.05, *=p <0.10;

BDI-II=Beck Depression Inventory 2nd edition, BAI=Beck Anxiety Inventory, CESD= Center for Epidemiologic Studies Depression Scale, PSS=Perceived Stress Scale, NBAS=Neonatal Behavioral Assessment Scale

Table 11. *Multiple regression analysis of Birth NBAS Autonomous Stability cluster regressed on 2nd Trimester Global Distress Score, Moderators: maternal social support & CRI behavioral avoidance, Covariates: parity*

n= 56

Outcome: NBAS3 Autonomic Stability

Overall Model Summary

R	R^2	F	df1	df2	*p*
0.4749	**0.2255**	**2.378**	**6**	**49**	**0.0428**

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Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**11.4997**	**3.4842**	**3.3006**	**0.0018**	**4.4979**	**18.5014**
maternal social support	**-1.772**	**0.5684**	**-3.1173**	**0.0031**	**-2.9143**	**-0.6297**
global maternal distress	**-0.1443**	**0.0605**	**-2.3837**	**0.0211**	**-0.2659**	**-0.0226**
int_1	**0.0292**	**0.0092**	**3.1548**	**0.0027**	**0.0106**	**0.0477**
CRI Behavioral Avoidance	-0.0179	0.051	-0.351	0.7271	-0.1205	0.0847
int_2	0.001	0.0008	1.2527	0.2162	-0.0006	0.0027
Number of Children	0.0574	0.1206	0.4758	0.6363	-0.1849	0.2997

Interactions:

int_1	**global maternal distress**	**X**	**maternal social support**
int_2	global maternal distress	X	CRI Behavioral Avoidance

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.1573**	**9.9528**	**1**	**49**	**0.0027**
int_2	0.0248	1.5693	1	49	0.2162
Both	**0.1613**	**5.1012**	**2**	**49**	**0.0097**

Note: Overall model includes specified main effects, interactions, and covariates

Table 12. *Multiple regression analysis of Birth NBAS Habituation regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI cognitive approach, Covariates: age, race, parity*

	n=	36				
Outcome:		NBAS3Hab				
	R	R^2	F	df1	df2	*p*
Overall Model	0.7257	0.5266	3.7542	8	27	0.0045
Regression Estimates						
	B	SE *B*	t	*p*	LLCI	ULCI
constant	**5.1947**	**0.9591**	**5.4164**	**0.0000**	**3.2268**	**7.1627**
maternal social support	0.3455	0.3272	1.0559	0.3004	-0.3259	1.0168
global maternal distress	-0.0185	0.0098	-1.8904	0.0695	-0.0387	0.0016
int_1	-0.004	0.0141	-0.2831	0.7793	-0.0328	0.0249
cognitive avoidance	**0.0558**	**0.0264**	**2.1121**	**0.0441**	**0.0016**	**0.1101**
int_2	**-0.0033**	**0.0013**	**-2.6154**	**0.0144**	**-0.0059**	**-0.0007**
number of children	0.0745	0.4816	0.1547	0.8782	-0.9138	1.0628
age	**-0.1199**	**0.0438**	**-2.7386**	**0.0108**	**-0.2097**	**-0.0301**
race	**0.971**	**0.2318**	**4.1886**	**0.0003**	**0.4953**	**1.4467**
Interactions:						
	int_1	global distress	X	social support		
	int_2	**global distress**	**X**	**cognitive avoidance**		
R^2 increase due to the interactions:						
	R^2 Δ	F	df1	df2	*p*	
int_1	0.0014	0.0801	1	27	0.7793	
int_2	**0.1199**	**6.8404**	**1**	**27**	**0.0144**	
Both	**0.122**	**3.478**	**2**	**27**	**0.0453**	

Note: Overall model includes specified main effects, interactions, and covariates

Table 13. *Multiple Regression Analysis of Birth NBAS Habituation cluster score regressed on 2nd Trimester Global Distress Score, Moderators: maternal social support & CRI cognitive avoidance, Covariates: parity, age, race*

	n= 36					
Outcome:	NBAS3Hab					
Overall Model	Summary					
	R	R^2	F	df1	df2	*p*
	0.6796	**0.4618**	**2.8961**	**8**	**27**	**0.0182**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**4.4976**	**1.0148**	**4.4322**	**0.0001**	**2.4154**	**6.5798**
social support	0.3934	0.3244	1.2127	0.2357	-0.2722	1.059
global distress	-0.0028	0.0093	-0.3022	0.7648	-0.0218	0.0162
int_1	0.0044	0.0144	0.3015	0.7653	-0.0253	0.034
cognitive avoidance	0.0019	0.0272	0.0701	0.9447	-0.0539	0.0577
int_2	**-0.003**	**0.0013**	**-2.3306**	**0.0275**	**-0.0056**	**-0.0004**
number of children	-0.0978	0.4955	-0.1975	0.8449	-1.1146	0.9189
age	-0.0734	0.0449	-1.636	0.1135	-0.1654	0.0187
race	**0.7693**	**0.2369**	**3.2476**	**0.0031**	**0.2832**	**1.2553**

Interactions:

	int_1	global distress	X	social support
	int_2	**global distress**	**X**	**cognitive avoidance**

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	0.0022	0.1149	1	28	0.7371
int_2	**0.1269**	**6.593**	**1**	**28**	**0.0159**
Both	**0.1304**	**3.3872**	**2**	**28**	**0.0481**

Note: Overall model includes specified main effects, interactions, and covariates

Table 14. *Multiple regression analysis of NBAS Motor Cluster 4 weeks after birth regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI cognitive approach, Covariates: parity*

n= 57

Outcome: NBAS4Mot

Overall Model Summary

R	R^2	F	df1	df2	*p*
0.5473	**0.2995**	**3.5629**	**6**	**50**	**0.0051**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**8.2001**	**1.1814**	**6.941**	**0**	**5.8272**	**10.5731**
social support	-0.2608	0.2403	-1.0856	0.2829	-0.7434	0.2218
global distress	**-0.0396**	**0.0192**	**-2.0632**	**0.0443**	**-0.0782**	**-0.001**
int_1	**0.0076**	**0.0037**	**2.0528**	**0.0453**	**0.0002**	**0.015**
cognitive approach	**-0.0387**	**0.0168**	**-2.2948**	**0.026**	**-0.0725**	**-0.0048**
int_2	0.0003	0.0003	1.0906	0.2807	-0.0003	0.0009
number of children	-0.0499	0.0471	-1.0596	0.2944	-0.1444	0.0447

Interactions:

int_1	**global distress**	**X**	**social support**
int_2	global distress	X	cognitive approach

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.059**	**4.2141**	**1**	**50**	**0.0453**
int_2	0.0167	1.1895	1	50	0.2807
Both	0.0647	2.3094	2	50	0.1098

Note: Overall model includes specified main effects, interactions, and covariates

Table 15. *Multiple regression analysis of NBAS Range of State 4 weeks after birth regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI cognitive approach, Covariates: parity*

n= 33

Outcome: NBAS4Sta

Overall Model

R	R^2	F	df1	df2	*p*
0.7161	**0.5127**	**4.56**	**6**	**26**	**0.0028**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**9.1717**	**2.3105**	**3.9696**	**0.0005**	**4.4223**	**13.9211**
social su[port	**-2.8534**	**0.7989**	**-3.5715**	**0.0014**	**-4.4957**	**-1.2111**
global distress	**-0.1328**	**0.0402**	**-3.2998**	**0.0028**	**-0.2155**	**-0.0501**
int_1	**0.0521**	**0.0141**	**3.6887**	**0.001**	**0.0231**	**0.0812**
cognitive approach	0.0526	0.0526	1.001	0.326	-0.0555	0.1607
int_2	-0.0005	0.001	-0.4344	0.6676	-0.0026	0.0017
number of children	-0.1262	0.1007	-1.2532	0.2213	-0.3332	0.0808

Interactions:

int_1	**global distress**	**X**	**social support**	
int_2	global distress	X	cognitive approach	

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.255**	**13.6066**	**1**	**26**	**0.001**
int_2	0.0035	0.1887	1	26	0.6676
Both	**0.391**	**10.4329**	**2**	**26**	**0.0005**

Note: Overall model includes specified main effects, interactions, and covariates

Table 16. *Multiple regression analysis of NBAS Range of State 4 weeks after birth regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI cognitive avoidance, Covariates: parity*

n= 33

Outcome: NBAS4Sta

Overall Model

R	R^2	F	df1	df2	*p*
0.7118	**0.5066**	**4.4497**	**6**	**26**	**0.0032**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**8.7196**	**2.4846**	**3.5095**	**0.0017**	**3.6124**	**13.827**
social support	**-2.7575**	**0.7211**	**-3.824**	**0.0007**	**-4.2397**	**-1.2752**
global distress	**-0.1288**	**0.0427**	**-3.0161**	**0.0057**	**-0.2166**	**-0.041**
int_1	**0.0511**	**0.0123**	**4.1658**	**0.0003**	**0.0259**	**0.0763**
cognitive avoidance	0.0513	0.043	1.1923	0.2439	-0.0371	0.1396
int_2	-0.0004	0.0008	-0.5397	0.594	-0.0021	0.0012
number of children	-0.0852	0.097	-0.8778	0.3881	-0.2846	0.1143

Interactions:

int_1	**global distress**	**X**	**social support**
int_2	global distress	X	cognitive avoidance

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.3293**	**17.3536**	**1**	**26**	**0.0003**
int_2	0.0055	0.2913	1	26	0.594
Both	**0.3885**	**10.2368**	**2**	**26**	**0.0005**

Note: Overall model includes specified main effects, interactions, and covariates

Table 17. *Multiple regression analysis of Birth NBAS Range of State regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI behavioral approach, Covariates: parity*

n= 33

Outcome: NBAS4Sta

Overall Model

R	R^2	F	df1	df2	*p*
0.6796	**0.4619**	**3.7193**	**6**	**26**	**0.0084**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**12.051**	**3.2971**	**3.655**	**0.0011**	**5.2733**	**18.828**
social support	**-2.3774**	**0.7358**	**-3.2309**	**0.0033**	**-3.8899**	**-0.8648**
global distress	**-0.1814**	**0.0628**	**-2.8907**	**0.0077**	**-0.3104**	**-0.0524**
int_1	**0.0452**	**0.012**	**3.7513**	**0.0009**	**0.0204**	**0.07**
behavioral approach	-0.0408	0.0695	-0.5866	0.5625	-0.1836	0.1021
int_2	0.001	0.0014	0.7557	0.4566	-0.0018	0.0039
number of children	-0.0833	0.1016	-0.8196	0.4199	-0.2921	0.1256

Interactions:

int_1	**global distress**	**X**	**social support**
int_2	global distress	X	behavioral approach

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.2913**	**14.0723**	**1**	**26**	**0.0009**
int_2	0.0118	0.571	1	26	0.4566
Both	**0.408**	**9.8574**	**2**	**26**	**0.0007**

Note: Overall model includes specified main effects, interactions, and covariates

Table 18. *Multiple regression analysis of NBAS State Organization 4 weeks after birth regressed on 2nd trimester global distress score, Moderators: maternal social support & CRI behavioral avoidance, Covariates: parity*

n= 33

Outcome: NBAS4Sta

Overall Model

R	R^2	F	df1	df2	*p*
0.7058	**0.4982**	**4.3018**	**6**	**26**	**0.0038**

Regression Estimates

	B	SE *B*	t	*p*	LLCI	ULCI
constant	**11.1125**	**2.8426**	**3.9093**	**0.0006**	**5.2693**	**16.9557**
social support	**-2.3666**	**0.6946**	**-3.4073**	**0.0021**	**-3.7944**	**-0.9389**
global distress	**-0.1741**	**0.0469**	**-3.7124**	**0.001**	**-0.2705**	**-0.0777**
int_1	**0.0451**	**0.0114**	**3.9546**	**0.0005**	**0.0216**	**0.0685**
behavioral avoidance	-0.0156	0.0472	-0.3299	0.7441	-0.1125	0.0814
int_2	0.0007	0.0008	0.9017	0.3755	-0.0009	0.0023
number of children	-0.0958	0.0988	-0.9705	0.3408	-0.2989	0.1072

Interactions:

int_1	**global distress**	**X**	**social support**
int_2	global distress	X	behavioral avoidance

R^2 increase due to the interactions:

	R^2 Δ	F	df1	df2	*p*
int_1	**0.3018**	**15.6385**	**1**	**26**	**0.0005**
int_2	0.0157	0.8132	1	26	0.3755
Both	**0.4108**	**10.6427**	**2**	**26**	**0.0004**

Note: Overall model includes specified main effects, interactions, and covariates

Figure 4. NBAS Autonomic Stability Regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

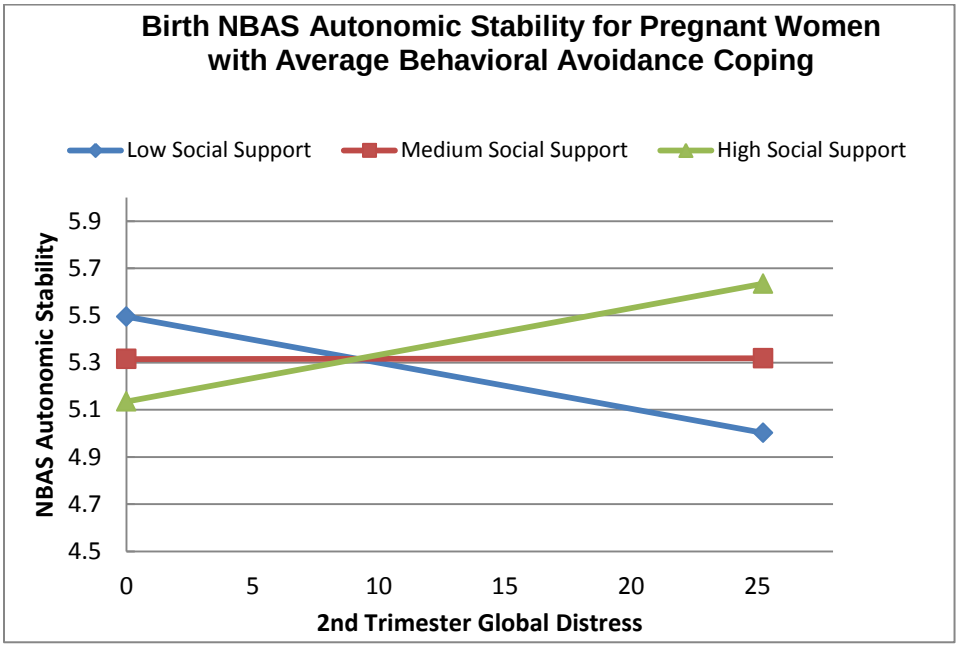

Figure 5. NBAS Habituation Regressed on 2nd trimester global distress. Interaction: global distress x maternal cognitive approach. Covariate: Parity, Race, Age

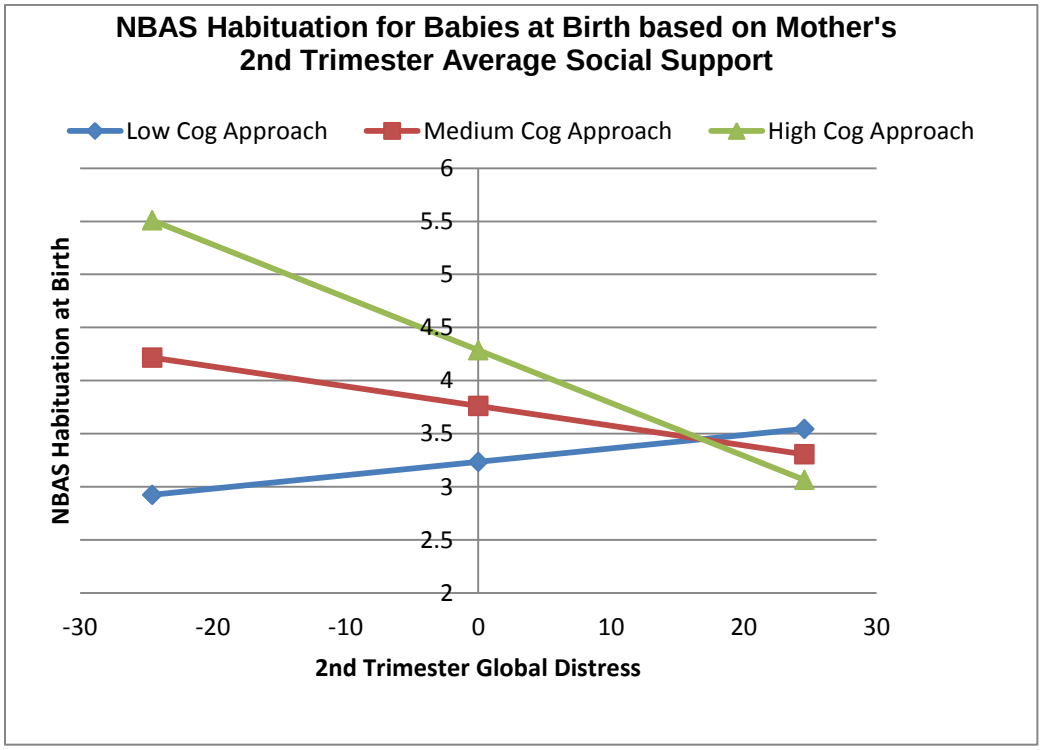

Figure 6. NBAS Habituation regressed on 2nd trimester global distress. Interaction: global distress x maternal cognitive avoidance. Covariate: Parity, Race, Age

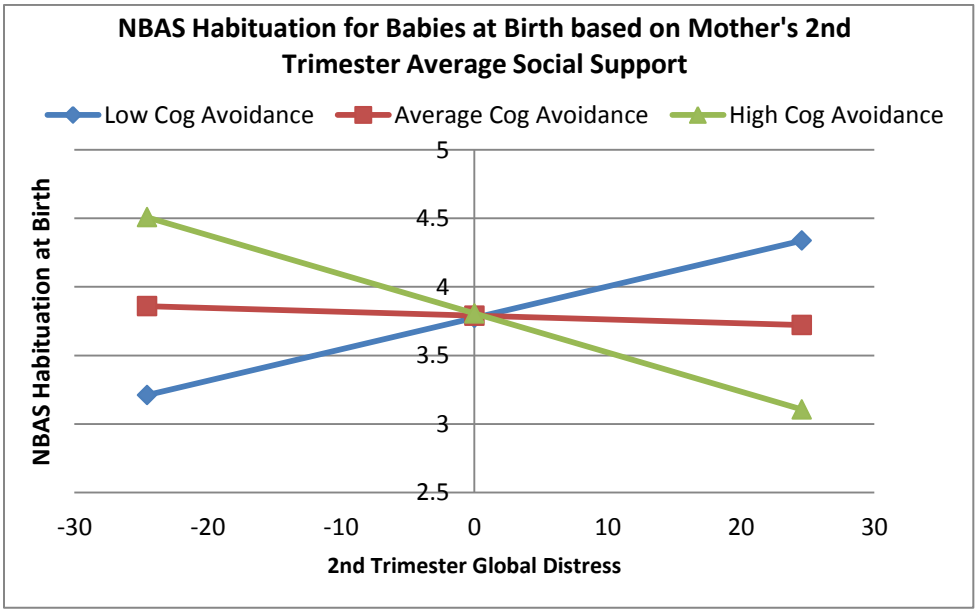

Figure 7. NBAS Motor Cluster Regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

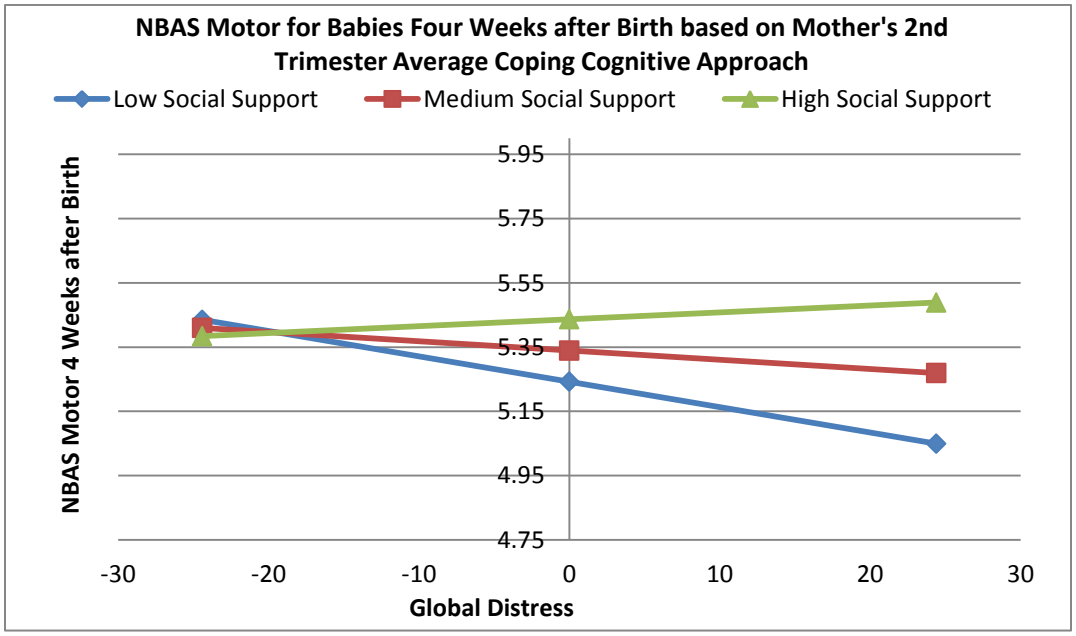

Figure 8. NBAS State Organization Regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

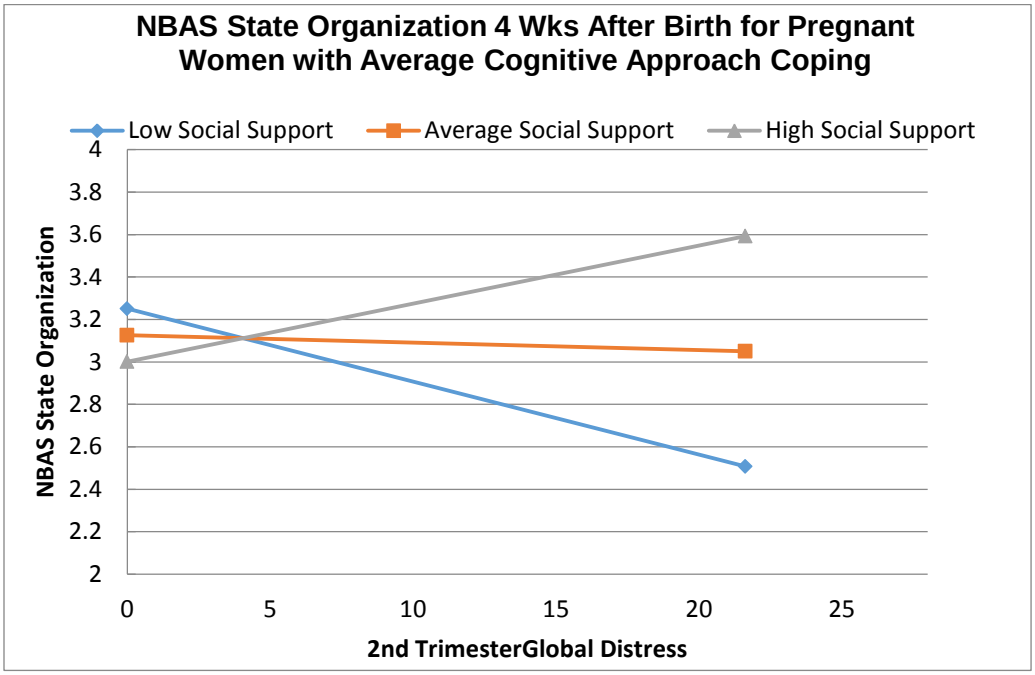

Figure 9. NBAS State Organization regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

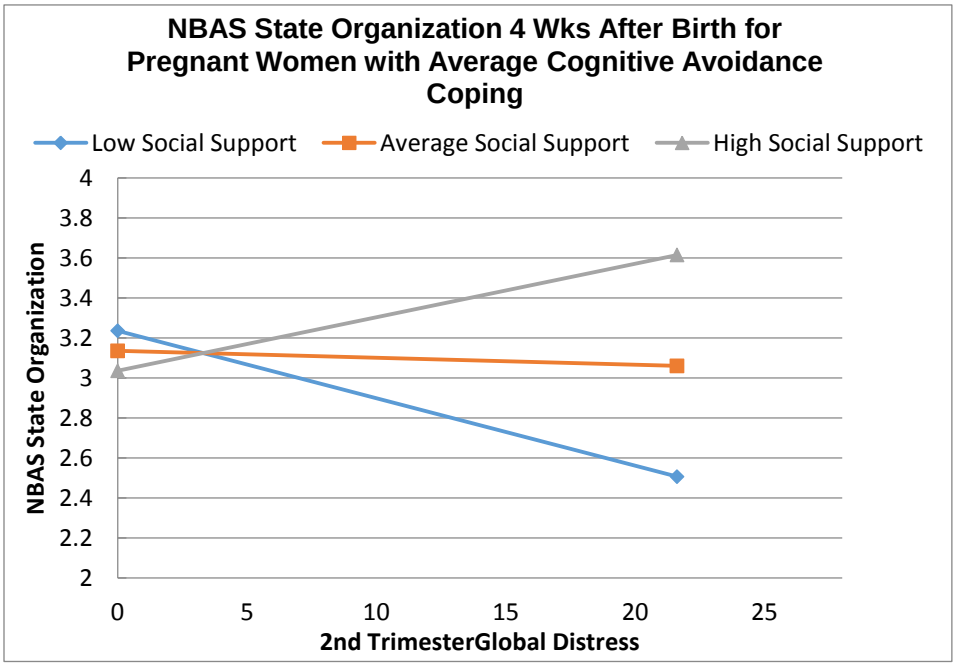

Figure 10. NBAS State Organization regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

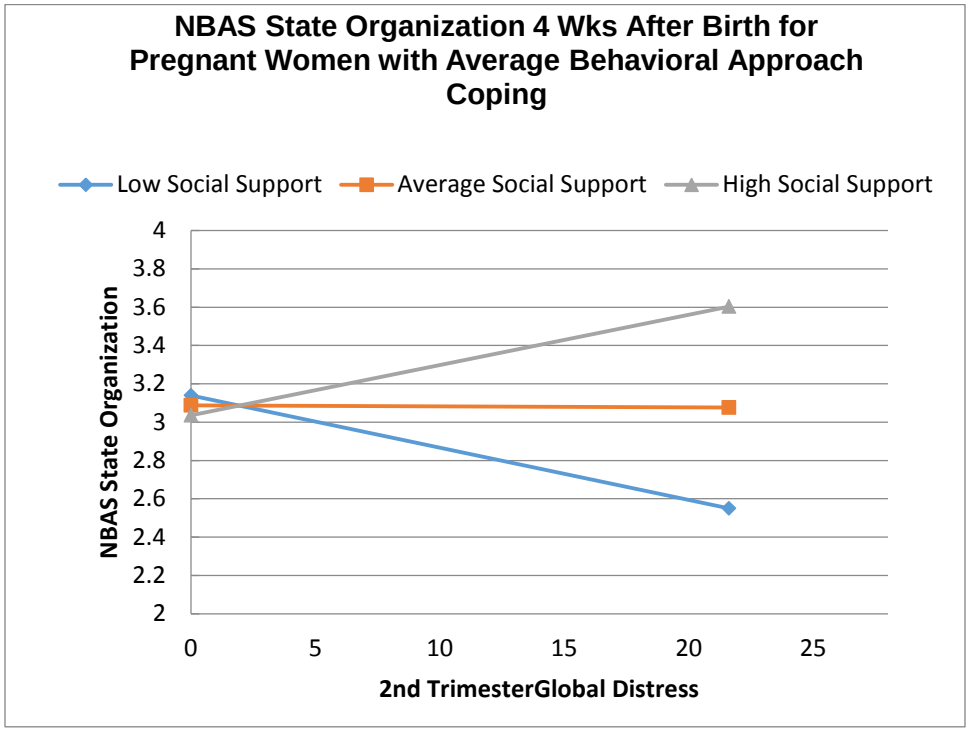

Figure 11. NBAS State Organization Regressed on 2nd trimester global distress. Interaction: global distress x maternal social support. Covariate: Parity

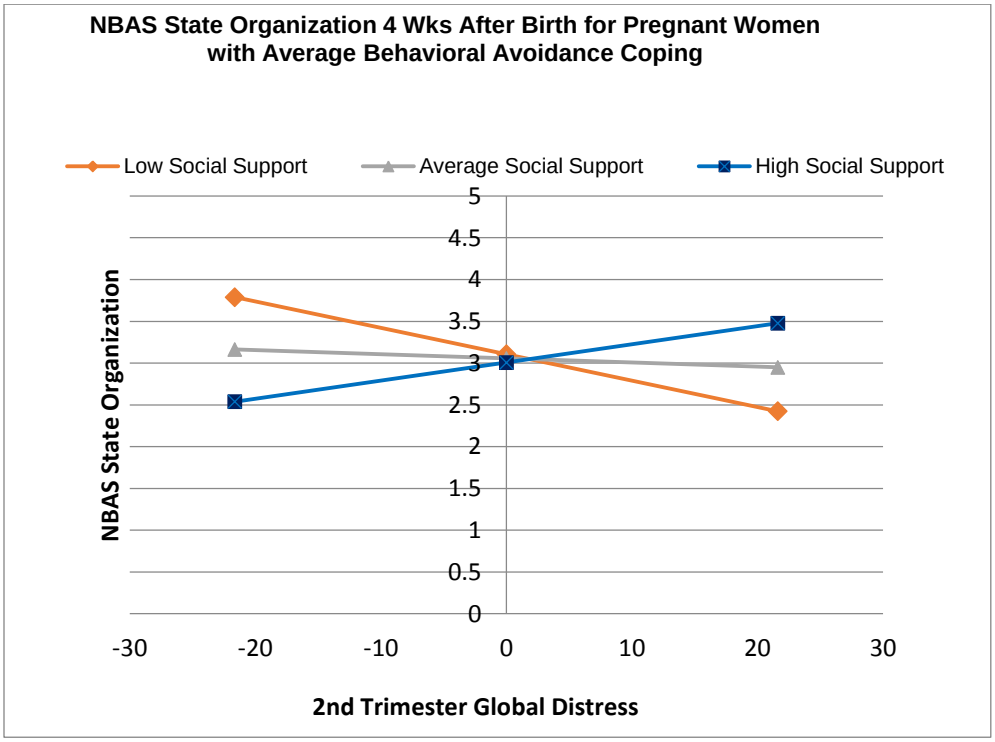

Figure 12. Simplified summary of significant interaction findings related to resilience/stress buffering hypothesis

Note: Info in parenthesis include p value, effect size, and classification of effect size according to Cohen (1992).

Appendix

Hollingshead Socioeconomic Status (SES) Index

The Hollingshead SES Index is derived from the occupation and educational status of an individual.

Occupation Scale:
1 Higher executives of large concerns, proprietors, and major professionals
2 Business managers, proprietors of medium-sized businesses, and lesser professionals
3 Administrative personnel, owners of small businesses, and minor professionals
4 Clerical and sales workers, technicians, and owners of little businesses
5 Skilled manual employees
6 Machine operators and semiskilled employees
7 Unskilled employees

Educational scale:
1 Professional (MA, MS, ME, MD, PhD, LLD, and the like)
2 Four-year college graduate (BA, BS, BM)
3 One to three years college (also business schools)
4 High school graduate
5 Ten to 11 years of school (part high school)
6 Seven to nine years of school
7 Less than seven years of school

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