4-15-2013

Examining trajectories of maternal depressive symptoms in relation to infant affect expression

Katherine Guyon-Harris

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Examining Trajectories of Maternal Depressive Symptoms in Relation to Infant Affect Expression

by

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Master’s Thesis
Submitted to the Department of Psychology
Eastern Michigan University
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE
in
Clinical Psychology

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April 15, 2013

Ypsilanti, Michigan
Abstract

Research has shown that maternal depression can have serious physical health effects on the developing fetus as well as later cognitive, behavioral, and affective problems in children. One area of clinical significance is the effect of maternal depression across time, including the differential effects of depression on early child development during the transition to motherhood. The present study explored trajectories of maternal depression from pregnancy through 2 years postpartum and their relation to infant affect expression. Data for the study were collected as part of a larger 5-panel longitudinal study on women’s transition to motherhood. The present study will use data from the third trimester of pregnancy (T1) and 3 months (T2), 1 year (T3), and 2 years (T4) postpartum. The sample is composed of 120 primarily low-income women and is diverse in terms of ethnicity (62% minority), marital status (64% single), and maternal age (18 – 42 years, $M = 26, SD = 5.7$). Maternal depression was measured at T1 and T2 using the Edinburgh Postpartum Depression Scale (Cox et al., 1987; Wisner et al., 2002) and at T3 and T4 using the Beck Depression Inventory-II (Beck et al., 1996). Infant affect expression was assessed at T3 and T4 using coded observations from videotaped mother-infant free-play interactions. It was hypothesized that different subsamples or trajectories of maternal depression would emerge, having differential effects on infant affect expression at each time point. Results indicated that a 4-class model best fit the data, including stable-low, stable-high, increasing, and decreasing trajectories. These trajectories of depressive symptoms were not found to have differential associations with infant affect expression at age 1 or age 2. Results from this study further inform clinicians about possible patterns of maternal depression and aid in the planning of interventions directed at preventing or reducing cases of maternal depression and problematic child affect development.
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Introduction

Depression during the childbearing years has been shown to negatively affect the developing fetus as well as the mother’s parenting resources including her ability to care for her infant following birth. Research has shown that maternal depression can have various physical effects on the developing fetus such as low birth weight, premature birth, and reduced neuromotor activity, as well as later cognitive and behavioral problems in children (Campbell, Mateste, von Stauffenberg, Mohan, & Kirchner, 2007; Diego, Field, Hernandez-Reif, Schanberg, Kuhn, & Gonzalez-Quintero, 2009; Field, 1995; Field, Diego, & Hernandex-Reif, 2010; Luoma, Tamminen, Kaukonen, Laippala, Puura, Salmelin, & Almqvist, 2001; O’Hara, 2009; Wu, Selig, Roberts, & Steele, 2011). Furthermore, even mild levels of maternal depression have been shown to have negative effects on various aspects of parenting such as maternal sensitivity, engagement, and positive affection, as well as less reciprocity and enjoyment between the mother and her infant (Albright & Tamis-Lemonda, 2002).

The prevalence rate of depression during pregnancy ranges from 1.7% to 20.8%, depending on whether problematic symptom levels or actual diagnoses of depression are measured (Banti, Mauri, Oppo, Borri, Rambelli, Ramacciotti, Montagnani, Camilleri, Cortopassi, Rucci, & Cassano, 2011; Bennett, Einarson, Taddio, Koren, & Einarson, 2004). A recent meta-analysis by Gavin, Gaynes, Lohr, Meltzer-Brody, Gartlehner, and Swinson (2005) reported prevalence rates of diagnoses of at least minor depression in the perinatal period (i.e., pregnancy through the first year postpartum) to be between 6.5% and 12.9% (1.0% to 5.6% for diagnoses of major depression). Furthermore, studies examining prevalence rates of problematic symptom levels of maternal depression during the child bearing years report rates as high as 40% (Chaudron, Szilagy, Kitzman, Wadkins, & Conwell, 2004). During the transition to parenthood,
research has shown that depression during pregnancy is commonly followed by postpartum depression. Furthermore, chronic courses of depressive symptoms that begin during pregnancy and continue throughout the transition to parenthood tend to be more problematic than episodes of major depression that occur during pregnancy (Field, Diego, & Hernandez-Reif, 2008). Taken together, it is clear that maternal depression is a prevalent and important condition throughout the transition to parenthood and has considerable implications for maternal well-being and child emotional development.

Infants learn how to regulate their emotions from the affective messages they receive from their mothers, and it has been suggested that the relay of negative feelings through facial expressions may impede healthy emotional development (Pauli-Pott, Mertesacker, Bade, Haverkock, & Beckmann, 2003). Findings by Pauli-Pott et al. suggest that maternal psychological distress such as depression that a child is exposed to in the early years of life may adversely affect the development of emotion regulation and affect expression. Furthermore, Albright and Tamis-LeMonda (2002) found that toddlers of mothers reporting depressive symptoms used less positive affect, engaged less with the mother, and exhibited less gentleness than toddlers with non-depressed mothers. Taken together, these studies indicate the powerful effects of maternal depression on infant emotional development and provide impetus for further research. However, few studies have examined the effects of trajectories of maternal depression on infant emotional development, especially extending beyond the first year postpartum. The examination of trajectories is important because it may be that not all women experience the same course of depressive symptoms, which has implications for assessment and intervention at different time points for different women. The following paper will first review the literature on maternal depression during the transition to parenthood, conceptualizations and measurement of
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infant affect expression, and the effect of maternal depression on infant emotional development. This paper will then describe the present study including aims, methods, results, and implications for future work in this area.

Maternal Depression during the Transition to Parenthood

Major depressive disorder (MDD) is a clinical disorder that is indicated by the presence of at least one major depressive episode, which is defined by the Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association, 2000) as:

A. Five (or more) of the following symptoms that have been present nearly every day during the same 2-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure:
   (1) Depressed mood most for the day, nearly every day
   (2) Markedly diminished interest or pleasure in all, or almost all, activities
   (3) Significant weight loss or gain
   (4) Insomnia or hypersomnia
   (5) Psychomotor agitation or retardation
   (6) Fatigue or loss of energy
   (7) Feelings of worthlessness or excessive or inappropriate guilt
   (8) Diminished ability to think or concentrate, or indecisiveness
   (9) Recurrent thoughts of death, recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms must not meet criteria for a mixed episode.

C. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

D. The symptoms are not due to the direct physiological effects of a substance or a general medical condition.

E. The symptoms are not better accounted for by bereavement.

The Centers for Disease Control and Prevention’s National Center for Health Statistics estimates prevalence rates of major depressive disorder among Americans to be 5.4% across both sexes and 6.7% among women specifically (Pratt & Brody, 2008). A postpartum onset specifier is assigned when the onset of the major depressive episode is within 4 weeks postpartum (APA, 2000). However, the term “postpartum depression” will be referred to in this paper as diagnoses
of depression or significant symptom levels of depression that occur throughout the first year after birth, as is common in the literature. There is no such designation for prenatal depression; therefore, the term “prenatal depression” in this paper will refer to significant symptom levels of depression, as well as diagnoses of depression, that occur during pregnancy.

The rates of maternal depression during the childbearing years, as noted earlier, are of concern due to the known negative effects that depression can have on the developing fetus and child, as well as the mother herself, and provide impetus for further study of maternal depression across the transition to parenthood. Rates of maternal depression in prior research and epidemiological studies are typically reported in terms of point or period prevalence rates. Point prevalence refers to the percentage of women experiencing depression at a given time of assessment such as 2 months postpartum, for example. Period prevalence refers to the percentage of women experiencing depression during a specified period such as the first year postpartum. Prevalence rates are typically reported based on specified thresholds of depressive symptoms as indicated by cut-off scores on self-report measures, which indicate the probable presence of a depressive disorder, as well as clinical diagnoses of major and minor depression obtained through structured clinical interviews. Thus, definitions of what constitutes depression vary by study and assessment tool. Overall, reported prevalence rates of major and minor depression, that is, levels of depressive symptoms that are of a significant intensity to be problematic but do not meet diagnostic criteria or cut-off scores for a clinical diagnosis of a depressive disorder, for women in the perinatal period range from 1.7% to 40% across criteria for what constitutes minor or major depression and assessment tools (Banti et al., 2010; Chaudron et al., 2004).

Although the prevalence of maternal depression during the childbearing years is worrisome, much of the focus in research has been on postpartum depression rather than prenatal
depression. While there is no specific diagnosis for prenatal depression, the prevalence and effects of prenatal depression have received some attention. Researchers report on rates of prenatal depression based on clinically significant symptom levels as well as diagnoses of depression during pregnancy. For example, a meta-analysis by Bennett and colleagues (2004) examined the prevalence rates of maternal depression during each trimester of pregnancy. They included 21 studies that reported prevalence rates of maternal depression using structured clinical interviews identifying diagnoses of minor or major depression and/or suggested cut-off scores on self-report measures of depression, indicating probable cases of depression. Prevalence rates of combined cases of minor and major depression in the first, second, and third trimesters were 7.4%, 12.8%, and 12.0%, respectively. Furthermore, the authors reported separate rates for minor and major depression among the studies that assessed maternal depression with structured clinical interviews. The prevalence of minor depression in studies reporting rates within the first trimester ranged from .5% to 10.8%, in the second trimester from 3.0% to 11.5%, and in the third trimester from .5% to 20.8%. The prevalence rates of major depression during pregnancy among studies reporting rates in the first, second, and third trimesters were reported as 1%, 6.1% to 16.1%, and 4.2%, respectively. A meta-analysis by Gavin and colleagues (2005) mentioned earlier reported prevalence rates of maternal depression in the perinatal period using only structured clinical interviews. They reported a pregnancy period (i.e., from conception to birth) prevalence of significant depressive symptoms as 18.4%. They also stated that as many as 12.7% of women experience a major depressive episode during pregnancy.

More recently, researchers have continued to report high prevalence rates of maternal depression using clinical diagnoses of depression, self-report measures, or structured clinical interviews. For example, a study by Dietz, Williams, Callaghan, Bachman, Whitlock, and
Hornbrook (2007) reported prevalence rates of maternal depression during pregnancy in a sample of 4,398 pregnant women obtained via their membership in a large, west coast health care organization. A period prevalence of 6.9% of maternal depression during pregnancy was reported. Depression status was obtained from the participants’ medical records and indicated by an ICD-9-CM diagnosis of depression or anti-depressant medication dispensed within the past 30 days. Another study by Le Strat, Dubertrat, and Foll (2011) found that 12.4% of women were experiencing a major depressive episode during pregnancy using a structured diagnostic interview in a sample of 1,524 women who were pregnant within the last year. Similarly, Banti and colleagues (2011) used structured clinical interviews and a self-report measure to assess the prevalence of perinatal depression in the third, sixth, and eighth months of pregnancy in 1,066 Italian women in order to capture prevalence rates of maternal depression during all three trimesters. The women were initially assessed using a structured interview during the first trimester; at all subsequent visits, all women were first assessed using a self-report measure and then assessed with the structured interview if they met a predetermined cut-off score on the self-report indicating at least probable minor depression in order to include cases of both minor and major depression. Cases of maternal depression, indicated by at least probable cases of minor depression, were then confirmed with the structured interview. Banti and colleagues reported prevalence rates of combined cases of both minor and major depression of 8.6% at 3 months, 2.6% at 6 months, and 1.7% at 8 months. Furthermore, they reported an overall period prevalence of 12.4% during pregnancy. They concluded that rates during pregnancy are typically higher than rates during the first year postpartum; they reported 1-year period prevalence of 5.7% in the first year postpartum.
In sum, rates of prenatal depression reported in the literature range from .5% to 20.8% across all three trimesters, which exceed rates reported for the general population (5.4%) and for women (6.7%). Rates of maternal depression in the postpartum period have also been published and also have been reported at or above rates of depression in the general population, as will be described next.

Prevalence rates of postpartum depression are not only more widely published but are also considered to be more reliable than rates of prenatal depression. This is largely due to the reduction of somatic symptoms experienced in pregnancy that tend to overlap with symptoms of depression such as fatigue and appetite changes. A meta-analysis by O’Hara and Swain (1996) examined 59 studies reporting prevalence rates of postpartum depression; they defined postpartum depression as the presence of symptoms above the designated cut-off score on the self-report measure used or via a structured diagnostic interview yielding a diagnosis of major depressive disorder. O’Hara and Swain reported an overall prevalence rate of 13% based on 12,810 women 1-2 months after birth. More specifically, they reported a rate of 12% based on studies using self-report measures and 14% based on studies using diagnostic interviews. More recently, a meta-analysis by Gavin and colleagues (2005) examined studies using structured clinical interviews only to identify diagnoses of major and minor depression in the postpartum period. They estimated the combined period prevalence rate, including diagnoses of major and minor depression, in the postpartum period to be 19.2% (7.1% for major depression only). In sum, reported prevalence rates of at least minor depression in the postpartum period, across outcome measures and criteria used, range from 5.7% to 19.2%. Prevalence rates of major depression in the postpartum period range from 1% to 14%.
Although prior studies have consistently found higher prevalence rates of maternal depression during the childbearing years than during other years in adulthood, prevalence rates of prenatal and immediate postpartum depression have been somewhat difficult to assess due to a significant overlap between symptoms of depression and more typical symptoms of pregnancy such as fatigue, sleep difficulties, appetite changes, and somatic complaints (Matthey & Ross-Hamid, 2011); this may account for the wide variability of prevalence rates reported across studies. Further, some researchers believe that reported prevalence rates of prenatal depression may be inflated (Matthey & Ross-Hamid, 2011; O’Hara, 2009). However, these effects may be minimized by the use of diagnostic clinical interviews where symptoms can be discussed more thoroughly or by more well-designed self-report measures such as the Edinburgh Postpartum Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987; Wisner, Perry, & Piontek, 2002). Self-report measures are widely used due to their ease of administration and relatively low cost compared to the use of diagnostic clinical interviews. Another factor that may affect reported prevalence rates of depression in the perinatal period are the criteria used in previous studies to define the construct of depression. For example, some studies report rates of major depressive episodes or diagnoses of depressive disorders, while others report the presence or absence of any symptoms or the presence or absence of symptoms above some pre-determined cut-off score indicating significant endorsement of symptoms or some level of risk for clinical depression. These methodological differences likely lead to varying prevalence rates.

In sum, the reported prevalence rates in the literature on maternal depression in pregnancy and postpartum tend to vary based on a multitude of factors. Regardless, reported prevalence rates of maternal depression are roughly equivalent to, if not higher than, rates in the general population, indicating that depression during the perinatal period remains a prevalent and
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troublesome condition that warrants further study (Gotlib, Whiffen, Mount, Milne, & Cordy, 1989; O’Hara, 2009). Furthermore, there is extensive evidence that depression affects both women and their children in the perinatal period. The following section will briefly outline the effects of maternal depression in the perinatal period on the mother in relation to caregiving. Later sections in this paper will focus more specifically on the effects of maternal depression on early child emotional development.

Research has shown that depression during the childbearing years negatively affects the mother’s parenting resources, including her ability to care for her infant following birth, as well as the quality of mother-child interactions (Field, 2010). In a study of 53 low-income mothers, Albright and Tamis-Lemonda (2002) demonstrated the negative effects of maternal depression on various aspects of parenting such as lower levels of maternal sensitivity, engagement, and positive affection, as well as less reciprocity and enjoyment between the mother and her infant. Furthermore, a study by Herrera, Reissland, and Shepherd (2004) noted that mothers who were depressed after giving birth touch their babies more negatively, such as rough tickling and poking, and have less rich and informative verbal interactions with their babies than mothers who were not depressed. Rich and informative verbal interactions were defined as verbally sharing feelings, as well as confirming cognitive information in reference to the infants’ perceptual experiences such as pointing out and labeling interesting things in the infants’ environment. Herrera et al. also noted that mothers who were depressed in the postpartum period were less likely to respond effectively to their infants’ needs, which seemed to be corroborated by the finding that infants of depressed mothers tended to do more self-touching and self-soothing, likely in attempts to self-regulate. Similarly, O’Hara (2009) has reported that mothers who are depressed in the postpartum period tend to gaze at their infants less and be less
responsive to their infants’ cries than non-depressed mothers. Depressed mothers also tend to show more flat, withdrawn, and sad facial expressions than non-depressed mothers. Finally, Murray (1992) found that postpartum depression tends to negatively affect the quality of the communication between mothers and their infants at 2 months. More specifically, it was reported that postpartum depression affects mothers’ capacity to understand their babies, as well as their ability to actively and pleasurably engage in play with the child.

While the negative influence of minor depression tends to be less strong when compared to the effects of major depression, research has indicated that even mild levels of depression can have negative effects on women and their young children (Fleming, Ruble, Flett, & Shaul, 1988). For instance, in a longitudinal study of 56 first-time mothers, Fleming et al. demonstrated that even women experiencing mild depression in pregnancy and/or at 3 months postpartum tended to be less verbally responsive and physically affectionate with their infants 1-3 months postpartum and were more likely to have discontinued breastfeeding by the third month than first-time mothers who did not report any depressive symptoms. Furthermore, women experiencing minor levels of depression also reported feelings of inadequacy as a mother and negative feelings about caretaking activities.

In sum, varying levels of depressive symptoms during the transition to parenthood have been shown to negatively impact the mother’s available parenting resources and her ability to adequately care for and respond to her child, which have important implications for ongoing child development; these will be discussed in more detail in later sections of this paper. Furthermore, there is a need in the field for studies examining the prevalence of maternal depression beyond the first year postpartum, as well as how trajectories (or patterns) of maternal depression across the transition to parenthood affect both the mother and her developing child.
Patterns of Maternal Depression

As noted previously, there is a need for research to examine the effects of depression on infant well-being at different points across the transition to parenthood. In addition, it is important to better understand the possible patterns of maternal depression over time, as depression is a condition that may (or may not) be episodic.

For example, researchers have found that rates of prenatal depression tend to be higher than postpartum depression and that prenatal depression is a powerful predictor of depression in the postpartum period. A study noted earlier by Banti and colleagues (2011) found depression during pregnancy in general to be higher (12.4%) than in the postpartum period (9.6%), as assessed by both clinical interviews and self-report screening assessments. More specifically, they noted higher levels in the first trimester (3rd month of pregnancy, 8.6%) than in the second (6th month of pregnancy, 2.6%) and third trimesters (8th month of pregnancy, 1.7%). A similar decreasing pattern was noted in the postpartum period, with an initially higher prevalence at 1 and 3 months postpartum (3.2% and 2.7%, respectively) and consistently lower rates during the 6th, 9th, and 12th months postpartum (1.9%, 1.2%, and 1.8%, respectively). In the study by Gotlib et al. (1989), presented earlier, half of the women who were identified as depressed following pregnancy were also identified as depressed during pregnancy. These studies suggest that for most women, there may be a decline in depression from pregnancy to the postpartum period, but other women may experience different patterns or trajectories across this time period.

Many researchers have examined more complex patterns of maternal depression across longer periods of time. For example, Luoma et al. (2001) noted continuous changes in symptom levels of maternal depression from pregnancy through 8-9 years after giving birth, suggesting that many women experience recurring episodes rather than a single episode or a stable
Participants were identified as depressed when they scored above the suggested cut-off score on a self-report measure of depression indicating probable cases of major depression. The highest percentage of their sample was identified as depressed during pregnancy (11%) with a second spike at 6 months postpartum (10%); rates then tapered off to about 7% at 8-9 years postpartum. Another study by Wu et al. (2011) examined trajectories of maternal depression from 1 to 36 months postpartum, again using cut-off scores based on a self-report measure to indicate probable or risk of depression. They reported that depression symptoms tended to decrease over time for the whole sample on average. Additionally, they noted that, while symptoms initially decreased rather quickly between 1 and 6 months, they continued to taper off at a much slower rate from 6 to 36 months for the entire sample.

Because depression is known to change over time, including rates of symptoms and diagnoses, better understanding a more chronic or enduring course of depression and a more episodic or varying course of depression is becoming an important topic of research. For instance, a study of 72 depressed mothers by Field, Diego, and Hernandez-Reif (2008) explored the differential effects of maternal dysthymia versus major depression in the prenatal period on newborns. Field et al. used the DSM-IV-TR (APA, 2000) definition of dysthymia, which refers to an enduring or chronic course of less severe depressive symptoms during a majority of days for 2 or more years. Their sample of depressed mothers contained 33 women with dysthymia and 39 women with major depression identified using a structured clinical interview. The neonates of women with dysthymia were reportedly of lower gestational age and had lower birth weights and smaller head circumferences compared to neonates of women with major depression. Furthermore, the women with dysthymia experienced more obstetric and postnatal complications than the women with major depression. Overall, this study suggests that depression that begins
during pregnancy and continues throughout the transition to parenthood, even at milder levels, may be more problematic than briefer episodes of major depression that occur during pregnancy.

Beyond chronic depression, researchers have also focused on identifying other possible trajectories of maternal depression across the transition to parenthood. A study by Campbell et al. (2007) examined trajectories of maternal depression from 1 month to 7 years following the birth of a child. Women in this study were identified as depressed when they scored above a suggested cut-off score on a self-report measure of depression considered to indicate potentially clinically significant symptoms of depression. In their sample of 1,261 women, they identified six trajectories of maternal depression: low-stable (n = 577), moderate-stable (n = 469), intermittent (n = 40), moderate-increasing (n = 73), high-decreasing (n = 71), and chronic (n = 31); the latter group included women whose symptoms remained the highest throughout the course of the study. They concluded that stable patterns of depression, especially of a low to moderate severity level, are the most common trajectories. Nevertheless, other important trajectories of depression over this period were found.

Overall, it appears that different patterns or trajectories of maternal depression are possible in the years following birth and may depend on the variables studied and the methodology used (e.g., a person-centered approach versus a variable-centered approach). What is less well known is how different trajectories of maternal depression may affect women and their developing infants. Furthermore, there remains a need in the field for studies examining patterns of maternal depression that not only begin during pregnancy but also extend beyond the first year postpartum such as the studies by Campbell et al. (2007) and Luoma et al. (2001). Just as maternal depression changes over time, the child continues to develop over time in the context of the relationship with the mother. Maternal depression, perhaps especially chronic depression,
can have a lasting effect on the emotional development of children, as they learn about their own emotions via the affective messages they receive from their caregivers.

**Conceptualization and Measurement of Infant Affect Expression**

Affect expression in infancy has been conceptualized as the expression of discrete basic emotions in the form of facial expressions in response to the world around [them] (Camras & Shutter, 2010; Izard & Malatesta, 1987). The concept of infant affect expression has been closely examined by Izard, Hembree, and Huebner (1987), who have reported data suggesting that the muscle movements associated with adult facial expression are identical to those seen in infants. Therefore, it was concluded by these researchers that it is reasonable to assume facial expressions or movements made by infants can be observed and coded or labeled based on what we know about adult facial expression. Therefore, affect expression in infancy is often observed and coded by researchers based on what is known about adult displays of emotion.

In fact, differential emotions theory (DET), pioneered by Izard and colleagues, is based on the belief that infants experience discrete basic emotions indexed by corresponding, observable facial expressions (Izard, 1971, 1991; Izard & Malatesta, 1987). Several discrete expressions have been identified in infants such as interest, joy, surprise, sadness, anger, disgust, contempt, and fear (Izard, Huebner, Risser, McGinnes, & Dougherty, 1980). An early study by Izard et al. (1980) involved the ratings of 21 untrained undergraduate students who rated the facial expressions of infants and then re-rated the expressions after being trained using a collection of written descriptions and photographic illustrations of facial patterns identified as expressions of emotion. The purpose of the study was to examine whether infants display discrete and code-able expressions of emotion. The students initially demonstrated an accuracy of about 50% across all types of expression but increased to 65% accuracy after training. The
expressions most accurately coded included joy (81%) and sadness (72%). The same study also examined accuracy in a sample of 62 health services professionals who were trained with the same procedures. The expressions most accurately coded were again joy (85%) and sadness (78%). The authors concluded that infants are able to produce discrete expressions of emotion in the first year of life that can be reliably coded by trained observers.

More recently, Hertenstein (2010) argued that the definition of infant affect expression can be further clarified by adding vocal tones or utterances in tandem with facial expressions in order to have the most accurate and observable index of affect expression. However, the underlying feelings or emotions associated with infant affect expressions are less clear. Researchers, therefore, attempt to measure only what is observable, which are the facial expressions and vocal utterances exhibited by infants, rather than attempting to decipher and extrapolate the underlying meaning based on what we know of adult emotional experiences. While some researchers readily view affective displays as a window into the internal emotional experience of infants, others feel this is an undue assumption, as infants lack the ability to verbally report on, and therefore confirm, the underlying emotions behind their facial and vocal expressions (Camras & Shutter, 2010; Hertenstein, 2010). Therefore, whether infants experience the same underlying, internal emotions as adults cannot be easily studied empirically. Thus, affective displays in terms of facial expressions and vocal utterances expressed by infants are what is typically examined in research on infant affect.

The measurement of infant affect expression comes with several inherent complications, largely based on the lack of language and self-attributed meaning of affective displays by infants. Because infants lack the language necessary to define their inner experience, researchers must rely on reports about their emotional experience from others close to the child such as parents.
and teachers, or observations by trained researchers or computerized programs designed to detect facial expressions. Due to these difficulties, Hertenstein (2010) argues that research on infant emotional displays greatly benefits from the use of both facial expressions and behavioral displays, as noted earlier. Furthermore, in a recent review of measurement issues in emotion research, Zeman, Klimes-Dougan, Cassano, and Adrian (2007) point to the importance of contextual variables, such as what led up to the affective display or the behaviors associated with it or what setting the observations are occurring in; a multi-method approach to measurement of emotions also seems important. In sum, an approach to studying infant emotion or affect expression that combines the use of facial expressions and vocal utterances, as well as information from multiple settings, will likely be the best way to obtain an accurate depiction of infant affect expression.

One such source of information about infant affect expression includes reports from parents or caregivers. Parent reports are usually in the form of a questionnaire or checklist and require the parent to report on the presence or absence, and sometimes frequency and duration, of certain observable behaviors. They offer convenience and ease in administration and interpretation, as well as relatively low cost of administration (Rothbart & Bates, 2006). Parent reports are usually completed by mothers, though father reports have been found to be consistent with mother reports and equally informative. Parental reports are also favored by some researchers because they provide a unique vantage point for the observation of behavior due to the time parents are assumed to spend with their infants (Rothbart & Bates, 2006). That is, parents are in the unique position to witness behaviors across several situations and are also more widely exposed to generalized patterns of behavior allowing them the unique ability to assess
whether a given behavior is part of the child’s typical behavioral repertoire. Therefore, parents may offer a more comprehensive and rich report of infant behavior (Rothbart & Bates, 2006).

Despite general recommendations to include reports by parents or significant others in infants’ lives, there are some specific problems with this method of measurement for the assessment of infant affect expression. First, others’ reports require an individual to be close to the child in order to offer confident ratings of the child’s emotional or affective displays. Also, many of the existing parent-report assessments of infant affect expression are actually conceptualized as measures of infant temperament that include items and scales pertaining to emotionality and affect expression. This may be reasonable, but it is important to keep in mind that temperamental dimensions related to emotionality may be a different construct than more broad affective or emotional experience or expression.

Another potential problem with parent reports of infant emotion is the possible presence of perceptual or response biases. For example, parent reports could simply reflect what the parent thinks the researchers want to hear or what the parent believes to be socially acceptable, such as in the case of reporting lower negative emotionality, rather than what is true of the infant (Rothbart & Bates, 2006). In one study, for example, Zeanah and Benoit (1995) reported that parents held preconceived notions about what their child’s temperament and behaviors would be like before the infants were born. Furthermore, they found that these notions were relatively stable from pregnancy through the first few months of life. Additional research suggests that maternal psychological distress, such as symptoms of depression, may also have an impact on reporting accuracy of infant emotion. In a study of 176 mothers with newborns, mothers reporting depression at 6 months postpartum had less accurate reports of their own infant’s negative emotionality at 6 months, but not at 9 months, than those of non-depressed mothers.
Inaccuracy was determined by discrepancies in coding relative to observational codes obtained by trained researchers. In addition, these results held true only for infant negative emotion; depressed and non-depressed mothers did not differ in the accuracy of reporting infant positive emotionality at 6 or 9 months.

Similarly, in a study of 61 mothers, Broth, Goodman, Hall, and Raynor (2004) found mixed results for the accuracy of depressed mothers’ interpretations of infant emotion. However, rather than interpreting emotions in their own children, these women were presented with photographs of infants displaying discrete emotions. Broth et al. reported that higher levels of maternal depressive symptoms were associated with less accuracy in the interpretation of positive, but not negative, emotions. Furthermore, a study of 45 British women demonstrated that depressed women rated the negative facial expressions of infants more negatively than did non-depressed women (Stein, Artecha, Lehtonen, Craske, Harvey, Counsell, & Murray, 2010). Similar to Forman et al., there were no differences observed for positive facial expressions. Therefore, maternal characteristics such as depression have been found to have differential effects on the reporting accuracy of infant facial expressions among mothers.

As a result of these potential problems with parent-report of infant emotions, a preferred source of information about infant affect expression is observational codes of infant facial expressions obtained by trained researchers. Anatomically-based observational coding systems are one way researchers obtain observational codes of infant affect. Anatomically-based systems use standard formulas to measure affect displays based on discrete facial expressions captured from video-tapes of infants alone or interacting with others, typically in a paradigm designed to elicit certain emotions. Several types of anatomically-based systems exist in the literature and are typically preferred for the measurement of discrete emotions (Camras & Shutter, 2010; Zeman et
The Monadic Phases Coding System (MP: Cohn & Tronick, 1987; Tronick, Als, & Brazelton, 1980), the Maximally Discriminative Facial Movement Coding System (MAX: Izard, 1979, 1995), and the Facial Action Coding System adapted for infants (babyFACS; Oster, 2007) are examples of such systems. BabyFACS was adapted for use with infants from the original Facial Action Coding System designed by Ekman, Friesen, and Hagar (2002). The MP is typically considered more comprehensive, as it combines information about facial expressions and vocal affect expression, as well as gaze and type of activity, whereas the MAX uses only facial expressions (Matias, Cohn, & Ross, 1989). Furthermore, the MAX requires the infant be facing the camera at all times, whereas the MP is more well suited to codes based on partial expressions because it also takes into consideration vocalizations by the child (Matias et al., 1989).

Although anatomically-based systems are often recommended for the measurement of discrete emotions in infancy and early childhood, they carry some important limitations. First, they do not take into account important aspects of the context of facial expressions such as bodily expressions and vocalizations, with the exception of MP, which does take into account vocalizations (Hertenstein, 2010). Second, they require strict videotaping conditions that are typically only available in a laboratory setting and are unsuitable for real-time coding (Ekman & Oster, 1979) or coding in natural settings. Third, as mentioned previously, these systems also require that a good portion of the child’s face be towards the camera in order for the coding system to be adequately applied (Camras & Shutter, 2010). Last, they are expensive and difficult to use for longer segments of video as they require slow-motion viewing. These conditions make such systems problematic for use with many interactions and observational tasks used in infant research, such as the videotaped interactions obtained in the present study.
Although the coding of discrete emotions is a well-known and common method for assessing infant affect expression, other researchers note the utility of coding global categories such as positive or negative affect rather than specific categories of discrete emotion such as joy or sadness (Belsky, Hsieh, & Crnic, 1996; Zeman et al., 2007). For example, in a study examining the relationship between negative affect and later behavioral problems, Pauli-Pott, Haerkock, Pott, and Backmann (2007) coded the global presence or absence of expression of negative affect and found that the presence of negative affect strengthened the relationship between disorganized attachment and later issues with social adjustment and behavioral problems. Observations in this study were obtained from item sets taken from the Bayley Mental Scale (Bayley, 1993), which is a broad assessment of infant developmental functioning.

Similarly, other researchers have coded infant emotionality using videotaped item sets from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995), which contains various paradigms designed to elicit emotional responses from infants and very young children (Hayden, Klein, Durbin, & Olino, 2006). Codes are based on 4- or 5-point scales, depending on the paradigm used and the type (i.e., positive or negative) of emotion elicited. Both facial expressions and physical displays (i.e., posture) of emotion are coded based on the frequency, intensity, and duration of the display.

Although some researchers elect to code global categories of affect (i.e., positive and negative) based on an entire observed interaction, others use global scores based on codes assigned at smaller, given intervals across the interaction. For example, one study coded positive and negative affect for each 10-second interval to reflect the proportion of time each type of affect (positive or negative) was expressed across a 2-hour protocol that consisted of various affect-eliciting tasks done in a laboratory setting (Olino, Lopez-Duran, Kovacs, George,
Another study coded positive and negative affect at 1-minute intervals using a 10-minute videotaped mother-infant interaction (Pauli-Pott & Mertesacker, 2009). Similarly, another study coded positive and negative emotion in 12-13-month-old infants using laboratory paradigms designed to elicit positive or negative emotion, including a mother-infant free-play interaction (Park, Belsky, Putnam, & Crnic, 1997). The paradigms and interactions were videotaped and later coded by trained observers. Codes were assigned every 15 seconds using a 5-point scale based on the extent and intensity of the emotional display. Scores ranged from 0 (no emotion) to 4 (intense emotion). Due to high intercorrelations between the sub-scales, composites for positive and negative affect were formed using exploratory factor analysis.

Thus, many researchers tend to code global domains of positive and negative affect using videotaped mother-child interactions or laboratory paradigms designed to elicit emotional displays. It is important to note that different coding schemes take into account different aspects of affective displays; some studies use global (macro-level) codes, while others rely on micro-level codes. The present study used global codes of infant affect expression coded from a videotaped mother-infant free-play interaction.

**The Effects of Maternal Depression on Infant Development**

The effects of maternal depression on infant development in the childbearing years can be far-reaching and typically vary based on the timing of the exposure (i.e., in pregnancy versus in the postpartum period). The following section will briefly discuss how exposure to maternal depression during pregnancy and in the postpartum period can affect the physical, behavioral, and cognitive development of infants. Then, a more detailed discussion of the effects of maternal depression on infant emotional development across the transition to parenthood will be presented.
Depression during pregnancy has been linked to several birth complications such as low birth weight, premature birth, and delayed fetal growth (Diego, Field, Hernandez-Reif, Schanberg, Kuhn, & Gonzalez-Quintero, 2009; Field et al., 2010; O’Hara, 2009). Maternal depression during pregnancy has also been linked to elevated cortisol and norepinephrine levels and lower dopamine levels in newborns, as well as greater relative right frontal EEG asymmetry in newborns (Diego, Field, Hernandez-Reif, Cullen, Schanberg, & Kuhn, 2004). In the postpartum period, maternal depression has been linked to several behavioral and cognitive difficulties in infants such as lower activity level and the expression of less positive and more negative facial expressions than in infants whose mothers are not depressed (Field, 1995). Additionally, maternal depression has been linked to cognitive deficits, lower academic competence, behavioral difficulties, and poorer social skills in school-aged children (Campbell, Matestic, von Stauffenberg, Mohan, & Kirchner, 2007; Luoma, Tamminen, Kaukonen, Laippala, Puura, Salmelin, & Almqvist, 2001; Wu, Selig, Roberts, & Steele, 2011). Thus, research indicates that maternal depression can have various deleterious effects on the fetus and developing child. Beyond effects of maternal depression on the physical and cognitive health of the developing infant, research has also identified long-lasting effects of maternal depression on the affect expression and more general emotional development of the infant.

The underlying processes involved in the effects of maternal depression on infant emotional development can be largely explained through understanding the bonds that infants share with caregivers; infants learn about the world and how to respond to it through relationships with others. Furthermore, caregivers influence infant development in a transactional fashion through dyadic interactions (Dodge, 1990). Maternal depression is believed to disrupt the central relational connection between a mother and her infant because of how it impairs mother-
infant interactions (Tronick & Weinberg, 1997). Furthermore, the effects of maternal depression on child emotional development are posited to stem largely from the relay of negative affect from the mother during interactions with her young child (Goodman & Gotlib, 1999). Therefore, it has been suggested that maternal psychological distress, such as depression, may adversely affect infant emotional development (Dodge, 1990; Pauli-Pott et al., 2004; Tronick & Weinberg, 1997).

As noted above, maternal depression in the childbearing years is often manifested by the relay of more negative and less positive facial expressions toward infants. Research suggests that infants of depressed mothers find negative affect to be less novel than infants of non-depressed mothers because of their prior exposure to it in their mothers (Albright & Tamis-Lemonda, 2002; Field, Pickens, Fox, Gonzalez, & Nawrocki, 1998). A study of 24 3-month old infants and their mothers (Field et al., 1998) examined infants’ responses to the presentation of sad and happy faces. They found that infants of non-depressed mothers looked longer at the sad faces than did infants of depressed (based on a cut-off score from a self-report measure) mothers. This suggests that infants of depressed mothers found the sad faces to be less novel, presumably due to being exposed more to maternal sadness.

Because maternal depression affects caregiver behavior in these and other ways, infants of depressed mothers tend to display more negative and less positive affect themselves. This notion has been demonstrated by several studies that have shown that infants of mothers with depression are less expressive in general and tend to display more negative expressions and less positive expressions. For example, toddlers of mothers reporting depressive symptoms determined by a suggested cut-off on a self-report measure of depression used less positive affect, engaged less with the mother, and exhibited less gentleness than toddlers with mothers
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who do not report depressive symptoms (Albright & Tamis-LeMonda, 2002). Similarly, it has been found that infants of depressed mothers smiled less and exhibited less positive vocalizations when interacting with their mothers than infants of non-depressed mothers by 3 months of age (Righetti-Veltema, Conne-Perreard, Bousquet, & Manzano, 2002). The sample from this latter study consisted of 570 mother-infant dyads, and maternal depression status was determined using a designated cut-off score on a self-report measure of depression. Additionally, in a different sample of 100 mother-infant dyads, 9-month-old infants of mothers with probable cases of major depressive disorder, as indicated by a suggested cut-off score on a self-report measure of depression, were found to exhibit more negative emotionality than infants of non-depressed mothers and infants of mothers with anxiety disorders (Feldman, Granat, Pariente, Kanety, Kuint, & Gilboa-Schechtman, 2009). Further, in a sample of 64 mothers with 1-year-old infants, female, but not male, infants of depressed mothers showed less positive and more negative affect in a videotaped mother-infant play interaction (Hart, Field, del Valle, & Pelaez-Nogueras, 1998). Like most other studies, depression status was indicated by elevated scores on a self-report measure of depression. Thus, studies have consistently shown that maternal depression is associated with less positive and more negative infant affect expression during the first year postpartum.

While it is clear that maternal depression can have a detrimental effect on early child emotional development in general, emerging evidence suggests that the timing of exposure to maternal depression, as well as the severity of depressive symptoms, may be important variables that affect infant emotional development. In a sample of 36 mother-infant dyads (Field, Nadel, Hernandez-Reif, Diego, Vera, Gil, & Sanders, 2005) with 16 depressed and 16 non-depressed mothers, determined by a cut-off score on a self-report measure of depression in conjunction
with a structured clinical interview, no significant association between maternal depression and infant affect expression was found at 2 months postpartum, contrary to expectations. However, the authors noted that the mothers with depression exhibited more negative and less positive affect when engaged with their infant than mothers who were not depressed. It is possible that these results indicate a lag in the effects of maternal depression on infant affect expression (i.e., not yet seen at 2 months), as other studies have noted effects in older infants and children and/or when the mother’s depression has taken a more chronic or enduring course. For example, the study by Feldman et al. (2009), noted previously, found that 9-month-old infants of mothers with probable cases of major depression exhibited more negative emotionality than infants of non-depressed or anxious mothers. However, others have found an association between maternal depression and infant affect expression among newborns, thus, results have been mixed in regard to the age at which depression may affect infants (Lundy, Field, & Pickens, 1996). A closer examination of maternal history of depression including severity and duration of symptoms may afford a better understanding of the effects of maternal depression on infant emotional development. More specifically, it would be beneficial to examine trajectories of maternal depression beginning in pregnancy and extending across the postpartum period to further disentangle the effects of maternal depression on infants and to consider the possible importance of timing of exposure.

Beyond the timing of exposure, there is some evidence that symptom severity may also affect the relationship between maternal depression and infant emotional development. For example, Field, Diego, Hernandez-Reif, and Ascencio (2009) examined the differential effect of prenatal maternal dysthymia versus prenatal major depression on the emotional development of infants in a sample of 63 depressed pregnant women (n = 33 for major depression and n = 30 for
dysthymia based on a structured clinical interview). Results indicated that infants of mothers with dysthymia spent less time smiling than infants of mothers with major depression. Furthermore, infants of mothers with dysthymia spent more time engaged in distress behavior than infants of mothers with major depression. They concluded that dysthymia may be a greater risk factor than major depression due to its long, consistent course; this suggests the importance of examining maternal depression across time and level of severity to explore the differential effects of various trajectories on the developing child.

Due to the complexities involved in understanding the relationship between maternal depression and infant emotional development (i.e., symptom severity and timing of exposure and age of infant), it is clear that future research must continue to focus on longitudinal examinations of maternal depression and evolving infant emotional development rather than examining concurrent relationships only. Furthermore, the field would also benefit from research taking a more person-centered approach rather than the more typical variable-centered approach, as the former approach allows for the examination of unique and meaningful subgroups rather than global, across-sample trends (Bergman & Magnusson, 1997).

The Present Study

As demonstrated in the above literature review, research has shown that maternal depression can have deleterious effects on the mother’s caregiving, as well as her infant’s early affect development. However, there is a need for more research examining the unfolding of different trajectories of maternal depressive symptoms at different time points along the transition to motherhood and subsequent effects on infant affect development in the early years of life. Importantly, Albright and LeManda (2002) propose a transactional model for understanding these associations, whereby the infant’s behaviors and affect expression may
interact with the mother’s altered display of affect expression as a result of her depression; each individual may further exacerbate or affect one another in a transactional fashion. The longitudinal design of the present study will allow for the possibility of such transactions to be further explored. For example, it may be that different trajectories of maternal depression have an effect on affect expression at age 1 as compared to age 2.

Many researchers opt to operationalize maternal depression as a dichotomous variable (i.e., the presence or absence of depression) using self-report measures. This approach is widely used and accepted due to the ease and relatively low cost of administration. The present study will also use self-report measures of maternal depression but will examine depression severity by allowing depression to be a continuous variable.

In light of research on the measurement of infant affect, the present study used coded observations of global categories that take into account both facial expressions and behavioral displays, as well as the frequency and intensity of such expressions in an attempt to gather comprehensive and reliable data on infant affect. Furthermore, the present study relied on observer rated infant affect expression especially since the aim was to examine global displays of affect rather than facial expressions of discrete emotions. Because maternal reports of mothers with trajectories indicating depressive symptoms may be unduly distorted, the present study used observer ratings of infant affect expression by coders blind to mothers’ depression scores.Codes, therefore, were expected to reflect more accurate displays of the infant rather than reports based on the mother’s perception. While maternal reports would offer additional and interesting information, it is not the within the aims of the present study.

In sum, there has been a fair amount of research documenting the deleterious effects of maternal depression on child development. Furthermore, research has also demonstrated that
women experience different patterns of depression throughout the transition to parenthood. The present longitudinal study explored trajectories of maternal depression from pregnancy through 2 years postpartum and their relation to infant affect expression at 1 and 2 years postpartum. It is hypothesized that:

1. Different trajectories of maternal depression will emerge.
   Specifically, trajectories characterized by increasing, decreasing, or stable patterns in maternal depressive symptoms are expected

2. Trajectories of maternal depression will have differential effects on infant affect expression at 1 and 2 years postpartum.
   a. A trajectory characterized by consistently high or increasing levels of maternal depressive symptoms will be related to generally negative affect expression, such as negative and flat affect, aggression, and shared negative and flat affect, in infants at 1 and 2 years postpartum.
   b. A trajectory characterized by consistently low or decreasing levels of maternal depressive symptoms will be related to generally positive affect expression, such as positive and shared positive affect, in infants at 1 and 2 years postpartum.

**Method**

**Participants**

Participants for the present study include a community sample of 120 pregnant women participating in a larger 5-panel longitudinal study on parenting beginning in pregnancy and extending through the child’s third birthday. Data from the first four panels are used in the present study. The first panel (T1) was completed when the women were in their third trimester of pregnancy, the second (T2) panel was completed when their infants were 3 months old, the
third (T3) panel was completed at 1 year postpartum, and the fourth (T4) panel was completed at 2 years postpartum.

Participants were recruited through the posting of flyers (see Appendix A) in public locations, as well as local community organizations and agencies serving low-income families in Washtenaw and Wayne counties. More specifically, 23% were recruited through community-based health clinics serving low-income and/or uninsured individuals, 18% through the Women, Infants, and Children (WIC) social service program, 16% through student areas at one community college and one regional-level university, 11% through a “community baby shower” sponsored by local service programs, 11% heard about the study through word of mouth (via a friend, relative, another research study, or church), 7% through Head Start and local daycare programs, 7% through subsidized housing and/or temporary housing facilities, 5% through second-hand donation centers for pregnant women and their children, and 2% through a parenting class. The strategic distribution of fliers allowed for the recruitment of economically disadvantaged pregnant women, which was a specific focus of the overall larger, longitudinal study.

Participants ranged in age from 18 to 42 ($M = 26.2, SD = 5.7$). Forty-seven percent of participants were African American, 36% were Caucasian, 13% were Biracial, and 4% belonged to other racial groups. Twenty percent of the sample reported having a high school diploma/GED or less, 44% reported some college or trade school, and 36% reported having a college degree. Furthermore, 64% described themselves as single (never married), 28% married, 4% separated, and 4% divorced. Thirty percent of participants were first time mothers, and those who were not first time mothers had an average of 2.7 children (range = 1 – 12).
Participants in the present study were economically disadvantaged overall. At the first assessment, the median family monthly income of participants was $1,500 (range = $0 - $10,416), 88% reported receiving services from WIC, 62% were receiving food stamps, 90% were receiving Medicaid, MI-Child, or Medicare, and 20% were receiving public supplemental income. Forty-five percent were employed at the time.

**Procedures**

The fliers posted called for pregnant women who were interested in participating in a research study (called the EMU Parenting Project) about women’s health and their experiences during and after pregnancy. Interested women were encouraged to call the research office and, upon doing so, were read a scripted description of the study by a research assistant (see Appendix B). The description included information on the intended purpose of the study, as well as other logistics including the amount of time the interviews would take, confidentiality, compensation, and the types of questions they would be asked. The description also indicated that the researchers were interested in remaining in contact until their infants turned 1 year old (at that time, the study was only intended to go through the first year postpartum). Last, the script included a description of the rights of research participants. Women who were still interested in participating were asked to give their verbal consent to continue gathering basic information, which would help to determine that woman’s eligibility for the study. Eligibility requirements included being pregnant, being at least 18 years of age, and having the ability to speak fluent English, as bilingual translators were not available. Once eligibility was determined, research assistants collected basic demographic and contact information. The information collected included the potential participants’ name, date of birth, anticipated due date, phone number/s, email, mailing address, ethnicity, education level, and where they had heard about the study.
Those women in their third trimester of pregnancy at the time of the initial contact were scheduled for the pregnancy interview at the participants’ convenience. The women were given the choice of having research assistants come to their home for the interview, or meeting in a research office on campus. The contact information of those women not in their third trimester at the time of the initial contact was placed in a binder of potential participants. As these women entered their third trimester, they were contacted to set up the pregnancy interview.

Approximately 78% of the participants chose to have the pregnancy interviews conducted in their home, and 22% of the interviews were conducted at a research office on campus. Interviews were conducted by teams of two research assistants and lasted approximately 2½ to 3 hours. One interviewer would lead the interview while the second would either provide childcare to the participants’ other children or observe the interview.

Prior to interviewing, all research assistants were thoroughly trained by the principal investigator on study procedures and protocol related to home visits (safety, ethical issues, appropriate conduct, etc.), as well as the proper administration of all measures. All research assistants were required to attend mandatory training sessions before they were allowed to lead interviews. Research assistants consisted of both graduate and undergraduate students at Eastern Michigan University.

Training of the research assistants (both graduate and undergraduate) involved covering each measure in detail, as well as the details of study procedures and protocol as a team on a weekly basis until every study procedure and protocol had been taught and learned by all team members. Then, advanced research assistants (i.e., graduate students) were observed by the primary investigator as they led interviews. Next, the advanced research assistants led interviews while less advanced research assistants observed. It was required that less advanced research assistants observed.
assistants go through the training and then observe two interviews before they could start to lead
in the company of more advanced research assistants. Meetings were held on a weekly basis with
the primary investigator for ongoing training and to discuss the questions and concerns that had
arisen during the course of the interview. Weekly meetings also provided an opportunity to share
and discuss previous interviews that were completed and the issues that arose. This process
allowed the principal investigator to carefully monitor whether or not all research assistants were
correctly administering measures and adhering to study protocol. This process was also helpful
in evaluating the readiness and competency of new research assistants as they began to lead
interviews.

The pregnancy interview began with the reading and signing of an informed consent form
(see Appendix C). The consent form was read aloud by the leading research assistant and signed
by both parties. Two copies were signed in order for the participant and the researcher to have a
signed copy. The interview began with a brief demographic section and was followed by a
battery of questionnaires. Also included was a 1-hour semi-structured interview asking
participants about their ideas and feelings about their unborn child. This interview was audio-
recorded for later transcription and coding. The questionnaires were administered in the same
predetermined order for each participant, which was strategically determined by the principal
investigator to build rapport with the participants before asking more sensitive and personal
questions. The reasoning was that such rapport would increase the participants’ comfort and
therefore their likelihood to report honest answers. This was especially important due to the
method of administration; research assistants read the questions aloud and circled the response of
the participant. Participants were given a copy of the questionnaire packet to follow along. The
reading aloud of questions by the research assistant was strategically chosen as the method of
administration in order to minimize random responding and protect against possible literacy difficulties.

Each pregnancy interview lasted approximately 2½ to 3 hours. At the conclusion of the interview, the women were asked by the research assistants for their permission to stay in contact (via tracking calls every 3 months) in order to continue with the ongoing longitudinal study. Those who agreed to continue their participation were asked to provide contact information for themselves as well as the names and contact information of up to three “recontact people” who could provide information on the location of the study participant in the event that she could not be reached directly at a given tracking interval. Upon completion, participants were then thanked for their time, given a referral list of area community resources, and compensated with a $25.00 gift card to Target.

As a prelude to the second interview, each participant was contacted by a research assistant approximately 2 weeks after the expected due date of her baby. The purpose of this phone call was to confirm the baby’s date of birth, sex, and name, as well as to update the participants’ contact information. Shortly thereafter, the second interview was conducted, usually over the phone but in a few circumstances (less than 5%) at the participants’ home. This second interview was conducted when the participants’ infant was approximately 3 months old. This interview typically lasted 30 to 45 minutes, with the purpose of obtaining information about the infants’ first three months of life such as their crying, feeding, and sleeping routines, as well as information about the health and well-being of the mother and her infant. The second interview began with the reading aloud of the informed consent (see Appendix D) by a research assistant to the participant, who then had the opportunity to verbally consent to the interview. Next, participants were led through a series of questionnaires, which were in the same pre-determined
order for each participant, for the same reasons noted above. After the completion of the questionnaires, participants were asked to update their contact information as well as the contact information of their recontact people. In closing, participants were thanked for their time, sent a shortened referral list of area community resources, and mailed a $10.00 Meijer gift card. One hundred and nineteen women completed the T2 interview (retention: 99.2%).

The women were then contacted approximately 2 weeks before the child’s first birthday with the intent to schedule the third wave (T3) interview around the time the child was 1 year old. Many of the interviews were completed in the women’s homes (93%), although 7% were completed at Eastern Michigan University. The interview began with the reading aloud of the informed consent by the research assistant (Appendix E). The interview took approximately 3-3½ hours and contained questionnaires, in a predetermined order for reasons noted above. In addition to the battery of questionnaires, the women were asked to engage in a 10-minute free-play and 2-minute clean-up interaction task with their child. This interaction was videotaped and later coded by trained research assistants (more details about this procedure are located in the measure section).

As in previous interviews, the research assistants read all questionnaires aloud to the participant. At the end of the interview, the woman was asked for her permission to remain in contact with her and her baby because the study had been extended at that time; recontact information was also updated at this time. Last, the participants were thanked and given a referral list of community resources. Participants were compensated with $50 cash and a baby gift for their participation. One hundred and fourteen women completed the T3 interview (retention: 95%).
Two weeks before the child’s second birthday, the participants were contacted and scheduled for the fourth wave (T4) interview. The T4 interview followed the same procedures noted above for the T3 interview. The informed consent was read aloud (see Appendix F), followed by a battery of questionnaires administered in a predetermined order for reasons previously mentioned. Ninety-three percent of the T4 interviews took place in the women’s home, and 7% took place at Eastern Michigan University or over the phone. For those interviews conducted in person, a videotaped mother-infant free-play and clean-up interaction was obtained in a similar manner as during T3 interviews, to be later coded by trained research assistants. The T4 interview lasted approximately 3½ to 4 hours. At the end of the interview, participants were thanked for their time, given an updated referral list, and compensated with $40 cash, a $10 Target gift card, and a baby gift for their participation. Ninety-nine women completed the T4 interview (retention: 82.5%).

During the course of the study, women were tracked every 3 months between each wave by research assistants to obtain updated contact information and to stay in contact with the women until the next scheduled interview. These “tracking assignments” were completed by trained research assistants, and progress was monitored at weekly lab meetings.

Measures

Maternal depression. Maternal depression was measured at T1 and T2 using the Edinburgh Postpartum Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987; Wisner, Perry, & Piontek, 2002). The EPDS is a 10-item questionnaire (see Appendix G) designed to assess the frequency of prenatal and postpartum depressive symptoms such as decreased energy, feelings of worthlessness, diminished interest or pleasure in activities, and decreased concentration. Items are scored using a Likert-type scale from 0 to 3 with question-specific
answers such as 0 = *never*, 1 = *not very often*, 2 = *yes, some of the time*, 3 = *yes, most of the time* or 0 = *not at all*, 1 = *definitely not so much now*, 2 = *not quite so much now*, 3 = *as much as I always could*. Respondents are asked to endorse items corresponding to how they have been feeling during the “past 7 days.” Items 3 and 5-10 are reverse scored. Possible scores range from 0 to 30, with higher scores indicating more depressive symptoms. The 10 items yield a total score of prenatal or postpartum depression; there are no subscales. The psychometric properties of the EPDS have been reported by Cox et al. (1987) based on a sample of 84 British postnatal women identified by their health care professionals as depressed. A score of 12 or greater is recommended as an indicator of major depression, whereas a score of 9 or higher has been suggested as a good cut-off score for identifying minor or possible depression. The EPDS has demonstrated good internal consistency (α = .87) as well as a sensitivity of 86% in identifying depressed individuals when a cut-off score of 12 or higher is employed. The measure will be used as a continuous variable (depressive symptom severity) for the purposes of the present study. Convergent validity between the EPDS and the Postpartum Depression Screening Scale (PDSS; Beck & Gable, 2001) has been reported by Beck and Gable (2001) (r = .79). Currently, published information on the temporal stability and factor structure of the EPDS is not available. However, using the present sample of 120 pregnant women, the correlation between the third trimester of pregnancy and 3 months postpartum assessments was r = .43. An exploratory factor analysis using varimax orthogonal rotation was also performed analyzing the EDPS at T1 (pregnancy) and T2 (3 months postpartum). A one-factor solution was obtained for both time periods with 40.5% of the variance accounted for at pregnancy and 42.5% of the variance accounted for at 3 months postpartum. The EPDS demonstrated good internal consistency in the present sample at T1 (α = .76) and T2 (α = .84).
Maternal depression at T3 and T4 was assessed using the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a 21-item self-report questionnaire (see Appendix H) that measures the severity of depression in adults. The questionnaire consists of 21 groups of statements scored from 0 to 3 with question-specific answers such as 0 = I do not feel sad, 1 = I feel sad much of the time, 2 = I am sad all of the time, 3 = I am so sad or unhappy that I can’t stand it or 0 = I feel the same about myself as ever, 1 = I have lost confidence in myself, 2 = I am disappointed in myself, 3 = I dislike myself. Respondents are asked to endorse items corresponding to how they have been feeling during the “past week, including today.” All 21 items are summed to create a total score; no items are reverse scored. Possible scores range from 0 to 63, with higher scores indicating higher frequency and severity of depressive symptoms. The psychometric properties of the BDI-II have been reported by Beck et al. (1996) based on four outpatient samples from different psychiatric outpatient clinics and one college student sample. The BDI-II demonstrated good internal consistency in both the outpatient (α = .92) and college student (α = .93) samples. Convergent validity between the BDI-II and the BDI-IA (Beck & Steer, 1987) was also reported (r = .93, p < .001). Adequate test-retest reliability was demonstrated in a sub-sample of 26 outpatients over a 1-week period (r = .93, p < .001). Additionally, convergent validity has been reported with the Beck Hopelessness Scale (BHS; Beck & Steer, 1988; r = .68, p < .001) and the Scale for Suicidal Ideation (SSI; Beck, Kovacs, & Weissman, 1979; r = .37, p < .001). The BDI-II demonstrated good internal consistency in the present sample at T3 (α = .90) and T4 (α = .94).

Scores for both depression measures were converted to z-scores to allow for comparisons across measures.
Infant affect expression. Infant affect expression was assessed using a mother-infant interaction observation task. Infant behaviors and affect expression were assessed at waves three and four of data collection by video-taped observations during a 10-minute free-play task and a 2-minute clean-up task at the participants’ homes (typically); infant affect expression and behaviors were later coded from the videotapes. The current study used only the affect codes in analyses (more details below). A standard set of developmentally appropriate toys that were novel to each family were brought to the interview and used for the interaction task. The wave three set included toys appropriate for 1-year-old infants, whereas the wave four set contained different toys appropriate for 2-year-olds. Participants were informed in advance of the videotaped interaction prior to scheduling the interview. Participants were free to refuse this portion of the interview “without any penalty or negative consequences.” No women refused videotaping of the mother-infant free-play at the T3 or T4 interviews. The same standardized instructions for the interaction were read aloud to the mother at each wave right before the task began:

Now we’d like to videotape you and your baby playing together with some of the toys that we brought along. Please feel free to play and interact with your child as you normally would. Go ahead and have a seat behind the toys and facing us. If possible, please try to keep your child around this area and these toys for the next 12 minutes. After about 10 minutes, we’ll let you know that there’s about 2 more minutes left and then you and your baby can clean up the toys by putting them back in the bucket. One of us will make sure the camera is working, and the other will just be sitting aside organizing paperwork. Ready to begin?

At a later time, trained coders viewed the entire 10-minute free-play segment and the entire 2-minute clean-up segment and provided separate, global infant behavioral and affect expression ratings for each task from the wave three (age 1) and wave four (age 2) videotapes. The coding scheme for wave three was adapted primarily from Clark (1985), Feldman (1998),
Miller (1998), Tronick and Weinburg (1999), and Beeghly, (2006). The wave three coding scheme included nine scales (four behavioral scales, three affect scales, and two dyadic scales) of infant affect expression and behavior. The behavioral scales included _Compliance_, or the degree to which the infant complied with or responded to the mother’s bids; _Object Engagement_, or the degree to which the infant was engaged with toys; _Social Engagement_, or the degree to which the infant engaged with the mother or initiated social interaction; and _Disorganization_, or the degree to which the infant displayed behaviors indicative of a disorganized attachment system such as direct expressions of fear of the parent or odd movements or vocalizations. The affect scales included _Positive Affect_, or the frequency, intensity, and duration of displays of positive affect such as smiles, upbeat vocal tones, laughter, and exuberant vocal utterances; _Negative Affect_, or the frequency, intensity, and duration of displays of negative affect such as fussing, whining, limb flailing, or sustained crying; and _Withdrawn/Flat_, or the frequency and duration of displays of withdrawn/flat affect such as disinterest, lack of facial animation, or little or slowed movement. Dyadic codes included _Reciprocity/Fluency_, or the degree of similarity, rhythm, or matching of the mother’s and infant’s energy, interest, and engagement in the interaction, and _Shared Affective Valence_, or the degree of similarity between the mother’s and infant’s affect states including the duration of shared positive, neutral, and negative affect expression. Codes were assigned with a 5-point, anchored rating system: 1 (_none or very little_), 2 (_some_), 3 (_moderate_), 4 (_much_), and 5 (_very much_). Higher scores indicate more of the given construct. In the case of non-normally distributed scales at T3 and T4, data transformations were done and the resulting values were used in analyses (more details can be found in the Results section).

A doctoral student in clinical psychology trained two master’s level students, including this investigator, on the wave three infant behavioral and affect coding system. Weekly trainings
were conducted that lasted 1.5 hours each for approximately 12 weeks. During these meetings, each of the codes was described in detail, and behavioral examples of the codes were provided and explored within both free-play and clean-up tasks. Also, numerous mother-infant interaction tapes obtained with permission from a different research study were coded during the meetings as practice for coders to become more familiar with the codes and the coding procedures. The research assistants practiced coding the free-play and clean-up tasks separately, as this would be the procedure during the actual coding for the current study. These initial training meetings continued until the investigator felt comfortable with each of the coders’ understanding of each of the nine codes based on information obtained during the training meetings.

Following training, each individual coder’s reliability was established with the investigator for both free-play and clean-up tasks using a random subset of the mother-infant interaction tapes from the present study \((n = 22; \text{approximately } 20\% \text{ of the sample})\). Reliability was calculated using intra-class correlation coefficients (ICC), which ranged from \(.58\) for the object engagement subscale to \(.95\) for the infant positive affect subscale for the free-play task, and \(.46\) for the shared withdrawn affect subscale to \(.96\) for the infant negative affect subscale for the clean-up task (Gallagher, 2011). Throughout the reliability coding period, which lasted approximately 6 weeks (coding approximately four free-play and four clean-up segments per week), 1-hour weekly meetings were held to receive feedback about reliability statistics and to come to agreement on individual codes from certain tapes that were not in an acceptable reliability range.

Following the establishment of initial inter-rater reliability for the free-play and clean-up tasks (ICCs greater than \(.70\) based on acceptable ranges in the published literature), each coder was randomly assigned 42 free-play and 42 different clean-up interactions to code over a 7-week
period, coding no more than four tapes per week to ensure careful, accurate coding. Additionally, some interactions were chosen at random and double-coded by the doctoral student supervising the coding. Coders did not know when this would occur, nor did they know which interactions would be double-coded. Each week, the supervisor coded at least one of each coder’s free-play and clean-up segments, resulting in an additional 18 total interaction tapes being double-coded throughout the 7-week coding period (six additional tapes per coder). When disagreements occurred, the coders resolved their differences, and these conferenced codes were used in the analyses. Final reliabilities reflect a combination of the initial and ongoing reliability calculations and ranged from .66 for the shared negative affect subscale to .97 for the infant negative affect subscale for the free-play task, and .71 for the infant withdrawn/flat subscale to .97 for the infant positive affect subscale for the clean-up task (Gallagher, 2011). These final reliability estimates are more than adequate (Cicchetti & Sparrow, 1981). Infant affect codes from the clean-up segment at age 1 were not used in the present study. The free-play task is a longer segment, allowing for a larger sample of the infants’ emotionality. Moreover, it was the object of the present study to observe the affective expressions of infants in a more neutral situation to glean the general nature of the infant rather than under specific, high-demand situations.

Table 1 displays the inter-correlations between the infant affect codes at T3. Infant positive affect was significantly negatively correlated with infant withdrawn/flat affect and shared neutral affect, and significantly positively correlated with shared positive affect. Based on these inter-correlations, these four subscales were summed to create a positive affect composite; infant withdrawn/flat and shared neutral affect were reverse-coded first so that higher numbers indicated less flat and less neutral affect. Thus, higher scores on the composite indicated more positive observed affect. An exploratory factor analysis conducted in SPSS version 18.0
confirmed that the four subscales accounted for 65% of the variance in the positive affect factor.

All factor loadings exceeded .75. Additionally, infant negative affect was significantly positively correlated with shared negative affect; therefore, the two codes were combined to form a negative affect composite. An exploratory factor analysis confirmed that these two subscales accounted for 63% of the variance in the negative affect factor; factor loadings exceeded .75. Subsequent analyses were done using both the individual codes, as well as the composites.

Table 1

*Inter-correlations between Infant Affect Codes at T3*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Positive affect</td>
<td>1.0</td>
<td>.04</td>
<td>-.61**</td>
<td>.65**</td>
<td>-.51**</td>
<td>-.06</td>
</tr>
<tr>
<td>2. Negative affect</td>
<td>1.0</td>
<td>-.12</td>
<td>-.01</td>
<td>-.12</td>
<td>.26*</td>
<td></td>
</tr>
<tr>
<td>3. Withdrawn/Flat affect</td>
<td>1.0</td>
<td>-.43**</td>
<td>.45**</td>
<td>.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Shared positive affect</td>
<td>1.0</td>
<td>-.52**</td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Shared neutral affect</td>
<td>1.0</td>
<td>-.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Shared negative affect</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

At wave four, this investigator adapted the coding system to be more appropriate for use with 2-year-old toddlers in consultation with the primary investigator of the larger, ongoing study. All nine codes were retained, though Negative Affect was split into General Fussiness, or the frequency, intensity, and duration of displays of general fussiness such as brief or mild facial expression of sadness or anger, brief negative vocalizations, limb flailing, intermittent crying, sustained crying, or temper tantrums; and Aggression, or the frequency, intensity, and duration of displays of instrumental aggression such as throwing toys or instances of low physical aggression directed towards the mother such as swatting or yelling at the mother and high physical aggression directed towards the mother such as hitting, shoving, or biting. The decision to split the Negative Affect scale into two subscales at wave four was based on viewing most of the wave four videotapes and knowledge of a much wider range of behavior in the 2-year-olds.
Two master’s level and one post-bachelor’s level students were trained by this investigator using similar procedures described above, to code infant behaviors and affect based on the mother-infant interaction videotapes at age 2. Following training, each individual coder’s reliability was established with this investigator for both free-play and clean-up tasks using a random subset of the mother-infant interaction tapes from the present study \( n = 24; \) approximately 27% of the sample). Weekly meetings were held with all three coders together to provide feedback about their reliability statistics and to come to agreement on individual codes from certain tapes that were not in an acceptable reliability range (within one point of this investigator’s codes). Reliability was calculated using intra-class correlation coefficients (ICC), which ranged from .60 for the object engagement subscale to .93 for the infant positive affect subscale for the free-play task and .40 for the social engagement subscale to .89 for the infant negative affect subscale for the clean-up task. Throughout the reliability coding period, which lasted approximately 12 weeks (coding approximately two free-play and two clean-up segments per week), 1-hour weekly meetings were held to receive feedback about reliability statistics and to come to agreement on individual codes from certain tapes that were not in an acceptable reliability range.

Following the establishment of initial inter-rater reliability for both the free-play and clean-up tasks, each of the three coders was randomly assigned free-play and different clean-up interactions to code independently, coding no more than two tapes per week to ensure careful, accurate coding. As before, different research assistants coded the free-play and clean-up segments for the same participant in order to reduce bias between segments, and some interactions were chosen at random and double-coded by this investigator. Each week, this investigator coded at least one of each coder’s free-play and clean-up segments, resulting in an
additional 18 total interaction tapes being double-coded throughout the coding period (six additional tapes per coder). When disagreements occurred, the coders resolved their differences, and these conferredenced codes were used in the analyses. Final reliabilities reflect a combination of the initial and ongoing reliability calculations and ranged from .67 for the infant withdrawn/flat affect subscale to .95 for the infant disorganization subscale for the free-play task, and .68 for the infant withdrawn/flat subscale to .95 for the infant negative affect subscale for the clean-up task. These final reliability estimates are more than adequate (Cicchetti & Sparrow, 1981). Infant affect codes from the clean-up task at age 2 were not used in the present study.

Table 2 displays the inter-correlations between the infant affect codes at T4. Similar inter-correlation patterns to the T3 codes were apparent. As with T3, infant positive affect was significantly negatively correlated with infant withdrawn/flat affect and shared flat affect, as well as significantly positively correlated with shared positive affect. A positive affect composite was again created using these four codes, with infant withdrawn/flat and shared flat affect reverse coded first. An exploratory factor analysis revealed that the four scores accounted for 61% of the variance in the positive affect composite, and all factor loadings exceeded .65. Additionally, infant negative affect was significantly positively correlated with infant aggressive behavior and shared negative affect. An exploratory factor analysis indicated that the three scores accounted for 60% of the variance in the negative affect composite, and all factor loadings exceeded .75. Analyses were done using both the individual codes, as well as the composites.
Table 2

Inter-correlations between Infant Affect Codes at T4

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Positive affect</td>
<td>1.0</td>
<td>-0.25*</td>
<td>-0.28**</td>
<td>-0.56**</td>
<td>0.75**</td>
<td>-0.32**</td>
<td>-0.20†</td>
</tr>
<tr>
<td>2. Negative affect</td>
<td></td>
<td>1.0</td>
<td>0.42**</td>
<td>-0.06</td>
<td>-0.27*</td>
<td>-0.01</td>
<td>0.41**</td>
</tr>
<tr>
<td>3. Aggression affect</td>
<td></td>
<td></td>
<td>1.0</td>
<td>-0.12</td>
<td>-0.28**</td>
<td>0.35**</td>
<td>0.37**</td>
</tr>
<tr>
<td>4. Withdrawn/flat affect</td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>-0.41**</td>
<td>0.54**</td>
<td>0.09</td>
</tr>
<tr>
<td>5. Shared positive affect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>-0.30**</td>
<td>-0.13</td>
</tr>
<tr>
<td>6. Shared flat affect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>-0.05</td>
</tr>
<tr>
<td>7. Shared negative affect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
</tbody>
</table>

Results

Missing Data

Maternal depression data are missing for some participants at T2, T3, and T4, and are believed to be missing at random (MAR; Little & Rubin, 2002). At T2, 5 participants are missing maternal depression scores because four participants were unable to be located at the time of the interview, and the call was dropped with one other participant who could not be relocated to finish the interview. Six participants are missing maternal depression scores at T3 because three participants were unable to be located at the time of the interview, two participants withdrew from the study at the time of the interview, and one participant moved out of the country and could not be contacted for a phone interview. At T4, 21 participants are missing maternal depression scores because 10 participants were unable to be located at the time of the interview, four were too busy at the time of the interview to complete the measure (but agreed to be contacted for future waves), two had withdrawn at the time of the T3 interview, three withdrew during tracking phone calls between T3 and T4, one withdrew at the time of the T4 interview, and one moved out of the country at T3 and was unable to be contacted for a phone interview at T4. Because missing data on depression scores are believed to be MAR (Little & Rubin, 2002), Maximum Likelihood Ratio (MLR), a type of full-information maximum-likelihood (FIML)
estimation, was used in the present study to handle missing data on the depression scales. This is the recommended method for handling missing data in latent class growth analysis (LCGA; Wang & Bodner, 2007). Therefore, the model estimation procedures in Mplus to test hypothesis 1 were based on all 120 participants.

Analyses to test Hypotheses 2a and 2b were conducted in SPSS 18.0, and some infant affect codes were missing. At T3, 13 participants did not have infant affect codes because the free-play interaction was not done. Consistent with reasons for missing data for maternal depression at T3, three participants were unable to be contacted at the time of the interview, two participants refused to participate and withdrew from the study, and one participant moved out of the country. Seven additional participants did not have infant affect data at T3 because the interviews were done over the phone (four participants) or the participants did not have custody of their child at the time of the interview (three). Thus, analyses examining T3 infant affect codes were initially done with 107 participants, and those results are detailed below.

At T4, 32 participants did not have infant affect codes because the free-play interaction was not done. Consistent with reasons for missing data for maternal depression at T4, 21 participants were not able to be contacted at the time of the interview. Additionally, six participants did not have custody of their children at the time of the interview, four participants did the interview over the phone, and one participant’s child was asleep during the interview. Thus, initial analyses examining T4 infant affect codes were done with 88 participants, and those results are detailed below.

As noted, missing infant affect codes at T3 and T4 were not estimated or used in initial analyses due to a large amount of missing data at T4 (28% missing; McCartney, Burchinal, & Bub, 2011) and a desire to remain consistent for both waves. However, analyses were
subsequently examined using Multiple Imputation in SPSS 18.0 to increase sample size. Multiple Imputation is a commonly used technique that some researchers believe can handle large amounts of missing data as long as they are MCAR or MAR (Enders, 2013; McCartney et al., 2011). Due to space constraints and redundancy of findings, those results are mentioned, but not detailed, below.

**Descriptive Statistics**

Descriptive statistics for the study variables are presented in Tables 3 and 4. Many standards for acceptable skew and kurtosis values have been presented in the literature. Some state that an absolute value greater than 1.0 for both skew and kurtosis is considered to indicate slight non-normality, whereas values between 1.0 and 2.3 indicate moderate non-normality, and values above 2.3 indicate severe non-normality (Lei & Lomax, 2005); others have reported that absolute values for skew above 2.0 and kurtosis above 7.0 are unacceptable (Curren, West, & Finch, 1996). However, it has also been believed that such cutoffs should be used as guidelines rather than strict rules (Gao, Mokhtarian, & Johnston, 2008). In the current study, variables with skew and kurtosis values exceeding 4.0 were transformed in an attempt to reduce distribution problems.

As can be seen in Table 3, the depression scores for waves 2-4 revealed problematic skew and kurtosis values. Skew and kurtosis were corrected using the winsorizing technique, a procedure similar to trimming, where data considered outliers are replaced with the value of the 5th or 95th percentile, depending on whether the outlier is at the lower or the upper end of the distribution (Huber, 2002). This procedure was effective at reducing skew and kurtosis for these variables (see Table 3). All depression variables were subsequently transformed into z-scores due to their different scoring metrics to allow for comparisons across time points in the trajectory
analyses. Overall, the women in the present study reported generally low levels of depressive symptoms across time.

As can be seen in Table 4, some infant affect codes at T3 and T4 also had problematic skew and kurtosis values. As with the depression scores, winsorizing was used to reduce non-normality. Specifically, infant negative affect and shared negative affect at T3 were winsorized; this improved infant negative affect, but not shared negative affect, and the latter was subsequently dropped from analyses. The negative affect composite at T3 was also winsorized, which improved skew and kurtosis values. At T4, infant negative affect, infant aggression, and withdrawn/flat affect were winsorized due to non-normality. This procedure led to an acceptable improvement in negative affect, but not in flat/withdrawn affect or infant aggression; thus, the latter two were excluded from analyses. Shared flat and shared negative affect at T4 were not able to be winsorized due to a low base rate of observations; the 5th and 95th percentiles were both 1, so transforming all outliers into “1” led to a range of 1-1 and a variance of 0. These two scales were dropped from subsequent analyses. Finally, the negative affect composite at T4 was winsorized, which improved skew and kurtosis values.
Table 3

Descriptive Statistics for Maternal Depression Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>Skew</th>
<th>Kurtosis</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Possible</td>
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<tr>
<td>T1 EPDS</td>
<td>120</td>
<td>12.78</td>
<td>3.60</td>
<td>0-30</td>
<td>7-23</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Actual</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-1.60-2.84)</td>
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<tr>
<td>T2 EPDS</td>
<td>115</td>
<td>5.08</td>
<td>4.46</td>
<td>0-30</td>
<td>0-21</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Actual</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(-1.19-2.39)</td>
<td>(2.99)</td>
<td>(-1.14)</td>
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<tr>
<td>T3 BDI-II</td>
<td>114</td>
<td>10.78</td>
<td>8.78</td>
<td>0-63</td>
<td>0-51</td>
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<td>Actual</td>
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<td></td>
<td></td>
<td></td>
<td>(-1.46-2.44)</td>
<td>(3.43)</td>
<td>(.19)</td>
</tr>
<tr>
<td>T4 BDI-II</td>
<td>99</td>
<td>10.83</td>
<td>10.14</td>
<td>0-63</td>
<td>0-57</td>
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<td>Actual</td>
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<td></td>
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<td></td>
<td>(-1.16-2.60)</td>
<td>(4.13)</td>
<td>(.50)</td>
</tr>
</tbody>
</table>

Note. Values in the first row represent raw data. Values in parentheses represent winsorized and z-scored values. EPDS = Edinburgh Postpartum Depression Scale; BDI-II = Beck Depression Inventory–II. Skew and kurtosis values reflect the product of the values divided by the standard error.
Table 4

*Descriptive Statistics for Infant Affect Codes at T3 and T4*

<table>
<thead>
<tr>
<th>Variable</th>
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<tbody>
<tr>
<td>T3 affect scales</td>
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<tr>
<td>Positive</td>
<td>107</td>
<td>2.70</td>
<td>1.02</td>
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<td>1-4</td>
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</tr>
</tbody>
</table>

*Note.* Values in the first row represent raw data. Values in parentheses represent winsorized values. Skew and kurtosis values reflect the product of the values divided by the standard error.<sup>a</sup> Excluded from analyses with individual codes due to extreme skew and kurtosis values that were not improved with winsorizing.

**Correlations between Study Variables**

Correlation coefficients for study variables are presented in Table 5. As expected, depression scores are significantly positively correlated across all time points for the entire sample. Depressive symptoms at T1, T2, and T3 were unrelated to all infant affect variables at
T3 and T4. However, there was a significant positive correlation between depressive symptoms at T4 and shared neutral affect at T3. No other associations were revealed between T4 depressive symptoms and infant affects codes at T3 or T4.

Table 5

Correlation Matrix for Study Variables

<table>
<thead>
<tr>
<th></th>
<th>T1 EPDS</th>
<th>T2 EPDS</th>
<th>T3 BDI-II</th>
<th>T4 BDI-II</th>
</tr>
</thead>
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<tr>
<td>Depression</td>
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<td></td>
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</tr>
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<td>.45**</td>
<td>.32**</td>
<td>.30**</td>
</tr>
<tr>
<td>T2 EPDS</td>
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<td>1.0</td>
<td>.35**</td>
<td>.30**</td>
</tr>
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<td>T3 BDI-II</td>
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<td>-</td>
<td>1.0</td>
<td>.62**</td>
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<td>T4 BDI-II</td>
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<td>-</td>
<td>-</td>
<td>1.0</td>
</tr>
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<td></td>
</tr>
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<td>-.06</td>
<td>-.10</td>
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<td>-.05</td>
<td>-.19†</td>
<td>-.10</td>
</tr>
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<td>-.02</td>
</tr>
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<td>-.18†</td>
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<td>-.07</td>
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<td>T4 Infant affect</td>
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<td>.10</td>
<td>.07</td>
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<tr>
<td>Negative affect composite</td>
<td>.18†</td>
<td>-.00</td>
<td>-.03</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note. All variables presented in this table are those included in study analyses (including some that have been transformed as described earlier). EPDS = Edinburgh Postpartum Depression Scale; BDI-II = Beck Depression Inventory–II.

† p < .10. * p < .05. ** p < .01.

Trajectory Analysis

The present study sought to examine trajectories of maternal depressive symptoms from pregnancy through 2 years postpartum and how they relate to infant affect expression at age 1 and age 2. While variable-centered approaches (e.g., regression analysis, factor analysis) examine mean change and relationships between variables within an entire sample, the objective of person-centered approaches (e.g., LCGA, cluster analysis) is to examine relationships among
variables within sub-sets of individuals (Muthén & Muthén, 2000). Further, whereas variable-centered approaches assume that individuals within a sample are all equally influenced by a given construct, person-centered approaches assume that unobserved subsets of individuals exist within the sample that may be differentially influenced by a given construct; thus, these approaches allow for the study of the differential effects of constructs on members of different trajectory classes (Muthén, 2001). In other words, variable-centered approaches assume that all participants in a given sample are drawn from a single population and, therefore, change in similar and predictable ways over time. Person-centered approaches have gained popularity as many psychological constructs have been found to be multifaceted with differential effects on various subgroups within a once-presumed homogenous sample. The person-centered approach is an important and emerging concept in the field of developmental psychology, which is heavily centered on the study of change and growth, as well as the identification and study of developmental pathways (Muthen & Muthen, 2000; Nesselroade, 1991).

As noted earlier, trajectories of maternal depressive symptoms in the present study were identified using latent class growth analysis (LCGA) in Mplus version 6.0, which is a person-centered, latent growth modeling approach used to identify underlying heterogeneity in a sample (Wang & Bodner, 2007). LCGA is a commonly used person-centered statistical technique for modeling trajectories of various constructs across time and, therefore, is optimal for longitudinal data. In LCGA, unobserved heterogeneity of a variable across time within a given sample is captured by categorical latent variables (i.e., trajectory classes; Wang & Bodner, 2007). There are some important assumptions of this data analytic approach. First, it is assumed that the growth curve variables, maternal depression in this case, are normally distributed (Jung & Wickrama, 2008). This assumption was met in the current study by using the winsorizing
In the present study, Hypothesis 1 posited that distinct trajectories of maternal depressive symptoms would exist within the current sample. To test this hypothesis, a univariate growth curve model was examined using all four waves of maternal depression scores to determine whether the data were optimally explained by a single growth curve. The unequal time intervals between assessments were retained by coding time scores in months, anchoring at zero, such that T1@0, T2@3, T3@12 and T4@24, which is an appropriate sequencing for unequal time intervals (Jung & Wickrama, 2008). The univariate model was a poor fit for the data ($X^2[5, N = 120] = 1.83, p = .87$) when compared to more complex models, supporting Hypothesis 1. Therefore, model testing continued in order to determine the optimal number of classes.
In order to determine the optimal number of classes, models for 2, 3, 4, and 5 trajectories were examined. The optimal model was chosen based on an evaluation of fit statistics. The most commonly used and recommended fit statistic is the Bayesian information criteria (BIC) statistic (Jung & Wickrama, 2008; Wang & Bodner, 2007). The model with the lowest BIC value is considered to be the best-fitting model. The present study also considered entropy values, the bootstrap likelihood ratio test (BLRT), and the Lo, Mendell, and Rubin (2001) likelihood ratio test (LMR-LRT) to identify the model that best fits the data. Entropy values are based on posterior probabilities and, therefore, reflect how neatly and exclusively subjects are classified into each trajectory group (Wang & Bodner, 2007). Entropy values exceeding .80 indicate good classification (Wang & Bodner). The BLRT and LMR-LRT statistics reflect the relative fit of a \( k \) class model compared to a \( k-1 \) class model, where \( k \) indicates the number of latent classes. For example, when testing a 3-class model, the BLRT and LMR-LRT statistics indicate whether a 3-class model has a better fit than a 2-class model. Statistical significance \((p < .05)\) indicates that the \( k \) class model exceeds the \( k-1 \) model. The BLRT statistic has been shown to outperform the LMR-LRT; however, it is recommended that both be used and compared (Jung & Wickrama, 2008). Since there are competing opinions about which fit indices best determine the appropriate number of classes, it is recommended that a combination of factors be used beyond these fit statistics such as considerations of parsimony, theoretical justification, and interpretability (Jung & Wockrama, 2008).

The fit indices of the models examined in the present study are presented in Table 6. The 3- and 4-class models emerged as good fitting models with equal BIC values and entropy above .80. Significant BLRT values also indicated that a 3-class model is better than a 2-class model, and a 4-class model improves on a 3-class model. Although the LMR-LRT statistic was
significant for the 3-class but not the 4-class model, it has been suggested that the BLRT statistic performs better and should be followed above the LMR-LRT (Jung & Wickrama, 2008).

Furthermore, important theoretical considerations indicate that the 4-class model is more appropriate due to the extraction of a class describing a decreasing trajectory of maternal depressive symptoms that is composed of 15 women (see Table 6). The slope and intercept of this trajectory suggest that this group of women indicated that they were experiencing a significant amount of depressive symptoms in pregnancy that then significantly declined throughout the transition to parenthood. This decreasing class is not represented in the 3-class model, where these 15 women were forced to fit into one of the other groups. This is reflected by the improved entropy value from a 3- to a 4-class model, which indicates that the women in the 4-class model were more neatly and precisely classified into their respective groups.

Furthermore, posterior probabilities improved from the 3- to the 4-class model, indicating that women were more exclusively and decisively classified into their respective groups. For these important reasons, the 4-class model was chosen as the best fitting model. Posterior probabilities and descriptive statistics for each class in the 3- and 4-class models are presented in Tables 7 and 8.

Table 6

*Fit Indices for Latent Classes*

<table>
<thead>
<tr>
<th>Model</th>
<th>Entropy</th>
<th>BIC</th>
<th>LMR-LRT</th>
<th>BLRT</th>
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<tr>
<td>2-class</td>
<td>.82</td>
<td>1209</td>
<td>-632.265</td>
<td>p &lt; .001</td>
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<td>1189</td>
<td>-583.168</td>
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<tr>
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<td><strong>-565.705</strong></td>
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<td>5-class</td>
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<td>-558.680</td>
<td>p = .31</td>
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</tbody>
</table>

*Note.* BIC = Bayesian information criteria; LMR-LRT = Vuong-Lo-Mendell-Rubin Likelihood ratio test; BLRT = Bootstrap likelihood-ratio test; Model in bold face is the best fitting model.
Table 7

*Posterior Probabilities and Descriptive Statistics for 3-class Model*

<table>
<thead>
<tr>
<th>Posterior Probabilities</th>
<th>n (proportion of sample)</th>
<th>Slope</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 3</td>
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</tr>
<tr>
<td>Class 1</td>
<td>.986</td>
<td>.000</td>
<td>.014</td>
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<tr>
<td>Class 2</td>
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<td>.029</td>
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<tr>
<td>Class 3</td>
<td>.036</td>
<td>.039</td>
<td>.924</td>
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</tbody>
</table>

Table 8

*Posterior Probabilities and Descriptive Statistics for 4-class Model*

<table>
<thead>
<tr>
<th>Posterior probabilities</th>
<th>n (proportion of sample)</th>
<th>Slope</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>Class 2</td>
<td>Class 4</td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>.945</td>
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<tr>
<td>Class 4</td>
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<td>.007</td>
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</table>

In Hypothesis 1, it was expected that trajectories that depict relatively low stable and relatively high stable levels of symptoms across time, as well as increasing or decreasing patterns, would emerge based on previous studies examining trajectories of maternal depression over time (Campbell et al., 2007; Chang & Fine, 2007; Trentacosta, Criss, Shaw, Lacourse, Hyde, & Dishion, 2011). The 4-class model supports this hypothesis; trajectories that emerged included stable-moderate depressive symptoms (n = 27), stable-low depressive symptoms (n = 71), increasing symptoms (n = 7), and decreasing symptoms (n = 15; see Figure 1).
Figure 1. Trajectories of Maternal Depression from Pregnancy through 2 years Postpartum

Table 9

Descriptive Statistics for Depression Variables by Trajectory Class

<table>
<thead>
<tr>
<th>Class</th>
<th>T1 EPDS</th>
<th>T2 EPDS</th>
<th>T3 BDI-II</th>
<th>T4 BDI-II</th>
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<td>m</td>
<td>sd</td>
<td>m</td>
<td>sd</td>
</tr>
<tr>
<td>Class 1</td>
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</tr>
<tr>
<td>Stable-moderate</td>
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</tr>
<tr>
<td>Class 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stable-low</td>
<td>10.87</td>
<td>2.55</td>
<td>2.88</td>
<td>2.43</td>
</tr>
<tr>
<td>Class 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreasing</td>
<td>16.93</td>
<td>3.10</td>
<td>9.67</td>
<td>4.30</td>
</tr>
</tbody>
</table>

Note. Values represent raw data. EPDS = Edinburgh Postpartum Depression Scale; BDI-II = Beck Depression Inventory–II.
Relations with Infant Affect Expression

Hypothesis 2a stated that mothers reporting chronically high or increasing levels of depression across time would have infants who display more generally negative affect, while Hypothesis 2b stated that mothers reporting stable, low, or decreasing levels of depression across time would have infants who display more generally positive affect. These hypotheses were examined in SPSS 18.0 using ANOVA tests with Tukey post-hoc analyses to examine between-group contrasts on infant affect expression at age 1 and age 2. Both individual codes and positive and negative affect composites were examined, with the exception of shared negative affect at T3 and aggression, flat affect, shared negative affect, and shared flat affect from T4, which were not examined due to extreme non-normality. Results indicated that trajectory classes did not differ on infant affect at the subscale or composite level for T3 or T4, contrary to Hypotheses 2a and 2b (see Table 9). As noted earlier, results were not notably different after analyses were subsequently performed using multiple imputation procedures; significant differences were still not found between trajectory classes and any affect scales at T3 or T4.
Table 10

Between Group Comparisons on Infant Affect by Trajectory Class

<table>
<thead>
<tr>
<th></th>
<th>Class 1 Stable-moderate</th>
<th>Class 2 Stable-low</th>
<th>Class 3 Increasing</th>
<th>Class 4 Decreasing</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
<td>sd</td>
<td>m</td>
<td>sd</td>
<td>m</td>
<td>sd</td>
</tr>
<tr>
<td>T3 Affect</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Positive</td>
<td>2.63</td>
<td>1.06</td>
<td>2.75</td>
<td>1.10</td>
<td>2.50</td>
<td>.55</td>
</tr>
<tr>
<td>Negative</td>
<td>1.58</td>
<td>.78</td>
<td>1.63</td>
<td>.68</td>
<td>1.50</td>
<td>.84</td>
</tr>
<tr>
<td>Withdrawn/flat</td>
<td>2.58</td>
<td>.72</td>
<td>2.64</td>
<td>.72</td>
<td>2.67</td>
<td>1.03</td>
</tr>
<tr>
<td>Shared positive</td>
<td>1.79</td>
<td>.66</td>
<td>1.95</td>
<td>.68</td>
<td>1.67</td>
<td>.52</td>
</tr>
<tr>
<td>Shared neutral</td>
<td>3.08</td>
<td>.65</td>
<td>2.98</td>
<td>.75</td>
<td>3.67</td>
<td>.52</td>
</tr>
<tr>
<td>Positive composite</td>
<td>10.75</td>
<td>2.49</td>
<td>11.08</td>
<td>2.71</td>
<td>2.46</td>
<td>1.72</td>
</tr>
<tr>
<td>Negative composite</td>
<td>2.63</td>
<td>.82</td>
<td>2.63</td>
<td>.68</td>
<td>2.50</td>
<td>.84</td>
</tr>
<tr>
<td>T4 Affect</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>2.83</td>
<td>.94</td>
<td>3.20</td>
<td>.97</td>
<td>3.80</td>
<td>1.09</td>
</tr>
<tr>
<td>Negative</td>
<td>1.61</td>
<td>.84</td>
<td>1.46</td>
<td>.61</td>
<td>1.20</td>
<td>.45</td>
</tr>
<tr>
<td>Shared positive</td>
<td>2.26</td>
<td>.75</td>
<td>2.52</td>
<td>.97</td>
<td>3.20</td>
<td>1.09</td>
</tr>
<tr>
<td>Positive composite</td>
<td>14.67</td>
<td>2.19</td>
<td>15.46</td>
<td>2.20</td>
<td>16.60</td>
<td>2.51</td>
</tr>
<tr>
<td>Negative composite</td>
<td>4.04</td>
<td>1.19</td>
<td>3.66</td>
<td>1.00</td>
<td>3.60</td>
<td>1.34</td>
</tr>
</tbody>
</table>

Discussion

As noted earlier, maternal depression during the transition to parenthood has been shown to have numerous deleterious effects on the developing fetus and child, as well as the mother’s ability to care for her infant following birth (Albright & Tamis-Lemonda, 2002; Campbell et al., 2007; Diego et al., 2009; Field, 1995; Field et al., 2010; Luoma et al., 2001; O’Hara, 2009; Wu et al., 2011). Depression during the perinatal period has also been shown to be quite prevalent (Gavin et al., 2005). Past research has shown that levels of depressive symptoms are typically
highest during pregnancy, especially in the first and third trimester, and tend to decrease across the postpartum period. However, not all women follow a decreasing course of symptoms; other trajectories such as increasing or consistently high levels of depressive symptoms have been identified in more person-centered research (Campbell et al., 2007; Vanska et al., 2011; Wu et al., 2011). Further research is needed to identify alternative trajectories and explore the effects of different trajectories of depressive symptoms during the transition to parenthood on infant development. Thus, the present study sought to identify trajectories of maternal depressive symptoms from pregnancy to 2 years after birth, as well as examine the differential effects of trajectories of maternal depressive symptoms on infant affect expression at age 1 and 2. Results demonstrated that four distinct trajectories of maternal depressive symptoms existed across the transition to parenthood in the present sample; however, their association with infant affect expression was less clear. An overview of the results for each hypothesis will be provided next, followed by a discussion of the strengths and limitations of the present study.

Self-reported symptoms of depression were assessed during pregnancy and at 3 months, 1 year, and 2 years postpartum. Not surprisingly, correlational findings revealed that depressive symptoms at all waves were positively associated. Also, waves closest in time (e.g., T1 and T2) were more strongly correlated than waves with greater distance in between measurements (e.g., T1 and T3). For the sample as a whole, higher levels of depressive symptoms were found during pregnancy compared to later postpartum waves. Following pregnancy, a tapering off of symptoms from pregnancy through the postpartum period was observed at the sample level. However, this univariate (1-class) growth curve model demonstrated a poor fit. This decreasing pattern across time is similar to previous reported findings (Banti et al., 2011; Gotlib et al., 1989; Wu et al., 2011); however, many other studies have not attempted to identify more than one
trajectory. In another study, Luoma and colleagues (2001) also noted higher levels of depressive symptoms during pregnancy, indicated by scores above a suggested cut-off on a self-report measure of depression, compared to the postpartum period, but unlike the findings in the present study, a second spike in symptoms around 6-months postpartum was observed, followed by a slow tapering of symptoms. Because the present study did not assess maternal depression between 3 and 12 months postpartum, it is unclear if there would have been a second spike in the current sample. More frequent assessment of maternal depressive symptoms would be needed to assess for other possible univariate curves during the first year postpartum.

Significant inter-correlations among the infant affect codes at each wave were also found, which provided justification for the creation of positive and negative affect composites at both age 1 and age 2. In fact, the forming of composites is a common practice in research using observational codes of infant affect and behavior where inter-correlations at the sub-scale level are consistently found (McElwain & Volling, 2004; Park et al., 1997).

In terms of bivariate relations between depressive symptoms and infant affect codes at age 1, no significant correlations between depressive symptoms during pregnancy, at 3 months, or 1-year postpartum and infant affect expression were found. At 2 years postpartum, however, maternal depressive symptoms were positively correlated with observed shared neutral affect at age 1, indicating that mothers reporting more depressive symptoms at 2 years postpartum spent more time jointly displaying neutral affect with their children at 1 year. There were no other significant correlations between maternal depression at age 2 and any infant affect codes.

Thus, maternal depression at every time point was generally unrelated to infant affect expression and shared affect within the dyad at age 1 and age 2. Only one significant correlation was found, between maternal depression at age 2 and shared neutral affect at age 1, out of many
possible bivariate associations. The one significant association is difficult to interpret because it suggests that earlier dyadic interactions (and only one aspect of them) are related to a mother’s later report of maternal depressive symptoms. This is in contrast with previous research, which has indicated that maternal psychopathology is typically associated with concurrent or later infant outcomes and functioning (Albright & Tamis-LeMonda, 2002; Feldman et al., 2009; Field et al., 2005; Hart et al., 1998). That is, it is typically expected that maternal depression disrupts the relational connection between a mother and her infant due to the relay of negative affect from the mother during mother-infant interactions, which subsequently negatively affects the child’s affective expression (Goodman & Gotlib, 1999; Tronick & Weinberg, 1997). For instance, past studies have found that children as young as 3 months of age find negative affect to be less novel when they have mothers who are depressed (Field et al., 1998). Furthermore, infants and toddlers of depressed mothers have been found to exhibit less positive vocalizations and more negative affect when interacting with their mothers (Feldman et al., 2009; Hart et al., 1998; Righetti-Veltema et al., 2002), but it is typically presumed that these infant affective displays are a result of living with a depressed mother. Furthermore, the age of the child at the time at which they experience their mother as being depressed has been shown to be important for infant outcomes (Campbell et al., 2007; Field; 1995; Field et al., 2010; O’Hara, 2009), indicating that different periods of depressive symptoms may have a greater effect on infant affect than other periods of depression; however, the absence of bivariate correlations in the present study did not support this. Several explanations for the lack of these associations are discussed in a later section below.

**Trajectory Analyses**

Hypothesis 1 stated that different trajectories of maternal depressive symptoms would be found within the sample. As expected, a single growth curve was found to be inadequate, as
DEPRESSIVE SYMPTOM TRAJECTORIES AND INFANT AFFECT

noted earlier. Instead, results indicated that four distinct trajectories of maternal depressive symptoms best fit the data and explained well the experiences of subgroups of women in the sample. Furthermore, trajectories characterized by increasing, decreasing, and stable patterns of maternal depressive symptoms were identified. Thus, the first hypothesis was supported.

One trajectory group was composed of women who continued to report consistently moderate levels of depressive symptoms from pregnancy through 2 years postpartum, and another trajectory was composed of women who continued to report consistently low symptoms of depression across time. Thus, both of these trajectory groups represented stable courses of depression across the transition to motherhood, and these two trajectories represented most of the women in the sample. The other two trajectory groups, made up of smaller numbers of women, depicted increasing and decreasing courses of depressive symptoms. The increasing group initially reported few depressive symptoms during pregnancy but continued to report increases throughout the postpartum period. By 2 years postpartum, this group was reporting a high, clinical level of depressive symptoms. Conversely, the decreasing group initially reported high levels of depressive symptoms during pregnancy, higher than the other three groups, and then reported decreases throughout the postpartum period. In fact, they reported little to no symptoms by 2 years postpartum.

The findings indicating that four distinct trajectories of maternal depressive symptoms existed within the present sample are somewhat similar to those reported by Campbell and colleagues (2007), who identified six distinct trajectories of maternal depressive symptoms from 1 month to 7 years following the birth of a child. Similar to the present study, they identified stable-low, stable-moderate, increasing, and decreasing trajectories. In addition, they also identified trajectories of chronic (stable-high symptoms), as well as intermittent symptom levels.
across time. The present study did not seek to examine quadratic patterns of depressive symptoms; only linear trajectories were specified within the model, so an intermittent trajectory was not able to be identified. The lack of a stable-high trajectory group in the present study could be due to sample size. The study by Campbell and colleagues had 1,261 participants, compared to 120 in the present study. The stable-high trajectory group in their sample was the smallest of the six trajectories (2% of the sample), indicating that it may be difficult to detect in smaller samples. Similar to the present study, Campbell and colleagues reported that, generally, stable patterns of depression were most common. In fact, 82% of the women in the present study were classified as having low or moderate stable patterns of depressive symptoms across time, and 83% were classified in a stable pattern in the Campbell sample.

Similarly, Ashman and colleagues (2008) identified three trajectories of maternal depressive symptoms from 1 to 7 years following the birth of a child in a sample of 159 mostly Caucasian mother-child dyads recruited at 14 months after birth. These trajectories included decreasing symptoms (n = 40), stable-high symptoms (n = 11), and stable-mild symptoms (n = 82). In this study, depression was assessed using a clinician interview of depressive symptoms, and the trajectory groups were specified in terms of months out of a given year where symptoms of depression were reported. The stable-mild group was defined as 0-2 months of depressive symptoms each year, and the stable-high group was defined as 8-12 months of depression each year. Thus, this study demonstrated that stable courses of depressive symptoms, particularly low or mild levels, are more common than other courses of symptoms. One advantage of the present study over the studies by Campbell and colleagues and Ashman and colleagues is that the present study included trajectories that began during pregnancy, a time when depressive symptoms are known to be fairly common. Although several studies mentioned earlier (Banti et al., 2011;
Gotlib et al., 1989; Wu et al., 2011) reported symptom levels from pregnancy throughout the postpartum period, they focused on the sample as a whole rather than on subgroups within the sample. The present study is the first known study to take a person-centered approach to the examination of trajectories of maternal depressive symptoms beginning in pregnancy and extending across several years after birth.

Also, importantly, when depressive symptoms are considered in the sample as a whole, a decrease in symptoms across time is evident, a pattern heavily supported by and discussed in past literature. However, only 15 women were classified into the decreasing trajectory group when trajectory analyses were conducted, whereas the other 105 women in the sample were classified into three very different patterns of symptoms. Likewise, in past studies noted above, a decreasing trajectory group was found for only a subset of individuals. The finding that three other important trajectories besides a decreasing trajectory exist within the present sample would not have been discovered through variable-centered analyses, where the focus is on the mean level of symptoms reported across time rather than the stark individual variability that can be uncovered through person-centered analyses. The use of variable-centered analyses only would have led to the conclusion that most women experience high rates of depressive symptoms during and soon after pregnancy and little to no depressive symptoms in the years following the birth of a child, as much of the past research implies. However, this conclusion is faulty and fails to uncover the experience of the majority of women in this and other samples.

Being able to identify and understand the many distinct patterns of depressive symptoms over time holds powerful implications for the development of psychological practices and interventions aimed at assessing and reducing the risk for maternal depression across the transition to parenthood. For example, the results of this study indicate the need for frequent...
assessment of symptoms throughout the transition to parenthood that begins during pregnancy. If depression is assumed to decrease following the birth of a child, providers may be less likely to assess for or recognize possible cases of maternal depression in the following years. Also, the results indicate a need for interventions aimed at reducing symptoms of depression beginning in pregnancy because many women will not experience a decrease in symptoms following the birth of a child. Additionally, health care workers cannot assume that women will not experience later depression if they don’t experience depression during pregnancy, as a small subset of women have increasing symptoms over time (sometimes even reaching clinical levels after birth in the absence of prenatal symptoms). In sum, person-centered analyses provide important information above and beyond variable-centered analyses that holds powerful implications for those concerned with maternal depression across the transition to parenthood.

Trajectories of Maternal Depressive Symptoms and Relations with Infant Affect Expression

Hypothesis 2 stated that trajectories of maternal depressive symptoms would have differential effects on infant affect expression at 1 and 2 years postpartum. More specifically, trajectories characterized by consistently high or increasing levels of maternal depressive symptoms would be related to generally negative affect expression in infants at 1 and 2 years postpartum, whereas trajectories characterized by consistently low or decreasing levels of maternal depressive symptoms would be related to generally positive affect expression in infants at 1 and 2 years postpartum. Unexpectedly, results revealed no differences between trajectory groups on infant affect at age 1 or age 2 at the subscale or composite level. Although there has not been much research examining depression trajectories and infant outcomes, one relevant recent study (Vanska et al., 2011) examined trajectories of self-reported maternal mental health
(depression, anxiety, sleeping difficulties, and social dysfunction) from pregnancy through 1 year postpartum and the effects of these trajectories on infant health and development. They uncovered five distinct trajectories of mental health profiles: stable-low (75%), prenatal (7%), early postpartum (9%), late postpartum (6%), and chronic high (5%). The women in the prenatal class reported the highest number of symptoms during pregnancy, the women in the early postpartum class reported a high amount of symptoms at 2 months postpartum but little to no symptoms during pregnancy or at 1 year postpartum, and the late postpartum group reported few symptoms during pregnancy and at 2 months postpartum but reported a high level of symptoms at 1 year postpartum.

In terms of infant outcomes, Vanska and colleagues reported that the trajectory classes differed in terms of mother-reported infant internalizing, but not externalizing, problems such that children of mothers in the early postpartum and chronic high classes were reported to have more internalizing problems when compared to the children of mothers in the other trajectory classes. These results suggest that different trajectories of maternal mental health symptoms from pregnancy through 1 year postpartum have an impact on child emotionality; however, this study did not focus solely on depressive symptoms, and the researchers obtained a maternal report of child emotional problems. In contrast, the present study focused only on depressive symptoms and used an objective report of infant affect expression.

Similar to the present study, Campbell and colleagues (2007) focused on trajectories of maternal depressive symptoms specifically, but from 1 to 7 years following the birth of a child. However, unlike the present study, the researchers examined associations with child emotionality as reported by the mother. This study found that mothers with depressive symptom trajectories characterized by increasing, decreasing, or stable-high patterns reported more internalizing and
externalizing symptoms in their 7-year-old children. These results are somewhat similar to those of Vanska and colleagues and also suggest that different trajectories of maternal depressive symptoms across a longer time period (1 to 7 years postpartum) have an impact on child emotionality, as reported by the mother. Unlike the present study, Campbell and colleagues did not include symptoms during pregnancy, and the researchers relied on maternal report of child emotional problems. Thus, the present study is the first known study to examine the relationship between trajectories of maternal depressive symptoms beginning in pregnancy and extending across 2 years postpartum and objective observations of infant affect expression.

There are a few possible explanations for why maternal depressive symptom trajectories were not found to be related to infant affect expression in the present study. One is that the sample size and resulting low number of participants in each trajectory class could have resulted in power issues. It may be that there were not enough participants in some of the groups (e.g., only 7 women in the increasing group) to detect differences. Another possibility is that the 10-minute free-play interaction videos that were used to obtain infant affect codes did not provide a large enough sample of the infant’s affect to accurately reflect their true level of affective expression. For example, it is possible that longer periods of time or the combination of more varied tasks designed to elicit certain emotional responses would have uncovered a wider and more accurate affective repertoire in the children. Furthermore, it may be more beneficial to observe children on more than one occasion on different days at each wave to obtain a larger sample of behaviors.

Also, the task used was an unstructured free-play interaction with very interesting, novel toys brought by the researchers. Given that the families in this sample were mostly economically disadvantaged, the standard set of toys used to conduct the play interactions may have created a
scenario where the children behaved differently than is typical. Anecdotally, the researchers often noted that the children in this study were highly engaged with and focused on the toys, which is partially reflected by the higher rates of positive affect and relatively lower rates of negative affect observed in this sample during the play task. The high-risk nature of this sample may have also impacted the lack of associations between maternal depressive symptoms and infant affect. Although past literature suggests that maternal depression can lead to problematic infant emotional development, there are many other experiences in high-risk families that lead to problematic child development such as dangerous living situations, overall household and neighborhood chaos, and limited financial resources. Therefore, it could be difficult to tease out the impact of maternal depression on infant affect expression amidst other concurrent risk factors.

The lack of expected findings may also have something to do with the way affect was coded in the present study, in that the coding scheme primarily focused on what the child was doing. More specifically, the individual (not shared) affect codes were influenced by how the child played with the toys in addition to how the child interacted with the mother. For example, a child of a depressed mother who happily played with the toys and expressed a lot of positive affect and little negative affect while engaged with the toys would have received higher positive affect scores regardless of how much or little the child interacted with the mother. In other words, the novelty of the toys, coupled with the relative poverty of the environment in many of these families, may have created a situation where a child who typically does not express much positive affect may have been more positive and engaged than usual. Although this explanation may explain the absence of associations between trajectories and some of the infant codes, the shared affect codes did measure how the mother and child interacted together (i.e., those were
less influenced by engagement with toys per se). In this case, the trajectories of maternal depressive symptoms were still not found to be associated with the shared affect codes.

Last, the lack of findings between maternal depressive symptom trajectories and infant affect expression could, in fact, indicate no real associations. That is, there could be no differences in infant affect expression, as measured using observational methods, between groups of mothers reporting different courses of depressive symptoms across the transition to motherhood; however, this seems unlikely given the consistent findings in past research that has demonstrated that infants of mothers reporting depressive symptoms show less positive and more negative affect during interactions with their mothers (Feldman et al., 2009; Hart et al., 1998).

Strengths

Despite the unexpected lack of findings regarding associations between depressive symptom trajectories and infant affect, the present study has many strengths worth noting. First, this study was the first known study to use a person-centered approach to examine maternal depressive symptoms across the transition to parenthood beginning in pregnancy. The use of a person-centered analytic technique allowed for the examination of important inter-individual differences within the sample that would not have been detected in variable-centered analyses. The field of developmental psychology is heavily centered on the study of change and growth, as well as the identification and study of developmental pathways (Muthen & Muthen, 2000; Nesselroade, 1991). Thus, the person-centered approach is an important framework that is gaining popularity due to the multifaceted nature of many psychological constructs of interest such as maternal depression. Second, the longitudinal nature of the present study allowed for an examination of trajectories of maternal depressive symptoms across four time points, beginning in pregnancy and lasting through the transition to parenthood. Few studies examining the effects
of maternal depression on infant emotional development begin during pregnancy, which is a very important and influential time for later child development. For instance, research has shown that depression during pregnancy is linked to premature birth, low birth weight, and delayed fetal growth, as well as physiological profiles of high levels of dopamine and norepinephrine in infants that are similar to those of adults with depression (Diego et al., 2009; Diego et al., 2004; Field et al., 2010; O’Hara, 2009).

Third, the sample for the present study is unique in that it is composed of predominantly economically disadvantaged women who are diverse in terms of race and ethnicity. Many other studies in this area, such as the study by Vanska and colleagues (2011) on maternal mental health symptom trajectories and infant emotion outcomes, were done using predominantly Caucasian, middle class families. Similarly, the studies by Campbell and colleagues (2007) and Wu and colleagues (2011) on maternal depressive symptom trajectories and infant, or child development more broadly, also used mostly Caucasian, middle class women and their children. It is important to focus on high-risk samples because these mothers tend to have higher rates of depression and be in greater need of services than women who are classified as lower risk (Blazer, Kessler, McGonagle, & Swartz, 1994). More research is needed with high-risk samples in order to inform interventions for the populations who need them the most.

**Limitations**

Some limitations are also evident in the present study. First, the sample size was relatively small, which restricts the number of possible trajectories that can be detected and limits statistical power. As mentioned previously, although there are no firm sample size requirements for conducting latent class growth analysis, samples must be large enough to allow for groups composed of at least 1% of a population. When doing trajectory analyses that aim to
parse participants into defined groups, smaller samples result in smaller groups, which may impede the ability to detect differences between groups. No extracted class contained less than 6% of the sample in the present study; however, it is still possible that between-group differences were not detected due to statistical power. Second, the very small window of observation of infant affect (10 minutes) in a single context (free-play) on a single occasion may have not been sufficient to gather the data needed to detect differences in the affective profiles of children with mothers reporting different trajectories of depressive symptoms across time. More than one assessment for longer periods of time may be necessary, along with the addition of different paradigms that are specifically designed to elicit affective responses such as those in the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, & Prescott, 1995). Administering the Lab-TAB was out of the scope of the present study as it requires a strict protocol within a laboratory setting, whereas the present study conducted home-based interviews. Third, due to the episodic nature of depression, more frequent assessment of depressive symptoms may be preferable. Assessing depressive symptoms every 9-12 months, as was the case in this study, may not be sufficient to accurately detect changes in levels of depressive symptoms across time, particularly since most depression questionnaires assess only a short, recent time frame, such as the last 2 to 4 weeks.

**Future Directions**

Despite some important findings in the present study about depressive symptom trajectories, there were some shortcomings that could be improved upon in future research. First, it is important for future research to continue to focus on longitudinal, person-centered analyses to capture inter-individual differences in change processes. Second, it will be important to replicate this study in a larger sample to see if other trajectories can be detected, such as a stable
high trajectory that has been identified by other studies with larger samples. Furthermore, a larger sample would allow for greater statistical power and may aid in the detection of differences between groups on infant affect expression and other important child outcomes. It would also be important to explore other methods of measurement. For example, maternal reports of infant emotionality may be useful, although subject to same-informant bias (i.e., the mother would be asked to report on both her own symptoms of depression and her child’s emotionality). Perhaps the mother’s perceptions of her child’s emotionality differ by depression course and severity. Alternatively, it may be that observational methods are sufficient, and perhaps even preferred, if an emotion-eliciting task is used to set the stage for the observation of infant affect. It could be that infants of depressed mothers are more likely to express more negative (i.e., fussing, whining) or more blunted (i.e., flat, withdrawn) emotional responses when faced with an emotion-eliciting task, such as the Lab-TAB tasks. Third, an examination of the effects of depressive symptoms in other caregivers (e.g., fathers) on infant affect expression would also add to the field. It may be that infants with one depressed caregiver will develop more typically as long as they have one non-depressed caregiver.

**Conclusion**

The present study used a person-centered approach to identify maternal depressive symptom trajectories beginning in pregnancy across the transition to parenthood and to examine the influence of different courses of depressive symptoms on infant affect expression. Four distinct trajectories of maternal depressive symptoms were found: stable-low, stable-moderate, increasing, and decreasing. Despite an overall decreasing pattern for the sample as a whole, the majority of women (88%) experienced courses of depressive symptoms other than a decreasing pattern across the transition to parenthood. A few other studies have also found that a majority of
women follow a stable-low or stable-moderate course across time when trajectories are examined throughout the postpartum period. However, this is the first study to do a person-centered analysis of maternal depressive symptom trajectories beginning in pregnancy in relation to infant affect outcomes. Although trajectories were not related to infant affect at age 1 or age 2, as measured in the current study, it is clear that subgroups of mothers experience distinct courses of depressive symptoms during the transition to parenthood. Future studies using multiple methods of measuring infant affect and emotionality should be conducted in order to understand how trajectories of depression, as well as other types of caregiver psychopathology, are associated with infant affect development. This type of work is needed to further understand the links between parental mental health over time and child outcomes. Results from such studies will have important implications for intervention efforts concerned with reducing the effects of parental mental health problems on child emotional well-being.
References


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Appendix A: Recruitment Flyer

Eastern Michigan University’s PARENTING PROJECT

Looking for PREGNANT WOMEN to participate in a research study about:

- Experiences during pregnancy
- Other life experiences
- Women’s health

***Participants will be given GIFT CARD and/or CASH after completion of interview***

INTERESTED? CONTACT 734-487-2238
Appendix B: Phone script for participant intake

**PHONE SCRIPT FOR INTAKE FORM**

Thank you for your interest in the Parenting Project. You are being asked to participate in a research study about women’s experiences during and after pregnancy, as well as how these experiences influence mothers and babies after birth. This research will help psychologists and other health service workers better understand mothers’ and babies’ well-being during the transition to parenthood.

As part of this study, you will be asked to fill out a number of questionnaires during your last trimester of pregnancy; these questionnaires will ask you about a variety of experiences including your experiences during pregnancy, other important life events, and your overall health. In order to protect your confidentiality, you will be assigned an identification number, which will be used instead of your name, on all of your questionnaires and interviews.

The entire procedure will last approximately 2 ½ to 3 hours. At the end of this interview, we will ask your permission to stay in contact with you so that we may see how you and your baby are doing around 3 months and 1 year after birth. These follow-up interviews will take approximately 30-45 minutes at 3 months and 2 ½ to 3 hours at 1 year.

Your participation in this study is completely voluntary. You may refuse to answer any questions and may choose to withdraw from the study at any time with no penalty or negative consequences.

In order to complete the interview, you may choose to come to Eastern Michigan University’s campus, or a research assistant on the project would be willing to come to your home. In return for your participation in the pregnancy interview, you will be given a $25 Target gift card, and a gift card, baby gift, or cash will be given for any follow-up interviews.

Do I have your verbal consent to continue and gather some basic information about you to determine your eligibility in this study?

If “yes,” complete the intake form.
If “no,” thank individual for calling and for their interest in the study.
Appendix C: Written Informed Consent Agreement – Pregnancy Interview

The EMU Parenting Project

Investigator: Alissa Huth-Bocks, Ph.D.

WRITTEN INFORMED CONSENT AGREEMENT
(Pregnancy Interview)

Description of the Research Study:
You are being asked to participate in a research study about women’s experiences during and after pregnancy, as well as how these experiences influence mothers and babies after birth. This research will help psychologists and other health service workers better understand mothers’ and babies’ well-being during the transition to parenthood.

As part of this study, you will be asked to fill out a number of questionnaires during your last trimester of pregnancy; these questionnaires will ask you about a variety of experiences including childhood experiences, current relationships, your mental health, important life events, and social support. You will also be interviewed about your feelings about your pregnancy, motherhood, and your infant; this interview will be audio-recorded so that research assistants may better understand your responses at a later date. The entire procedure will last approximately 2 ½ to 3 hours. At the end of this interview, we will ask your permission to stay in contact with you so that we may see how you and your baby are doing around 3 months and 1 year after birth. These follow-up interviews will take approximately 30-45 minutes at 3 months and 2 ½ to 3 hours at 1 year.

Participation is Voluntary:
Your participation in this study is completely voluntary. You may refuse to answer any questions and may choose to withdraw from the study at any time with no penalty or negative consequences. You will be informed if significant new findings develop during the course of this research that may impact your willingness to continue in the study.

Confidentiality:
You will be assigned an identification number, which will be used instead of your name, on all of your questionnaires and interviews to protect your confidentiality. Your name or other identifying information will never be placed on any of your materials so that your responses will be kept completely private. All responses will be stored in a locked research office which is located in a locked hallway of our building. Similarly, audio- and video-tapes will be placed in a locked cabinet in the same locked office immediately after the interview is completed to ensure confidentiality of these data. A log of names and identification numbers will be locked in a separate cabinet in a separate office; only the principal investigator and project managers will have access to this log. Results from the study will only be reported or published about groups of participants at professional conferences or through publications in scientific journals;
individual responses will never be reported. Individual audio- or video-tapes will never be disseminated.

If, during the course of the interview, project staff learns that your safety is in jeopardy, we may be required to seek outside help in order to keep you safe. If we learn that your infant’s safety is in danger, we are required to make a report to Child Protective Services. These are the only exceptions to complete confidentiality.

**Risks and Benefits to Participation:**

There are no known or anticipated risks from participating in this study. However, some participants may find answering certain questions uncomfortable or distressing. If you experience any distress, project staff will help direct you to appropriate referrals in the community. All women will be given a comprehensive list of referrals that are designed for mothers and young children at the end of the interview.

Your participation in this study will help researchers better understand the unique experiences that women and babies go through during and after pregnancy. Some participants will find discussing these important life events with project staff relieving and enjoyable. You will be given a $25.00 Target gift card at the end of this interview, and if you choose to participate in future interviews, you will be compensated with gifts, gift cards, or cash.

**Future Questions:**

If, at any time, you have questions or concerns about study procedures or your participation in the study, please contact the principal investigator, Dr. Alissa Huth-Bocks, at (734) 487-0112 or ahuthboc@emich.edu.

**Human Subjects Review:**

This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee for use from 9/26/08 to 9/26/09. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu).

**CONSENT TO PARTICIPATE:** I understand my rights as a research participant and I voluntarily consent to participate in this study. I understand the purpose and procedures of the study. I will receive a copy of this consent form for my future reference.

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<th>Participant Signature</th>
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<th>Witness Signature</th>
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Appendix D: Written Informed Consent Agreement – 3-month Telephone Interview

The EMU Parenting Project

Investigator: Alissa Huth-Bocks, Ph.D.

WRITTEN INFORMED CONSENT AGREEMENT
(3-month telephone interview)

Description of the Research Study:

Thank you for participating in the first parts of our study. As you know, you are being asked to continue participating in this research study about women’s experiences during and after pregnancy, as well as how these experiences influence mothers and babies after birth. This research will help psychologists and other health service workers better understand mothers’ and babies’ well-being during the transition to parenthood.

During this interview on the phone today, we will ask you a number of questions about your health during pregnancy and the delivery, as well as how you and your infant have been going since birth. This interview will take approximately 30-45 minutes. At the end of the interview, we will ask your permission to stay in contact with you so that we may see how you and your baby are doing around your child’s first birthday. The interview at that time will include both you and your baby and will take about 2 ½ to 3 hours.

Participation is Voluntary:

Your participation in this study is completely voluntary. You may refuse to any questions and may choose to withdraw from the study at any time with no penalty or negative consequences. You will be informed if significant new findings develop during the course of this research that may impact your willingness to continue in the study.

Confidentiality:

As a reminder, your name or other identifying information will never be placed on any of your questionnaires so that your responses will be kept completely private. All responses will be stored in a locked cabinets in a locked research office. A log of names and identification numbers will be locked in a separate cabinet in a separate office; only the principal investigator and project managers will have access to this log. Results from the study will only be reported or published about groups of participants at professional conferences or through publications in scientific journals; individual responses will never be reported. Individual audio- or video-tapes will never be disseminated.

If, during the course of the interview, project staff learns that you may seriously harm yourself, we may be required to seek outside help in order to keep you safe. If we learn that your
current children’s safety is in danger, we are required to make a report to Child Protective Services. These are the only exceptions to complete confidentiality.

**Risks and Benefits to Participation:**

There are no known or anticipated risks from participating in this study. However, some participants may find answering certain questions uncomfortable or distressing. If you experience any distress, project staff will help direct you to appropriate referrals in the community.

Your participation in this study will help researchers better understand the unique experiences that women and babies go through during and after pregnancy. Some participants will find discussing these important life events with project staff relieving and enjoyable. You will be sent a $10 gift card at the end of this interview, and if you choose to participate in future interviews, you will be compensated with gifts, gift cards, or cash.

**Future Questions:**

If, at any time, you have questions or concerns about study procedures or your participation in the study, please contact the principal investigator, Dr. Alissa Huth-Bocks, at (734) 487-0112 or ahuthboc@emich.edu.

**Human Subjects Review:**

This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee for use from 9/26/08 to 9/26/09. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu).

CONSENT TO PARTICIPATE: I understand my rights and my baby’s rights as a research participant and I voluntarily consent for both my baby and I to participate in this study. I understand the purpose and procedures of the study. I will receive a copy of this consent form for my future reference.

Participant Name

Date

Witness Signature

Date
Description of the Research Study:
Thank you for participating in the first parts of our study. As you know, you are being asked to continue participating in this research study about women’s experiences during and after pregnancy, as well as how these experiences influence mothers and babies after birth. This research will help psychologists and other health service workers better understand mothers’ and babies’ well-being during the transition to parenthood.

During this interview today, we will ask you and your baby to play together for about 12 minutes with some toys that we have brought. This part of the interview will be video-taped so that only research staff can view it at a later time. Then, you will be given a number of questionnaires about your experiences since the last interview and about your baby; many of these questionnaires will be the same ones you filled out earlier, but some of them will be new to you. This interview will take approximately 2 ½ to 3 hours. While this is the last interview we have planned for the study at this time, it is possible that we may continue the study at some point in the future. At the end of the interview, we will ask if you are willing to have us contact you in the future if the study does continue at some point.

Participation is Voluntary: Your and your baby’s participation in this study is completely voluntary. You may refuse to complete any part of the interview and may choose to withdraw from the study at any time with no penalty or negative consequences. You will be informed if significant new findings develop during the course of this research that may impact your willingness to continue in the study.

Confidentiality: As a reminder, your name or other identifying information will never be placed on any of your questionnaires so that your responses will be kept completely private. All responses will be stored in a locked research office which is located in a locked hallway of our building. Similarly, audio- and video-tapes will be placed in a locked cabinet in the same locked office immediately after the interview is completed to ensure confidentiality of these data. A log of names and identification numbers will be locked in a separate cabinet in a separate office; only the principal investigator and project managers will have access to this log. Results from the study will only be reported or published about groups of participants at professional conferences or through publications in scientific journals; individual responses will never be reported. Individual audio- or video-tapes will never be disseminated.

If, during the course of the interview, project staff learns that you may seriously harm yourself, we may be required to seek outside help in order to keep you safe. If we learn that your current
children’s safety is in danger, we are required to make a report to Child Protective Services. These are the only exceptions to complete confidentiality. We do not report domestic abuse.

**Risks and Benefits to Participation:**
There are no known or anticipated risks from participating in this study. However, some participants may find answering certain questions uncomfortable or distressing. If you experience any distress, project staff will help direct you to appropriate referrals in the community. All women will be given a comprehensive list of referrals that are designed for mothers and young children at the end of the interview.

Your participation in this study will help researchers better understand the unique experiences that women and babies go through during and after pregnancy. Some participants will find discussing these important life events with project staff relieving and enjoyable. You will be given a baby gift and $50.00 at the end of this interview.

**Future Questions:**
If, at any time, you have questions or concerns about study procedures or your participation in the study, please contact the principal investigator, Dr. Alissa Huth-Bocks, at (734) 487-2238 or ahuthboc@emich.edu.

**Human Subjects Review:**
This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee for use from 9/26/09 to 9/26/10. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu).

CONSENT TO PARTICIPATE: I understand my rights and my baby’s rights as a research participant and I voluntarily consent for both my baby and I to participate in this study. I understand the purpose and procedures of the study. I will receive a copy of this consent form for my future reference.

_____________________________  __________________________
Participant Signature          Date

_____________________________
Participant Name

_____________________________  __________________________
Witness Signature              Date
Appendix F: Written Informed Consent Agreement – 2-year Interview

**The EMU Parenting Project**
Investigator: Alissa Huth-Bocks, Ph.D.

**WRITTEN INFORMED CONSENT AGREEMENT**
(2 year Interview)

**Description of the Research Study:**
Thank you for participating in the first parts of our study. As you know, you are being asked to continue participating in this research study about women’s experiences during and after pregnancy, as well as how these experiences influence mothers and babies after birth. This research will help psychologists and other health service workers better understand mothers’ and babies’ well-being during the transition to parenthood.

During this interview today, we will ask you a number of questions about your child and we will ask you and your child to play together for about 12 minutes with some toys that we have brought. These parts of the interview will be audio- and/or video-taped so that only research staff can view them at a later time. Then, you will be given a number of questionnaires about your experiences since the last interview and about your child; many of these questionnaires will be the same ones you filled out earlier, but some of them will be new to you. This interview will take approximately 3 hours. While this is the last interview we have planned for the study at this time, it is possible that we may continue the study at some point in the future. At the end of the interview, we will ask if you are willing to have us contact you in the future if the study does continue at some point.

**Participation is Voluntary:**
Your and your child’s participation in this study is completely voluntary. You may refuse to complete any part of the interview and may choose to withdraw from the study at any time with no penalty or negative consequences. You will be informed if significant new findings develop during the course of this research that may impact your willingness to continue in the study.

**Confidentiality:**
As a reminder, your name or other identifying information will never be placed on any of your questionnaires so that your responses will be kept completely private. All responses will be stored in a locked research office which is located in a locked hallway of our building. Similarly, audio- and video-tapes will be placed in a locked cabinet in the same locked office immediately after the interview is completed to ensure confidentiality of these data. A log of names and identification numbers will be locked in a cabinet in a separate office; only the principal investigator and project managers will have access to this log. Results from the study will only be reported or published about *groups* of participants at professional conferences or through publications in scientific journals; individual responses will never be reported. Individual audio- or video-tapes will never be disseminated.

If, during the course of the interview, project staff learns that you may seriously harm yourself, we may be required to seek outside help in order to keep you safe. If we learn that your current
children’s safety is in danger, we are required to make a report to Child Protective Services. These are the only exceptions to complete confidentiality. We do not report domestic abuse.

**Risks and Benefits to Participation:**
There are no known or anticipated risks from participating in this study. However, some participants may find answering certain questions uncomfortable or distressing. If you experience any distress, project staff will help direct you to appropriate referrals in the community. All women will be given a comprehensive list of referrals that are designed for mothers and young children at the end of the interview.

Your participation in this study will help researchers better understand the unique experiences that women and young children go through during and after pregnancy. Some participants will find discussing these important life events with project staff relieving and enjoyable. You will be given a baby gift, $40 cash, and a $10 Target gift card at the end of this interview.

**Future Questions:**
If, at any time, you have questions or concerns about study procedures or your participation in the study, please contact the principal investigator, Dr. Alissa Huth-Bocks, at (734) 487-0112 or ahuthboc@emich.edu.

**Human Subjects Review:**
This research protocol and informed consent document has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee for use from 12/16/10 to 12/15/11. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu).”

CONSENT TO PARTICIPATE: I understand my rights and my child’s rights as a research participant and I voluntarily consent for both my child and I to participate in this study. I understand the purpose and procedures of the study. I will receive a copy of this consent form for my future reference.

Participant Signature  
Date

Participant Name

Witness Signature  
Date
Appendix G: Edinburgh Postpartum Depression Scale (EPDS)

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

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

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

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

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

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

6. Things have been getting on top of me
   - Yes, most of the time I haven’t been able to cope at all
   - Yes, sometimes I haven’t been coping as well as usual
   - No, most of the time I have coped quite well
   - No, I have been coping as well as ever
7. I have been so unhappy that I have had difficulty sleeping
   □ Yes, most of the time
   □ Yes, sometimes
   □ Not very often
   □ No, not at all

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

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

10. The thought of harming myself has occurred to me
    □ Yes, quite often
    □ Sometimes
    □ Hardly ever
    □ Never
Appendix H: Beck Depression Inventory-II (BDI)

INSTRUCTIONS: This questionnaire consists of 21 statements. After you read each one, please pick out the one statement in each group that best describes the way you’ve been feeling during the past 2 weeks, including today. Note: If 2 statements apply equally well, circle the highest number for that group.

1.

0 I do not feel sad.
1 I feel sad much of the time.
2 I am sad all of the time.
3 I am so sad or unhappy that I can’t stand it.

2.

0 I am not discouraged about my future.
1 I feel more discouraged about my future than I used to be.
2 I do not expect things to work out for me.
3 I feel my future is hopeless and will only get worse.

3.

0 I do not feel like a failure.
1 I have failed more than I should have.
2 As I look back, I see a lot of failures.
3 I feel I am a total failure as a person.

4.

0 I get as much pleasure as I ever did from the things I enjoy.
1 I don’t enjoy things as much as I used to.
2 I get very little pleasure from the things I used to enjoy.
3 I can’t get any pleasure from the things I used to enjoy.

5.

0 I don’t feel particularly guilty.
1 I feel guilty over many things I have done or should have done.
2 I feel quite guilty most of the time.
3 I feel guilty all of the time.

6.

0 I don’t feel I am being punished.
1 I feel I may be punished.
2 I expect to be punished.
3 I feel I am being punished.

7.

0 I feel the same about myself as ever.
1 I have lost confidence in myself.
2 I am disappointed in myself.
3 I dislike myself.
8. 0 I don’t criticize or blame myself more than usual.
   1 I am more critical of myself than I used to be.
   2 I criticize myself for all of my faults.
   3 I blame myself for everything bad that happens.

9. 0 I don’t have any thoughts of killing myself.
   1 I have thoughts of killing myself, but I would not carry them out.
   2 I would like to kill myself.
   3 I would kill myself if I had the chance.

10. 0 I don’t cry anymore than I used to.
     1 I cry more than I used to.
     2 I cry over every little thing.
     3 I feel like crying, but I can’t.

11. 0 I am no more restless or wound up than usual.
     1 I feel more restless or wound up than usual.
     2 I am so restless or agitated that it’s hard to stay still.
     3 I am so restless or agitated that I have to keep moving or doing something.

12. 0 I have not lost interest in other people or activities.
     1 I am less interested in other people or things than before.
     2 I have lost most of my interest in other people or things.
     3 It’s hard to get interested in anything.

13. 0 I make decisions about as well as ever.
     1 I find it more difficult to make decisions than usual.
     2 I have much greater difficulty in making decisions than I used to.
     3 I have trouble making any decisions.

14. 0 I do not feel I am worthless.
     1 I don’t consider myself as worthwhile and useful as I used to.
     2 I feel more worthless as compared to other people.
     3 I feel utterly worthless.

15. 0 I have as much energy as ever.
     1 I have less energy than I used to have.
     2 I don’t have enough energy to do very much.
     3 I don’t have enough energy to do anything.
16. I have not experienced any change in my sleeping pattern.

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<tr>
<td>0</td>
<td>I have not experienced any change in my sleeping pattern.</td>
</tr>
<tr>
<td>1a</td>
<td>I sleep somewhat more than usual.</td>
</tr>
<tr>
<td>1b</td>
<td>I sleep somewhat less than usual.</td>
</tr>
<tr>
<td>2a</td>
<td>I sleep a lot more than usual.</td>
</tr>
<tr>
<td>2b</td>
<td>I sleep a lot less than usual.</td>
</tr>
<tr>
<td>3a</td>
<td>I sleep most of the day.</td>
</tr>
<tr>
<td>3b</td>
<td>I wake up 1-2 hours early and can’t get back to sleep.</td>
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17. I am no more irritable than usual.

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<tr>
<td>0</td>
<td>I am no more irritable than usual.</td>
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<tr>
<td>1</td>
<td>I am more irritable than usual.</td>
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<tr>
<td>2</td>
<td>I am much more irritable than usual.</td>
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<tr>
<td>3</td>
<td>I am irritable all the time.</td>
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18. I have not experienced any change in my appetite.

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<td>0</td>
<td>I have not experienced any change in my appetite.</td>
</tr>
<tr>
<td>1a</td>
<td>My appetite is somewhat less than usual.</td>
</tr>
<tr>
<td>1b</td>
<td>My appetite is somewhat greater than usual.</td>
</tr>
<tr>
<td>2a</td>
<td>My appetite is much less than before.</td>
</tr>
<tr>
<td>2b</td>
<td>My appetite is much greater than usual.</td>
</tr>
<tr>
<td>3a</td>
<td>I have no appetite at all.</td>
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<tr>
<td>3b</td>
<td>I crave food all the time.</td>
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19. I can concentrate as well as ever.

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<td>0</td>
<td>I can concentrate as well as ever.</td>
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<tr>
<td>1</td>
<td>I can’t concentrate as well as usual.</td>
</tr>
<tr>
<td>2</td>
<td>It’s hard to keep my mind on anything for very long.</td>
</tr>
<tr>
<td>3</td>
<td>I find I can’t concentrate on anything.</td>
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20. I am no more tired or fatigued than usual.

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<tr>
<td>0</td>
<td>I am no more tired or fatigued than usual.</td>
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<tr>
<td>1</td>
<td>I get more tired or fatigued more easily than usual.</td>
</tr>
<tr>
<td>2</td>
<td>I am too tired or fatigued to do a lot of the things I used to do.</td>
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<tr>
<td>3</td>
<td>I am too tired or fatigued to do most of the things I used to do.</td>
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21. I have not noticed any recent change in my interest in sex.

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<td>0</td>
<td>I have not noticed any recent change in my interest in sex.</td>
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<tr>
<td>1</td>
<td>I am less interested in sex than I used to be.</td>
</tr>
<tr>
<td>2</td>
<td>I am much less interested in sex now.</td>
</tr>
<tr>
<td>3</td>
<td>I have lost interest in sex completely.</td>
</tr>
</tbody>
</table>