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ARTICLE



Maternal Stress: The First 14 Months Postpartum

Sarah E. Maylott , Zabin Patel-Syed , Mendel Lebowitz , Tiffany S. Leung,
and Elizabeth A. Simpson 

SYNOPSIS

Objective. Maternal stress is a psychological response to the demands of motherhood. A high level of maternal stress is a risk factor for maternal mental health problems, including depression and anxiety, as well as adverse infant socioemotional and cognitive outcomes. Yet, levels of maternal stress (i.e., levels of stress related to parenting) among low-risk samples are rarely studied longitudinally, particularly in the first year after birth.

Design. We measured maternal stress in an ethnically diverse sample of low-risk, healthy U.S. mothers of healthy infants ($N = 143$) living in South Florida across six time points between 2 weeks and 14 months postpartum using the Parenting Stress Index-Short Form, capturing stress related to the mother, mother-infant interactions, and the infant. **Results.** Maternal distress increased as infants aged for mothers with more than one child, but not for first-time mothers whose distress levels remained low and stable across this period. Stress related to mother-infant dysfunctional interactions lessened over the first 8 months. Mothers' stress about their infants' difficulties decreased from 2 weeks to 6 months, and subsequently increased from 6 to 14 months. **Conclusions.** Our findings suggest that maternal stress is dynamic across the first year after birth. The current study adds to our understanding of typical developmental patterns in early motherhood and identifies potential domains and time points as targets for future interventions.

INTRODUCTION

Maternal stress—a psychological response to the demands of motherhood (Bornstein, 2019)—is theorized to be elevated when there are inadequate resources to meet parenting demands (Abidin, 1995). Elevation in parenting stress is associated with more negative maternal and infant outcomes (Crnic & Coburn, 2019). Mothers with higher levels of stress are at greater risk of having mental health problems, including depression and anxiety (Misri et al., 2010), and are more likely to have lower maternal self-efficacy and parenting competence than mothers with lower stress levels (Jackson & Huang, 2000). Furthermore, elevated maternal stress levels are associated with adverse infant socioemotional and cognitive outcomes (Azhari et al., 2019; de Cock et al.,

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2017; Kinsey et al., 2014). Yet, few studies have explored typical patterns of stress during the first year of parenthood (Mughal et al., 2018). Understanding parenting stress in a low-risk, healthy sample (e.g., adult mothers of full-term and typically developing infants with adequate socioeconomic resources and no major birth complications or health issues)—hereafter referred to as low-risk maternal stress—may help to better support families through the challenging period of child development.

Mothers who identify as an ethnic minority are likely to experience systemic inequalities and racial discrimination (Hassoun Ayoub et al., *in press*; Thiede et al., 2021), which may contribute to their increased likelihood of experiencing higher stress levels during pregnancy than Non-Latina White mothers (Robinson et al., 2016). Yet, few studies have examined maternal stress in low-risk ethnic minorities in the first year of motherhood (Barroso et al., 2016; Cardoso et al., 2010; Horowitz & Damato, 1999; Huang et al., 2019; Robinson et al., 2016), with most research focusing on predominantly White or high-risk samples (e.g., adolescent mothers, low-income mothers, mothers of preterm infants, and mothers of children with behavior challenges; BeLue et al., 2015; Huang et al., 2019; Keim et al., 2011). Ensuring healthy maternal well-being is important to the healthy development of the infant; therefore, the limited information about patterns of low-risk maternal stress is troubling.

Previous research offers a broad perspective of early maternal stress in low-risk populations (for a review of studies, see Table 1). However, with only one or two measurements falling in the first postnatal year, this broad viewpoint overlooks potentially rapid and nonlinear fluctuations in maternal stress. Furthermore, measuring maternal stress across wide time spans may explain some apparently contradictory findings among previous longitudinal studies of parenting stress. For example, one study—across three time points—reported a linear increase in parenting stress from 9 to 36 months postpartum (Crnic & Booth, 1991). Yet, another study—across five time points—found that parenting stress was higher at 1 and 6 months, but lower and stable from 15 to 36 months (Mulsow et al., 2002). These divergent findings could be attributed to the addition of two early time points in the latter study, which may have captured more variability in parenting stress trajectories over time. Study designs that include more frequent measurements across a narrower range of time can more accurately capture variability in maternal stress (Holditch-Davis et al., 2009).

We theorized that maternal stress may undergo significant changes in the first year after birth because this transformative time is marked by substantive and rapid developmental changes in both infants and their families (Franklin & Volk, 2018; Walle, 2016). Infants gain a vast amount of knowledge as they engage in socioemotional interactions, develop fine and gross motor skills, and begin to understand and produce language (Arterberry & Bornstein, 2023; Walle, 2016). Furthermore, mothers undergo many changes that aid in positive maternal behaviors such as increased empathy and sensitivity to their

Table 1. Prior published studies of stress in low-risk mothers.

Citation	Sample size	Mother & Infant characteristics	Ethnicity	Measure(s)	Infant Age(s) Postpartum & Number of Time Points
Horowitz and Damato (1999)	95	TD (U.S.)	44% Black, 39% White	MIT, WPL-R	6 weeks (1 time)
Lu (2006)	201	TD (Taiwan)	Not reported	PSS	6 weeks# (1 time)
Osman et al. (2014)	452	TD (Lebanon)	Not reported	PSS	8–12 weeks (1 time)
Davis et al. (2007)	247	TD (U.S.)	49% non-Hispanic White, 20% Hispanic White	PSS	2 months# (1 time)
Gray et al. (2012)	183	Preterm & full term (Australia)	91% White	PSI-SF##	4 months (1 time)
Keim et al. (2011)	358	Preterm/low birth weight & TD (U.S.)	69% White, 22% Black	PSS	4 months# (1 time)
Feinberg et al. (2009)	73	Primiparous mothers of TD (U.S.)	91% non-Hispanic White	PSI-SF##	6 months (1 time)
Oddi et al. (2013)	101	TD (U.S.)	Not reported	PSI##	8 months (1 time)
Rolle et al. (2017)	134	TD (Italy)	Not reported	PSI-SF##	12 months (1 time)
Cardoso et al. (2010)	2,998	TD (U.S.)	58% non-Hispanic Black, 27% non-Hispanic White, 15% Mexican American	Aggravation in Parenting Scale	Birth, 1 year (2 time points)
Ryan et al. (2009)	2,736	Unmarried mothers of TD (U.S.)	57% Black	PDIS-CDS	Birth, 12 months (2 time points)
Gameiro et al. (2009)	179	TD (Portugal)	Not reported	PSS	2–5 days, 8 months (2 time points)
Dipietro et al. (2008)	137	TD (U.S.)	85% Non-Hispanic White, 12% Black, 3% Asian	DSI, PSS	6 weeks, 24 months# (2 time points)
Hildingsson and Thomas (2014)	783	TD (Sweden)	Not reported	SPSQ##	2 months, 1 year# (2 time points)
Vismara et al. (2016)	181	Primiparous mothers of TD (Italy)	Not reported	PSI-SF##	3 months, 6 months (2 time points)
Crnic and Booth (1991)	79	TD mothers & fathers (U.S.)	Not reported	PDH	9–12, 18–24, & 30–36 (3 time points)
Asselmann et al. (2020)	306	TD (Germany)	Not reported	DASS-21	10 days, 2, 4, & 16 months# (4 time points)
Perren et al. (2005)	74	Primiparous mothers of TD (Switzerland)	Not reported	BELA	1, 3, 12, & 18 months# (4 time points)
Golfenshtein et al. (2017)	129	TD & infants with congenital heart disease	89% White	PSI##	3, 6, 9, & 12 months (4 time points)

(Continued)

Table 1. (Continued).

Citation	Sample size	Mother & Infant characteristics	Ethnicity	Measure(s)	Infant Age(s) Postpartum & Number of Time Points
Mughal et al. (2018)	1,983	TD (Canada)	Not reported	PSS	4 months, 1, 2, & 3 years [#] (4 time points)
Huang et al. (2019)	227	TD & adolescent mothers	61% Black; 39% Hispanic/Latina	PSI ^{##}	6, 12, 18, 24 months (4 time points)
Mulsow et al. (2002)	134	TD (U.S.)	87% White, 8% Hispanic, 6% Black	PSI ^{##} , PES	1, 6, 15, 24, & 36 months (5 time points)

Note. Studies are listed by the number of time points after birth, reported parenthetically e.g., 1, 2, or 3 time points), youngest infant age tested (chronologically), and then alphabetically by study's first author's last name. Prior published studies of stress in parents that included mothers and at least one measurement of stress within the first year postpartum. All studies with more than one time-point were longitudinal (the same parents tested over time). We included studies of high-risk samples if they had a low-risk comparison sample. Interventions were only included if there was a control group that did not receive the intervention. We only report measures of stress (no other study measures) and infant ages in which stress was measured. ^{##}Measures of parent related stress. [#]These studies also included measures of stress during pregnancy. Sample sizes report the number of mothers (or "parents" if mothers were not reported) in the control group. TD refers to typically developing infants and mothers (no reported elevated risk). Measures of parental stress included the following:

BELA: Questionnaire of Stressful Life Situations; DASS-21: Depression Anxiety Stress Scale; DSI: Daily Stress Inventory; MIT: Mother's Information Tool; PDH: Parenting Daily Hassles; PDIS-CDS: Child Development Supplement of the Panel Study of Income Dynamics; PES: Parenting Experiences Scale; PPQ: Perinatal PTSD Questionnaire; PSI-SF: Parenting Stress Index-Short Form; PSI: Parenting Stress Index; PSS: NICU: Parental Stressor Scale: Neonatal Intensive Care Unit; PSS: PBC: Parental Stress Scale: Prematurely Born Child; PSS: Perceived Stress Scale; SPSQ: Swedish Parental Stress Questionnaire; WPL-R: What Being the Parent of a Baby is Like.

infants (Boorman et al., 2019; Franklin & Volk, 2018; Thompson-Booth et al., 2014). Although prior literature examining the age-related variability in maternal stress among low-risk samples is limited, we propose that maternal and infant developmental changes occurring during the first year after birth likely coincide with changes in maternal stress. In other words, maternal stress may be more dynamic across the first year of child development than previously reported.

Moreover, parenting stress is often reported as an overall index, with few studies examining the components of stress related to the parent, the parent-child interaction, and the child (Abidin, 1995; Sidor et al., 2011; Thomason et al., 2014). Yet, interventions aimed at reducing overall levels of parenting stress often report decreases in only one of these three parenting stress domains (Kang et al., 2019; Mersky et al., 2015; Patel et al., 2022), indicating that different processes may underlie each stress domain and highlighting the importance of examining and comparing their distinct trajectories. Therefore, we also hypothesized that the three domains of parenting stress—parental distress, parent-child dysfunctional interactions, and difficult child, hereafter referred to maternal distress, mother-infant dysfunctional interactions, and difficult infant—would show unique patterns of change over time in the first year after birth.

Although not an exhaustive review, we next highlight several key developing qualities in infants, parents, and the broader support network that are theoretically relevant to each stress domain. We hypothesized non-linear patterns of change in parenting stress domains across the first year postpartum, which are driven partly by changes that occur as a result of parenthood.

Parenting Stress Domain 1: Maternal Distress

The first domain of parenting stress is *maternal distress* (i.e., parental distress), which refers to mothers' reported level of stress based on their perceived social support, partner conflicts, and life restrictions due to parenting (Abidin, 1995; Lee et al., 2016). The first year after birth is a critical time in parenting to capture maternal distress among low-risk mothers when they are often lacking consistent social support (Negron et al., 2013; Vik & DeGroot, 2021). Social support appears particularly crucial for mothers' well-being as it is linked to higher maternal efficacy and lower risk for postpartum depression (Leahy-Warren et al., 2012; Nielsen et al., 2000). Social support also tends to decline across the first 4 weeks postpartum and up to 36 months after birth (Bratter & Whitehead, 2018; Li et al., 2017). We hypothesized that mothers, who are typically burdened with most of the childcare responsibilities in the United States (Forbes et al., 2020), may feel increasing distress and isolation in their parental role across the first postnatal year.

Parenting Stress Domain 2: Mother-Infant Dysfunctional Interactions

The second domain of parenting stress is mother-infant dysfunctional interactions, which refers to mothers' evaluation of the extent to which their mother-infant interactions meet their expectations (Abidin, 1995). Mothers' feelings of dissatisfaction with their parent-child interactions may be particularly heightened in the first weeks after birth when high maternal parenting demands coexist with increased fatigue and depressed mood (Badr & Zauszniewski, 2017; Hunter et al., 2009; Kim et al., 2013). These factors can interfere with positive mother-infant interactions (King et al., 2020; Okun, 2016) but tend to improve after the newborn period (Goyal et al., 2007; Hunter et al., 2009), suggesting that mother-infant dysfunctional interactions may be fewer and/or less dysfunctional as caregiving demands, fatigue, maternal confidence, and depressive symptoms improve.

Furthermore, 1 to 3 months after birth, infants' social engagement increases, including more smiling, cooing, motor excitement, and laughter in social interactions (Addyman & Addyman, 2013; Lavelli & Fogel, 2005; Messinger et al., 2019; Murray et al., 2016), allowing for more positive maternal-infant interactions (Karreman & Riem, 2020). Based on the timing of these

maternal and infant behaviors, we hypothesized that mothers would perceive more stress related to mother-infant dysfunctional interactions in the early postpartum period that declines after the first month postpartum.

Parenting Stress Domain 3: Difficult Infant

The third domain of parenting stress is *difficult infant*, which captures mothers' assessment of how difficult their infant is to manage relative to other infants (Abidin, 1995). Mothers' perceptions of their infant's difficulty may be exacerbated by the everyday needs of the infant (e.g., feeding, changing, soothing), which can amplify mothers' fatigue and frustration (Gay et al., 2004; Hunter et al., 2009). Mothers may be more likely to report high stress levels related to their infant's difficulty in the first months after birth than later infancy as mothers adjust to these high initial parenting demands. Therefore, we hypothesized that mothers would report heightened levels of infant difficulty.

The Current Study

In the current study we tested these hypotheses and began to address the need to examine maternal stress longitudinally during this unique period of development, with more frequent measurements to uncover variability over time and identify periods when low-risk mothers may be more likely to experience elevated stress. We explored the developmental trajectories of maternal stress during the early postpartum period (2 weeks, and 2, 4, 6, 8, and 14 months after birth) in a low-risk sample of ethnically diverse mothers. We examined parenting stress longitudinally in three related, but distinct areas defined by Abidin (1995), focused on the mother, the mother-infant interaction, and the infant (Barroso et al., 2016; Reitman et al., 2002).

METHOD

Participants

We recruited 143 U.S. mothers (49% Hispanic/Latina [30% higher than the national average, but similar to the average in South Florida—Miami-Dade and Broward Counties—population: 51%]; 64% White [10% lower than the national average, and 7% lower than the South Florida average]; 19% Black [5% higher than the national average, and 5% lower than the South Florida average]; for full ethnicity and race information see Table 2) reflective of the greater South Florida population (U.S. Census Bureau, 2023a, 2023b). Participants were recruited through local events and community centers (e.g., pregnancy classes), online advertisements, and word of mouth. As

Table 2. Maternal and infant sociodemographic descriptive statistics.

		<i>n</i>	%
Relationship	Married or living with domestic partner	106	74
	Single with other adults living in the home	34	24
	Single with no one else living in the home	1	1
	Not reported	2	1
Infant Sex	Female	66	46
	Male	77	54
Birth Complications	No birth complications	106	74
	Minor birth complications	34	24
	Not reported	3	2
Parity	Primiparous (first-time parents)	62	43
	Multiparous (already parents)	76	53
	Not reported	5	3
Ethnicity	Hispanic/Latina	70	49
	Other	68	48
	Not reported	5	4
Race	White	91	64
	Black	27	19
	Asian	2	1
	Multiracial	8	6
	Unknown	6	4
	Not reported	9	6
Income	Less than \$5,000	1	1
	\$5,000–\$9,999	5	4
	\$10,000–\$19,999	5	4
	\$20,000–\$29,999	8	6
	\$30,000–\$39,999	15	10
	\$40,000–\$49,999	13	9
	More than \$50,000	93	65
	Not reported	3	2
Education	High school	7	5
	Some college	23	16
	Two years of college	18	13
	Four years of college	46	32
	Advanced degree	44	31
	Not reported	5	4
Number of Visits Completed	6 visits	39	27
	5 visits	21	15
	4 visits	22	15
	3 visits	25	17
	2 visits	20	14
	1 visit	16	11

Note. Most mothers were (39%) Hispanic/Latina, White; 24% were Non-Hispanic/Non-Latina, White; 16% were Non-Hispanic/Latina, Black.

a part of a larger longitudinal study examining infant social development, mothers were invited to six in-person visits to the University of Miami at 2 weeks and at 2, 4, 6, 8, and 14 months postpartum. Mothers were healthy, with full-term pregnancies (≥ 37 weeks of gestation; $M = 39.20$, $SD = 1.36$) and were on average 32 years old ($M = 32.38$, $SD = 5.56$). Mother-reported birth complications were minor and included cesarean sections, high blood pressure, and anemia, among others. Sixty-five percent of mothers reported a household income of \$50,000 or higher, close to the national median income of ~\$69,000, and 65% had an education level at or above a 4-year college degree, above to the national average of 33.7% (U.S. Census Bureau, 2023b). Most of the mothers (74%) were married or living with a partner, but 25% were single

and living with other adults, which could include the child's father (if not considered the partner), immediate or extended family, friends, or roommates. Only 1% of mothers were single and living alone. About half of participants (43%) were first-time mothers. Maternal reports indicated that infants had no major health issues.

Mothers ($N = 143$) completed the Parenting Stress Index-Short Form version 4 (PSI-SF-4; Abidin, 2012); online shortly before or during six in-person postpartum visits: 91 mothers completed it when their infant was a newborn ($M = 19$ days, $SD = 5$ days, range = 7 to 33 days), 112 mothers completed it when their infant was 2 months ($M = 62$ days, $SD = 6$, range = 51 to 77 days), 111 mothers completed it when their infant was 4 months ($M = 126$ days, $SD = 7$, range = 109 to 147 days), 99 mothers completed it when their infant was 6 months ($M = 186$ days, $SD = 9$, range = 154 to 200 days), 77 mothers completed it when their infant was 8 months ($M = 245$ days, $SD = 7$, range = 226 to 266 days), and 68 mothers completed it when their infant was 14 months ($M = 405$ days, $SD = 25$, range = 361 to 443 days). Data were not available for all participants at all ages for various reasons (e.g., illness, vacation). Missing data were not statistically different from the available data based on characteristics of the sample (Table S1) or based on average values of stress across visits in any subscale or the total stress scale (Table S2).

Measure

Maternal stress was assessed at all ages using the Parenting Stress Index, Fourth Edition Short Form (PSI-SF), which includes 36 items, with total scores ranging from 36 to 180 (Abidin, 2012). The PSI-SF has psychometric support for parents of children from 1 month to 12 years of age (Azhari et al., 2019; Barroso et al., 2016) and has been validated for use in its three-domain form in Hispanic/Latino populations (Barroso et al., 2016; Rivas et al., 2020). No modifications were made to the PSI-SF for this study. We examined the PSI-SF's three subscales labeled in this study as: (1) Maternal Distress or parents' perceptions of their ability to handle negative emotions related to parenting, which is captured through feelings of competency, restrictions, conflicts, support, and depression (e.g., "I feel trapped by my responsibilities as a parent."), (2) Mother-Infant Dysfunctional Interactions or parents' evaluation of disrupted expectations in their parent-child interactions (e.g., "My child rarely does things for me that make me feel good."), and (3) Difficult Infant or parents' assessment of how difficult their child is to manage (e.g., "My child seems to cry or fuss more often than most children."). Mothers read a series of 12 statements for each subscale and responded via a 5-point Likert scale (1 = *Strongly Agree*, 5 = *Strongly Disagree*). All items were reverse coded. Each subscale score ranged from 12 to 60, with higher scores signifying higher

levels of maternal stress. Before conducting the main analysis, we measured the reliability of the maternal stress subscale scores. The subscales showed strong internal consistency for each age (Maternal Distress, $\alpha = 0.85$ to 0.90 , Mother-Infant Dysfunctional Interaction, $\alpha = 0.82$ to 0.85 , and Difficult Infant, $\alpha = 0.75$ to 0.85).

Procedures

Mothers completed the PSI-SF at each of the six postpartum visits. At the first visit (around 2 weeks post-birth) mothers completed a demographics questionnaire (Table 2) through REDCap (<https://projectredcap.org>; Harris et al., 2019). We obtained mothers' informed consent, and they were compensated \$50 for each visit (up to \$300 total).

Data Analysis

We used R version 3.4.4 and RStudio version 1.1.423 (R Core Team, 2021). We used multilevel modeling with the lmerTest package (Kuznetsova et al., 2017). This advanced statistical approach allowed us to account for dependence in the data due to nesting (i.e., time within mothers), or the hierarchical grouping of repeated observations nested within each individual, and to explain both within- and between-group variance (Luke, 2019). Multilevel models also operate with fewer assumptions than other methods, tolerating a lack of independence in observations, missing data, and heterogeneity of variances (Woltman et al., 2012). A minimum of 50 groups (i.e., number of mothers) is recommended for this type of analysis (Maas & Hox, 2005). Our repeated-measures independent variable was time postpartum (i.e., infant age: 2 weeks, and 2, 4, 6, 8, and 14 months) modeled as a continuous variable, with time recoded so that the first time point (2 weeks) was set at zero. To explore the development of maternal stress, we visualized the data for each domain (Figure 1A) and examined the means within each domain (Table S3) to assess which patterns of change over time (e.g., linear, quadratic, piecewise) were appropriate to test in the models.

First, we ran an unconditional model, or a multi-level model with no predictors, to calculate the total between-group (i.e., between-mother) variance for each dependent measure (maternal distress, mother-infant dysfunctional interactions, and difficult infant) using an intraclass correlation (ICC). Next, we examined each stress domain score in separate models across time with no covariates to find the best fitting pattern of change over time. In a stepwise fashion, we began by examining the linear effects and moving on to quadratic, and piecewise if the model fit continued to improve. If model fit diminished by adding another time variable, we retained the prior model. We added the random linear effect of time to each model; however, these models failed to converge, suggesting that mothers had similar patterns of change in each domain of maternal stress across infancy.

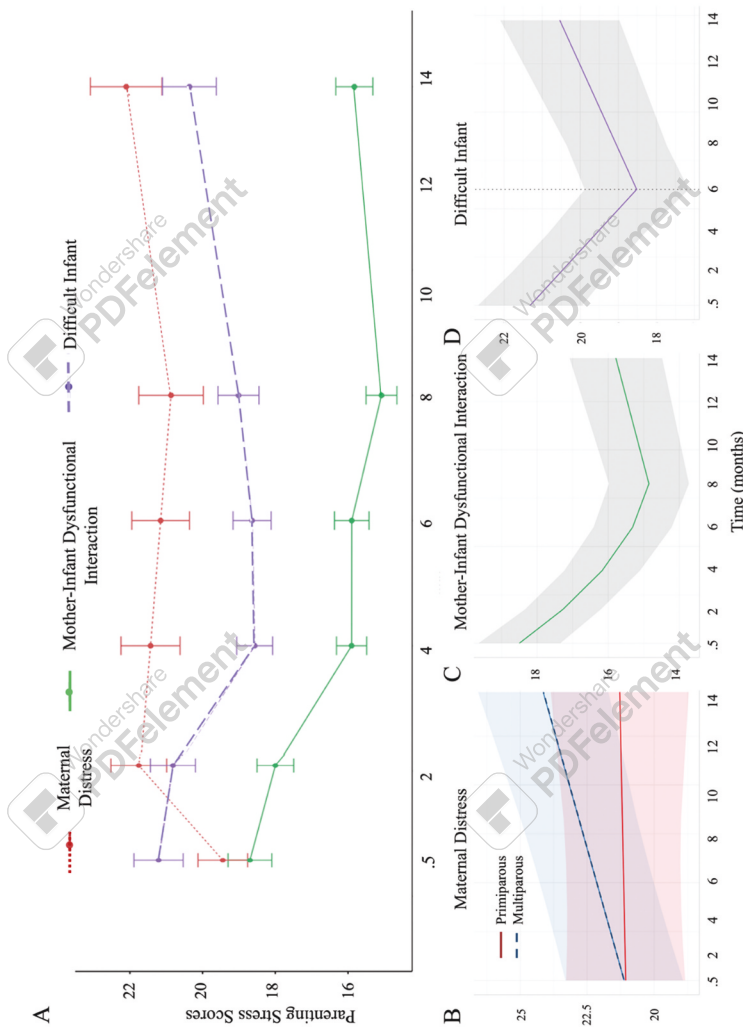


Figure 1. (A) The top graph depicts the means of the parenting stress domain scores over time (months) after birth. The Maternal Distress subscale score is represented by the dotted, red line. The Mother-Infant Dysfunctional Interaction subscale score is represented by the solid green line. The Difficult Infant subscale score is represented by the dashed purple line. Error bars reflect the standard error of the mean. Model predicted values across the first year postpartum with shading representing 95% CIs (bottom): (B) Maternal Distress and Parity interaction (bottom left), blue dashed line represents mothers with more than one child (multiparous), and red solid line represents first-time mothers (primiparous). (C) Mother-Infant Dysfunctional Interaction (bottom middle) and (D) Difficult Infant (bottom right). The vertical dashed line at 6 months represents the knot for the piecewise model. Shading around each line represents confidence intervals.

Therefore, we removed the random effects of time from all models. As parenting may differ by ethnicities (Halgunseth, 2019; McLoyd et al., 2019), we examined potential interactions with ethnicity in the models (Table S4); however, as no significant differences were present, we chose to maintain ethnicity as a control variable in our final models. Given, the diverse racial sample and the associations with health disparities (Algarin et al., 2019; Champion et al., 2022; Ibrahimou et al., 2023), we also controlled for race in the final models. We also observed variability in parity (primiparous, multiparous) and infant sex, so we controlled for these variables in each final model to account for any variance in changes in maternal stress due to differences in these factors. Finally, because maternal psychopathology is related to high levels of parenting stress (Williford et al., 2007), we controlled for depression with average maternal depression scores across the postpartum period measured with the Center for Epidemiologic Studies Depression scales (CES-D; Radloff, 1977). Furthermore, we did not have strong exceptions for all the independent variables, and we were only interested in one dependent variable at a time. Not all associations would survive rigorous control for multiple hypotheses testing, but this control was likely not appropriate given that multilevel models address the multiple comparisons problem and yield more efficient estimates by performing partial pooling—shifting estimates toward each other (Gelman et al., 2012).

RESULTS

Descriptive Analysis

We examined descriptive statistics for each parenting stress domain. For maternal distress, the scores ranged from 12, which is the minimum possible score on all subscales, to 55 ($M = 21.1$, $SD = 7.82$), with 60 being the maximum possible score on all subscales. For mother-infant dysfunctional interaction, scores ranged from 12 to 37 ($M = 16.7$, $SD = 4.88$). For difficult infant, scores ranged from 12 to 44 ($M = 19.7$, $SD = 5.80$). Maternal distress showed the most variability in scores and had the highest reported scores of the three stress domains. Clinical levels of stress are indicated by a total score of 109, which would mean scoring above 36 in each subscale or a combination thereof. In our sample, only 1% ($n = 2$) of mothers had clinical levels of stress based on this classification, one mother only at 2 months postpartum and the other mother only at 6 months postpartum; no mothers had elevated stress levels after 6 months of age. Given the small percentage of elevated maternal stress, we retained these data in the analyses. See Table S5 for complete results.

Maternal Distress

The intercept for the initial model was statistically significant, indicating that at 2 weeks postpartum, mothers' average maternal distress score was 20.54 ($p < .001$). The ICC was .40, signifying that 40% of the variation in maternal distress was explained by between-mother differences. A simplified model examining only the effect of time on maternal distress showed that a linear model fit the data best. The effect of time, $b = .10$, $p = .051$, was not statistically significant, but increases in maternal distress across time were statistically significant while controlling for maternal race, ethnicity, parity, depression, and infant sex, $b = .14$, $p = .007$. Based on preliminary examinations of descriptive statistics (Table S6), multiparous mothers appeared to show a different pattern of change in maternal distress over time compared to primiparous mothers. Therefore, we ran one exploratory analysis based on the data with the parity variable added as an interaction term to the model to examine if this factor was underlying the increase in maternal distress over time. We also retained the linear model, which fit the data better than the non-linear terms. Although the final model indicated that time postpartum was no longer statistically significant, $\gamma_{10} = .01$, $p = .90$, there was an interaction between time and whether mothers were parenting their first child or had children previously, $\gamma_{11} = .22$, $p = .039$. Multiparous mothers' distress increased over the course of the first year postpartum, $b = .23$, $p = .001$; however, primiparous mothers' distress did not show any statistically significant changes over time ($p > .05$; Figure 1B). For full results see Table 3 and Table S7.

Maternal-Infant Dysfunctional Interaction

The intercept for the initial model was statistically significant, indicating that at 2 weeks postpartum, mothers' average mother-infant dysfunctional interaction score was 17.51 ($p < .001$). The ICC was .24, signifying that 24% of the variation in mother-infant dysfunctional interaction was explained by between-mother differences. The simplified model examining the effect of time on mother-infant dysfunctional interaction showed that a quadratic model fit the data best. The quadratic effect of time, $b = .05$, $p < .001$, revealed a rapid decrease in mother-infant dysfunctional interaction in the first few months after birth that slowed over time, and remained statistically significant while controlling for maternal race, ethnicity, parity, depression, and infant sex, $\gamma_{20} = .05$, $p < .001$. There were no further effects in the final mother-infant dysfunctional interaction model (Table 3; Figure 1C).

Difficult Infant

The intercept for the initial model was statistically significant, indicating that at 2 weeks postpartum, mothers' average difficult infant score was 19.96

Table 3. Final model results for each Parenting Stress domain.

Maternal Distress				
Predictors	Estimates	SE	CI	p
(Intercept)	22.54	1.43	19.72–25.36	<.001***
Infant age	0.01	0.08	–0.15–0.17	.902
Maternal race	–0.20	0.57	–1.31–0.91	.726
Maternal ethnicity	–1.89	1.26	–4.37–0.59	.134
Parity	0.11	1.28	–2.41–2.63	.933
Depression	–0.04	0.03	–0.10–0.03	.240
Infant sex [M]	–1.83	1.22	–4.23–0.58	.136
Infant age*Parity	0.22	0.11	0.01–0.42	.039*
Mother-Infant Dysfunctional Interaction				
Predictors	Estimates	SE	CI	p
(Intercept)	17.69	0.88	15.97–19.41	<.001***
Infant age	–0.87	0.12	–1.10 – –0.64	<.001***
Infant age ²	0.05	0.01	0.03–0.07	<.001***
Maternal race	0.24	0.81	–1.35–1.82	.767
Maternal ethnicity	0.49	0.75	–0.98–1.96	.514
Parity	0.43	0.71	–0.97–1.84	.543
Depression	0.003	0.02	–0.04–0.05	.884
Infant sex [M]	–0.21	0.72	–1.62–1.19	.765
Difficult Infant				
Predictors	Estimates	SE	CI	p
(Intercept)	21.82	1.06	19.74–23.90	<.001***
Infant age < 6mo	–0.48	0.09	–0.66 – –0.30	<.001***
Infant age > 6mo	0.73	0.14	0.45–1.01	<.001***
Maternal race	0.40	0.97	–1.49–2.30	.677
Maternal ethnicity	–0.35	0.90	–2.11–1.41	.697
Parity	–0.29	0.85	–1.97–1.39	.734
Depression	–0.02	0.03	–0.08–0.03	.454
Infant sex [M]	–0.98	0.86	–2.66–0.70	.254
Parenting Stress Index (total score)				
Predictors	Estimates	SE	CI	p
(Intercept)	61.21	3.07	55.18–67.24	<.001***
Infant age	–1.42	0.34	–2.08 – –0.75	<.001***
Infant age ²	0.10	0.03	0.05–0.15	<.001***
Maternal race	0.22	2.89	–5.46–5.90	.940
Maternal ethnicity	–1.75	2.70	–7.04–3.54	.516
Depression	–0.06	0.07	–0.19–0.08	.401
Infant sex [M]	–3.00	2.56	–8.03–2.04	.245
Parity	1.16	2.56	–3.87–6.18	.652

Note. SE = standard error; CI = 95% confidence intervals. * $p < .05$. *** $p < .001$.

($p < .001$). The ICC was .24, signifying that 24% of the variation in difficult infant was explained by between-mother differences. In a simplified model examining the effect of time on the difficult infant rating, time had a quadratic effect, $\gamma_{20} = .06$, $p < .001$. There was a decrease in difficult infant from 2 weeks to 6 months and an increase from 6 to 14 months of age. Therefore, we ran a piecewise model—used when the data follows different linear trends over different time points in the data—with a “knot value” at 6 months to examine if the decrease and subsequent increase in the difficult infant subscale were statistically significant. This model fit the data better than the quadratic model, $\chi^2(1, N = 143) = 1.14$, $p < .001$; however, this model may be more susceptible to overfitting and less generalizable than a quadratic model. Yet by modeling the regression in two pieces, we found that difficult infant ratings decreased from 2 weeks to 6 months, $\gamma_{10} = -.48$, $p < .001$, and increased from 6 to 14 months,

$\gamma_{20} = .73$, $p = < .001$, controlling for maternal race, ethnicity, parity, depression, and infant sex. For full results see [Table 3](#) and [Figure 1D](#).

Results for the full parenting stress scale are reported in Supplemental Materials and [Table 3](#).

DISCUSSION

This study examined average developmental changes in maternal stress in an ethnically diverse sample of low-risk mothers with typically developing infants across six time points from 2 weeks through 14 months postpartum. Across this period, we found varying patterns of developmental changes in maternal stress levels within each parenting stress domain. By highlighting the rapid changes that occur during the first 14 months after birth, our findings capture nuanced information about typical levels of maternal stress development during this period.

Maternal Distress

We found that maternal distress—reported distress levels based on perceived social support, partner conflicts, and life restrictions due the parenting role (Abidin, 2012; Lee et al., 2016)—at 2 weeks postpartum was unrelated to parity. However, maternal distress levels diverged between primiparous and multiparous mothers with age across the first 14 months postpartum. Primiparous mothers showed no changes in distress over time, but multiparous mothers' distress increased as their infants aged. That is, we found partial support for our hypothesis that maternal distress would increase across the first year postpartum, but this effect was only observed among mothers with multiple children. We consider why we did not observe changes in maternal distress among first-time mothers, whereas mothers with more than one child reported increasing maternal distress across the first year.

Beyond the newborn period, first-time mothers may have fewer negative emotions about parenting or may better manage negative feelings about parenting than mothers with multiple children. In fact, first-time mothers reported improvements in their maternal distress from 3 to 6 months postpartum (Vismara et al., 2016) and from birth to 8 months postpartum (Gameiro et al., 2009), suggesting that their ability to handle their negative emotions related to parenting may be developing as they adjust to motherhood. One possibility why first-time mothers may have fewer negative emotions or better management of negative feelings about parenting is that first-time mothers have more adequate maternal resources (e.g., social support) than mothers with more than one child who may not have the needed support to handle increased parenting demands (Lagerberg & Magnusson, 2013). For example, first-time mothers engage in fewer household chores and infant care

tasks at 3 and 6 months postpartum than mothers with multiple children, which was theorized to be due to having more sufficient social support to meet their parenting demands (McVeigh, 2000).

Consistent with our findings, mothers with more than one child reported increased distress from birth to 8 months postpartum (Gameiro et al., 2009). Multiparous mothers of 18-month-old infants also scored higher on parental stress, reported less social support, and felt their workload was more demanding than that of primiparous mothers; moreover, compared to first-time mothers, mothers with multiple children reported that their interactions with their youngest child were less satisfactory, mothers participated in less shared reading with their child, and their child had more restricted vocabulary at 18-months of age (Lagerberg & Magnusson, 2013). Mothers with more than one child may have insufficient resources, like social support, to meet their parenting demands (Lagerberg & Magnusson, 2013), leaving them feeling more distressed in the parenting role than mothers caring for only one child.

Maternal-Infant Dysfunctional Interaction

Mother-infant dysfunctional interaction scores—evaluations of mothers' disrupted expectations with their mother-infant interactions—decreased from 2 weeks to 8–14 months postpartum, suggesting a general improvement in mothers' experiences of their mother-infant interactions (i.e., fewer and/or less dysfunctional interactions with their infant across the first year postpartum). In the first weeks after birth, mothers' fatigue, depressed mood, and preoccupation with their newborns' health and well-being may lead to more intrusive and less sensitive parenting, negatively influencing mother-infant interactions (Badr & Zauszniewski, 2017; Hunter et al., 2009; Kim et al., 2013). Yet, as mothers adjust to the demands of parenting (Kristensen et al., 2018), and as infants begin to spend more time awake and in social interactions during the day (Addyman & Addyman, 2013; Messinger et al., 2019), more opportunities arise for positive and reciprocal mother-infant social interactions (Karreman & Riem, 2020; Kim et al., 2013). In fact, around 1 to 3 months of age infants begin to show more social smiles, cooing expressions, motor excitement, and laughter (Addyman & Addyman, 2013; Lavelli & Fogel, 2005; Messinger et al., 2019; Murray et al., 2016), potentially making maternal-infant social interactions more pleasurable. The development of this positive mother-infant engagement coincides with our mothers' ratings of increasingly more functional interactions with their infant over the first year postpartum. In sum, we found support for our hypothesis that mother-infant dysfunctional interaction would be elevated early in the first year and decline with age.

Difficult Infant

Mothers' difficult infant scores—how difficult they find their child to manage compared to other children—began high at 2 weeks and decreased until 6 months postpartum, suggesting that mothers rated their infant as increasingly less difficult across early infancy. This finding is consistent with previous reports of decreases in difficult infant scores from 3 to 6 months (Vismara et al., 2016). Very early ratings of infant difficulty for the first couple of months after birth may be reflective of the difficult initial changes of becoming a mother to a newborn. One example of these changes is disrupted sleep; infant night wakings occur around two times per night for about an hour each in the first 2 months after birth (Galland et al., 2012; Sorondo & Reeb-Sutherland, 2015), and mothers are more likely to rate their infants as difficult if the infants woke more during the night (Sorondo & Reeb-Sutherland, 2015). The timing of these shifts in sleep mirror the higher difficulty ratings of infants in our sample at 2 weeks and 2 months of age compared to infants at older ages (through 14 months of age).

In partial contrast to our hypothesis, we also found a U-shaped curve in the difficult infant subscale; after the initial decline, difficult infant began to increase from 6 months through 14 months postpartum. Mothers may rate their child as increasingly more difficult across the latter half of the first year for several reasons, including increases in infant mobility (e.g., crawling to walking; Perren et al., 2005) requiring parental vigilance and/or infant teething and illness, which begin or become more common at these ages (Pavičič et al., 2016; Rahman et al., 2004) and often lead to fever, pain, irritability, and sleep disturbances. Like infant night wakings, these infant symptoms are also associated with higher ratings of infant difficulty (Wake et al., 1999) and may reflect mothers' stress regarding their difficult infant ratings.

Changes in Maternal Stress: Additional Contextual Factors

We proposed a few examples of key potential child, maternal, and environmental factors that may play roles in these unique changes in maternal stress over time; however, other factors may have independently or additively impacted maternal stress in our low-risk sample. Infant factors like separation anxiety and fear of strangers (Ainsworth, 1985; LoBue & Adolph, 2019) as well as maternal factors like caregiving responsibilities, social support, and partner conflicts may also alleviate or intensify mothers' feelings of distress (Epifanio et al., 2015; Nyström & Öhrling, 2004).

Limitations and Future Directions

Due to the large number of different sociodemographic groups, and the limited number of individuals per group, we lacked statistical power to examine these variables as predictors in our models (Bornstein et al., 2013). Furthermore, although the PSI-SF was validated in Latino/Hispanic populations (Barroso et al., 2016; Rivas et al., 2020), the roles of related factors (e.g., country, culture, immigration) are unclear; therefore, future studies should use more nuanced measures of ethnicity to assess measurement invariance (i.e., examine whether participants from different groups similarly conceptualize the PSI-SF measurement items; Lee, 2018). However, our ethnically heterogeneous sample enabled us to begin to understand maternal stress over the first year postpartum in a diverse, South Florida sample of low-risk mothers with typically developing infants. In addition to assessing ethnicity invariance, future studies should examine measurement invariance based on the age of the child as items may take on different meaning based on caring for a 1-month-old infant versus a 14-month-old infant. Because of our intensive longitudinal design, we had some attrition; however, we detected no demographics differences based on missing data and our statistical approach was tolerant of missing data. Larger studies of maternal stress are needed, across a wider geographic range in and outside of the United States, to better characterize the full spectrum of ethnic, cultural, and socioeconomic diversity.

Additional contextual variables, beyond those captured here, may relate to maternal stress, such as maternal employment (e.g., working or attending school full-time, part-time, or not at all), caregiving roles (e.g., who is primary/secondary caregiver caring for, feeding, and waking with the infant), types of care (e.g., breastfeed or bottle fed, daycare or homecare), infant temperament, and family or partner conflict, as well as the quantity and quality of social support. Siblings' ages should also be explored in future studies to provide information about family planning, potentially indicating an opportune spacing for rearing siblings. Fathers' or other caregivers' stress levels should also be measured concurrently to provide insights into the broader collaborative caregiving context. Future studies should also examine a high-risk, intensive longitudinal comparison sample to highlight differences in high- and low-risk maternal stress levels over time.

IMPLICATIONS FOR PRACTICE, APPLICATION, THEORY, AND POLICY

The transition to parenthood is a challenging time in adult development. We discovered that changes in maternal stress across the first year postpartum are more complex than previously documented. Detailing these typical changes in maternal stress over the first year postpartum is

a necessary first step on which future studies could help identify mothers at-risk for high stress and the negative associated consequences. For example, mothers whose stress increased over pregnancy, not following the typical decreasing pattern across gestation, were more likely to deliver preterm (Glynn et al., 2008). Our results might also offer insight into periods in infancy when maternal stress in specific domains is more likely to be elevated, which may provide mothers with more accurate parenting expectations. This insight may be important because mothers with disrupted parenthood expectations tend to have poorer partner relationship adjustment and a more depressed mood than mothers whose expectations matched their parenting reality (Harwood et al., 2007). Therefore, knowing what types of stress are considered typical for low-risk mothers may help with coping during this demanding time.

We found that each stress domain presented a different pattern of development across the first year of motherhood. Consistently, parenting stress interventions tend to impact only one of the three areas of stress (i.e., maternal distress, mother-infant dysfunctional interactions, or difficult infant; Kang et al., 2019; Mersky et al., 2015). Therefore, our findings support a domain-targeted intervention approach. For example, parenting distress may benefit from targeting parents' distress tolerance skills (e.g., mindfulness, relaxation), whereas dysfunctional interactions may require more child-focused play therapy (e.g., monitoring, communication), and difficult infant stress may be lessened through psychoeducation about temperament or further assessments about why parents perceive their child to be difficult. Along with differentiating among the domains of parenting stress, focusing on the postnatal timing of parenting stress interventions may also maximize their effectiveness to have the largest impact on maternal well-being. Various factors contribute to the development of parenting stress across the first year postpartum, so recognizing these early, typical patterns of maternal stress could help identify mothers who diverge from these trajectories, clarify parental expectations for mothers, and facilitate more targeted interventions for high-risk mothers.

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Conflict of Interest Disclosures

The authors have no conflicts of interest to declare.

Ethical Principles

The authors affirm having followed professional ethical guidelines in preparing this work. These guidelines include obtaining informed consent from human participants, maintaining ethical treatment and respect for the rights of human or animal participants, and ensuring the privacy of participants and their data, such as ensuring that individual participants cannot be identified in reported results or from publicly available original or archival data. The University of Miami Institutional Review Board approved this study.

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Data Availability Statement

This dataset is available from the corresponding author on reasonable request.

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