THE TRANSITION TO PARENTHOOD AND THE FAMILY SYSTEM: LINKS FROM GRANDPARENTS, PARENTS, AND INFANTS TO PERINATAL MEDICAL RISK AND EARLY PARENT AFFECT

by

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DISSERTATION ABSTRACT

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Title: The Transition to Parenthood and the Family System: Links from Grandparents, Parents, and Infants to Perinatal Medical Risk and Early Parent Affect

Biopsychosocial factors in early childhood set the foundation for later neurocognitive and language competence. This dissertation aimed to identify and characterize the early psychosocial correlates of perinatal medical risk and parent affect. Prior research has documented associations between both perinatal medical risk and parenting behavior and child functional outcomes across a wide array of developmental domains, including cognition and language. However, perinatal medical risk and parent affect do not emerge out of a vacuum. Rather, they are formed against the backdrop of, and in response to, factors embedded within the family system across time and among individuals.

In three sub-studies, this dissertation sought to elucidate the multigenerational psychosocial factors associated with outcomes in pregnancy, birth, and parenting across the transition to parenthood. Participants were three generations within 137 individual families who took part in both the Oregon Adolescent Depression Project (OADP) and the Infant Development Study (IDS). The proband participants were adolescents who enrolled in the OADP; this cohort and their partners represented Generation 2 (G2) of the overall dissertation project. The parents of the G2 participants constituted the Generation 1 (G1) cohort, while the infant children of the G2 participants represented Generation 3 (G3). Indices of environmental context, psychological adaptation, relationship dynamics, and affect at both family and

individual levels across the three generations were collected between the G2 cohort's adolescence through the early period of their transition to parenthood. Analyses sought to broadly identify and characterize the links among grandparental, parental, and child psychological and relational functioning and outcomes in perinatal medical risk and parent affect. Results across the series of three studies revealed a lack of clear links between the majority of factors sampled from the familial ecology and the outcomes of perinatal medical risk and parent affect, likely due to restricted power resulting from the relatively small sample size. However, in support of the view of the parent-child relationship as mutually reinforcing, infant positive affect was related to parent positive affect. The implications of these findings and proposed areas for ongoing research are discussed.

Keywords: perinatal, medical risk, complications, infant affect, parent affect, parenting behavior, intergenerational transmission, transition to parenthood

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To my family

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CHAPTER 1

INTRODUCTION

Significance

Biological and environmental factors early in development set the stage for subsequent child outcomes. Perinatal medical risk and parent affect represent two particularly salient sources of potential biological and environmental influence on child outcomes across an array of functional areas. Perinatal medical risks (including, but not limited to, diabetes and neonatal asphyxia) have been shown to relate to challenges to adaptive child development, including decrements in intelligence quotient (IQ; Camprubi Robles et al., 2015) and memory difficulties (de Haan et al., 2006). Likewise, parenting behavior has been linked to cognitive functioning (Malberg et al., 2016; Mermelshtine & Barnes, 2016; Merz et al., 2017; Feldman & Eidelman, 2009) and language ability (Topping et al., 2013). Given these relations to child outcomes, it is critical to understand the antecedent factors that have the potential to shape perinatal medical risk and parent affect themselves. Doing so will allow for interventions to take place earlier in development, leading to more robust cognitive and language functioning in children. Given that children exist within the larger familial milieu, a comprehensive appreciation of the psychosocial factors that may impinge on perinatal medical risk and parent affect would necessarily incorporate the role of the family system.

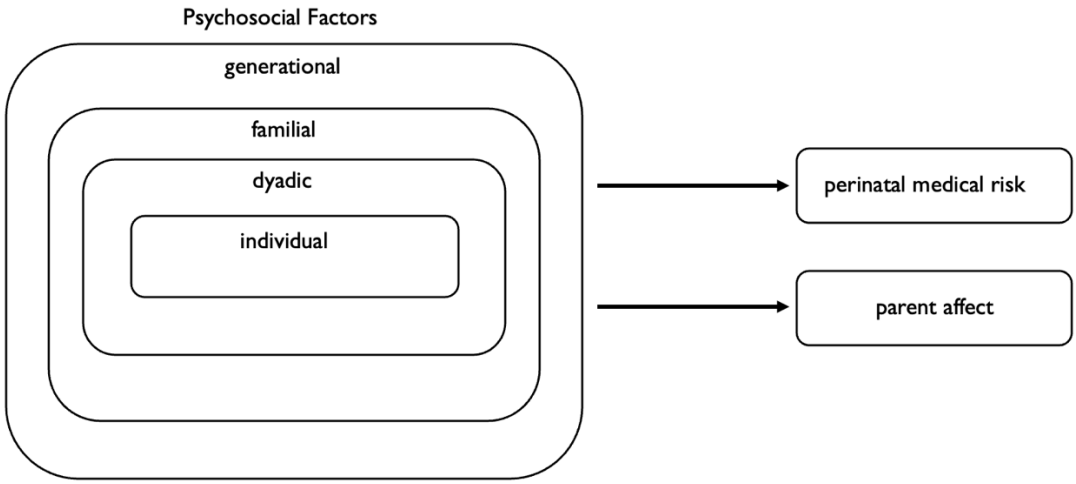
Innovation

Despite their robust links to child cognitive and language competence, much remains to be elucidated regarding the antecedent psychosocial correlates of perinatal medical risk and parenting behavior. The present dissertation harnessed the strengths of a multigenerational family study design bolstered by observational data to investigate the psychosocial determinants

of perinatal medical risk and parent affect during the transition to parenthood (Figure 1). As Duarte and colleagues noted as recently as 2020, research studies that allow for the investigation of multiple familial generations are rare within the realm of psychiatry. The knowledge that could be gained from this type of research will further the development of precision medicine to ameliorate risk that could transmit from one generation to the next within families (Raballo et al., 2021; Duarte et al., 2020). Along those same lines, acquiring a clearer appreciation of the intergenerational factors that may shape birth outcomes would advance the ability of perinatal mental health providers to implement prevention measures that would pay dividends in promoting the cognitive and language development of infants. As shown in Figure 1, psychosocial factors were sampled at the individual, dyadic, and familial levels across generations within families. Characterizing the correlates of perinatal medical risk and early parent affect allows for the identification of targets of interventions that can ultimately support and promote the cognitive and language development of children.

Figure 1

Overarching Conceptual Model



Specific Aims

The overarching aim of the project was to interrogate the role of multigenerational familial factors in (1) perinatal (i.e., pregnancy and birth) outcomes and (2) parent affect. This dissertation sought to address the following broad primary aims across three sub-studies:

Study 1 Aim. To characterize the association between psychosocial factors of previous generations (i.e., socioeconomic status [SES], history of major depressive disorder [MDD], parent-child relationship quality, parental death in childhood, and prenatal stress) and perinatal outcomes.

Study 2 Aim. To investigate the association between psychosocial characteristics (i.e., SES, history of MDD, parent-child relationship quality, and parental death) of parents' family of origin and parent affect immediately following the transition to parenthood. A secondary objective was to identify mechanisms that underly any associations between grandparental history of MDD and parent affect in early childhood.

Study 3 Aim A. To describe the association between psychosocial factors at the individual (i.e., anxiety and depressive symptoms, personality, and parenting stress) and dyadic (i.e., SES and relationship quality) levels and parent affect among couples navigating the transition to parenthood.

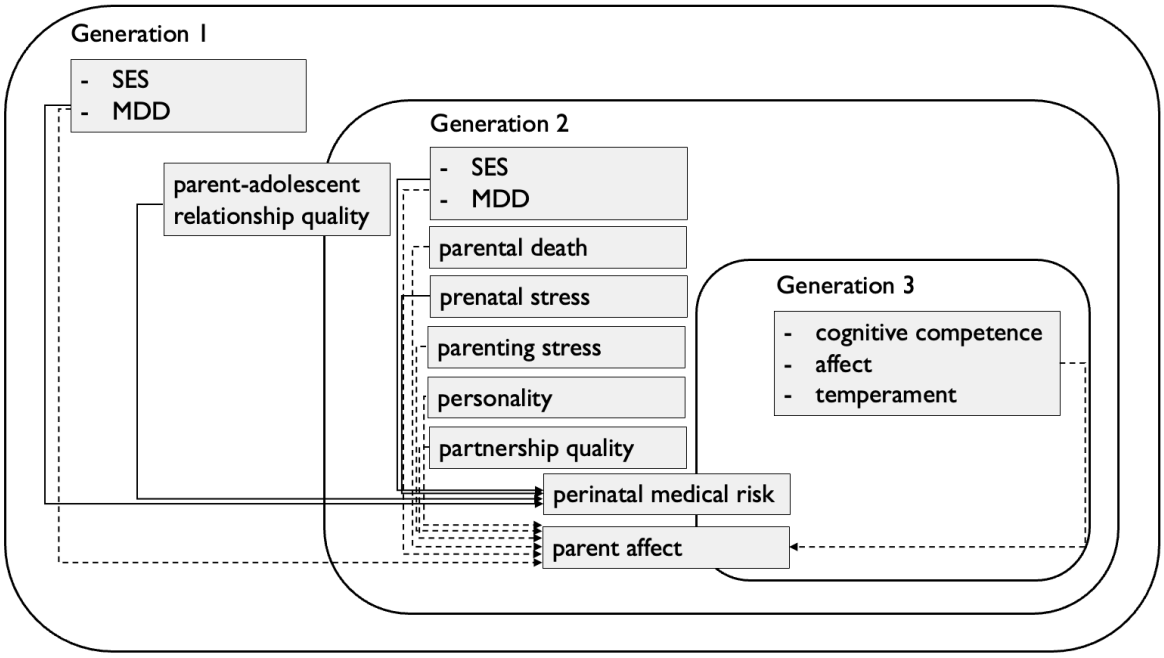
Study 3 Aim B. To clarify the association between child psychological functioning (i.e., temperament, affect, and cognitive competence) and parent affect in infancy.

Project Measurement Model

The study's overarching measurement model is depicted in Figure 2. The nested rectangles represent the three family generations in the study. Shaded rectangles represent variables within and shared between generations. The solid lines connect candidate predictors (i.e., G1 history of MDD and SES; G2 history of MDD, SES, prenatal stress, parental death in childhood; and G1-G2 relationship quality during G2's adolescence) to the outcome of perinatal medical risk. The dashed lines connect candidate predictor variables (i.e., G1 history of MDD and SES; G2 history of MDD, SES, parental death in childhood, negative emotionality, anxiety, depression, parenting stress; G1-G2 relationship quality during G2's adolescence; G2-G2 relationship quality; G3 cognitive competence, positive affect, and negative emotionality) to the dependent variable of parent positive affect.

Figure 2

Overarching Measurement Model



To address these aims, the present dissertation brought together the efforts of three separated studies. Study 1 examined the grandparental and parental correlates of perinatal medical risk. Study 2 investigated the grandparental and parental correlates and underlying mechanisms of parent affect in infancy. Study 3 evaluated the parental and child correlates of parent affect in infancy.

CHAPTER 2

STUDY 1. PSYCHOSOCIAL CORRELATES OF PERINATAL MEDICAL RISK ACROSS TWO FAMILIAL GENERATIONS: GRANDPARENTS AND PARENTS

Perinatal Medical Risk and Child Outcomes

Adverse outcomes across pregnancy-, birth-, and the neonatal period are pervasive and may herald risk for later parental and infant functioning. Perinatal medical risk encompasses a wide range of conditions that can pose a risk to the mother, fetus, or both. Conditions can vary by bodily system or organ (e.g., the placenta) and present primarily in the mother (e.g., preeclampsia) or infant (e.g., being small for gestational age [SGA]). Furthermore, multiple conditions can co-occur, which may compound the degree of risk for the mother and/or infant. For example, first-trimester vaginal bleeding is linked to preterm birth before 35 weeks' gestation (Yang et al., 2004). Mothers who experience manual removal of the placenta are also more likely to experience hemorrhaging (Tandberg et al., 1999). The odds of developing puerperal infection may increase with hemorrhaging (Song et al., 2020) and meconium-stained amniotic fluid (Tran et al., 2003; Javaid et al., 2019). Infants who are SGA have been found to be more common among mothers who experienced low weight gain in pregnancy (Chung et al., 2013). In a Chinese study, infants born SGA were more likely to also develop hypoglycemia and hyperbilirubinemia compared to infants born typical for gestational age (Liu et al., 2019). On the other hand, large for gestational age status is linked to a higher occurrence of postpartum hemorrhage and infant hypoglycemia (Weissman-Brenner et al., 2012). Infants born preterm are more susceptible to developing sepsis than their full term peers (Polin et al., 2012; Shane et al., 2017). Neonates born very or extremely preterm between 24 and 29 weeks and who were also SGA experience elevated odds of death (Boghossian et al., 2018).

For children in particular, existing research has demonstrated that medical risk during the perinatal period (i.e., the time span beginning in pregnancy and ending shortly after birth) has far-reaching links to children's developmental outcomes in cognition and language. The deleterious implications of perinatal medical risk for later cognitive skills have been well-documented across multiple literatures. Medical risk is present at all stages of the perinatal period, including pregnancy, birth, and early infancy. The unique types of risk vary in their incidence rates, presentation, and implications for later child cognitive and language outcomes. A comprehensive examination of the myriad risk factors present during the perinatal period is essential for identifying points of prevention.

Obstetric Risk Factors

Abnormal Weight Gain. The definition of "abnormal" gestational weight gain can vary from study to study, as ideal gestational weight gain has not been clearly defined (Voerman et al., 2019). Investigations on gestational weight gain have been conducted on geographically distinct cohorts of expectant mothers. In a study of mothers in Ireland, New Zealand, and Australia, low weight gain in pregnancy was found to occur at a rate of 8.6%, while elevated weight gain was found to occur at a rate of 74.3% (Chung et al., 2013). In a study of mothers in the United States, stratified by state, 17.7% of mothers in Oregon were found to demonstrate low gestational weight gain, while 50.6% of mothers in that state experienced high gestational weight gain (Deputy et al., 2015). In a study of mothers in Canada, low weight gestational weight gain occurred among 18.7% of mothers, while elevated weight gain occurred in 48.7% of mothers (Kowal et al., 2012).

Findings from studies on the role of gestational weight gain in cognitive development have been mixed. In a sample of families in the United Kingdom, gestational weight gain below

the recommended threshold has been linked with lower child academic performance in the preschool period and adolescence (Gage et al., 2013). On the other hand, gestational weight gain exceeding the recommended threshold has also been linked to decrements in academic performance in adolescence (Gage et al., 2013). In their sample of American families, Keim and Pruitt (2012) found no relation between gestational weight gain and cognitive outcomes in children, with the exception of high gestational weight gain demonstrating a positive relation with spelling performance at 7 years. Elevated gestational weight gain has also been linked to challenges with spelling and reading in adolescents at 14 years (Pugh et al., 2016).

Abnormal Uterine Size. Uterine size fluctuates as a function of age and number of pregnancies (Verguts et al., 2013). Of note, it has been documented that during the life stage when fertility is most robust (21 years), when the average uterus length and width are considered together, they take on the "golden ratio" of 1.6 (Verguts et al., 2013). It remains unclear if and how abnormal uterine size may impact cognitive development.

Preeclampsia. Recent research suggests that preeclampsia—high blood pressure typically accompanied by proteinuria during pregnancy—occurs in 4.6% of births around the world (Abalos et al., 2013). Among children born preterm, preeclampsia appears to contribute extra vulnerability to cognitive challenges, above and beyond the risk presented by intrauterine growth restriction (Morsing & Maršá, 2013). Rätsep and colleagues (2016) found that school-aged children born to mothers who experienced preeclampsia during pregnancy performed more poorly on a standardized measure of working memory relative to controls. Impairment in working memory is a feature of the neurodevelopmental condition, attention-deficit/hyperactivity disorder (ADHD). Emerging research identifies inflammation and oxidative stress as candidate

pathways by which preeclampsia can lead to the onset of neurodevelopmental conditions, such as ADHD (Barron et al., 2021).

Significant Bleeding. Estimates of the incidence of significant bleeding during pregnancy vary by study and region. Among one patient sample based in the southern United States, significant first-trimester bleeding occurred in 8% of pregnancies (Hasan et al., 2010), while among another patient sample in India, significant first-trimester bleeding occurred in 1.4% of pregnancies (Kamble et al., 2017). Bleeding that takes place early in pregnancy may pose a risk to the viability of a given pregnancy. DeVilbiss and colleagues (2020) found that bleeding in the sixth through early eighth week of pregnancy is linked to heightened risk of miscarriage.

Abnormal Presentation. A fetus can assume a wide range of possible positions in the womb in anticipation for delivery. Presentations that confer the greatest degree of safety for the infant and mother include the cephalic presentation in which the fetus' head is oriented downward toward the birth canal (Moldenhauer, 2021). Abnormal presentation can include the breech position, in which the fetus' legs are pointing towards the birth canal. A recent population-based investigation in Belgium observed a breech presentation incidence rate of 4.59% (Cammu et al., 2014). The etiology and sequelae of breech presentation continue to be clarified, and the findings are mixed with regard to whether breech presentation is linked to greater risk for later adverse outcomes. A large-scale investigation of births in Missouri, United States revealed that congenital complication co-occurred more frequently with breech presentation relative to cephalic presentation (Mostello et al., 2014). Research from France on infants born preterm found that breech presentation was not linked to infant death or later

cognitive challenges (Azria et al., 2016). An Australian study found that vaginal breech birth did not lead to increased risk for academic difficulties at school age (Bin et al., 2016).

Fever in Labor. Maternal fever during labor has been estimated to occur in 6.8% of births that happen at or after 36 weeks of gestation (Towers et al., 2017).

Meconium-Stained Amniotic Fluid. Meconium is neonatal fecal matter, and meconium-stained amniotic fluid may occur as a result of neonatal hypoxic challenge, which may contribute to further respiratory difficulties in the infant that could pose a risk to the infant's survival (Fanaroff, 2008). While infants typically express meconium in the one or two days following birth, it is estimated that 8-25% of infants express meconium during the delivery period (Fanaroff, 2008).

Current evidence indicates that obstetric risk factors are common and varied in their presentation and documented impact on child cognitive functioning. While it is important to recognize that the presence of a risk factor during pregnancy does not directly ensure the presence of developmental challenges for the fetus in the future, identifying the social determinants of adverse prenatal conditions would support interventions to bolster maternal and infant health. Given that prenatal risk factors can co-occur with birth risk factors, it is important to also understand relations between adverse birth outcomes and later child development.

Delivery Complications

At birth, a number of distinct complications can arise and potentially introduce ongoing risk to the health and well-being of mothers and children.

Blood Loss. Postpartum hemorrhage has been documented in 2.9% of births and 19.1% of post-birth hospital-based fatalities in the United States (Bateman et al., 2010). It represents the greatest contributor to maternal death globally (Urner et al., 2014). Over the course of recent

decades, the rate of postpartum hemorrhage has alarmingly demonstrated an upward trajectory (Reale et al., 2020).

Significant Lacerations. Lacerations at birth can be categorized by increasing severity of the tear, with third and fourth degrees representing the most severe end of the categorization range. Third- and fourth-degree lacerations have been estimated to occur in 3.3% and 1.1% of deliveries, respectively (Friedman et al., 2015). First-time mothers experience greater odds of experiencing significant lacerations during labor (Landy et al., 2011).

Puerperal Infection. Puerperal infection refers to maternal infection during the perinatal period. Puerperal infection is thought to have an incidence rate of approximately 1-4%, depending on the type of infection and particular time point of the perinatal period (Woodd et al., 2019). One type of puerperal infection—puerperal sepsis—is linked to heightened risk for organ complications and maternal death in the perinatal period (Arulkumaran & Singer, 2013; van Dillen et al., 2010).

Anesthetic Complications. Anesthetic complications have been found to occur in 0.46% of deliveries in New York State (Cheeseman et al., 2009). One type of anesthetic complication, regional anesthesia failure, has been found to occur in 3% of attempts (Bloom et al., 2005). Between the years of 1970 and 1990, the United States saw a downward trend in the number of maternal fatalities linked to anesthesia (Hawkins et al., 1997).

Manual Removal of Placenta. Manual removal of the placenta is generally recommended in cases in which the placenta has yet to be excreted within 30 minutes following birth (Urner et al., 2014). An investigation in Norway noted that manual removal of the placenta occurred among 0.6% of the births in the study (Tandberg et al., 1999).

Birth morbidities also span a wide range of presentations and levels of complexity. Given that complications are present with many deliveries, it is critical to identify the potential sources of birth-related risk. If risk factors are identified and intervened upon in advance of birth, later adverse health and developmental outcomes for mothers and infants can be circumvented.

Infant Outcomes

An extensive literature has highlighted the links between infant outcomes at birth and later cognitive sequelae. Acute risk present at birth typically introduces the infant to a wide range of medical interventions to optimize development. In addition to preterm birth, other conditions compromising neonatal functioning have been examined to understand their respective etiologies and relevance for development beyond infancy. It is important to appreciate that multiple complications across the perinatal period can develop, which may further compound the risk to future development.

Preterm and Post-Term Birth. In 2013, The American College of Obstetricians and Gynecologists Committee on Obstetric Practice and Society for Maternal-Fetal Medicine put forth a set of guidelines for classifying the range of gestational duration in an effort to promote consistency across clinical and research realms. According to this classification scheme, "preterm" describes pregnancies that are less than 37 weeks long, "early term" is used for pregnancies that are between 37 0/7 and 38 6/7 weeks inclusive in duration, "full term" references pregnancies that are between 39 0/7 and 40 6/7 weeks inclusive in length, "late term" corresponds to pregnancies that are between 41 0/7 and 41 6/7 weeks inclusive in duration, and "postterm" denotes pregnancies that are 42 0/7 weeks or longer.

A recent estimate of the current United States preterm birth rate placed it at 10.1% (March of Dimes, 2022; Hamilton et al., 2021), which represents the only reduction in the

preterm incidence rate over the preceding six years (Hamilton et al., 2021). Neuroimaging investigations have revealed that differences in brain tissue volume can be appreciated between infants born preterm and term by the time infants reach their term adjusted age (Keunen et al., 2012) . Furthermore, additional research documents that preterm birth confers risk for a wide range of cognitive and language challenges. Preterm birth is linked to higher odds of language impairments that can be detected in toddlerhood (Ene et al., 2019; Zambrana et al., 2021), the preschool period (Sansavini et al., 2010; Zambrana et al., 2021), and up to adolescence (Vandormael et al., 2019). Preterm birth combined with low SES is linked to even greater risk for language difficulties during the toddler years (Ene et al., 2019). A Dutch study demonstrated that one-year-old infants who had been born preterm displayed visual processing deficits (Kooiker et al., 2019). Children born preterm also experience difficulties in the domains of attention and executive functioning (Oudgenoeg-Paz et al., 2017). A meta-analysis and meta-regression of studies on intellectual functioning among children and adults with a history of very or extremely preterm birth (i.e., born more than two months early) revealed substantial difficulties with intellectual skills among this group (Twilhaar et al., 2018).

A population-based investigation of births across a fourteen-year period in Sweden observed that 8.94% of births occurred at or after 42 weeks' gestation (Roos et al., 2010). Studies of cognitive skills in individuals with a history of post-term birth reveal that individuals born post-term demonstrate weaker cognitive functioning relative to individuals born at term (Glover Williams & Odd, 2018). At 5 years, children born post-term demonstrate high levels of developmental risk relative to children born full term and late term (Smithers et al., 2015).

Small for Gestational Age and Large for Gestational Age. SGA status is linked to heightened vulnerability for intrauterine fetal death (Pilliod et al., 2012). The smaller the fetus,

the higher the odds of mortality (Pilliod et al., 2012). The current literature on later cognitive functioning and language in children born SGA is mixed. Being SGA has been linked with cognitive and language challenges (de Bie et al., 2010). For example, among toddlers born preterm, children with a history of being born SGA demonstrate increased odds of achieving low cognitive scores on the Bayley Scales of Infant and Toddler Development compared to peers who were also born preterm but were not SGA (De Jesus et al., 2013). Similarly, prior research has demonstrated that among toddlers born full term, children with a history of being born SGA achieve worse cognitive and language scores relative to peers who were also born full term but were not SGA (Savchev et al., 2013). SGA status has been found to relate to reduced IQ scores among 5- (Sommerfelt et al., 2000) and 6-year-old (Yang et al., 2010) children who had been born at term. A Norwegian study observed that in early adulthood, infants who were born SGA demonstrate poorer IQs relative to peers who were born typical weight for gestational age; this difference may be linked to intrauterine growth restriction (Løhaugen et al, 2013). Intrauterine growth restriction appears to pose a risk to cognitive development. Sacchi and colleagues (2020) reported in their recent systematic review and meta-analysis that among children born preterm and at term, the presence of both intrauterine growth restriction and SGA status was linked to worse cognitive performance relative to appropriate age peers. On the other hand, an analysis of cognitive functioning in 5-year-old children following a history of preterm birth and SGA found no deleterious impact from SGA status (Bickle Graz et al., 2015). Jensen and colleagues (2015) similarly found comparable IQ scores between adolescents in their SGA and appropriate for gestational age cohorts.

"Large for gestational age" is generally regarded as weight that exceeds the 90th percentile given a particular gestational age (Damhuis et al., 2021), although this definition can

vary across studies (Chiavaroli et al., 2016). Among births in Sweden, the incidence of large-for-gestational-age neonates went up between 1992 and 2001 (Surkan et al., 2004).

Apgar Scores. The Apgar score indexes an infant's health immediately after birth using a set of five parameters, which include respiratory effort, reflex irritability, heart rate, muscle tone, and color (Apgar, 1953). The total score ranges from 0 to 10, with 10 denoting robust health (Apgar, 1953). The Apgar score, introduced in 1953, is widely used in delivery wards across the United States today, with the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists recently releasing a revised version of the measure, which allows clinicians to take resuscitation efforts into consideration (Watterberg et al., 2015). The Apgar score has been shown to account for variance in infant mortality (Casey et al., 2001; Cnattingius, 2017) and has performed as a more robust predictor of that variable than at least one other candidate index of neonatal health, umbilical artery blood pH (Casey et al., 2001). Apgar scores have demonstrated some predictive value in the domain of cognitive functioning. Stuart and colleagues (2011) demonstrated that low Apgar values are linked to academic challenges in adolescence. In addition, Apgar scores below 7 either within the first five minutes of life or after have been found to relate to decreased IQ scores in adulthood (Odd et al., 2007).

pH Correction. Neonates with umbilical artery blood pH found to be within the acidic range are more likely than neonates without acidemia to experience seizures (Casey et al., 2001). pH correction within the two-hour window following birth reduces the odds of seizure occurrence among neonates with acidemia (Casey et al., 2001).

Volume Expansion. Volume expansion refers to fluid-based intervention efforts to enhance the hemodynamic status of the critically ill infant, although the empirical justification for the use of this particular type of therapy has been questioned (Evans et al., 2003). Volume

expansion is also used in conjunction with cardiopulmonary resuscitation (CPR) in the setting of cardiovascular complications (Wyckhoff et al., 2005). Volume expansion can be conducted with a selection from an array of fluids, including saline and blood, and usually occurs within the initial 72 hours of a neonate's life (Osborn & Evans, 2009). Prior research has shown that volume expansion enhances left ventricular output, an index of hypotension (Lundstrom et al., 2000). A systematic review of the literature on this intervention among infants born preterm has demonstrated little evidence that volume expansion is indicated in infants born preterm experiencing cardiovascular challenge (Osborn & Evans, 2009).

Transfusion. A population-based study in New South Wales, Australia across a nine-year period documented perinatal transfusion intervention in 1.4% of hospital-based births (Patterson et al., 2014).

Hypoglycemia. Hypoglycemia refers to substantially decreased levels of glucose in the blood. Neonatal hypoglycemia has been detected in up to 12% of infants (Bromiker et al., 2019). A population-based report from Sweden documented that child hypoglycemia in the postpartum period is linked to an elevated likelihood of cognitive delay two to six years later (Wickström et al., 2018).

Hyperbilirubinemia. Hyperbilirubinemia describes the presence of excess levels of bilirubin, a byproduct of the process involved in red blood cell degeneration (Dennery et al., 2001). Hyperbilirubinemia can lead to significant insults to regions of the brain (Dennery et al., 2001), including the basal ganglia, hippocampus, cerebellum, and brainstem (Koziol et al., 2013). Recent data reveal that the incidence of hyperbilirubinemia among both infants born preterm and full term has grown, from 33.5% to 45% and 9.4% to 15.5%, respectively (Vidavalur & Devapatla, 2021). A diagnosis of hyperbilirubinemia in the absence of preterm

birth appears to confer risk for cognitive development. A Finnish study of term infants found that relative to control subjects, infants with a history of hyperbilirubinemia were more likely to have a developmental disorder and subsequently demonstrate difficulties with cognitive functioning, academic performance, educational attainment, and occupational security (Hokkanen et al., 2014).

Hypocalcemia. Hypocalcemia refers to a reduced concentration of calcium within the body, although no consensus within the scientific community currently exists regarding the exact threshold at which the ratio of calcium to serum is deemed "hypocalcemic" (Cho et al., 2015) and when to intervene on infants who present with hypocalcemia in the absence of symptoms (Vuralli, 2019). Calcium serves a critical role in supporting essential functions within the body, such as maintenance of the structure of cells (Jain et al., 2010). Hypocalcemia has been linked to perturbations in neonatal electroencephalogram (EEG) activity (Cho et al., 2015). Estimates of hypocalcemia can vary from one region of the world to the next. In one research report from Egypt, hypocalcemia was found to be present in 76% of infants (Elsary et al., 2018).

Treatment for Sepsis. Sepsis in the newborn (also known as systemic inflammatory response syndrome) refers to a constellation of pathophysiological, including hematological, alterations that result from a virus, bacteria, or fungus (Shane et al., 2017). The current standard of care for treatment for sepsis is antibacterial pharmacology (Shane et al., 2017). Infants born preterm frequently develop sepsis; however, it has not been shown to lead to elevated risk for cognitive difficulties among children born preterm (Cai et al., 2019).

Meconium Aspiration Pneumonitis. Meconium aspiration syndrome, of which meconium aspiration pneumonitis is a diagnostic feature, has been linked to developmental delay, with one study reporting an incidence rate of 21% (Beligere & Rao, 2008).

Infant health indices are closely tracked shortly after delivery to promote well-being during the earliest period of development. Given that infants gestate and develop within a particular social context, it is important to understand the ways in which features of the social environment, including risk, can potentially contribute to risk trajectories for expectant parents and their infants.

Psychosocial Correlates of Perinatal Medical Risk

One current understanding of the mechanisms that underlie the relation between early perinatal medical risk and later challenges in cognitive and language functioning implicates compromised brain structures in the transmission of risk (Peterson, 2003; Ment & Vohr, 2008; Gumusoglu et al., 2020). Biological systems, however, are inextricably linked to children and families' psychosocial functioning. The literature on the social determinants of health provides a framework for understanding how psychosocial factors from a family's environmental context can relate to maternal and child well-being during pregnancy and at birth. For example, Kane and colleagues (2018) showed the maternal SES in adolescence is related to subsequent birth weight through social variables, such as smoking in pregnancy. While studies have documented links among early perinatal medical risk, familial environment, and child cognitive and language outcomes, much remains unknown regarding the origins of perinatal medical risk. Identifying the antecedents of risk during pregnancy and at birth could help prevent developmental difficulties following birth. Understanding the factors that may contribute to perinatal medical risk would allow for preventative measures to be put in place before pregnancy and birth and improve outcomes for both the mother and the infant, particularly if the identified antecedent factors are modifiable. Just as with understanding the mechanisms that undergird perinatal medical risk and child cognitive and language outcomes, a biopsychosocial framework may also be appropriate

for identifying the antecedents of adverse outcomes during pregnancy and at birth. The extant literature implicates several factors in the development of perinatal medical risk and will be reviewed here.

While perinatal medical risk certainly includes biological factors in its etiology, physical health unfolds in the context of a social world. As such, social determinants of health should also be evaluated when considering how perinatal medical risk develops. Indeed, in recent years, there has been a push to better understand the psychosocial predictors of biological perinatal outcomes. For examples, Kominiarek and Peaceman in 2017 highlighted the importance of directing the focus of scientific endeavors on elucidating the relationship between psychosocial factors and gestational weight gain. Taking psychosocial factors into account when considering perinatal medical risk would allow for a more holistic view of the myriad factors that impinge on physical health and allow for more potential points of intervention. A growing literature demonstrates the ways in which variables such as family history of depression and SES relate to perinatal medical risk.

Family History of Psychopathology. Prior research has documented the enduring legacy of psychopathology across generations within families. Emerging empirical evidence suggests that psychosocial stress in the form of adverse childhood experiences, including parental psychopathology, may also be involved in the development of subsequent perinatal medical risk in adulthood (Smith et al., 2016). Maternal mood concerns are present in a high percentage of pregnancies. Dadi and colleagues (2020) reported in their recent review that prenatal depression occurs at a rate of 15-65% around the world. Prior research has highlighted ties between maternal psychological adjustment and greater perinatal medical risk. Prenatal maternal anxiety (Ding et al., 2014; Campbell et al., 2018; Loomans et al., 2012) and prenatal depression (Dadi et

al., 2020; Lefkovics et al., 2014; Liou et al., 2016; Loomans et al., 2012) have been linked to preterm birth. Prenatal care appears to play a role in the robustness of the relation between maternal prenatal depression and preterm birth. Smith and colleagues (2015) found that maternal prenatal depression was related to a higher likelihood of preterm birth; however, that link disappeared after prenatal care was taken into account. Maternal prenatal depression has also been implicated in the development of preeclampsia (Lefkovics et al., 2014).

While parental, specifically maternal, history of psychopathology has been implicated in elevated risk of adverse health outcomes in the perinatal period, much less is known about the contributions of the intergenerational transmission of psychopathology, including from grandparents and fathers.

Prenatal Stress. Across studies, prenatal stress has been operationalized in numerous ways, including as the presence of stressful life events, depression, and anxiety. Studies on the relation between prenatal stress and perinatal medical risk have been mixed, likely due in part to considerable heterogeneity in methods. Mothers who experience pre-conception or prenatal emotional distress have similarly been found to be more likely to give birth prematurely (Martini et al., 2010; Heaman et al., 2013) or have a newborn classified as SGA (Heaman et al., 2013). Mothers who have experienced stressful life events have also been shown to experience birth complications. Dancause et al. (2011) found that mothers who had experienced prenatal life event stress in the form of the 1998 St. Lawrence River Valley ice storms in Québec had infants with decreased birth weights. Precarious housing has also been linked to perinatal medical risk. A recent study of families in Georgia noted that women who experienced eviction while pregnant went on to experience preterm birth, and their children had decreased birth weights (Himmelstein & Desmond, 2021). A study of Taiwanese mothers found no relation between

prenatal stress and preterm birth or birth weight (Liou et al., 2016). Further, previous research has documented a link between expectant parents' relationship dynamics and perinatal medical risk. Khaled and colleagues (2020) found that more negative behaviors displayed between expectant parents during a laboratory conflict task was linked to elevated medical risk at birth.

Socioeconomic Status. SES represents one potential social determinant of perinatal health for parents and infants. Previous research has demonstrated links between low SES and increased odds of preeclampsia (Kim et al., 2018); blood loss during delivery (Kim et al., 2018); preterm birth (Blumenshine et al., 2010; Kim et al., 2018; Heaman et al., 2013; Ruiz et al., 2015) and small infant size for gestational age (Blumenshine et al., 2010; de Bie et al., 2010; Wilding et al., 2019; McCowan et al., 2010; Ruiz et al., 2015). Low SES has also been implicated in the development of puerperal infections, although the precise mechanism(s) by which this occurs remains to be fully elucidated (Maharaj et al., 2007).

Emerging research has also shown the long-term role that SES in childhood may have in the development of perinatal medical risk. Miller and colleagues (2017) have shown that socioeconomic insecurity in childhood is related to later having a child born prematurely and SGA. A constellation of factors appear to underlie this relation, including inflammation (Miller et al., 2017).

Findings on the relation between SES and prenatal weight gain across studies have been mixed. Park et al. (2011) noted that less educational attainment in mothers and fathers was related to poor prenatal weight gain. Kowal et al. (2012) indexed SES using educational attainment in mothers and family earnings and found that decreased SES was related to an increased risk of elevated weight gain.

Parental Death in Childhood. Loss of a parent in childhood has been identified as one potential risk factor for poorer health outcomes in the perinatal period. Harville and colleagues (2010) found that alterations to the family structure in the first sixteen years of life, whether by the death of a parent or by other circumstances, were linked to a higher likelihood of later having a child born prematurely.

Parent-Adolescent Relationship Quality. During the transition to parenthood, the quality of the relationship between expectant parents and their own parents may play a role in the degree of medical risk experienced during the perinatal period. Existing research has focused on childhood adversity in the context of the family system and demonstrated that stressors in childhood are related to later perinatal health (Harville et al., 2010; Miller et al., 2017).

The Present Study

Taken together, current evidence highlights the potential role that the psychosocial milieu across parents' development can play in the onset of medical risk during the perinatal period. However, the mechanisms underlying such associations remain unclear. As an initial step towards that larger effort, more empirical investigations must be undertaken to identify the most potent psychosocial correlates of perinatal complications. Characterizing the associations and mediating factors between risk in the familial environment across generations and later maternal and infant health risk would help to identify important targets of intervention to ensure positive outcomes for parents and their children. The present study sought to identify psychosocial correlates of perinatal medical risk. We hypothesized that a greater prevalence of psychosocial challenges (i.e., low SES, history of MDD, and higher prenatal stress) across generations within families will be related to greater medical risk during pregnancy and at birth. Exploratory analyses examined the relation between proband parents' experiences in their family

environment (parental death in childhood and the quality of the parent-child relationship in adolescence) and later perinatal medical risk.

Methods

Data Collection

This project used data previously collected for two projects conducted at Oregon Research Institute: the Oregon Adolescent Depression Project (OADP) and the Infant Development Study (IDS; Principal Investigator: Peter Lewinsohn). Both studies received prior approval from the institutional review board (IRB) and families provided written consent before participating in the study protocols. Existing reports document other findings from the OADP (e.g., Allen et al., 1998; Lewinsohn et al., 1998; Lewinsohn et al., 1999) and the IDS (Forbes et al., 2004).

Participants. Proband parents initiated participation in the overall project when they were adolescents through the longitudinal OADP. Participation continued into adulthood with the enrollment of their partners and infants in the IDS. For the present analyses, data from four time points were examined: Time Point 1 (T1; proband parents were 14-18 years of age), Time Point 2 (T2; proband parents were 15-19 years of age), Time Point 3 (T3; proband parents were 24 years of age), and Time Point 4 (T4; 3 months postpartum). Families (N = 137) were selected for the current study if they had complete maternal and paternal positive affect data at 6 months postpartum, an outcome of relevance to Studies 2 and 3 in this investigative series.

Measures

Socioeconomic Status. An index of SES was obtained through reported education level. Parent education level has been demonstrated to be the most robust socioeconomic correlate of birth morbidity (Parker et al., 1994) and has been used to index SES in studies of infants who are

SGA (Wilding et al., 2019). Self-reported family SES was collected during the proband parents' adolescence and at the infants' 3-month study time point.

Grandparent and Parent History of Major Depressive Disorder. History of MDD in proband grandparents (G1) was assessed using two interviews that took place around T3: (1) the Structured Clinical Interview for DSM-III-R, Nonpatient version (SCID-NP; Spitzer et al., 1992) and (2) the revised Family Informant Schedule and Criteria (FISC; Mannuzza & Fryer, 1990). History of MDD in non-proband grandparents was assessed with the Structured Clinical Interview for Axis I DSM-IV Disorders – Patient Edition (First et al., 1994). Proband parents and their partners (i.e., all parents) also underwent the Structured Clinical Interview for Axis I DSM-IV Disorders - Patient Edition (First et al., 1994) to assess for lifetime history of MDD during the transition to parenthood at 3 months postpartum (T4).

Grandparent-Parent Relationship Quality during the Parent's Adolescence. The quality of the relationship between each proband parent and her/his/their parent was assessed during the proband participants' adolescence (T1 and T2) by evaluating the degree of issues that was present in their relationship with the Issues Checklist (Robin & Weiss, 1980). An average score indexing the severity of discord within the parent-child relationship was computed from the two time points.

Prenatal Stress. The Psychiatric Epidemiology Research Inventory (PERI; Dohrenwend et al., 1986) and the Social Readjustment Rating Scale (SRRS; Holmes & Rahe, 1967) were used to generate an array of 33 possible stressful life events from which proband participants and their partners indicated whether they had experienced any of the events. Researchers confirmed the presence of the indicated stressful life events in a subsequent "stress interview," derived from a

Life Events and Difficulties Schedule (LEDS) adaptation and prompts used in prior research from Shrout and colleagues (1989).

Perinatal Medical Risk. The Peripartum Events Scale (PES; O'Hara, 1995) was utilized to document perinatal medical events from the mothers' medical records. For the purposes of the present analyses, a composite perinatal medical risk score was produced from totaling all 27 perinatal risk factors noted in the following sections of the PES for each mother: seven Obstetric Risk Factors (abnormal weight gain of less than 4 kilograms or greater than 18 kilograms; abnormal uterine size, including multiple pregnancy; preeclampsia; significant bleeding; abnormal presentation; fever in labor; and meconium-stained amniotic fluid), six Delivery Complications (blood loss of greater than 600 cc; significant lacerations; puerperal infection; anesthetic complications; manual removal of the placenta; and other unspecified complications), and fourteen Infant Outcomes (gestational age of less than 37 weeks or greater than 41 weeks; SGA or large for gestational age; one-minute Apgar score of less than 6; five-minute Apgar score of less than 8; need for pH correction; need for volume expansion; need for transfusion or exchange transfusion; hypoglycemia; hyperbilirubinemia; hypocalcemia; treatment for sepsis; meconium aspiration pneumonitis; other non-immediate life-threatening event; and other life-threatening event) for a maximum total score of 27.

Parental Death. At 14-18 and 15-19 years old (T1 and T2, respectively), proband parent participants indicated on a demographic questionnaire whether a parent of theirs had passed away.

Statistical Analyses

Data Preparation. Missing data points were multiply imputed to have complete data across all variables for data analysis. Multiple imputation was conducted in SPSS, version 28.

The approach taken was based on the linear model. Five imputed datasets were generated. Maximum case draws were set at 5,000 and maximum parameter draws were set at 2,000. Maximum model parameters were set at 1,000. Pooled results were reported when possible.

Following multiple imputation, data reduction efforts were undertaken to generate a single index of the following constructs: grandparent-parent relationship quality (mean of the two relational issues scores captured at consecutive time points during G2's adolescence) and G2 SES (the higher education level between G2 participants and their partners was used).

To conduct proband-specific analyses, proband-specific versions of several variables were derived from the "mother" and "father" versions of the following variables: lifetime history of MDD, education level (SES), and perinatal medical risk. Because the sex of six proband participants was not recorded, proband-specific analyses were restricted to 131 families (and not the total sample number of 137 families).

Analytic Approach. Zero-order correlations among all study variables were computed to assess for any significant associations between variables. Separate correlations were run for full-pedigree analyses and proband analyses due to different sample sizes for each set of analyses. Hierarchical linear regression was used to identify associations between G1 and G2 psychosocial factors and G2-G3 perinatal medical risk. Independent variables for the full-pedigree analysis included G1 and G2 history of MDD, G1 and G2 SES, and G2 prenatal stress. In order to disentangle the contributions of G1 from G2 to predicting perinatal medical risk, Model 1 of this set of analyses included G1 history of MDD. Model 2 included G2 history of MDD and G2 prenatal stress. After Models 1 and 2 accounted for characteristics from G1 and G2 separately, Model 3 examined all factors together. The proband-only analyses mirrored the approach taken for the full-pedigree analysis, with some additional variables. G1 SES was added to Model 4. G2

parental death in childhood and G1-G2 relationship quality during G2's adolescence were added to Model 5. Again, all variables were evaluated together in the final model.

Results

Table 1 displays the incidence rate of each perinatal risk factor across the sample for participant families with such data (n = 133; data available for 97% of the study's families). 133 out of the 137 families in the study had complete perinatal medical risk data. In order of least to most common, the incidence of obstetric risk factors across the 133 families were as follows: 2.3% experienced fever in labor; 3.0% experienced an abnormal presentation; 3.0% experienced significant bleeding; 6.0% experienced abnormal uterine size, including multiple pregnancy; 6.8% experienced preeclampsia; 12.0% experienced meconium-stained amniotic fluid; and 33.1% experienced abnormal weight gain (< 4 kg or > 18 kg). With regard to delivery complications, 0.8% had anesthetic complications, 3.8% had a puerperal infection, 9.0% had significant lacerations, 13.5% experienced manual removal of the placenta, 16.5% had an unspecified "other" delivery complication, and 17.3% experienced blood loss of > 600 cc. Among infant outcomes, 0.8% had a need for volume expansion, 3.8% experienced hypoglycemia, 4.5% underwent treatment for sepsis, 5.3% of infants had hyperbilirubinemia, 5.4% had another life-threatening condition, 6.0% had another non-immediate life-threatening condition, 8.3% had a five-minute Apgar score below 8, 8.3% of infants were either SGA or large for gestational age, 12.8% of infants were born at less than 37 weeks' gestation or at greater than 41 weeks' gestation, and 13.5% had a one-minute Apgar score of less than 6.

Participant demographic and psychosocial history data are summarized in Table 2. The availability of data for each variable before imputation ranged from 104 families (75.6% of total study sample) to 137 (100.0% of total study sample). In Generation 1, the incidence of proband

grandmother lifetime history of MDD was 31.4% of the available sample (n = 127), and proband grandfather lifetime history MDD was 23.4% (n = 127). Within the proband spouse's family, grandmother MDD was present in 30.7% of families (n = 110) and grandfather MDD was present in 16.1% of families (n = 104). The mean SES level was 5.33 (*SD* = 1.01; n = 133), which denotes completion of some college. In Generation 2, 40.9% of the sample with available sex data (n = 131) was male. 92.7% of mothers (n = 136) was white. 87.6% of fathers (n = 133) was white. At 3 months postpartum, the mean maternal age was 26.00 years (*SD* = 2.46; n = 136). The mean paternal age was 27.76 years (*SD* = 3.26; n = 133). 30.7% of mothers (n = 136) had a lifetime history of MDD and 18.2% of fathers (n = 133) had a lifetime history of MDD. The mean maternal prenatal stress score was 4.10 (*SD* = 1.96; n = 136), while the mean paternal prenatal stress score was 3.75 (*SD* = 2.16; N = 137). The mean SES score was 14.47 (*SD* = 1.70; n = 136), denoting an education level of nearly 2.5 years of college. Parental death in childhood occurred in 3.6% of proband participants (N = 137), and the mean parent-proband adolescent relationship quality score was 10.53 (*SD* = 5.47; N = 137). Finally, the mean perinatal medical risk score was 1.95 events (*SD* = 1.95; n = 133).

Table 1

Summary of Perinatal Medical Risk Factor Incidence (n = 133)

Perinatal Medical Risk Factor	n (% of available sample n = 133) [a]
Obstetric risk factors	
Abnormal weight gain (< 4 kg or > 18 kg)	44 (33.1%)
Abnormal uterine size, including multiple pregnancy	8 (6.0%)
Preeclampsia	9 (6.8%)
Significant bleeding	4 (3.0%)
Abnormal presentation	4 (3.0%)
Fever in labor	3 (2.3%)
Meconium-stained amniotic fluid	16 (12.0%)
Delivery complications	
Blood loss > 600 cc	23 (17.3%)
Significant lacerations	12 (9.0%)
Puerperal infection	5 (3.8%)
Anesthetic complications	1 (0.8%)
Manual removal of placenta	18 (13.5%)
Other	22 (16.5%)
Infant outcomes	
< 37 weeks or > 41 weeks	17 (12.8%)
Small for gestational age (SGA) or large for gestational age (LGA)	11 (8.3%)
One-minute Apgar < 6	18 (13.5%)
Five-minute Apgar < 8	11 (8.3%)
Need for pH correction	0 (0%)
Need for volume expansion	1 (0.8%)
Need for transfusion or exchange transfusion	0 (0%)
Hypoglycemia	5 (3.8%)
Hyperbilirubinemia	7 (5.3%)
Hypocalcemia	0 (0%)
Treatment for sepsis	6 (4.5%)
Meconium aspiration pneumonitis	0 (0%)
Other: non-immediate life-threatening	8 (6.0%)
Other: life-threatening	7 (5.3%)

[a] Non-imputed data.

Table 2

Participant Demographic and Psychosocial History Data (original data before imputation, n = 104 -137)

	n	*M* or %	*SD*
Generation 1			
Grandmother MDD (proband family)	127	31.4%	-
Grandfather MDD (proband family)	127	23.4%	-
Grandmother MDD (proband spouse's family)	110	30.7%	-
Grandfather MDD (proband spouse's family)	104	16.1%	-
SES (proband family)	133	5.33	1.01
Generation 2			
% Male (proband participants)	131	40.9%	-
% white (mothers)	136	92.7%	-
% white (fathers)	133	87.6%	-
Maternal age in years at 3 months postpartum	136	26.00	2.46
Paternal age in years at 3 months postpartum	133	27.76	3.26
Maternal MDD	136	30.7%	-
Paternal MDD	133	18.2%	-
Maternal prenatal stress	136	4.10	1.96
Paternal prenatal stress	137	3.75	2.16
SES	136	14.47	1.70
Parental death in childhood (proband participants)	137	3.6%	-
Parent-adolescent relationship quality (proband family)	137	10.53	5.47
Generations 2 & 3			
Perinatal medical risk	133	1.95	1.95

Zero-order correlations for all study variables were evaluated for significant associations in anticipation of regression analyses (see Table 3). Correlations were examined using results pooled across imputed datasets (N = 137). Two statistically significant associations were revealed. Grandfather lifetime history of MDD within the proband's spouse's family (Generation 1) was significantly associated with father history of MDD (G2; $p < .001$). In addition, maternal prenatal stress was significantly correlated with paternal prenatal stress ($p < .001$). All other relations between study variables did not reach significance.

Predicting Perinatal Medical Risk from Full-Pedigree Psychosocial Factors

In the initial set of regressions examining the links between psychosocial factors and perinatal medical risk, contributions from Generation 1 were investigated first in Model 1 (see Table 4). Neither grandfather nor grandmother lifetime history of MDD on either side of the study families accounted for any significant variance in perinatal medical risk in the proband generation ($p = .407$-$.982$). In Model 2, Generation 2 factors were evaluated. Maternal prenatal stress demonstrated a trend towards significance in predicting perinatal medical risk ($B = .174$, $SE = .097$, $p = .072$). All other factors, including maternal and paternal lifetime history of MDD, paternal prenatal stress, and SES did not significantly predict perinatal medical risk. Model 3 included all Generation 1 and 2 variables. With all variables examined simultaneously, no factor significantly predicted the outcome of perinatal medical risk.

Table 3

Zero-Order Correlations between Study Variables for Full-Pedigree Analysis (pooled results, N = 137)

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Gen. 1	1. Grandmother MDD (proband family)	-									
	2. Grandfather MDD (proband family)	.171	-								
	3. Grandmother MDD (proband spouse's family)	.028	-.136	-							
	4. Grandfather MDD (proband spouse's family)	.143	.037	.218	-						
Gen. 2	5. Maternal MDD	.135	.058	.160	.142	-					
	6. Paternal MDD	-.124	-.167	**.295*** **	.002	.125	-				
	7. Maternal prenatal stress	.022	-.085	.027	.098	.144	.082	-			
	8. Paternal prenatal stress	.069	-.013	-.121	-.053	.014	.066	**.361*** **	-		
	9. SES	-.041	.057	.003	.075	-.022	-.181	-.124	-.115	-	
Gen. 2 & 3	10. Perinatal medical risk	-.001	-.087	.090	.067	-.007	-.036	.138	.002	.095	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 4

Hierarchical Linear Regressions Predicting from Full-Pedigree Psychosocial Factors to Perinatal Medical Risk (pooled results; N = 137)

	Model 1			Model 2			Model 3		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Gen. 1									
Grandmother MDD (proband family)	.009	.395	.982	-	-	-	.018	.404	.965
Grandfather MDD (proband family)	-.357	.429	.407	-	-	-	-.347	.432	.423
Grandmother MDD (proband spouse's family)	.263	.433	.547	-	-	-	.347	.464	.459
Grandfather MDD (proband spouse's family)	.259	.467	.582	-	-	-	.152	.477	.752
Gen 2.									
Maternal MDD	-	-	-	-.109	.373	.771	-.150	.384	.696
Paternal MDD	-	-	-	-.115	.435	.791	-.303	.486	.534
Maternal prenatal stress	-	-	-	**.174**	**.097**	**.072**	.157	.099	.113
Paternal prenatal stress	-	-	-	-.044	.086	.609	-.028	.089	.754
Socioeconomic status	-	-	-	.122	.112	.278	.116	.111	.298
ΔR^2 range across imputed datasets [a]		-			-			2.1%-4.8%	
Total R^2 range across imputed datasets		1.8%-2.7%			2.0%-5.2%			4.5%-7.1%	

Note. B = unstandardized beta.

[a] ΔR^2 represents the change in R^2 from Model 1 to Model 3.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Predicting Perinatal Medical Risk from Proband-Specific Psychosocial Factors

Next, psychosocial factors from the proband parents' families with data available for imputation (n = 131) were evaluated in a separate set of regressions. In order to examine the relations among study variables in anticipation of the regression analyses, zero-order correlations were evaluated (Table 5). Three significant sets of correlations were revealed. Grandmother lifetime history of MDD was found to be significantly associated with parents' experience of parental death in childhood (r = .193, p = .027). Grandparental SES was significantly related to parental SES (r = .311, p < .001). Grandparental SES was also significantly linked to the quality of parents' relationship with their parents (the grandparents in the present study) during adolescence (r = -.213, p = .018), such that higher grandparental SES was related to fewer reported issues within the relationship between the grandparents and parents during the parents' adolescence.

Following the exploration of zero-order correlations, hierarchical linear regression analyses were conducted to identify the contributions of psychosocial factors across generations to perinatal medical risk (Table 6). In Model 4, the Generation 1 variables of grandmother lifetime history of MDD, grandfather lifetime history of MDD, and SES were entered, with all variables demonstrating non-significant relations to perinatal medical risk in Generation 2 (p < .311-.878). Relations examined in Model 5 yielded similar findings, with all Generation 2 psychosocial factors (i.e., parental lifetime history of MDD, prenatal stress, SES, experience of parental death in childhood, and parent-adolescent relationship quality) showing non-significant links to perinatal medical risk (p = .219-.521). Model 6 included Generation 1 and 2 variables, with all factors showing non-significant ties to perinatal medical risk (p = .194-.837)

Table 5

Zero-Order Correlations between Study Variables for Proband Analysis (proband pooled results, n = 131)

		1.	2.	3.	4.	5.	6.	7.	8.	9.
Gen. 1	1. Grandmother MDD	-								
	2. Grandfather MDD	.165	-							
	3. SES	-.150	-.072	-						
Gen. 2	4. Proband parent MDD	.083	-.009	-.123	-					
	5. Proband parent prenatal stress	.053	-.073	-.056	.133	-				
	6. Proband parent SES	.001	.079	**.311*** **	-.148	-.030	-			
	7. Parental death in childhood	**.193***	-.026	.031	-.120	.027	-.053	-		
	8. Parent-adolescent relationship quality	.081	.161	**-.213***	-.037	.092	.033	-.025	-	
Gen. 2 & 3	9. Perinatal medical risk	.001	-.101	.020	-.065	.062	.071	-.098	-.066	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 6

Hierarchical Linear Regressions Predicting from Proband Parent Psychosocial Factors to Perinatal Medical Risk (n = 131)

	Model 4			Model 5			Model 6		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Gen. 1									
Grandmother MDD	.080	.419	.848	-	-	-	.193	.431	.654
Grandfather MDD	-.464	.455	.311	-	-	-	-.463	.463	.321
Socioeconomic status	.028	.184	.878	-	-	-	-.041	.199	.837
Gen 2.									
Parent MDD	-	-	-	-.369	.405	.363	-.392	.411	.340
Prenatal stress	-	-	-	.091	.101	.370	.079	.102	.440
Socioeconomic status	-	-	-	.061	.095	.521	.075	.101	.456
Parental death in childhood	-	-	-	-1.125	.916	.219	-1.227	.946	.194
Parent-adolescent relationship quality	-	-	-	-.032	.038	.393	-.029	.040	.473
ΔR^2 range across imputed datasets [a]		-			-			2.6%-4.1%	
Total R^2 range across imputed datasets		0.5%-1.9%			2.6%-4.3%			3.3%-5.8%	

Note. B = unstandardized beta.

[a] ΔR^2 reflects the change in R^2 from Model 4 to Model 6.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Discussion

A growing body of literature highlights the role that social determinants play in influencing physical well-being in adults (Braveman et al., 2011) and children (Chung et al., 2016). The present study sought to identify psychosocial correlates of perinatal medical risk across two family generations comprised of parents and grandparents. Results detected mild evidence that could signal a link between greater maternal prenatal stress and increased perinatal medical risk, which would have to be further evaluated with a larger sample. At the outset of the study, we had projected that the presence of more psychosocial challenges across generations would be related to a higher degree of perinatal medical risk in the current generation.

Prenatal Stress and Perinatal Medical Risk

Prenatal stress is common and has been operationalized as numerous variables in the literature, including the presence of stressful life events, anxiety, and depression. Estimates place rates of prenatal anxiety and depression at 21-25% (Field, 2017) and 10-25% (Field, 2006), respectively. The present study found that higher levels of maternal prenatal stress, indexed as a count of stressful life events, demonstrated a trend towards predicting greater perinatal medical risk. Ongoing research with a larger sample is needed to examine this link further. Extant evidence in the parental and infant health literature suggests that prenatal stress may be related to compromised infant development. Dancause and colleagues (2011) showed that prenatal life event stress in the form of the 1998 ice storms in the St. Lawrence River Valley of Canada was linked to decreased birth weight. Himmelstein and Desmond (2021) found that eviction in the prenatal period was related to decreased birth weight, low birth weight, and a briefer gestational period. Taken together, the evidence from the current and existing studies suggests that distressing events that take place during pregnancy can have cascading consequences for the

health of mothers and infants. While some stressors, such as natural disasters, are difficult to predict and control, others such as housing security are more amenable to prevention through social and public policy efforts. Given the toll that social risk factors could have on the well-being and later cognitive functioning of infants, interventions that mitigate the risks that expectant parents and their infants experience are well worth the investment.

The Social Environment and Morbidity During Pregnancy and at Birth

In addition to maternal prenatal stress, the current report also evaluated the predictive value of familial history of MDD, paternal prenatal stress, SES, parental loss in childhood, and parent-grandparent relationship quality for the outcome composite measure of perinatal medical risk. These factors did not account for variance in the outcome of perinatal medical risk. The field's understanding of the psychosocial correlates of perinatal morbidity is currently in its early stages. However, the finding that SES was unrelated to perinatal medical risk is inconsistent with recent evidence from Kane and colleagues (2018), which had demonstrated that mothers' SES in adolescence is tied to later infant birth weight.

Significant associations were found within constructs and within and across generations. Paternal history of MDD was positively associated with grandmother history of MDD. This result aligns with other findings in the literature. Previous research has shown that risk for MDD is often passed down from one generation to the next (Goodman, 2020; Gotlib et al., 2020; Hammen et al., 2012). In the present study, results further indicated that paternal prenatal stress is positively associated with maternal prenatal stress. While prior research has documented a link between parenting stress in mothers and fathers in the postpartum period (Epifanio et al., 2015), prenatal stress within couples represents an underexamined area of study. The finding from the current report highlights the need to clarify the relation between maternal and paternal stress

during pregnancy and the implications that it could have for perinatal outcomes and early childhood cognitive and language functioning.

Exploratory analyses conducted with the data of proband parents who had previously also participated in the Oregon Adolescent Depression Project prior to the Infant Development Study revealed several significant associations. The quality of the parent-child relationship in adolescence and SES in adulthood were associated with the SES of the family of origin. It is possible that higher SES confers greater stability to the family environment, which in turn may contribute to decreased tension and conflict within the parent-adolescent relationship. An additional finding was that the experience of parental death in childhood was correlated with grandmother history of MDD. While the exact cause of death was not recorded for the present study, this finding suggests that mental health concerns may contribute to greater risk of parental mortality.

Strengths and Limitations

Several strengths and limitations in the present study warrant mention. A primary strength of the present study was the multigenerational and longitudinal design of the study that afforded the examination of an array of psychosocial factors from grandparents to parents to infants. The proband parents had participated in the Oregon Adolescent Depression Project and Infant Development Study during the formative periods of adolescence, young adulthood, and the transition to parenthood, which provided within-individual data over time from which to investigate the role of the social environment on perinatal medical risk. On the other hand, the families in the present study were predominantly white and comprised of heterosexual couples. In addition, the fact that the families in the present study sustained their research participation over time suggests that they may have possessed attributes (e.g., elevated conscientiousness) that

are uncommon in the general population. As such, the generalizability of the findings are limited to families with similar characteristics. In addition, the overall sample size was relatively small, particularly when compounded by missing data, compared to that of population-based investigations in the perinatal health literature.

Future Directions

The present study highlighted the potential role that maternal prenatal stress can play in shaping perinatal health outcomes for mothers and infant. Elevated stress during pregnancy may contribute to greater risk during pregnancy and birth. More research is needed to fully elucidate the most salient forms of prenatal stress to address through interventions. Given the costly and time-consuming nature of psychosocial interventions, additional research is needed to support the design of well-timed and effective treatments. In addition, future treatment trials could evaluate the impact of stress-reduction interventions during the prenatal period on perinatal outcomes. In future investigations, it will also be critical to investigate the factors that promote resilience in the perinatal period.

Implications for Clinical Practice

Some efforts are currently underway to address the growing need for parental mental health services within perinatal care settings. The current study revealed associations between history of MDD across familial generations (paternal history of MDD associated with grandmother history of MDD within the proband spouse's family). Such evidence points to the need to take genetic loading of mood concerns into account when conducting clinical assessments, as some individuals may be more genetically predisposed to developing MDD. An appreciation of the risk for mood symptoms within a family line can also support prevention or early intervention efforts to bolster the mood regulation capacities of individuals who do not yet

meet full diagnostic criteria for MDD. In particular, children and adolescents who may not have experienced a complete depressive episode could be particularly vulnerable to having an episode in the future if there is a positive family history of mood concerns.

Conclusion

In the present investigation, maternal prenatal stress demonstrated a trend towards predicting adverse perinatal outcomes. The current study provides evidence that history of major depressive disorder is associated across two generations – grandmothers and fathers. Maternal prenatal stress is also linked to paternal prenatal stress. The social determinants of perinatal medical risk warrant further investigation to reduce the burden of pregnancy- and birth-based morbidities and by extension, risk to later cognitive and language development.

CHAPTER 3

STUDY 2. PSYCHOSOCIAL CORRELATES OF PARENT AFFECT: GRANDPARENTS AND PARENTS

A substantial literature provides empirical evidence supporting the reinforcing link between parenting behavior and cognitive functioning in early childhood (Feldman & Eidelman, 2009; Clark & Woodward, 2015; Bernier et al., 2012) and into the school-aged years (Smith et al., 2006). Emerging evidence demonstrates that parenting behavior is linked to early child executive functioning, over and above the role of genes (Bridgett et al., 2018). Taken together, the extant literature highlights the critical and unique position that parenting assumes in understanding the origins of cognitive competence and executive regulation. Parenting behavior is undeniably dynamic and complex, encompassing not only observable actions, but also the orchestrated regulation of affective (Rueger et al., 2011), physiological (Mills-Koonce et al., 2009), and social cognitive (see Bornstein et al., 2018) states and processes. Given the centrality of parenting behavior in building a strong cognitive foundation in children, a deeper understanding of the antecedent correlates of parenting behavior is warranted in order to strengthen the effectiveness of parenting intervention efforts aimed at promoting cognitive development.

Parent Positive Affect

Parent affect represents one dimension of an array of overlapping variables that have been utilized in the literature to investigate parenting behavior. Some existing research in the parenting literature has subsumed parent affect under the larger construct umbrella of parenting behavior (e.g., Treyvaud et al., 2009; Gordon et al., 2010). Additional research has directly examined how the separate constructs of parent affect and parenting behavior may be linked. The

results of a meta-analysis from Rueger and colleagues (2011) demonstrated that parent affect exhibits reliability as an index of parenting behavior. The findings further revealed that parent negative affect courses with hostile parenting behavior while parent positive affect courses with supportive parenting behavior. In the present study, we focused on a behaviorally-derived measure of parent affect as the outcome of interest and refer to it alternately as "parent affect" and "parent behavior." Prior research points to several psychosocial factors embedded within the family milieu that are associated with parenting affect and behavior.

Familial Loading of Depression Risk and Parenting Behavior in Infancy

Children of parents with a history of depression are more likely to develop depression themselves (Goodman, 2020). The link between the experience of having a parent with a history of psychopathology and later mental health outcomes has been shown to extend into children's early adulthood, a time when many children transition into parenthood themselves. That is, familial history of depression may have a downstream impact on parenting practices in subsequent generations. A sizeable literature has explored the associations between parental psychopathology and parenting behavior. For example, recent work from Mitchell and colleagues (2019) demonstrated that mothers who experienced elevated depressive symptomatology in the prenatal period went on to display less warm responsiveness when their infants were 4 months old.

Over the last several decades, greater scientific effort has been devoted to understanding the prevalence and impact of paternal depression on the family system. Ramchandani and colleagues (2005) noted that in their population-based sample of families, maternal postpartum depression occurred at a rate of 10% and paternal postpartum depression occurred at a rate of 4%.

Despite the high prevalence of intergenerational transmission of depression in the general population, relatively little research has examined the relation between family history of depression and parent affect during infancy. Relatively more is known about the relation between parental depression (particularly maternal) and parenting practices during the postpartum period. Existing research has found that maternal depression is linked to less sensitive parenting behaviors displayed with 3-month-old infants (Ierardi et al., 2018). Mothers with sub-threshold depression and mothers without depression have been shown to exhibit comparable levels of positive affect while engaging with their children at 4 months (Braarud et al., 2017). Paternal depression is related to maternal unresponsiveness (Ierardi et al., 2018), paternal withdrawal (Sethna et al., 2015), and reductions in active engagement, playful excitation, and tactile stimulation with infants of the same age (Sethna et al., 2018). Such evidence suggests that parental mood states inform the behaviors that parents engage in when interacting with their infants during a stage of development when parent-child interactions serve a critical role in promoting cognitive and language capacities.

As most studies on parental depression and parenting behavior and affect have been devoted to understanding parental depression in the postpartum period, more research is needed to understand the implications of intergenerational and individual lifetime depression on parent affect. Existing research on parent lifetime history of depression has focused on infant attachment classification as the outcome of interest, namely that no relation exists between lifetime depression in mothers and adverse attachment outcome for their infants (Tharner et al., 2012).

Socioeconomic Status

To our knowledge, no studies to date have examined the role of SES in parent affect during interactions with their children. The existing evidence has focused more broadly on parenting behavior. Studies have produced mixed findings between SES and parenting behavior. Decreased SES has been found to relate to a higher degree of parental control exerted during play interactions with toddlers (Smith, 2010). Altafim and colleagues (2018) found no evidence to support a tie between SES and their study's factor of maternal Emotional and Behavioral Regulation.

Parental Death in Childhood

Adversity in the form of the residual impact of the death of an important relational figure may also be linked to parenting behavior. Past research has shown that a history of an unresolved loss, which encompasses parental death among other types of loss, is related to authoritative parenting among mothers of preschoolers (Busch et al., 2008). In general, however, very little research has investigated how experiencing the death of a parent in childhood impacts later caregiving approaches. Much more has been examined with regard to death of a parent and later adult risk for psychopathology, which would presumably inform affect displayed towards children during interactions. Parental death early in life has been linked to elevated odds of developing depression in adulthood (Berg et al., 2016; Simbi et al., 2020).

Parent-Adolescent Relationship Quality

Prior research has examined the trans-generational durability of parenting behaviors. Campbell and Gilmore (2007) found in their sample of families that a permissive or authoritarian parenting approach in one generation of parents is associated with use of the same set of parenting behaviors in the previous generation. Work by Belsky and colleagues (2005) revealed

that mothers who had enjoyed a higher degree of trust and communication with caregivers during adolescence went on to display higher levels of constructive parenting when their own children were 3 years old. Similarly, Madden et al. (2015) documented that fathers who reported more maternal affection in childhood through age 16 also displayed greater positive responsiveness towards their 24-month-olds. On the other hand, Kovan and colleagues (2009) found no association between positive parenting received in adolescence and subsequent parenting when offspring were 24 months of age. Given the inconsistencies in findings in the literature, more research is needed to understand the trajectory of parenting behavior across family lines with a closer examination of effects across multiple levels, including when and how parenting behavior is sampled.

Extensive empirical efforts have been devoted to elucidating the underpinnings of child abuse across generations. Parental history of experienced child abuse appears to be related to decreased positive parent affect through maternal psychological well-being (Greene et al., 2020). Mothers of 8- to 11-year-old children with a positive parenting approach have a less significant history of childhood emotional abuse relative to mothers with parenting styles characterized as negative and at risk (McCullough et al., 2014). Recent evidence has served to elucidate the particular pathways that underly the link between early adversity and later parenting styles. Morelli and colleagues (2020) reported that for mothers, abuse in childhood is related to abusive caregiving approaches through stress and depressive symptoms.

The Present Study

Taken together, these findings suggest that factors embedded within the familial ecosystem are associated with distinct patterns of parenting practices. However, much remains unclear about the relation between distal familial factors (e.g., grandparental psychopathology)

and parent affect. Further empirical investigation is needed to identify the most salient features of the family environment that are relevant for parent affect. The present study leveraged the richness of data collected on families across two generations in order to identify psychosocial correlates of parent positive affect in infancy. We hypothesized that an immediate and extended familial history of psychosocial difficulties (i.e., low SES and history of MDD) will be associated with less positive parent affect following the transition to parenthood. Exploratory analyses investigated the relation between factors from the proband parents' family of origin (parental death in childhood and quality of the parent-child relationship in adolescence) and parent affect at 6 months. Associations between psychosocial strife and later parent affect were hypothesized to be mediated by the quality of grandparent-parent interactions assessed during the proband parent's adolescence.

Methods

Participants

Families in the present study were enrolled in the longitudinal Oregon Adolescent Depression Project (OADP) and the subsequent Infant Development Study (IDS). Existing results from the studies have been documented elsewhere (e.g., Lewinsohn et al., 1998; Allen et al., 1998; Lewinsohn et al., 1999; Forbes et al., 2004). The IRB provided approval prior to the commencement of study procedures. Families provided written consent at the start of study participation. Enrollment in the studies started with the "proband" parents who had enrolled in the OADP in high school when individual- and family-level data were collected on them and their parents. In young adulthood, the proband parents were contacted and invited to participate in the IDS with their spouses and infants, forming the sample for the IDS. In the present study,

137 families were included based on the presence of complete parent positive affect data at 6 months for both parents in the dyad.

Measures

Family History of Major Depressive Disorder. Grandparents' lifetime history of MDD within the proband family was assessed with two clinical interviews -- the Structured Clinical Interview for DSM-III-R, Nonpatient version (SCID-NP; Spitzer, et al., 1992) and the revised Family Informant Schedule and Criteria (FISC; Mannuzza & Fryer, 1990) – when the proband participants were 24 years old. Grandparents' lifetime history of MDD on the proband spouse's family's side was assessed with the Structured Clinical Interview for Axis I DSM-IV Disorders – Patient Edition (First, et al., 1994) at the same time point. Parents' lifetime history of MDD was assessed with the Structured Clinical Interview for Axis I DSM-IV Disorders - Patient Edition (First, et al., 1994) when their infants were 3 months of age.

Socioeconomic Status. SES was indexed using parental level of education. For proband grandparents and parents, the higher level within the parenting dyad was used for the present main analyses.

Parental Death in Childhood. As part of the OADP procedures, proband parents reported at two time points (at 14-18 years and 15-19 years) whether they had experienced the death of a parent.

Parent-Child Relationship Quality in Adolescence. During their participation in the OADP, the quality of the relationship between the proband participants and their parents was measured using the Issues Checklist (Robin & Weiss, 1980) at 14-18 years and at 15-19 years. The Issues Checklist is comprised of 44 subjects over which adolescents and their caregivers often experience discord. Adolescent-parent dyads were prompted to talk about the topics that

were most relevant to them. An average score over the two time points was computed for the present analyses.

Parent Positive Affect. At 6 months of age, G3 infants and their mothers and fathers (G2) completed an adaptation of Tronick's still-face paradigm (Tronick et al., 1978) in the laboratory over the course of one to two visits, dictated by the infant's level of fussiness. Infants participated in the task two times, one time each with their mother and father, with the order counterbalanced. The adapted still-face paradigm was comprised of four conditions: normal (3 minutes), peek-a-boo (40 seconds), still-face (2 minutes), and reunion (1 minute). Sessions were recorded and coded offline in one-second increments for affect and play behavior. Parent and infant affect were evaluated with a coding scheme generated from Tronick's Monadic Phases (Cohn & Tronick, 1987; Tronick, et al., 1980) and Izard's AFFEX guide (Izard et al., 1983). The normal interaction codes were used for the present analyses, as this was the only condition in which both parent and infant affect were evaluated. Parent affect was assessed for the following discrete dimensions: surprise, high positive, low positive, empathy, neutral, anger, and sadness. The present analyses utilized a composite parent positive affect variable derived from surprise, high positive, and low positive proportion codes. Empathy, anger, and sadness occurred at low rates. Neutral affect was beyond the focus of the study. As the affect data demonstrated skewness, arc sine transformation was conducted before analyses.

Statistical Analyses

Data Preparation. Due to missing data across the majority of variables, data were multiply imputed in order to conduct analyses with data for all participants across all variables. Multiple imputation using the linear model was conducted in SPSS, version 28. The following conditions were established: maximum case draws at 5,000; maximum parameter draws at 2,000;

maximum model parameters at 1,000. Five imputed datasets were produced, and pooled output was reported when available.

For proband-specific analyses, proband participants' sex was used to derive proband data from "maternal' and "paternal" data. As the sex was unknown for six proband subjects, only 131 proband subjects were included in the proband-specific analyses.

Study 2 Analytic Approach. In order to evaluate the associations between multigenerational psychosocial factors and G2 parent affect during the transition to parenthood, hierarchical linear regression models were run as part of a "full-pedigree" analysis (i.e., with data from the proband and proband's spouse) and "proband" analysis. For both sets of analyses, Model 1 consisted of G1 history of MDD. Model 2 was comprised of G2 history of MDD and SES. The final model, Model 3, included all variables together. In the proband analysis, additional variables were added. G1 SES was added to Model 4. The presence of parental loss in childhood and G1-G2 relationship quality in adolescence were added to Model 5. Model 6 again featured all variables. Mediation analyses were conducted to identify underlying mechanisms that facilitate the intergenerational transmission of familial contextual factors and parenting practices to subsequent generations (i.e., from G1 history of MDD to parent positive affect through G1-G2 relationship quality).

Results

Participant demographics using available (i.e., non-imputed data) are presented in Table 1. In Generation 1 of the proband family, 31.4% of grandmothers (of n = 127) and 23.4% of grandfathers (of n = 127) had a reported lifetime history of MDD. Within the proband spouse's family, 30.7% of grandmothers (of n = 110) and 16.1% of grandfathers (of n = 104) had a reported lifetime history of MDD. Mean SES was reported to be 5.33 (*SD* = 1.01), indicating

some college completion. In Generation 2, 40.9% of proband participants were male. The majority of parents identified as white (92.7% of mothers, n = 136; 87.6% of fathers, n = 133). On average, mothers were 26.00 years of age (*SD* = 2.46; n = 136) at 3 months postpartum. Mean age of fathers was 27.76 years (*SD* = 3.26; n = 133). The rate of maternal lifetime history of MDD was 30.7% and the rate of paternal lifetime history of MDD was 18.2%. Mean SES was 14.47 (*SD* = 1.01), reflecting some college completion (*SD* = 1.70). 3.6% of proband participants experienced the death of a parent during their childhood. The quality of the parent-adolescent relationship for proband subjects had a mean "issues" score of 10.53 (*SD* = 5.47). Across Generation 2 parents, positive affect was demonstrated with their 6-month-old infants 54% of the time, on average (*SD* = 0.18).

Predictors of Parent Affect. In order to identify associations among study variables for the full-pedigree analysis, zero-order correlations were examined. Table 2 shows the results pooled across the five sets of imputed data. One significant association emerged – grandfather lifetime history of MDD on the proband spouse's side of the family was significantly associated with paternal lifetime history of MDD ($r = .295$, $p < .001$). No other associations reached statistical significance.

Table 1

Participant Demographics (N = 137)

	n	*M* or %	*SD*
Generation 1			
Grandmother MDD (proband family)	127	31.4%	-
Grandfather MDD (proband family)	127	23.4%	-
Grandmother MDD (proband spouse's family)	110	30.7%	-
Grandfather MDD (proband spouse's family)	104	16.1%	-
SES	133	5.33	1.01
Generation 2			
% Male (proband participants)	131	40.9%	-
% white (mothers)	136	92.7%	-
% white (fathers)	133	87.6%	-
Maternal age in years at 3 months postpartum	136	26.00	2.46
Paternal age in years at 3 months postpartum	133	27.76	3.26
Maternal MDD	136	30.7%	-
Paternal MDD	133	18.2%	-
SES	136	14.47	1.70
Parental death in childhood (proband participants)	137	3.6%	-
Parent-adolescent relationship quality (proband family)	137	10.53	5.47
Parent positive affect	137	0.54	0.18

Table 2

Zero-Order Correlations between Study Variables for Full-Pedigree Analysis (pooled results, N = 137)

		1.	2.	3.	4.	5.	6.	7.	8.
Gen. 1	1. Grandmother MDD (proband family)	-							
	2. Grandfather MDD (proband family)	.171	-						
	3. Grandmother MDD (proband spouse's family)	.028	-.136	-					
	4. Grandfather MDD (proband spouse's family)	.143	.037	.218	-				
Gen. 2	5. Maternal MDD	.135	.058	.160	.142	-			
	6. Paternal MDD	-.124	-.167	**.295*** **	.002	.125	-		
	7. SES	-.041	.057	.003	.075	-.002	-.181	-	
Gen. 2 & 3	8. Parent positive affect	.036	-.061	-.004	.097	-.075	-.017	.080	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Next, full-pedigree hierarchical linear regression analyses were conducted to examine the predictive value of cross-generational psychosocial factors on parent positive affect six months postpartum. As seen in Table 3, Model 1 incorporated grandparent lifetime history of MDD on both sides of the family into the initial set of predictors. None of the factors approached statistical significance (p = .270-.696). Model 2 examined the role of parental lifetime history of MDD and parental SES in parent positive affect during play with their infant. Similar to Model 1, the results showed that these factors were not predictive of outcome. When all grandparent and parent factors were included in Model 3, no variables were shown to significantly account for variance in parent positive affect.

Proband-specific analyses were conducted to see if psychosocial variables that were uniquely collected from proband parents and their families were predictive of positive parent affect. This sample was comprised of 131 parents who had originally participated in the OADP as adolescents. Zero-order correlations were first examined using the five imputed data sets for the 131 proband participants with available data (see Table 4). Several significant associations between variables were found. Proband parent SES was significantly related to grandparent SES (r = .311, p < .001). In addition, the incidence of parental death in the proband parent's childhood was significantly correlated with grandmother lifetime history of MDD (r = .193, p = .027). Finally, the quality of the parent-adolescent relationship in the proband parent's adolescence was related to grandparent SES (r = -.213, p = .018)

Table 3

Hierarchical Linear Regressions Predicting from Full-Pedigree Psychosocial Factors to Parent Positive Affect (pooled results; N = 137)

	Model 1			Model 2			Model 3		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Gen. 1									
Grandmother MDD (proband family)	.013	.033	.696	-	-	-	.018	.033	.586
Grandfather MDD (proband family)	-.029	.035	.398	-	-	-	-.029	.035	.411
Grandmother MDD (proband spouse's family)	-.013	.034	.696	-	-	-	-.009	.036	.799
Grandfather MDD (proband spouse's family)	.040	.036	.270	-	-	-	.041	.037	.267
Gen. 2									
Maternal MDD	-	-	-	-.028	.033	.395	-.033	.034	.328
Paternal MDD	-	-	-	.003	.039	.948	.004	.042	.929
Socioeconomic status	-	-	-	.008	.009	.378	.008	.009	.388
ΔR^2 range across imputed datasets [a]		-			-			1.0%-1.9%	
Total R^2 range across imputed datasets		1.6%-2.4%			0.9%-1.8%			2.9%-3.8%	

Note. B = unstandardized beta.

[a] ΔR^2 represents the change in R^2 from Model 1 to Model 3.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 4

Zero-Order Correlations between Study Variables for Proband Analysis (proband pooled results, n = 131)

		1.	2.	3.	4.	5.	6.	7.	8.
Gen. 1	1. Grandmother MDD	-							
	2. Grandfather MDD	.165	-						
	3. Grandparent SES	-.150	-.072	-					
Gen. 2	4. Proband parent MDD	.083	-.009	-.123	-				
	5. Proband parent SES	.001	.079	**.311*** **	-.148	-			
	6. Parental death in childhood	**.193***	-.026	.031	-.120	-.053	-		
	7. Parent-adolescent relationship quality	.081	.161	**-.213***	-.037	.033	-.025	-	
Gen. 2 & 3	8. Parent positive affect	.104	-.136	.115	.032	.060	.132	-.057	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Hierarchical linear regressions were conducted using proband-specific data to investigate the relations between Generation 1 and 2 psychosocial variables and parent positive affect at 6 months postpartum. As shown in Table 5, Model 4 consisted of grandmother lifetime history of MDD, grandfather lifetime history of MDD, and SES. None of the variables in Model 4 achieved statistical significance (p = .088-.160). Model 5 was comprised of proband parent lifetime history of MDD, SES, incidence of parental death in childhood, and quality of the parent-adolescent relationship during the proband parent's adolescence. No variable in Model 5 was shown to significantly predict parent positive affect (p = .111-.547). Model 6 combined all variables across Generations 1 and 2 to see how the psychosocial factors would behave as predictors when they were all taken into account simultaneously. Results revealed non-significant relations between these variables and the outcome of interest, parent positive affect at infants' 6-month age point (p = .108-.848).

G1-G2 Relationship Quality as Potential Mediator of Grandparent Psychopathology and Parent Affect. As planned, mediation analyses were conducted across the five imputed datasets for the proband subjects with available data to evaluate quality of the grandparent-parent relationship during the parent's adolescence as a potential mediator in the relation between grandparental lifetime history of MDD and parent positive affect at 6 months. Separation mediation analyses were conducted for grandmother lifetime history of MDD (Figure 1) and grandfather lifetime history of MDD (Figure 2).

Table 5

Hierarchical Linear Regressions Predicting from Proband Parent Psychosocial Factors to Parent Positive Affect (n = 131)

	Model 4			Model 5			Model 6		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Gen. 1									
Grandmother MDD	.071	.043	.094	-	-	-	.058	.044	.193
Grandfather MDD	-.079	.046	.088	-	-	-	-.076	.047	.108
Socioeconomic status	.028	.020	.160	-	-	-	.023	.022	.286
Gen 2.									
Parent MDD	-	-	-	.030	.047	.519	.028	.047	.554
Socioeconomic status	-	-	-	.010	.011	.381	.007	.011	.571
Parental death in childhood	-	-	-	.168	.105	.111	.131	.108	.223
Parent-adolescent relationship quality	-	-	-	-.002	.004	.547	-.001	.004	.848
ΔR^2 range across imputed datasets [a]		-			-			1.2%-1.7%	
Total R^2 range across imputed datasets		4.8%-5.5%			2.6%-3.2%			6.1%-7.0%	

Note. B = unstandardized beta.

[a] ΔR^2 reflects the change in R^2 from Model 4 to Model 6.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Figure 1

Mediation Model 1

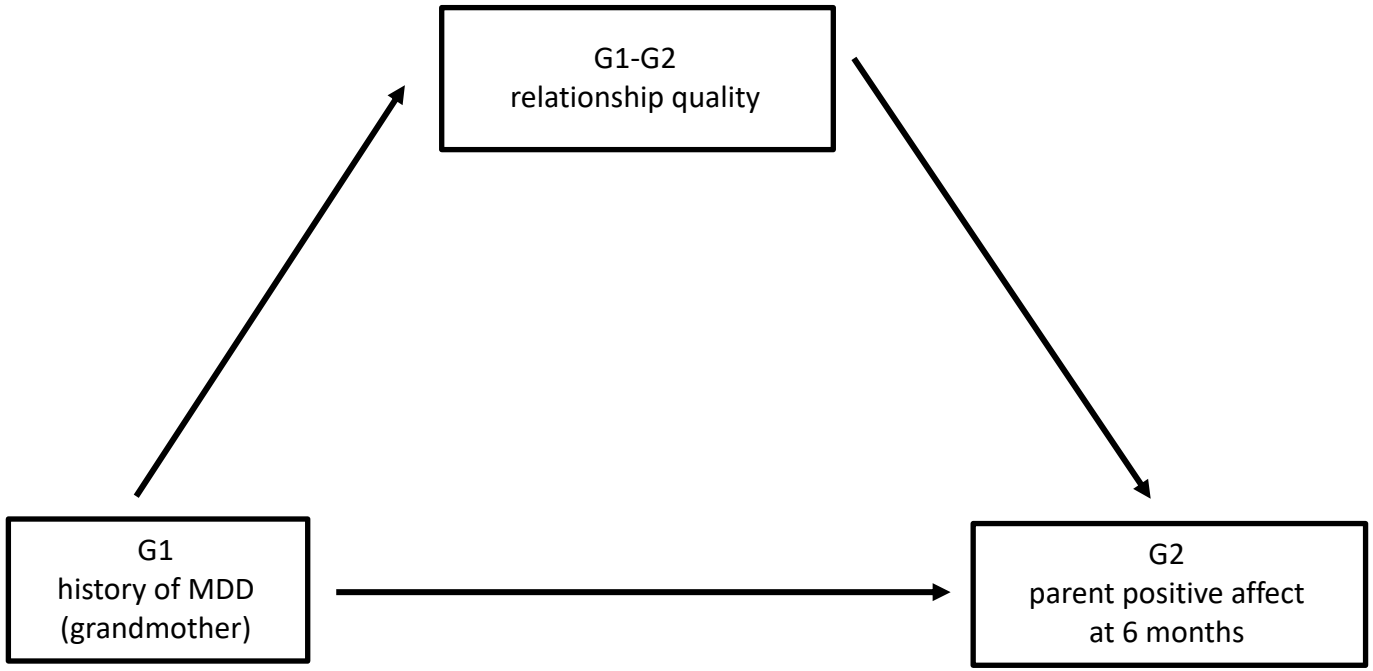


Figure 2

Mediation Model 2

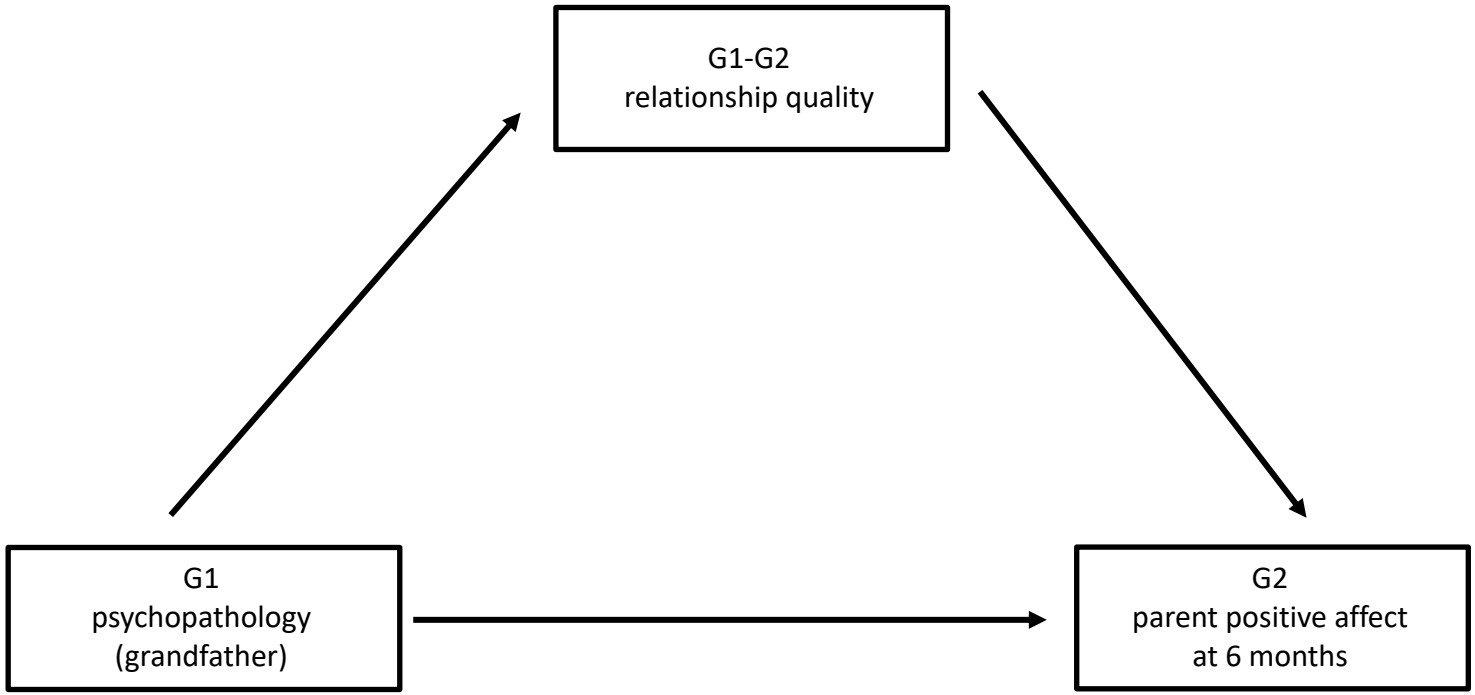


Table 6 displays the results for the analyses conducted with proband grandmother data. As reported above in the regression analyses, grandmother lifetime history of MDD was found to be unrelated to parent positive affect at the 6-month age point (p = .2265-.2516). Grandmother lifetime history of MDD was also noted to be unrelated to the quality of the grandparent-parent relationship during the parent's adolescence (p = .1933-.4756). The mediation model as a whole did not achieve statistical significance (p = .3114-.4389).

A parallel mediation analysis was conducted with proband grandfather data (Figure 2 and Table 7). Across the five imputed data sets, grandfather lifetime history of MDD was found to be significantly linked to parent positive affect at 6 months for at least one data set (p = .0488-.1991). Grandfather lifetime history of MDD was also found to be significantly related to the quality of the grandparent-parent relationship during the parent's adolescence for at least one data set (p = .0478-.1000). When the model was examined as a whole, the quality of the grandparent-parent relationship was not detected as a significant mediator between grandfather lifetime history of MDD and parent positive affect at 6 months (p = .2355-.4193).

Table 6

Mediation Analyses Predicting from Proband Grandmother MDD to Parent Positive Affect through Parent-Adolescent Relationship Quality (n = 131)

	B	*SE B*	t	*p*	LLCI	ULCI	R^2	F	df1	df2	*p*
grandmother MDD → parent positive affect	.0486-.0510	.0420-.0422	1.1517-1.2153	.2265-.2516	-.0349--.0320	.1322-.1340	.0102-.0113	1.3264-1.4771	1	129	.2265-.2516
grandmother MDD → parent-adolescent relationship quality	.6499-1.2319	.8970-.9421	.7155-1.3077	.1933-.4756	-1.1473--.6320	2.4471-3.0958	.0040-.1144	.5119-1.7101	1	129	.1933-.4756
grandmother MDD → parent positive affect	.0505-.0535	.0421-.0472	1.1897-1.2713	.2059-.2364	-.0381--.0298	.0047-.1367	.0128-.0181	.8288-1.1772	2	128	.3114-.4389
Parent-adolescent relationship quality → parent positive affect	-.0038--.0024	.0040-.0041	-.9374--.5814	.3503-.5620	-.0119--.0106	.0042-.0058					

Note. B = unstandardized beta.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 7

Mediation Analyses Predicting from Proband Grandfather MDD to Parent Positive Affect through Parent-Adolescent Relationship Quality (n = 131)

	B	*SE B*	t	*p*	LLCI	ULCI	R^2	F	df1	df2	*p*
grandfather MDD → parent positive affect	-.0750-1.9081	.0452-.9594	-1.6568-1.9888	**.0488-.1991**	-.1645-.0099	.0146-3.8062	.0127-.0298	1.6659-3.9555	1	129	**.0488-.1991**
grandfather MDD → parent-adolescent relationship quality	-.0750-2.0105	.0452-1.0062	-1.6568-1.9981	**.0478-.1000**	-.3120-.0197	.0146-4.0012	.0208-.0300	2.7449-3.9923	1	129	**.0478-.1000**
grandfather MDD → parent positive affect	-.0730--.0571	.0460-.0465	-1.5863--1.2279	.1151-.2217	-.1641--.1492	.0181-.0349	.0135-.0223	.8751-1.4626	2	128	.2355-.4193
parent-adolescent relationship quality → parent positive affect	-.0026--.0011	.0040-.0042	-.6414--.2589	.5224-.7961	-.0108--.0092	.0055-.0070					

Note. B = unstandardized beta.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Discussion

Much remains unknown about the environmental antecedents of parent affect displayed in parent-child engagement during early childhood. The present study evaluated the predictive value of an array of family system variables on early parent positive affect. Results found no evidence to support a relation between the candidate predictors of familial history of MDD, SES, occurrence of parental death in proband parents' childhood, and the quality of the parent-child relationship in proband parents' adolescence and the outcome of parent positive affect in infancy. The analysis results also did not provide evidence for the parent-child relationship in proband parents' adolescence as a mediator between grandparental history of MDD and parent positive affect at 6 months.

It is important to identify and understand the psychosocial correlates of parent affect in infancy for a number of reasons. Parent affect per se has been historically understudied in the larger parenting literature. However, related constructs, such as parental responsiveness, have been shown to relate to children's cognitive and language outcomes, suggesting that parent affect may also play a similar role in these emerging capacities. For example, Smith and colleagues (2006) demonstrated that parental responsiveness in the first several years is linked to children's cognitive skills up to the age of 10 years. Maternal sensitivity has similarly been found to account for differences in cognitive scores among infants and toddlers (Feldman & Eidelman, 2009). Eshel and colleagues (2006) found in their systematic review that parental responsiveness is related to children's language skills. Identifying the early sources of potential influence on the development of particular dimensions of parenting, including affect, will support the effectiveness of interventions that can be costly and time-limited.

The present investigation contributes to our current understanding of the potential antecedents of parent affect during the earliest period of development. Prior research on the psychosocial correlates of parent affect in infancy has been scarce. The extant literature has focused relatively more on the related construct of parenting behavior. In the present study's full-pedigree (i.e., data from proband participants and their partners) analysis, results showed that familial history of MDD and SES was not related to parent positive affect in infancy, which ran counter to the hypothesis that the presence of psychosocial risk factors would be linked with less positive parent affect at 6 months. Several factors may have contributed to the observed findings. The present study employed a multi-method approach, measuring variables of interest through a wide range of means, from self-report to observations of interactions. Such an approach to study design supports the validity of the data collected. There is a call in the literature for the implementation of multimethod analyses in pediatric research efforts (Holmbeck et al., 2002). However, constructs measured with different methods are less likely to demonstrate associations with one another due to variance unique to each method. The lack of relation between the predictors of family history of MDD and SES and the outcome of parent positive affect could also have been due to the presence of moderating factors that were not assessed in the present study. For example, history of treatment for MDD was not included in the present analyses. Prior research has demonstrated the effectiveness of cognitive-behavioral therapy and pharmacotherapy (e.g., selective serotonin reuptake inhibitors) for MDD (Cuijpers et al., 2013; DeRubeis et al., 2008). Grandparents and parents may have undergone treatment for depressive symptoms, which may then impact the presentation of parent affect during interactions with their children in infancy. It is also possible that MDD may be unrelated to parent affect altogether.

The work of Braarud and colleagues (2017) found similar rates of positive affect during infancy from mothers with and without depressive symptoms.

The null result for the link between SES and parent affect is congruent with the inconsistent conclusions on SES and parenting practices in the broader literature. As far as we are aware, no previous studies have investigated the association between SES and parent affect. However, Altafim et al. (2018) reported that SES was unrelated to caregiver emotional and behavioral regulation in their sample. On the other hand, Smith (2010) found that SES is related to differential levels of parental control. Parent engagement with children encompasses a wide range of practices and behaviors. More research is needed to elucidate the role of SES alone and in interactions with moderators on parent affect regulation during parent-child engagement in infancy.

We had also projected that history of MDD within the family system would be linked to parent positive affect through the quality of the parent-child relationship during parents' adolescence. Results did not provide evidence to support this mediation model. The finding that the quality of the parent-child relationship during the proband parents' adolescence was unrelated to parent positive affect during their child's infancy is inconsistent with prior work from Madden and colleagues (2015) who provided evidence for a relation between maternal affection experienced through mid-adolescence and positive responsiveness with one's own toddler. It should be noted that again here methodological differences make it difficult to directly compare the findings from the present study and others in the literature.

Additional research is needed moving forward to fully elucidate the factors within the familial milieu that are linked to parent affect during infancy given the important role that early parent-child interactions have in cognitive and language development. It is possible that the

predictors evaluated in the present study (e.g., family history of MDD, SES) represent forces within the family system that are too broad and distal in time to directly relate to parent affect displayed during the particular window of development that was the focus of the present study. It remains an open question whether more proximal factors, such as the degree of social support during the transition to parenthood, are more closely tied to parents' affect regulation in the postpartum period.

Strengths and Limitations

This study sought to clarify the role of several factors within the familial ecosystem on parent affect in infancy, which has been historically understudied in the wider parenting literature. A notable strength of the current project was the availability of data that spanned multiple generations across years as families expanded and proband participants and their partners took on new roles as parents. Rich observational data were collected to understand the dynamic interactive exchanges between parents and infants. While the analyses yielded null findings, the current project furthers our understanding of the factors across generations within families that may or may not be relevant for the display of parent affect while interacting with their infants. Limitations of the current report include the narrow range of family structure observed in the study as well as the low degree of racial and ethnic diversity across the sample, which hinder the generalizability of results. Furthermore, while the study featured data sampled across different generations and time periods, the study was limited in power due to a relatively small sample size, which precluded the ability to detect potentially additional meaningful signals in the data.

Future Directions

Parent affect, and parenting behavior more generally, plays a critical role in supporting the burgeoning cognitive and language capacities of young children from the earliest periods of development. Identifying and understanding the factors that potentially shape the degree to which parents display positive affect during infancy would allow for intervention efforts to address the most salient factors that could impact the quality of parent-infant interactions and child learning. Within this relatively small sample size, no relation was found between the predictors under consideration and the outcome of interest, which prompts the question of whether the pattern of results would hold up if similar empirical questions were evaluated with a sample of a larger size or with different demographic characteristics. Future studies would do well to continue to investigate the ways in which the family environment across generations contribute to parent affect and behavior during the infancy, as they set the stage for subsequent development in future generations.

Conclusion

In the present report, evidence did not support a link between a host of family system-based variables and parent affect during infancy. Such a finding does not rule out the possibility of associations between intergenerational psychosocial variables and parent affect. More research is needed moving forward to identify those factors in the family environment that hold the most potential for potentially shaping parent affect during the transition to parenthood.

CHAPTER 4

STUDY 3. PSYCHOSOCIAL CORRELATES OF PARENT AFFECT: PARENTS AND INFANTS

Parent and Infant Affect

Parent affect and behavior have important implications for children's development. A primary capacity that children begin to build in infancy is the ability to self- and co-regulate with caregivers, which supports exploring and learning from the environment. Early interactions between infants and their caregivers establish the foundation for later higher-order learning. As such, it is critical to understand the factors that contribute to individual differences in parent affect and behavior. Doing so would allow for intervention efforts to target the most salient factors within the familial ecology that promote early cognitive and language development.

The interactions between parents and their children have been characterized as "transactional." That is, caregivers and offspring mutually inform one another's responses during engagement with one another (Sameroff, 1975a; Sameroff, 1975b). Given that feature of parent-child interactions, a comprehensive consideration of parent affect and behavior should necessarily include an examination of infant affect and behavior and the ways in which serve and return between parents and their children result in particular interactive patterns and styles. Within the literature on parent-child interactions among older children, Aunola and colleagues (2013) have shown that school-aged children who experience psychological control from their parents go on to display elevated negative emotionality. Of note, Burke et al. (2008) found that child behavior may have a more potent impact on parenting approaches than vice versa. The researchers demonstrated that oppositional defiant disorder in children accounted for differences in parental involvement and communication; conduct disorder accounted for differences in

parental supervision. Similarly, Combs-Ronto, Olson, Lunkenheimer, and Sameroff (2009) found that elevated child externalizing behavior at 3 years is related to a greater degree of maternal negative parenting at 5½-6 years.

At the earliest developmental stages, young children also make discernible contributions to parents' affective and behavioral states, although more research is needed to fully characterize the early stages of parent-child reciprocal interactions. Infant positive affect at 12 months has been found to be associated with parent positive affect, though not at 6 months (Planalp et al., 2017). Mothers appear to be at heighted risk of experiencing more acute depressive symptoms when their children have a history of low levels of regulation issues in infancy and then go on to display externalizing behavior at 15 months of age (Choe et al., 2013). Among 24-48-month-olds, child negative affect is related to lax discipline (Del Vecchio & Rhoades, 2010). Child affective problems at 36 months are negatively correlated with maternal sensitivity (Mills-Koonce et al., 2007). Such findings highlight that infants are active agents within the relationships that they share with their parents. Relationship dynamics are co-created between children and their caregivers.

Socioeconomic Status and Parenting

When taking stock of the extant literature on these topics, it is critical to appreciate that socioeconomic status (SES) and parenting have separately been operationalized in myriad ways (Hoff et al., 2013). Furthermore, moderators and mediators, such as parental psychopathology may be present and have been infrequently acknowledged in extant research (Roubinov & Boyce, 2017). To our knowledge, no studies have previously examined how SES may relate to parent affect. However, prior research has been conducted on SES and other dimensions of parenting. For example, in infancy, children of lower SES backgrounds have been shown to

experience holding from their mothers at a higher frequency relative to children of middle SES backgrounds (Fouts et al., 2012). Norcross and colleagues (2020) found that depressive symptoms were related to less sensitivity displayed during interactions with infants among mothers experiencing elevated SES risk.

Parent Personality and Affect

Decades-long empirical efforts have been devoted to clarifying the role of individual parent personality in the presentation of parenting behavior. For example, both high and low agreeableness in mothers is tied to a higher degree of differential parenting (i.e., relating to one's children in a manner that is distinct from child to child; Browne et al., 2012). Mothers who are high on agreeableness are also more verbally elaborative with their 20-month-old children during play (Bornstein et al., 2011). Parental agreeableness has been found to relate to overreactive discipline and warmth in caregivers of adolescents (de Haan et al., 2012). Mothers who are high on conscientiousness offer their children a relatively lower degree of physical affection when playing (Bornstein et al., 2011). Caregivers with elevated agreeableness, conscientiousness, extraversion, and openness display greater behavioral control and warmth (Prinzie et al., 2009). These findings indicate the parent personality informs parenting approaches.

The present study focused on the personality dimension of neuroticism, also known as negative emotionality. To date, however, few studies have specifically examined how neuroticism relates to parent positive affect. Kochanska and colleagues (2004) demonstrated that increased maternal neuroticism is linked to decreased positive affective ambience when mothers engage with their infants at 7 months. Existing research has also found that less neuroticism in parents is linked to a higher degree of parental warmth, autonomy support, and behavioral

control (Prinzie et al., 2009). Puff and Renk (2016) found that among mothers of children ages 2 to 6 years, elevated parent neuroticism was tied to less positive parenting.

The results of past research also suggest that parent personality, and its moderation by child temperament, accounts for variance in parenting behavior (Clark et al., 2000). The transition to parenthood represents a period of wide-ranging changes to parent identity, including aspects of personality. Infants themselves appear to play a role in the personality shifts observed in first-time parents. Sirignano and Lachman (1985) observed in their sample of first-time parents and couples without children that increased infant adaptability and positive mood were linked to alterations in parent personality, including reductions in paternal anxiety and maternal sense of control. Zvara and colleagues (2019) found that among mothers who experienced elevated undermining in their relationship with their partner, neuroticism was linked to a higher degree of intrusive practices with their infants. As these findings demonstrate, neuroticism has been examined extensively in relation to parenting practices. Much remains unknown, however, about how parent neuroticism may relate to parent affect in infancy.

Parental Anxiety and Depression and Parenting

Depression and anxiety in parents have been shown to relate to parenting behavior in infancy. The presence of depressive and anxiety symptoms in fathers during the prenatal period has been linked to a lower degree of control displayed while engaging with infants at 3 months (Parfitt et al., 2013). Prior research has also documented that caregivers with a history of depressive symptoms demonstrate decreased positive affect while engaging with their infants at 3.5-5.5 months (Aktar et al., 2017). Mothers who had experienced depressive symptoms during pregnancy have been shown to display decreased warm responsiveness with their infants 4 months after birth (Mitchell et al., 2019). History of anxiety symptoms in parents has been

shown to have no bearing on parent affect during engagement with infants at 3.5-5.5 months postpartum (Aktar et al., 2017). Such evidence suggests inconsistency in the literature regarding the role that parental psychopathology may have in affect regulation during interactions with infants.

Parenting Stress and Affect

Parenting stress represents an individual-specific factor associated with differences in parenting behavior. Farmer and Lee (2011) found that among their sample of mothers and their 3-year-olds, a higher level of parenting stress was related to less frequent interactive engagement across the week. Parenting stress in the postpartum period in mothers and fathers has also been found to be related (Epifanio et al., 2015). This suggests that parenting stress may be experienced jointly within couples as they navigate the transition to parenthood, although the particular ways in which parenting stress manifests, including potential directionality of the stress between partners within the parenting dyad, warrants additional research.

The Co-Parenting Relationship and Parent Affect

The birth of a child heralds a sweeping change in the relationship dynamics of the parents. After the birth of a child, parents have a new lens through which to evaluate their relationship, and by extension, the degree to which they are satisfied with their relationship. Prior research has observed a decline over time in relationship functioning for first-time parents after the arrival of their child (Doss et al., 2009). However, more support between partners in the context of parenting is related to greater relationship quality (Durtschi et al., 2016). Relationship satisfaction in turn has been shown to relate to parenting behavior (Bernier et al., 2014). The degree to which romantic partners work effectively together to parent their child has also been found to be linked to parenting behavior. For example, a higher degree of perceived support

within the parenting dyad has been shown to relate to a decreased frequency of reported harsh parenting behavior (Choi & Becher, 2019). Such findings underscore the importance of examining parenting behavior from multiple levels of analyses (i.e., individual and dyadic), within and across generations.

Infant Cognition and Parenting

In any investigation of parenting behavior, it is critical to also consider the role that the child may play in the formation of parenting practices. The child represents an active agent in interactions with parents, rather than a passive recipient of parenting behaviors. Parenting behavior can be quantitatively and qualitatively analyzed through numerous several theoretical frameworks. Sameroff conceptualized the parent-child relationship as one that is transactional (Sameroff, 1975a; Sameroff, 1975b). That is, children themselves both are affected by and influence their parents' behaviors. Infants' participation in the parent-child exchange has been shown to relate to parenting behaviors. Mermelshtine and Barnes (2016) demonstrated that 10-month-old children who displayed more sophisticated object play had mothers who provided a higher level of responsive-didactic caregiving. Children's cognitive ability has also been shown to relate to parenting behaviors. Among 3- to 5-year-olds, children who evinced greater delay inhibition capacity during a lab task had parents who showed more interactive responsiveness at a 6.5-month follow-up assessment (Merz et al., 2017).

Infant Temperament and Parent Affect

Child temperament has also been investigated in relation to parenting behavior. Parenting behavior is dynamic and responds to intrinsic factors unique to the child, such as temperament. Kochanska and colleagues (2004) found that the temperament of 7-month-olds was related to three dimensions of interactions with their mothers: mother consistent tracking, mother

responsiveness, and shared positive ambience. Elevated infant negative emotionality at 6 months of age has been shown to course with poorer mother-infant bonding (Nolvi et al., 2016). Planalp and Goldsmith (2020) reported trending evidence that suggested that infants demonstrating "low negative" and "withdrawn/inhibited" temperaments were likely to have mothers with increased positive affect and fathers with decreased positive affect, respectively. Young children noted to demonstrate increased negative reactivity early in development have been found to experience decreased emotional support (Padilla et al., 2020). Such findings suggest that parenting behavior is dynamic, rather than static, and is likely informed by the very actor (i.e., the child) that is its intended target. There is growing recognition that the interaction between child temperament and parent personality warrants more in-depth analysis in the literature (Achtergarde et al., 2015).

The Present Study

Hypothesis 1. Parents with lower levels of inter- and intra-personal stress (i.e., fewer anxiety and depressive symptoms, parenting stress, higher SES, and higher partner relationship quality) will demonstrate more positive parent affect.

Hypothesis 2. Infants who display more positive affect and a higher degree of neurocognitive competence will have parents who demonstrate more positive affect.

Exploratory analyses were conducted to examine the role of parent personality, infant temperament, and the interaction between the two on parent positive affect.

Methods

Participants

Participating families in the present study were part of two larger longitudinal studies, the Oregon Adolescent Depression Project (OADP) and Infant Development Study (IDS). Each

study protocol was approved by the institutional review board (IRB), and families provided written consent prior to initial participation. Prior findings from these longitudinal investigations have been documented in the literature (e.g., Lewinsohn et al., 1998; Allen et al., 1998; Lewinsohn et al., 1999; Forbes et al., 2004). Families (N = 137) were included in the present study if they had parent positive affect data for both mothers and fathers at the 6-month time point in the IDS.

Measures

Parent and Infant Positive Affect. When infants were 6 months of age, parents and infants completed a series of study visits in the laboratory and participated in an altered version of the still-face paradigm (Tronick et al., 1978). Infants completed the task once with each parent. Parent order was counterbalanced across infant subjects. The study's version of the still-face paradigm consisted of four segments (40 seconds-3 minutes in duration each): normal, peek-a-boo, still-face, and reunion. The present study utilized data from the normal condition because this was the only portion of the task during which parent and child affect were measured. Research staff coded facial affect displayed during this phase of the paradigm using a coding framework based on Tronick's Monadic Phases (Cohn & Tronick, 1987; Tronick, et al., 1980) and Izard's AFFEX guide (Izard, et al., 1983). Parent affect was coded for the following components: anger, sadness, empathy, neutral, surprise, high positive, and low positive. Each code reflected the proportion of the condition that a particular emotion was displayed. Parent positive affect was derived from the surprise, high positive, and low positive scores. Infant affect was assessed along the following facets: positive, neutral, and negative. Infant positive affect was used in the current study to parallel the emotional construct used for parents. Due to skewness in the affect data, arc sine transformation of the scores was completed.

Socioeconomic Status. SES was indexed using the highest education level between both parents for each family.

Parent Anxiety and Depressive Symptoms. At the 3-month infant time point, both parents completed the Beck Anxiety Inventory (BAI; Beck et al., 1988) and Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), well-validated questionnaires that assess for anxiety and depression symptomatology, respectively. The BAI is comprised of 21 questions and produces a total score between 0 and 63, with higher scores indicating a higher degree of anxiety (0-21 reflects "low anxiety," 22-35 reflects "moderate anxiety," and 36-63 reflects "potentially concerning levels of anxiety"). The CES-D likewise consists of 20 questions. Higher scores suggest the presence of more depressive symptoms.

Parent Negative Emotionality. The NEO Five-Factor Inventory (Costa & McCrae, 1992) was utilized at 6 months postpartum to evaluate parent personality. This form consists of 60 probes divided across five construct areas: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. For the present study, the neuroticism scale was selected for analyses to mirror the negative emotionality temperament dimension indexed for infant participants.

Parenting Stress. The Parenting Stress Index, Short Form (PSI-Short Form; Abidin, 1986) was given to parents to complete at their infants' 3-month study time point. This widely used questionnaire consists of 36 probes aimed at capturing parents' subjective experience of stress related to caring for their child. Prior research employing factor analysis of the measure's items has demonstrated support for two factors separated along child and parent domains (Loyd & Abidin, 1985).

Parents' Relationship Quality. Parents completed the Dyadic Adjustment Scale (DAS; Spanier, 1976) at their infants' 3-month study time point. The DAS is a self-report measure that evaluates the partner relationship along the following four dimensions: "Dyadic Consensus," "Dyadic Satisfaction," "Dyadic Cohesion," and "Affectional Expression."

Infant Temperament. Infant temperament was assessed through parent-report at 3 months of age with the Infant Behavior Questionnaire (IBQ; Rothbarth, 1981). The IBQ consists of 87 questions arranged along six construct clusters: Distress to Limitations (20 items), Fear (16 items), Duration of Orienting (8 items), Activity Level (17 items), Soothability (11 items), and Smiling and Laughter (15 items). For the present set of analyses, the Distress to Limitations scale was used to index negative emotionality. Mother and father scale scores were averaged to produce a single Distress to Limitations score for each child.

Infant Cognitive Competence. The Bayley Scales of Infant Development, Second Edition (BSID-II; Bayley, 1993) was used to assess child cognitive competence at 3 months of age. The BSID-II includes standardized mental and psychomotor subtests that assess global cognitive and gross motor skills. The Mental Development Index, expressed as a standard score with a mean of 100 and standard deviation of 15, was used for the present analyses.

Statistical Analyses

Data Preparation. As missingness was observed in the data set, multiple imputation was completed through SPSS, version 28. The constraints set on the multiple imputation included the linear model; 5,000 maximum case draws; 2,000 maximum parameter draws; and 1,000 maximum model parameters. Five sets of imputed data were produced and pooled results were used.

Study A: Analytic Approach. In this set of analyses, we used hierarchical linear regression to explore the links among parent psychosocial factors (SES, negative emotionality, anxiety, depression, parenting stress, and partner relationship quality) and parent affect. Model 1 consisted of the singular variable of family SES to control for variance attributable to that factor in subsequent steps. Model 2 was comprised of psychological factors derived from fathers: negative emotionality, anxiety symptoms, depressive symptoms, and parenting stress. Model 3 mirrored Model 2 but featured factors from the mothers. Finally, in order to deduce the contribution of the parenting dyad after family- and individual-level factors had been accounted for, Model 4 consisted of the quality of the parents' relationship.

Study B: Analytic Approach. In order to better understand the contributions that children themselves make to parent affect, hierarchical linear regression were again utilized to characterize the links between child factors (cognitive competence, affect, temperament) and parent affect. A moderation analysis was included to evaluate how child temperament interacts with parental personality and relates to parent affect. Model 5 featured infant cognitive competence and positive affect. Model 6 included parent negative emotionality, infant negative emotionality, and the interaction of the two variables. Model 7 featured all variables together.

Results

Participant demographics are presented in Table 1. A range of data completeness was observed across variables (n = 132-137) for the 137 families included in the present study. Within Generation 2 (the parent generation), the mean SES level was 14.47 (*SD* = 1.70; n = 136), indicating that the average family had a maximum parent education level of approximately two years of college. The families in the present investigation represented a racially homogenous sample, with 92.7% of mothers (n = 136) and 87.6% of fathers (n = 133) identifying as white. At

3 months postpartum, the mean age of mothers was 26.00 years (*SD* = 2.46; n = 136). On average, fathers were 27.76 years old (*SD* = 3.26; n = 133). Across the sample, paternal negative emotionality had an average score of 2.37 (*SD* = 0.63; n = 132). At 3 months postpartum, paternal anxious symptomatology was found to be at a mean level of 5.04 (*SD* = 7.81; n = 133). Paternal depressive symptomatology was found to be at a mean level of 8.84 (*SD* = 8.28; n = 133). Endorsement of paternal parenting stress within the Parent domain resulted in an average score of 28.97 (*SD* = 8.29; n = 133). Endorsement of paternal parenting stress within the Child domain resulted in an average score of 34.65 (*SD* = 10.58; n = 133). The mean score for paternal view of parents' (i.e., father and mother's) relationship quality was 112.75 (*SD* = 16.35, n = 133). Maternal negative emotionality was found to be at an average level of 2.82 (*SD* = 0.71; n = 132). At 3 months postpartum, mothers exhibited a mean anxiety level of 5.48 (*SD* = 5.48; n = 136). Mean maternal depressive symptom level was found to be 9.70 (*SD* = 7.38; n = 136). Maternal parenting stress within the Parent domain received an average rating of 29.60 (*SD* = 7.07; n = 136). Maternal parenting stress within the Child domain received an average rating of 32.29 (*SD* = 7.93; n = 136). The mean score for maternal view of parents' (i.e., father and mother's) relationship quality was found to be 111.94 (*SD* = 17.76; n = 136). Parent displayed positive affect, on average, at a rate of 54% of the time during interactions with their infant (*SD* = 0.18; n = 137). The average infant cognitive competence score for the sample was 96.90 (*SD* = 5.28; n = 134). Infants displayed positive affect, on average, 24% of the time during interactions with their parents (*SD* = 0.17; n = 137). The mean paternal rating of infant negative emotionality was 3.38 (*SD* = 0.77; n = 132). The mean maternal rating of infant negative emotionality was 3.32 (*SD* = 0.71; n = 136).

Zero-order correlations between study variables were examined in anticipation of main analyses (Table 2). Results revealed that paternal anxiety symptoms at 3 months postpartum were significantly associated with paternal negative emotionality ($r = .349$, $p < .001$). Paternal depressive symptoms at 3 months postpartum were significantly related to parental SES, such that more depressive symptoms was linked to lower SES ($r = -.214$, $p = .029$). A larger count of paternal depressive symptoms was also significantly associated with greater paternal negative emotionality ($r = .336$, $p < .00$) and a larger count of paternal anxiety symptoms ($r = .790$, $p < .001$). Paternal parenting stress within the Parent domain was related to paternal negative emotionality ($r = .243$, $p = .015$), paternal anxiety ($r = .407$, $p < .001$), and paternal depressive symptoms ($r = .545$, $p < .001$). Paternal parenting stress within the Child domain was likewise related to paternal negative emotionality ($r = .191$, $p = .028$), paternal anxiety ($r = .343$, $p < .001$), paternal depressive symptoms ($r = .396$, $p < .001$), and paternal parenting stress within the Parent domain ($r = .663$, $p < .001$). Fathers' view of the quality of the relationship that they shared with their spouse was significantly associated with their anxiety symptoms ($r = -.289$, $p < .001$), depressive symptoms ($r = -.427$, $p < .001$), parenting stress within the Parent domain ($r = -.534$, $p < .001$), and parenting stress within the Child domain ($r = -.412$, $p < .001$).

Table 1

Participant Demographics (N = 137)

	n	*M* or %	*SD*
Generation 2			
SES	136	14.47	1.70
% white (mothers)	136	92.7%	-
% white (fathers)	133	87.6%	-
Maternal age in years at 3 mos. postpartum	136	26.00	2.46
Paternal age in years at 3 mos. postpartum	133	27.76	3.26
Paternal negative emotionality	132	2.37	0.63
Paternal anxiety symptoms at 3 mos. postpartum	133	5.04	7.81
Paternal depressive symptoms at 3 mos. postpartum	133	8.84	8.28
Paternal parenting stress: Parent domain at 3 mos. postpartum	133	28.97	8.29
Paternal parenting stress: Child domain at 3 mos. postpartum	133	34.65	10.58
Paternal view of parents' relationship quality at 3 mos. postpartum	133	112.75	16.35
Maternal negative emotionality	132	2.82	0.71
Maternal anxiety symptoms at 3 mos. postpartum	136	5.48	5.48
Maternal depressive symptoms at 3 mos. postpartum	136	9.70	7.38
Maternal parenting stress: Parent domain at 3 mos. postpartum	136	29.60	7.07
Maternal parenting stress: Child domain at 3 mos. postpartum	136	32.29	7.93
Maternal view of parents' relationship quality at 3 mos. postpartum	136	111.94	17.76
Parent positive affect at 6 mos. postpartum	137	0.54	0.18
Generation 3			
Infant cognitive competence at 3 mos. postpartum	134	96.90	5.28
Infant positive affect at 6 mos. postpartum	137	0.24	0.17
Infant negative emotionality (paternal view) at 3 mos. postpartum	132	3.38	0.77
Infant negative emotionality (maternal view) at 3 mos. postpartum	136	3.32	0.71

Correlations between maternal factors and other study variables were also examined. Maternal negative emotionality was significantly associated with the paternal view of parents' relationship quality with each other (r = -.200, p = .023). Maternal anxiety symptoms at 3 mos. postpartum were significantly linked to parents' SES (r = -.183, p = .034), such that more anxiety symptoms were related to low SES. Maternal anxiety symptoms were also significantly correlated with paternal negative emotionality (r = .247, p = .004). Maternal depressive symptoms at 3 months postpartum were significantly related to paternal negative emotionality (r = .234, p = .007), paternal depressive symptoms (r = .182, p = .036), paternal parenting stress within the Parent (r = .291, p < .001) and Child (r = .177, p = .043) domains, the paternal view of the quality of their relationship with their spouse (r = -.304, p < .001), maternal negative emotionality (r = .312, p < .001), and maternal anxiety symptoms (r = .488, p < .001). Maternal parenting stress within the Parent domain at 3 months postpartum was significantly associated with paternal negative emotionality (r = .170, p = .048), the paternal view of the quality of their relationship with their spouse (r = -.286, p < .001), maternal negative emotionality (r = .244, p = .006), maternal anxiety symptoms (r = .337, p < .001), and maternal depressive symptoms (r = .461, p < .001). Maternal parenting stress within the Child domain was significantly correlated with maternal anxiety symptoms (r = .181, p = .034), maternal depressive symptoms (r = .185, p = .040), and maternal parenting stress within the Parent domain (r = .463, p < .001). The maternal view of the quality of the parents' relationship was significantly associated with paternal depressive symptoms (r = -.218, p = .017), paternal parenting stress within the Parent domain (r = -.319, p < .001), the paternal view of the parents' relationship (r = .649, p < .001), maternal anxiety symptoms (r = -.190, p = .027), maternal depressive symptoms (r = -.404, p < .001), and maternal parenting stress within the Parent domain (r = -.406, p < .001). Parent

positive affect at 6 months postpartum during the play interaction with their infants was significantly correlated with paternal negative emotionality (r = -.178, p = .041), the paternal (r = .188, p = .030) and maternal (r = .175, p = .042) views of the quality of parents' relationship quality.

Hierarchical linear regression analyses were completed to evaluate contributions from parent factors to displays of parent positive affect during engagement with their infants at 6 months (Table 3). Model 1 examined the role of parental SES, which was not found to be a significant predictor of outcome (B = .008, SE = .009, p = .364). In Model 2, paternal factors were interrogated as candidate predictors of parent positive affect. Paternal negative emotionality demonstrated a trend towards significantly predicting parent positive affect, with higher paternal negative emotionality predicting less parent positive affect (B = -.046, SE = .026, p = .072). All other factors in Model 2, including paternal anxiety and depressive symptoms and parenting stress within the Parent and Child domains, accounted for non-significant variance in outcome (p = .392-.676). Model 3 examined the role of maternal factors in predicting parent positive affect. All maternal variables—negative emotionality, anxiety, depressive symptoms, and parenting stress—were found to be unrelated to parent positive affect (p = .164-.980). Finally, in Model 4, parents'—paternal and maternal—views of the quality of their relationship with their spouse were evaluated as potential predictors of parent positive affect. Here, neither factor accounted for significant variance in outcome (p = .254-.414). In one imputed dataset, the Model 4 set of variables accounted for 4.6% of the variance in outcome (p = .043).

Table 2

Zero-Order Correlations between Study Variables for Full-Pedigree Analysis (pooled results, N = 137)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Parents' SES	-													
2. Paternal negative emotionality	-.172	-												
3. Paternal anxiety symptoms at 3 mos. postpartum	-.103	**.349*** **	-											
4. Paternal depressive symptoms at 3 mos. postpartum	**-.214***	**.336*** **	**.790*** **	-										
5. Paternal parenting stress: Parent domain at 3 mos. postpartum	-.104	**.243***	**.407****	**.545*** **	-									
6. Paternal parenting stress: Child domain at 3 mos. postpartum	-.037	**.191***	**.343*** **	**.396*** **	**.663*** **	-								
7. Paternal view of parents' relationship quality at 3 mos. postpartum	.029	-.151	**-.289*** **	**-.427*** **	**-.534*** **	**-.412*** **	-							
8. Maternal negative emotionality	-.091	-.001	.029	.147	.144	.127	**-.200***	-						
9. Maternal anxiety symptoms at 3 mos. postpartum	**-.183***	**.247****	.003	.128	.115	.077	-.073	.145	-					
10. Maternal depressive symptoms at 3 mos. postpartum	-.076	**.234****	.062	**.182***	**.291*** **	**.177***	**-.304*** **	**.312*** **	**.488*** **	-				
11. Maternal parenting stress: Parent domain at 3 mos. postpartum	-.017	**.170***	.075	.114	.127	.056	**-.286*** **	**.244****	**.337*** **	**.461*** **	-			
12. Maternal parenting stress: Child domain at 3 mos. postpartum	-.018	.030	-.038	-.018	-.046	.065	-.035	.161	**.181***	**.185***	**.463*** **	-		
13. Maternal view of parents' relationship quality at 3 mos. postpartum	-.017	-.079	-.138	**-.218***	**-.319*** **	-.0179	**.649*** **	-.171	**-.190***	**-.404*** **	**-.406*** **	-.120	-	
14. Parent positive affect at 6 mos. postpartum	.080	**-.178***	-.071	-.042	-.120	-.135	**.188***	-.076	-.066	-.137	-.085	.070	**.175***	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 3

Hierarchical Linear Regressions Predicting from Parent Factors to Parent Positive Affect (pooled results; N = 137)

	Model 1			Model 2			Model 3			Model 4		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Parents' SES	.008	.009	.364	-	-	-	-	-	-	-	-	-
Paternal factors												
Paternal negative emotionality	-	-	-	**-.046**	**.026**	**.072**	-	-	-	-	-	-
Paternal anxiety symptoms at 3 mos. postpartum	-	-	-	-.001	.003	.676	-	-	-	-	-	-
Paternal depressive symptoms at 3 mos. postpartum	-	-	-	.003	.003	.392	-	-	-	-	-	-
Paternal parenting stress: Parent domain at 3 mos. postpartum	-	-	-	-.001	.003	.604	-	-	-	-	-	-
Paternal parenting stress: Child domain at 3 mos. postpartum	-	-	-	-.001	.002	.458	-	-	-	-	-	-
Maternal factors												
Maternal negative emotionality	-	-	-	-	-	-	-.010	.023	.651	-	-	-
Maternal anxiety symptoms at 3 mos. postpartum	-	-	-	-	-	-	-.000081	.003	.980	-	-	-
Maternal depressive symptoms at 3 mos. postpartum	-	-	-	-	-	-	-.003	.003	.325	-	-	-
Maternal parenting stress: Parent domain at 3 mos. postpartum	-	-	-	-	-	-	-.002	.003	.423	-	-	-
Maternal parenting stress: Child domain at 3 mos. postpartum	-	-	-	-	-	-	.003	.002	.164	-	-	-
Paternal & maternal factors												
Paternal view of parents' relationship quality at 3 mos. postpartum	-	-	-	-	-	-	-	-	-	.001	.001	.254
Maternal view of parents' relationship quality at 3 mos. postpartum	-	-	-	-	-	-	-	-	-	.001	.001	.414
Total R^2 range across imputed datasets	0.4%-1.1%			4.8%-5.6%			2.8%-4.2%			**3.5%-4.6%* [* for one imputed dataset]**		

Note. B = unstandardized beta.

**p* < 0.05. ***p* < 0.01. ****p* < 0.001.

The next set of analyses assessed the contributions of infant and parent factors to the outcome of parent positive affect. First, zero-order correlations assessed relations between variables (Table 4). Parent positive affect was significantly and inversely associated with paternal negative emotionality (r = -.178, p = .041). Infant negative emotionality, as rated by fathers, was significantly positively associated with maternal negative emotionality (r = .213, p = .020) and negatively associated with infant cognitive competence (r = -.201, p = .022). Infant negative emotionality, as rated by mothers, was significantly positively associated with maternal negative emotionality (r = .243, p = .005) and infant negative emotionality as rated by fathers (r = .431, p < .001). Finally, infant positive affect was significantly associated with parent positive affect (r = .373, p < .001).

Hierarchical regression analyses next sought to identify significant predictors of parent positive affect (Table 5). Model 5 featured the infant variables of cognitive competence measured at 3 months and positive affect at 6 months. The latter variable was a significant predictor of outcome (B = .388, SE = .083, p <.001). A higher proportion of infant positive affect during engagement with parents was significantly tied to a higher proportion of parent positive affect in the same set of interactions. Across the five imputed datasets, the amount of variance accounted for in outcome ranged from 13.9% to 14.0% (p < .001). Model 6 examined the role of parental and infant negative emotionality and the interaction of parent and infant negative emotionality in predicting parent positive affect. Maternal negative emotionality trended towards significance in predicting parent positive affect, with more maternal negative emotionality linked to less parent positive affect (B = -.177, SE = .099, p = .072). All other variables within Model 6 emerged as non-significant predictors of outcome, and the set of variables as a whole accounted for a non-significant 6.5% to 9.0% of variance in outcome across the five sets of imputed

datasets. The final set of predictors tested—Model 7—examined all variables in the analysis as potential predictors of outcome. Here again, infant positive affect was significantly related to parent positive affect (B = .382, SE = .083, p < .001). Two parent variables—paternal and maternal negative emotionality—were revealed to be significant predictors of parent positive affect (B = -.171, SE = .090, p = .058 and B = -.180, SE = .094, p = .054, respectively). All told, across two imputed datasets, Model 7 significantly accounted for 5.6%-8.3% of additional variance compared to Model 5 (p = .040-.046). Model 7 significantly accounted for 19.5% to 22.2% in total variance in outcome (p < .001) across all five imputed datasets.

Discussion

The present study sought to evaluate the parent and infant factors that contribute to the display of parent positive affect during infancy. Findings indicated that infant positive affect is related to concurrent parent positive affect. This finding underscores the bidirectional nature of parent-infant interactions. Trend-level evidence was also found to suggest links between paternal and maternal personality (indexed as negative emotionality) and parent positive affect, which may broadly reflect how parents' individual differences in emotion regulation during and outside of engagement with their infants may relate to emotion expression in the presence of their children.

Overall, the hypotheses of the study were partially supported by the results of the study. We had anticipated that less parental stress (measured as fewer symptoms of anxiety and depression, less parenting stress, higher SES, and higher relationship quality within the coparenting dyad) would be related to a higher degree of parent positive affect. The findings demonstrated no support for a relation between the different measures of parental stress and parent positive affect. These results are largely inconsistent with prior findings in the extant

Table 4

Zero-Order Correlations between Study Variables (pooled results; N = 137)

		1.	2.	3.	4.	5.	6.	7.
Gen. 2	1. Paternal negative emotionality	-						
	2. Maternal negative emotionality	-.001	-					
	3. Parent positive affect at 6 mos. postpartum	**-.178***	-.076	-				
Gen. 3	4. Infant cognitive competence at 3 mos. postpartum	-.078	.115	-.004	-			
	5. infant negative emotionality (paternal view) at 3 mos. postpartum	.009	**.213***	.092	**-.201***	-		
	6. Infant negative emotionality (maternal view) at 3 mos. postpartum	-.019	**.243****	.091	-.168	**.431*****	-	
	7. Infant positive affect at 6 mos. postpartum	-.095	.051	**.373*****	.055	.087	.048	-

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 5

Hierarchical Linear Regressions Predicting from Parent and Child Factors to Parent Positive Affect (pooled results; N = 137)

	Model 5			Model 6			Model 7		
	B	*SE B*	*p*	*B*	*SE B*	*p*	*B*	*SE B*	*p*
Gen. 3									
Infant cognitive competence at 3 mos. postpartum	-.001	.003	.767	-	-	-	.000	.003	.938
Infant positive affect at 6 mos. postpartum	**.388**	**.083**	**<.001**	-	-	-	**.382**	**.083**	**<.001**
Gen 2.									
Paternal negative emotionality	-	-	-	-.145	.095	.126	**-.171**	**.090**	**.058**
Maternal negative emotionality	-	-	-	**-.177**	**.099**	**.072**	**-.180**	**.094**	**.054**
Gen. 3									
Infant negative emotionality (paternal view) at 3 mos. postpartum	-	-	-	-.050	.071	.477	-.083	.067	.219
Infant negative emotionality (maternal view) at 3 mos. postpartum				-.106	.087	.225	-.104	.083	.208
Gen. 2 x Gen. 3									
Gen. 2 paternal negative emotionality x Gen. 3 infant negative emotionality (paternal view) at 3 mos. postpartum	-	-	-	.030	.028	.294	.041	.027	.134
Gen. 2 maternal negative emotionality x Gen. 3 infant negative emotionality (maternal view) at 3 mos. postpartum	-	-	-	.045	.030	.128	.045	.028	.111
ΔR^2 range across imputed datasets [a]		-			-		**5.6%-8.3% [* for two imputed datasets]**		
Total R^2 range across imputed datasets	**13.9%-14.0% [*** for all imputed datasets]**			6.5%-9.0%			**19.5%-22.2% [*** for all imputed datasets]**		

Note. B = unstandardized beta.

[a] ΔR^2 reflects the change in R^2 from Model 5 to Model 7.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

literature. While Aktar and colleagues (2017) similarly found no link between parental history of anxiety symptoms and parent affect at 3.5-5.5 months postpartum, parental history of depressive symptoms has been shown to course with decreased parent positive affect. Parenting stress in infancy has been linked to decreased parent-child interactions (Farmer & Lee, 2011). While no previous research has investigated how SES may relate to parent affect, prior research has documented links between SES and other dimensions of parenting, such as holding of infants (Fouts et al., 2012) and caregiver sensitivity (Norcross et al., 2020). The quality of the relationship between partners during the transition to parenthood has been shown to be linked to parenting behavior, such that a greater sense of support has been tied to lower levels of harsh parenting (Choi & Becher, 2019). The incongruence observed between the findings in the present study and others in the literature are likely attributable to differences in methodology, include operationalization of constructs of interest. More research is needed to clarify the links between parent characteristics and parent affect in infancy.

The current study also investigated the role of infant factors in parent positive affect. We had hypothesized that a higher rate of infant positive affect and greater infant cognitive competence would be related to more parent positive affect. While the results found no support for infant cognitive ability as a predictor of parent affect, infant affect emerged as a significant contributor to outcome. The findings from the present study are inconsistent with the work of Planalp and colleagues (2017) who had previously documented that no evidence was found to support a link between infant positive affect and parent positive affect when assessed at 6 months.

The results of exploratory analyses examining the relations among parent personality, infant temperament, and parent positive affect revealed trending links between parent personality

and parent affect such that decreased paternal and maternal negative emotionality appears to relate to more positive parent affect during engagement with their infants at 6 months postpartum. While limited research has been conducted on parent personality and parent affect, the finding that the two constructs may be linked is consistent with extant evidence in the literature for similar outcomes in parenting. Kochanska et al. (2004) found that elevated maternal neuroticism is linked to reduced positive affective ambience between mothers and their 7-month-old infants. Prinzie and colleagues (2009) noted that decreased parental neuroticism is tied to greater warmth, autonomy support, and behavioral control. Furthermore, Puff and Renk (2016) reported that less parental neuroticism is linked to more positive parenting. While more research is indicated given the limited power in the present study to detect more robust relations between parental negative emotionality and parent positive affect, accumulating evidence from the current study and others in the literature suggest that parent negative emotionality may be a hindrance to the demonstration of parent positive affect in infancy, which could have cascading detrimental implications for infant cognitive and language development.

In the current study, no support was found for a relation between infant temperament, assessed through negative emotionality, or the interaction between infant temperament and parent personality and the outcome of parent positive affect. These findings are inconsistent with studies that have examined related parenting outcomes. For example, Nolvi and colleagues (2016) reported that in their sample of 6-month-old infants and their families, more child negative emotionality anticipated worse mother-infant bonding. Child negative reactivity in the postpartum period has been linked to reductions in emotional support (Padilla et al., 2020). Planalp and Goldsmith (2020) reported trending-level evidence showing that infants designated at 6 months of age as “low negative” in their temperament (i.e., decreased anger and activity

level, elevated fearfulness) were more likely to have mothers with more positive affect. Furthermore, additional evidence nearing significance in the same report revealed that infants designated as "withdrawn/inhibited" were more likely to have fathers with decreased positive affect.

Strengths and Limitations

A primary strength of the current investigation was the sampling of multiple dimensions of parent and child characteristics through an array of methods (i.e., self-report, parent-report, and observation) during this early period of development. The study evaluated the relative contributions of parents across multiple levels as individuals and as a dyad. The present report also examined the role that infants play in the emerging relationship with their caregivers and aimed to understand what each party in the parent-infant relationship is adding to the dynamic interactions that take place during infancy, which have implications for later learning.

The current study featured several limitations that impact the interpretation of the results. In particular, the sample population for the study reflected a limited range of diversity in family structure, race, and ethnicity. As such, the interpretation of the results should take these contextual factors into account, as the results cannot necessarily be applied to all families. In addition, the sample size for the present study was relatively small, which limited the availability of sufficient power for analyses to potentially detect links that may be present between the constructs that were of interest in the study.

Future Directions

The results of this report highlight several promising avenues of future research. One important future line of inquiry concerns the populations that warrant further empirical attention. The present study was conducted with families and children who had been broadly recruited

from the general community when parents were adolescents. The infants of the study represented a relatively low-risk sample in terms of their psychosocial and neurodevelopmental profiles. Future research should examine the degree to which the present findings would hold up in the context of clinical samples of children, such as children who have experienced medical complexity and/or have a developmental disability. Doing so would enhance the development of more precise clinical intervention efforts to support the parent-child relationship and children's emerging cognitive and language skills in children and families who may be at the highest risk for adverse outcomes.

Conclusion

In the current study, we found that infant positive affect predicted parent positive affect, highlighting the dynamic and bidirectional nature of parent-child interactions. Parent affect during infancy is important for ongoing cognitive and language development. As such, more work is needed to fully elucidate the myriad factors that may influence parent affect regulation during infancy.

CHAPTER 5

GENERAL DISCUSSION

The present set of longitudinal studies investigated psychosocial determinants of perinatal medical risk and early parent affect. Factors of interest spanned three generations within families and included individual-, dyad-, and family-level variables. Pregnancy, birth, and infancy represent periods of considerable transition, change, and vulnerability to risk that could set the course for subsequent child cognitive and language development. As such, it is critical to identify and understand the role that factors within the family system can have in modulating risk at the earliest stages of development.

In a series of three studies, variables such as family history of MDD, SES, parental loss in childhood, and quality of the parent-adolescent relationship were examined to evaluate their predictive value for perinatal medical risk and parent positive affect. Study 1 revealed suggestions of a link between maternal prenatal stress and perinatal medical risk, which would necessitate further investigation with a larger sample before any conclusions can be drawn. Study 2 found no relation between the psychosocial variables of interest and the outcome of positive parent affect at 6 months postpartum. Study 3 demonstrated trending evidence for paternal and maternal negative emotionality as predictors of parent positive affect. In addition, infant positive affect at 6 months predicted concurrent parent positive affect. The findings of the present set of studies underscore the need for ongoing research to identify and understand the role of factors within and outside the family system on maternal and infant health outcomes during the perinatal period and on parent affect in infancy. Given differential rates of risk present across populations within the United States and across the globe, future work should also aim to better understand

the unique factors present within sub-systems that impact vulnerability to disruptions to development across the perinatal period and infancy.

Perinatal Medical Risk as a Social Disease

It is critical to understand the psychosical predictors of maternal and infant medical morbidities if we are to assume a family-centered approach to healthcare. The present study evaluated family history of MDD, SES, parental death in childhood, the parent-child relationship in adolescence, and stress during pregnancy as candidate correlates of perinatal medical risk. Within the relatively small sample of families, trending evidence suggested that higher prenatal stress may predict higher perinatal medical risk. The present study operationalized prenatal stress as the incidence of stressful events during pregnancy. Future investigations should continue to interrogate psychosocial factors in order to pinpoint additional social determinants of health in order to improve perinatal outcomes. A particularly critical social factor that warrants further empirical investigation is the role of differential access to healthcare in the well-being of mothers and infants in the United States and around the globe. In order to understand how risk is transmitted and embedded within a family system, it is also crucial to understand the larger context in which a family develops across generations. The present investigation focused on the family environment; ongoing work on risk within larger societal contexts is also critical to ensure the well-being of children and their families.

Racial Disparities in Perinatal Medical Risk

Across indices of perinatal medical risk, differential incidence rates are observed along racial lines. Black women have been found to be more likely, relative to white women, to experience having a term infant who is small-for-gestational-age (Ananth et al., 2004; Elo et al., 2009). South Asian and Black mothers are more likely to experience meconium-stained amniotic

fluid (Balchin et al., 2011). White mothers have been found to be more likely to experience an anesthetic complication during delivery (Cheeseman et al., 2009). In order to reduce racial disparities in maternal and infant health, future research should aim to document the sources and impact of inequitable access to healthcare and outline concrete and systematic measures that can be taken to ameliorate the role of bias in the development of perinatal medical risk.

Perinatal Medical Risk in Majority World Nations

Perinatal medical risk also varies widely from country to country around the globe as a function of access to healthcare. Perinatal medical risk may be particularly elevated in some majority world nations, which has implications for its impact on the cognitive and language outcomes of children. Research from India has demonstrated a link between preeclampsia and decrements in child visuo-spatial skills at 5-7 years of age (Koparkar et al., 2022). A recent report from the World Health Organization and collaborators noted that puerperal infection can reach as high as 16.4% among majority world countries, which introduces elevated odds of infant demise (Bellizzi et al., 2017). A survey of births in Brazil recorded puerperal infection in 2.92% of births (Guimarães et al., 2007). According to a recent estimate, the preterm birth rate in Ethiopia stands at 8.1% (Mengesha et al., 2016). Among majority world countries, 27% of neonates (34.4 million newborns) were classified as SGA in 2010, with south Asia demonstrating the highest relative rate of SGA status (41.5%) among infants (Lee et al., 2013). A report on infants born in Nepal documented an even higher rate of SGA status, such that over half of the sample of nearly 2,000 children were SGA at birth (55.4%; Christian et al., 2014). In the Nepalese sample, SGA status was linked to poorer performance on several measures of cognitive functioning seven to nine years later (Christian et al., 2014). Infants in majority world countries may experience compounded risk from the presence of multiple risk factors. In a

review of scientific reports from Latin America, Africa, and Asia, infants with a history of preterm birth and SGA status were more likely to die relative to infants with only one of these risk factors (Katz et al., 2013). Intriguingly, one study of births in China noted that gestational weight gain was related to lower odds of preterm birth (Li et al., 2013). The vast majority of published studies on child development are conducted in minority world countries. Ongoing efforts must be made at multiple levels to ensure that research accounts from majority world counties are also integrated into the literature in order to achieve greater balance and inclusivity in efforts to improve the well-being of all mothers and infants during the perinatal period.

The Intergenerational Legacy of the Family System and Parent Affect

The parent-child relationship is central to cognitive and language development. Parent affect represents a central feature of parent-child interactions. Relative to other indices of parenting, the psychosocial antecedents of parent affect have received little attention in the literature. The current study investigated several potential sources of psychosocial risk within the family system in an attempt to characterize the ways in which parent affect may be shaped over time across generations. Parenting practices in general and parent affect in particular can best be conceptualized as multiply determined constructs that are influenced by myriad intersecting forces that exist at the environment and biological levels. As such, multigenerational, multimethod investigations are needed moving forward if we are to understand the origins of psychosocial risk within the family system with temporal and source-level precision. Within the present study, several signals emerged for factors embedded within the family system that may be particularly salient to the presentation of parent affect during infancy. While the relatively small size of the current study precluded the possibility of more robust findings, it appears that parent personality – specifically, negative emotionality – is linked to less parent positive affect.

Given this finding, future research should aim to clarify how and why negative emotionality is relevant for parent positive affect and how this personality factor may interact with other salient variables to impact parent affect in the postpartum period. Other dimensions of personality should also continue to be investigated in relation to parent affect.

Study 3 highlighted the primacy of the role of the infant in understanding the display of parent affect. Infant positive affect at 6 months was found to be robustly predictive of concurrent parent positive affect. Winnicott (1987) famously declared, "There is no such thing as a baby." The converse of this observation is also true – "There is no such thing as a parent." Parents and infants co-exist and co-regulate in a dynamic fashion. It is critical to attend to the affective match between parents and infants in order to appreciate the degree to which parents are adequately supporting their children's emerging cognitive and language capacities. Parents and infants also inherit the strengths and risks unique to their particular familial ecology. As such, ongoing research is warranted to further investigate sources of risk and resilience within family systems in order to support the design and implementation of tailored family-centered interventions that will promote the well-being of children from the very start of their lives.

The present dissertation investigated a wide range of candidate psychosocial factors from the social environment in order understand links between the family system and the outcomes of perinatal medical risk and parent affect. Data were sampled across three generations with families and considered the role of individual- and dyad-level characteristics on infant and parent functioning. The findings underscored the bidirectional nature of the parent-child relationship and the importance of affective attunement in the early years. Ongoing empirical studies are needed to further our understanding of other factors within the family system that may be relevant to perinatal outcomes and early parenting practices.

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