Social Determinants of Infant Temperament: Parent Psychological Factors, Parenting Behaviors, and the Role of Social Disadvantage

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Acknowledgments

I made the decision to become a psychologist shortly after my youngest brother Christian was diagnosed with autism. I was 13 years old. My passion for this career was driven by a deep love for my community and the desire to increase access to care for immigrant families. In truth, I knew very little about what the process would entail at the time and could not have accomplished this herculean task without the support of very dear family, friends, and colleagues.

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Abstract

Background: Infant negative affectivity is considered a key predictor of future mental health outcomes. Social disadvantage (objective and subjective), parent psychological factors (e.g. maternal distress and self-competence), and parenting behaviors (sensitive and harsh-intrusive) are among the environmental influences involved in the development of temperament. However, it remains unclear (a) which dimensions of social disadvantage best predict maternal distress, self-competence, and parenting and (b) whether these factors mediate or moderate the association between socioeconomic risk and infant temperament. **Method:** Two empirical studies (Chapter 2 and Chapter 3) were completed using data from a prospective longitudinal cohort. Participants were pregnant individuals (n=297) enrolled in the 2nd trimester of pregnancy and their 302 infants seen at 6 months old. Socioeconomic status measures were collected at the 2nd trimester. Measures of maternal distress, self-competence, parenting behaviors, and address-coded area deprivation were obtained at 6 months postpartum. Outcome measures were parent-rated infant negative affectivity on the Infant Behavior Questionnaire-Revised subscales (fearfulness, sadness, distress to limitations, rate of recovery from distress) and lab-coded Still Face and Gentle Arm Restraint paradigms when infants were 6 months old. **Results:** Chapter 2 found that lower subjective (perceived) social status prenatally was associated with more postnatal maternal distress. Postnatal maternal distress in turn was associated with more parent-rated infant fearfulness, sadness, distress to limitations, and slower recovery from distress. Postnatal maternal distress partially mediated the effects of subjective social status on infant sadness, distress to limitations, and slow recovery from distress. Worse area deprivation was associated with less infant distress to limitations. In Chapter 3, worse objective and perceived social disadvantage influenced more maternal distress, reduced self-competence, and more harsh-intrusive parenting, which in turn were linked to infant negative emotions. Higher subjective social status was associated with more maternal self-competence, while higher objective SES predicted lower maternal distress and decreased harsh-intrusive parenting. Self-competence partially mediated the effects of subjective social status on infant negative affect. **Conclusion:** These results highlight the important influence of perceived social disadvantage, maternal psychological well-being, and correlated harsh-intrusive parenting on infant development and suggest that caregiver perceived social status may exert a particularly important influence on maternal–and indirectly, child–outcomes. Implications include the promotion of perinatal mental health care, enhancement of parenting self-competence, and broader socioeconomic supports. Collectively, this dissertation advances the literature on early temperament development by highlighting the interplay of social, psychological, and behavioral factors in shaping infant well-being.

Chapter 1: Introduction to Topic

Temperament: A Historical Overview of Prevailing Theories

Temperament refers to individual differences in emotional reactivity, self-regulation, and behavioral responses to the environment (Fu & Pérez-Edgar, 2015). One of the earliest conceptualizations of temperament in Western society has been traced back over two thousand years to the theory of the four humors (e.g. blood, phlegm, yellow bile, black bile). Galen identified four classes of temperament based on which humor predominated: phlegmatic, sanguine, choleric, and melancholic (Merenda, 1987). But in contemporary work, "types" are largely replaced by "traits" measured in various degrees. Early childhood traits are thought to be a foundational aspect of future personality development. Temperament is important to consider because of its role as a predictor of the development of future psychological disorders (Morales et al., 2022).

Early western research on temperament has pushed forth several prevailing theories on the structure and development of temperament as reviewed in Fu & Pérez-Edgar, 2015. One direction has been to seek to identify behavioral traits as temperament and that thread is pursued herein. Pavlov proposed that temperament was linked to types of nervous systems which were characterized by balance, mobility, and strength. His use of the conditioned reflex paradigm was one of the earlier objectively quantified measures of temperament (Ruch, 1992). Kagan argued that temperamental differences were present in early infancy. He examined the relationship between reactivity to stimuli and inhibition and proposed that high reactivity (motor activity, crying, etc.) was linked to inhibited temperament (Kagan, 1997; Kagan & Snidman, 1991).

In another example, Thomas and Chess (Thomas & Chess, 1977) identified nine behavioral dimensions (e.g. regularity, approach-withdrawal, adaptability, threshold of responsiveness, intensity of reaction, quality of mood, activity level, attention span/persistence, and distractibility) and categorized children into three types: "easy", "difficult", and "slow to warm". This model served to highlight temperament's interaction with environmental factors and its subsequent effects on adjustment and development (Fu & Pérez-Edgar, 2015; Thomas & Chess, 1977). Other theorists proposed a genetic-behavior model of temperament that identified three core traits—emotionality, activity, and sociability—that were proposed to be evolutionarily adaptive and relatively stable over the course of development. The partial genetic influence on these traits has been support by twin study findings (Buss, 1991; Buss & Plomin, 2013; Fu & Pérez-Edgar, 2015) however these genetic influences are far from deterministic. According to Goldsmith and Campos (1982), infant temperament can primarily be defined by individual differences in the expression of primary emotions as captured by child's vocal, facial, and motor behavior. This theory attempts to isolate temperament from concepts like cognition or socialization (Fu & Pérez-Edgar, 2015; Goldsmith & Campos, 1982). These theories all contribute to a broader understanding of temperament as behavioral traits, providing evidence that temperament is multifaceted, genetically linked (but not fully explained by genetics), and reflected in individual differences of both outward and internal emotional and regulatory processes as traits.

This body of work is primarily aligned with Rothbart's model of temperament development. This model posits that temperament is characterized by differences in reactivity and regulation of activational, emotional, and attentional processes (Rothbart et al., 2002; Rothbart & Derryberry, 2013). Rothbart's hierarchical model of temperament highlights three

broad dimensions: 1) surgency, which relates to extraversion and positive emotions, 2) effortful control, and 3) negative affect/emotionality (Evans & Rothbart, 2007; Rothbart & Derryberry, 2013). Surgency and negative affect are categorized as "reactive" processes that are measured by their "intensity, latency, timing of peak rise and recovery from the initial reaction" (Fu & Pérez-Edgar, 2015). Surgency has been linked to higher activity levels, sociability, impulsivity, and positive affect, and has often been linked to extroversion (Dollar & Stifter, 2012). By contrast, negative affectivity has been associated with low self-esteem, neuroticism, and increased vulnerability to psychological disorders (Kozlova et al., 2020). Meanwhile, effortful control serves as the self-regulation process through which reactivity is modulated (Rothbart, 1981). As individuals grow up, effortful control becomes the lens through which temperament is viewed, and has been linked to traits such as conscientiousness in older children and adolescents (Einziger et al., 2018; Martel et al., 2014; Nigg et al., 2020).

Negative affect is a particular area of interest when considering temperament development in infancy. This is because higher order dimensions of temperament (such as effortful control and surgency) are only in the very early stages of emergence in the earliest months of life. Negative affect is easier to capture in infancy because of its observable, frequent, and clearer emotional expressions.

Measuring Infant Temperament

Infant temperament presents some challenges in measurement due to an infant's limited communication skills. Therefore, most studies rely on parent-reported infant temperament and/or on standardized laboratory observations. Common parent-rated measures of temperament include the Infant Behavior Questionnaire (Revised) (Parade & Leerkes, 2008; Putnam et al., 2014), the Early Childhood Behavior Questionnaire (Putnam et al., 2006), the Children's Behavior

Questionnaire (Putnam & Rothbart, 2006), and the Emotionality, Activity, and Sociability Temperament Survey (Buss & Plomin, 1984). Parent-rated measures boast many strengths. They are relatively easy to administer and provide information about different subscales of temperament. Perhaps the biggest advantage of parent-reported measures is their ecological validity, since parents observe their children across diverse contexts. This can aid in the capture of less frequent behaviors that appear in naturalistic settings (Kopala-Sibley et al., 2018). However, parent measures are can also be influenced by extrinsic factors, such as parental stress, mental health, social acceptability, and socioeconomic factors, which can result in reporting biases (Kopala-Sibley et al., 2018).

To address some of the challenges of parent report, researchers have developed methods for measuring infant temperament in the laboratory. For example, the Laboratory Temperament Assessment Battery (Lab-TAB), utilizes structured episodes to capture five core dimensions of temperament: fear, anger, positive affect, interest, and activity level (Goldsmith & Rothbart, 1999; Planalp et al., 2017). Coding of these episodes include scoring the presence of facial expressions, vocalizations, and body movements. The observational nature of laboratory measures allows researchers to address concerns about parent bias in their ratings by controlling the observational environment. However, laboratory measures are limited in their ability to capture naturalistic responses and may result in findings that are more difficult to generalize to other contexts outside the lab. Studies on child temperament increasingly employ the use of both parental-rated temperament and observer-rated temperament to address the individual limitations associated with each and to enhance overall reliability.

Infant Negative Affectivity: A Key Predictor of Future Mental Health Risks

Negative affectivity includes several aspects of negative emotionality: fearfulness, sadness, distress to limitations (e.g. distress to physical restraints), and rate of recovery from distress, (also known as falling reactivity) (Rothbart et al., 2002). Negative affectivity develops and shifts across infancy and early childhood. In babies as young as 4 months old, negative affect is characterized by distress, anger, and sadness. In later infancy (the second half of the first year of life) fearfulness emerges as an infant's cognitive and socioemotional experience of the external environment grows more sophisticated (Fox et al., 2015). In toddlerhood, negative affect generally increases in intensity, including more heightened expressions of anger, sadness, and fear. This burst in negative emotionality is driven in part by increased child autonomy and desire for independence which interacts with parental expectations (Shaw et al., 2000). At this point in development, regulatory skills begin to emerge, and the interactive role of temperament and environmental factors (such as the parent-child relationship) begin to shape the expression of negative emotionality (Bridgett et al., 2009; Lipscomb et al., 2012). In early childhood, negative affectivity decreases slightly as children begin to develop communication and emotion regulation skills (Lipscomb et al., 2012). Also in this life stage, children become more aware and in some cases are more susceptible to the influence of the environment.

Temperament, while partially influenced by genetics, is also sensitive to positive and adverse environmental experiences. There is evidence that negative affectivity in early life stages remains relatively stable throughout childhood (Goldsmith et al., 1987; Putnam et al., 2001; Rothbart et al., 2000). These temperament differences in childhood describe and perhaps influence the way individuals respond to stressors or stimuli in their environment that can help or hinder emotional and social development into adolescence or adulthood. The nature of these associations are often bidirectional, establishing patterns of behavior based on a child's response

to the environment and the response that they evoke from their environment in recursive form (Blandon et al., 2010).

Negative affect is significant in the development of an individual's emotional regulation, cognitive skills, and attachment to primary caregivers. High negative affectivity in early childhood is associated with difficulties in self-regulation (Oldehinkel et al., 2004). Additionally, infant negative affect has also been associated with increased risk for internalizing and externalizing disorders (Kozlova et al., 2020; Muris & Ollendick, 2005). Beyond emotional and psychological impacts, negative affect has also been linked to differences in executive functioning and language development. In one study, children with high levels of negative emotionality at 9 months displayed lower language and executive functioning abilities at 7 years of age (Cioffi et al., 2021). Increased negative affectivity has also been linked to decreased social competence during childhood (Sallquist et al., 2009). Essentially, excessive negative affect in early life is a marker that children are at elevated risk for maladaptation, amplifying the effects of negative affect through bidirectional processes in the environment such that children that exhibit greater negative affectivity develop harmful behaviors that illicit greater negative feedback from caregivers and peers (Oldehinkel et al., 2004).

As previously mentioned, infant temperament is thought to have at least moderate genetic influences. Therefore, temperament is useful in the study of environmental, societal, and family influences. In fact, "both genetic and environmental factors, especially nonshared environmental influences, contribute to the stability and change of temperament overtime" (Fu & Pérez-Edgar, 2015). Social disadvantage (O'Connor et al., 2019), pre- and post-natal maternal mental health, parental self-competence, and parenting behaviors (Ercegovac et al., 2013; Erickson et al., 2017;

Hunter et al., 2021; Wu et al., 2022) have all been identified as additional influences on child temperament and associated emotional wellbeing.

Social Disadvantage: An Overview

Social disadvantage is a broad term encompassing different measures of socioeconomic risk. In research, social disadvantage is operationalized through a multidimensional lens, often encompassing a variety of domains meant to capture socio-economic status (e.g. income, education, poverty levels, neighborhood deprivation, health insurance status, etc.). While some of these measures are collected from objective sources (e.g. area deprivation being calculated from census tracks), others are derived from one's perception of their social status compared to others (Singh-Manoux et al., 2005). Given the sheer number of ways social disadvantage can be measured, some researchers choose to use composite indices that combine several of these variables to provide a broader assessment of cumulative risk exposure.

Social disadvantage is a global health challenge. Over 333 million children in the world live in extreme poverty (World Bank Group 2023). In the United States, approximately 7 million families and 11 million children in 2023 were reported as living below the poverty line (US Census Bureau, 2025). In 2022, 12% of Oregon's families and 134,000 of its children lived below the poverty line (UnitedForALICE, 2024). The prevalence of social disadvantage is influenced by regional differences in cost of living, access to housing, employment opportunities, and other factors. These differences can make disadvantage challenging to study.

Impact of Social Disadvantage on Families and Children

Social disadvantage can be a tremendous source of chronic stress on families and children. It disrupts family functioning by placing additional strain on the parenting team, as

socioeconomic status is associated with decreased parental involvement (Treviño et al., 2021). Objective indicators—such as income, educational attainment, and area deprivation—have been consistently linked to poorer childhood and lifelong outcomes, including adverse mental health trajectories, abnormal neural development, and difficulties with academic performance and self-regulation (Chin-Lun Hung et al., 2015; Kohen et al., 2008; O'Connor et al., 2014; Santiago et al., 2011). Children born to mothers with higher educational attainment tend to display more positive socio-emotional and cognitive development (Farah et al., 2006; Koutra et al., 2012; Noble et al., 2007). Studies have shown associations between higher area deprivation and a range of negative health and developmental outcomes, including poorer maternal mental health and increased behavioral difficulties in children—even when accounting for genetic contributions (Dash et al., 2023; Kind et al., 2014; Skapinakis et al., 2005).

Though less extensively studied, subjective social status as also been linked to adult and child well-being (Demakakos et al., 2008). Among mothers of young children, higher subjective social status has been associated with better psychological outcomes, particularly in marginalized populations (Michelson et al., 2016), while lower subjective social status has been linked to increased child behavioral problems—likely mediated by elevated parenting stress and altered caregiving behaviors (Roy et al., 2019).

There are several pathways through which socioeconomic risk can influence later development. Developmental Origins of Health and Disease (DOHaD) theory proposes that early environmental exposures during key developmental stages (such as prenatal, perinatal, and in early infancy) can influence an individual's propensity for chronic disease in later life. This theory emphasizes the importance of epigenetic modifications as mediating early life factors (nutrition, stress, toxin exposure) and their effect on gene expression (Lacagnina, 2020). While

the DOHaD theory has been used to investigate the link between nutrition, pollutants, medications, stress, and lifestyle factors on various diseases and to a lesser extent on neurodevelopment, further application of this framework as it relates to parent psychological factors (such as maternal distress and parent self-competence) as well as parenting behaviors (e.g. sensitive versus intrusive parenting) is warranted.

It is crucial to adopt a multidimensional framework when assessing the impact of social disadvantage on maternal and child health. By examining the combined and independent effects of objective socioeconomic indicators, and perceived social standing, this dissertation contributes to a more comprehensive understanding of the early-life social environments that shape maternal mental health and infant temperament.

Parental Psychological Factors: Maternal Distress and Parental Self-Competence

Maternal Distress: Prevalence and Risk Factors

Maternal distress is conceptually understood to be a multifaceted emotional response in the perinatal period. It can be comprised of a range of emotional experiences such as anxiety, depression, and stress (Jeličić et al., 2022). In the U.S., 800,000 families annually are impacted by maternal mental health conditions (Werner et al., 2015). Nearly 20 percent of mothers experience an episode of depression in the postpartum period (Werner et al., 2015). Mothers from socially disadvantaged groups are 11 times more likely to develop clinically elevated depression. Notable socioeconomic risks factors associated with maternal distress include lack of social support, lower education, and food insecurity (Saur & Dos Santos, 2021).

Influence of Maternal Distress on Child Development and Negative Affect. Maternal distress can influence child development through biological, behavioral, and environmental

mechanisms. Biologically, maternal distress can be transmitted through changes in the fetal environment. Maternal inflammatory cytokines have been found to mediate the association between prenatal depression and infant negative affectivity (Sutin et al., 2022). The placenta is crucial pathway through which maternal mood has been linked to infant temperament (Sutin et al., 2022). Pre- and postnatal maternal distress has been associated with disruptions in infant brain structures associated with emotional regulation (e.g. hippocampus, amygdala) (Bezanson et al., 2023).

Behaviorally, maternal distress influences infant temperament through maternal sensitivity (e.g. a caregiver's attunement to their child's needs and desires) and parenting behaviors. Maternal distress is thought to decrease maternal sensitivity, and higher sensitivity is associated with decreased negative affect in infancy and early childhood (Lahtela et al., 2023). Poor maternal mental health is associated with decreased quality of mother-infant interactions, which is subsequently associated with increased infant emotional reactivity (Bernier et al., 2010). Parenting behaviors that are categorized as harsh-intrusiveness are also influenced by maternal mood and are associated with increased infant negative affect expression (Eisenberg et al., 2015). Genetic predispositions can interact with stressors in the extrinsic environment and trigger epigenetic changes that result in increased vulnerability to maladaptive dysregulation (Lahti-Pulkkinen et al., 2024). This can occur through altered neurobiological stress sensitivity caused by epigenetic changes to the autonomic nervous system (Davis & Narayan, 2020).

Bidirectional Influences Between Maternal Distress and Infant Temperament. The association between maternal distress and infant temperament is theorized to be bidirectional (Tan & Smith, 2022). Temperament is shaped by the emotional environments that children are raised in, which are framed within their parents' own emotional experiences. Specifically,

maternal expression of negative emotions is thought to predict child negative affect (though biological and behavioral mechanisms such as epigenetics and parenting behaviors), while concurrently a child's temperament plays a role in shaping mothers' emotionally expressivity (Tan & Smith, 2022). Children who exhibit high negative affect may have intense emotional responses to stressors and more difficulty in adapting to their environment, which may lead to negative emotions in the caregiver and result in decreased support and socialization of the child (Bates & Pettit, 2007). This can create a feedback loop that results in poorer future development.

Gaps in the Literature: Maternal Distress as a Mediator of Interest. Extant research has established associations between social disadvantage and development across the lifespan (Demakakos et al., 2008; Fuller-Rowell et al., 2018; Prince et al., 2018), as well as documented the link between greater maternal distress and increased infant negative affect (Erickson et al., 2017; Howland et al., 2020; Lahti-Pulkkinen et al., 2024). Prior work has also provided evidence for social disadvantage and its role as a risk factor for increased maternal distress (Arditti et al., 2010; Daalderop et al., 2023; Michelson et al., 2016). However, limited attention has been given to how maternal distress may mediate or contribute to the effect of social disadvantage on infant temperament. Furthermore, few studies have examined the relationship between social disadvantage and infant negative affect by utilizing both objective and subjective measures of both social disadvantage and infant temperament. Finally, prior work has found distinct effects of maternal distress on different subscales of infant temperament (explained further in Chapter 2) (Gustafsson et al., 2018; Nolvi et al., 2016) yet research into these differential effects of distress on sadness, fearfulness, distress to limitations, and rate of recovery of distress is still limited.

Parental Self-Competence: Considering the Role of Self-Concept

Parental mood and other psychological factors are crucial for the development of emotional regulation in their offspring (Rainford, 2022). Parental self-competence is conceptualized as a parent's belief in their ability to successfully manage parenting tasks and challenges. Parental self-competence is understood to include elements of self-efficacy (e.g. belief in skill) and satisfaction (e.g. fulfillment with parenting experience) (Gilmore & Cuskelly, 2024). While parent-rated competence is less well-documented, parental self-efficacy (commonly defined as parent's confidence in their ability to effectively perform the responsibilities associated with raising their child) (Wittkowski et al., 2017) is a distinct yet overlapping construct that has previously been examined for its link to child development and its influence on parenting behaviors (Wittkowski et al., 2017).

Greater parental self-competence and self-efficacy can serve as buffers against other risk factors for both child and parent wellbeing (Albanese et al., 2019). Self-efficacy is also an important factor in parent mental health, as lower self-efficacy has been linked to postpartum depression, resulting in more negative perceptions of their child (Denis et al., 2012). Mothers with greater self-efficacy have less psychological distress (Haslam et al., 2006). These associations are theorized to be bidirectional as mental health challenges like depression may negatively impact an individual's perception of their own parenting (Dix & Meunier, 2009). Self-efficacy is also associated with facets of infant temperament, such as falling reactivity (the rate at which the child recovers from distress) and sadness (Hamzallari et al., 2022). Competence and self-efficacy are considered important factors in the bidirectional relationship between maternal mood and child development (Albanese et al., 2019; Fang et al., 2021). Self-efficacy has previously been identified as potential mediator between maternal emotional regulation and infant negative affect (Hamzallari et al., 2022).

Parental self-efficacy is also considered an important factor in shaping parenting behaviors (Coleman & Karraker, 1998; Ercegovac et al., 2013). Maternal self-efficacy is associated with sensitive and positive interactions with infants (Troutman et al., 2012). Higher self-efficacy has been linked to higher positive parenting practices (e.g. praising and rewarding good child behavior) as well as more consistent follow-through with discipline (Hamovitch et al., 2019). Some studies theorize that efficacy's influence on positive parenting behaviors leads to greater prosocial behavior and less emotional and behavior problems in children (Trecca et al., 2022).

While parental competence and self-efficacy have been linked to parent and child emotional wellbeing, few studies have examined how self-competence (in this case a combination of efficacy and satisfaction), is linked to infant negative affect, an important predictor of later emotional difficulties. Furthermore, few studies have examined its joint mediational effects with maternal psychological distress on the associations of social disadvantage on infant temperament.

Parenting Behaviors: Sensitivity and Intrusiveness

Parenting behaviors are a primary factor of interest in studying the development of temperament. Parenting behaviors can be classified in several ways, including parental involvement, warmth, sensitivity, and more maladaptive behaviors such as intrusiveness, harshness, and coercion. Parenting behaviors (sometimes referred to in relation to parenting skills) have been extensively studied, and the quality of these behaviors or skills has been associated with developmental outcomes of offspring including psychopathology risk (Jiang et al., 2023). Parenting behaviors can be verbal or physical and typically result in either positive or negative responses from the child. Harsh-intrusive parenting behaviors are characterized by

negative elements such as aggressive, coercive, or harsh punitive behaviors. While some level of intrusiveness is considered normative (particularly early in life), harsh-intrusive parenting is associated with harmful effects on emotion regulation in children (Mortensen & Barnett, 2019). Greater harsh-intrusiveness and controlling behaviors have been linked to increased risk of developing internalizing disorders and increased severity of ADHD symptoms (Hunter et al., 2021; Keown, 2012; Wood, 2006). Conversely, sensitive parenting behaviors are characterized by a parent's identification of and attunement to their child's needs and desires. Sensitive parenting behaviors consider and respect the child's autonomy and agenda (Ainsworth et al., 1974). According to a meta-analysis, sensitive parenting behaviors have been long-studied, and are thought to serve as a protective factor that decreases the risk of child externalizing and internalizing problems (Cooke et al., 2022). There is also evidence to suggest that this association may be stronger in low-SES populations (Cooke et al., 2022).

Bidirectional Processes and Other Influences

Yet the preceding is not to imply a simplistic direction of causality. Indeed, the relationship between parenting behaviors and child temperament is bidirectional, with child behaviors eliciting certain parenting responses, and those responses then reinforcing other child behaviors (Eisenberg et al., 2015; Zvara et al., 2018). Parenting behaviors are also influenced by parent psychological factors such as parent self-efficacy (Hamovitch et al., 2019; Troutman et al., 2012) and maternal distress (Choe et al., 2013). Depression has been linked to negative parenting behavior (Lovejoy et al., 2000), and other distress (such as that caused by social disadvantage) has been associated with harsh discipline practices (Arditti et al., 2010). Maternal emotional distress is also linked to diminished responsiveness (Gondoli & Silverberg, 1997). Socioeconomic status has also been linked to parenting, with low-resourced parents exhibiting

more intrusive behaviors, ultimately resulting in greater child negative affect (Ispa et al., 2004). In some contexts, intrusive parenting can be advantageous, as is the case for families with intersecting marginalized identities. Intrusive behaviors in low SES families may protect against external risks (e.g. such as exposures in dangerous neighborhoods) (Barnett & Scaramella, 2017) by inhibiting fearless or risk-taking behaviors and may teach skills that are useful in the workplace (e.g. compliance with authority). In the case of Black and Hispanic families, intrusive behaviors may be aimed at protecting their children them from risks that disproportionately people of color, such as police brutality (Diemer et al., 2021).

Parenting Behaviors as Mediators of Social Disadvantage

Parenting behaviors continue to be a point of interest for future research due to their modifiability. Parent-mediated interventions are often more effective in higher risk populations, and may serve as an effective buffer against social disadvantage (Cooke et al., 2022). As previously established, children who are exposed to adversity are at greater risk of developing mental health problems (Dash et al., 2023). Common risk factors include maternal mental health, education, income, and lower parent competence (Belsky et al., 2007; Bezanson et al., 2023; Denis et al., 2012), which often influence child outcomes through their influence on sensitive and intrusive parenting behaviors. In fact, parenting behavior has previously been established as a mediator of the effect of social disadvantage on antisocial behavior (Odgers et al., 2012), prefrontal cortical development (Whittle et al., 2017), and child conduct problems (Dodge et al., 1994). However, less is known about the mediational role played by parenting behaviors in buffering or amplifying the effects of social disadvantage on infant negative affectivity.

Theoretical Rationale and Objectives

This dissertation examines infant temperament from a theoretical framework that draws from several theories of child development. First, the Family Stress Model (Conger et al., 2000), argues that socioeconomic disadvantage is disruptive to family functioning through its influence on parental psychological distress. This distress can lead to altered caregiving behaviors and negatively impact a parent's engagement and responsiveness (Masarik & Conger, 2017). The Family Stress Model emphasizes the role of the family as a dynamic system that adapts to stressors in ways that either buffer or intensify risk for the child. This model serves as a conceptual foundation for understanding how social disadvantage is transmitted to the child through their parents' psychological wellbeing and parenting behaviors and the subsequent effects on temperament development.

Bronfenbrenner's Ecological Systems Theory argues that development is shaped by nested systems that influence the individual (Bronfenbrenner, 1999). The innermost system, the microsystem, includes influences such as family, school, friends, and neighbors. The next sphere of influence, known as the mesosystem, describes how influences in the microsystem interact with each other. The exosystem encompasses influences that are more distal to the child, such as extended family, media, and local government, while the macrosystem includes elements of social and cultural norms (e.g. gender roles) that impact the individual and the other influences across the micro and exosystems. Finally, the Ecological Systems Theory includes the chronosystem as a way of capturing development over time. The Ecological Systems theory is a useful framework for understanding how factors that influence temperamental development exist within a complex and layered ecosystem.

Finally, this dissertation views the development of infant temperament through a broader integrative developmental theory as developed by Dante Cicchetti. Cicchetti's framework for

understanding developmental psychopathology argues that psychopathology occurs due to disturbances or disruptions associated with multilevel processes, including biological, individual, family, and environmental contexts (Cicchetti, 2016). Central to understanding developmental psychopathology are the principles of multifinality and equifinality. Multifinality explains that a single risk factor (e.g. such as abuse in early childhood), can lead to different outcomes in different individuals due to differences in vulnerabilities or protective factors. Experiences that cause significant psychopathology in some individuals may create only minor difficulties in others (Cicchetti & Rogosch, 1996). Conversely, equifinality is the process by which one shared outcome (e.g. the development of depression, anxiety, or some other mental health disorder) may develop in individuals with different biological or psycho-social propensities that converge into a shared clinical presentation. This framework is helpful in conceptualizing infant temperament as one facet of a dynamic system that is differentially influenced by proximal (e.g. maternal mental health, parenting behaviors and self-competence) and distal (e.g. social disadvantage) factors that interact with early biological and behavioral tendencies to shape developmental pathways.

These theories can be drawn from to support a process-oriented view of temperament development. Through this lens, individual differences in temperament are brought about by longitudinal and reciprocal interactions between the infant and context in their environment (**Figures 1 and 2)**. This dissertation focuses on the particular interactions at play in the 6-month postnatal period. This period is especially important because temperament remains highly malleable to both biological, behavioral, and environmental factors. Increased motor control and social engagement means that the bidirectional associations between temperament and maternal mood and behavior can be more fully explored. This provides a unique opportunity for developing studies aimed at earlier intervention and amelioration of risk.

Infant negative affectivity is a predictor of future mental health challenges (Kozlova et al., 2020), and thus understanding the factors that influence negative affect is paramount to improving treatment strategies and prevention efforts. While the direct effects of social disadvantage (O'Connor et al., 2019), maternal distress (Lahti-Pulkkinen et al., 2024), parent self-efficacy (Hamzallari et al., 2022), and sensitive and intrusive parenting behaviors (Yan et al., 2019) have been established, these variables rarely operate in isolation and interact with each other in complex dynamic ways. Therefore, understanding the interactions and potential mediation effects of parent psychological factors and behaviors is necessary, as less is known about how these factors interact to influence infant negative affectivity. There remains a need in the literature to consider the multiple levels of influence involved in the development of infant negative affect. Understanding these pathways can inform the design of interventions targeting multiple risk and protective factors.

This body of work has several objectives. The first is to integrate and build upon extant literature on the individual effects of social disadvantage, maternal distress, parental self-competence, and parenting behaviors on infant negative affectivity. While these factors have each been examined individually, this dissertation hopes to provide a comprehensive perspective of their combined impact on child emotional development. The second objective is to explore the mediating and moderating effects of maternal distress, parenting self-efficacy, and parenting behaviors (both intrusive and sensitive) on negative affectivity. Lastly, this project hopes to fill some of the gaps in the literature about infant temperament and to identify critical points for future researchers, as well as informing future interventions and policy.

Figures for Chapter 1

Figure 1: Social Ecology of Temperament

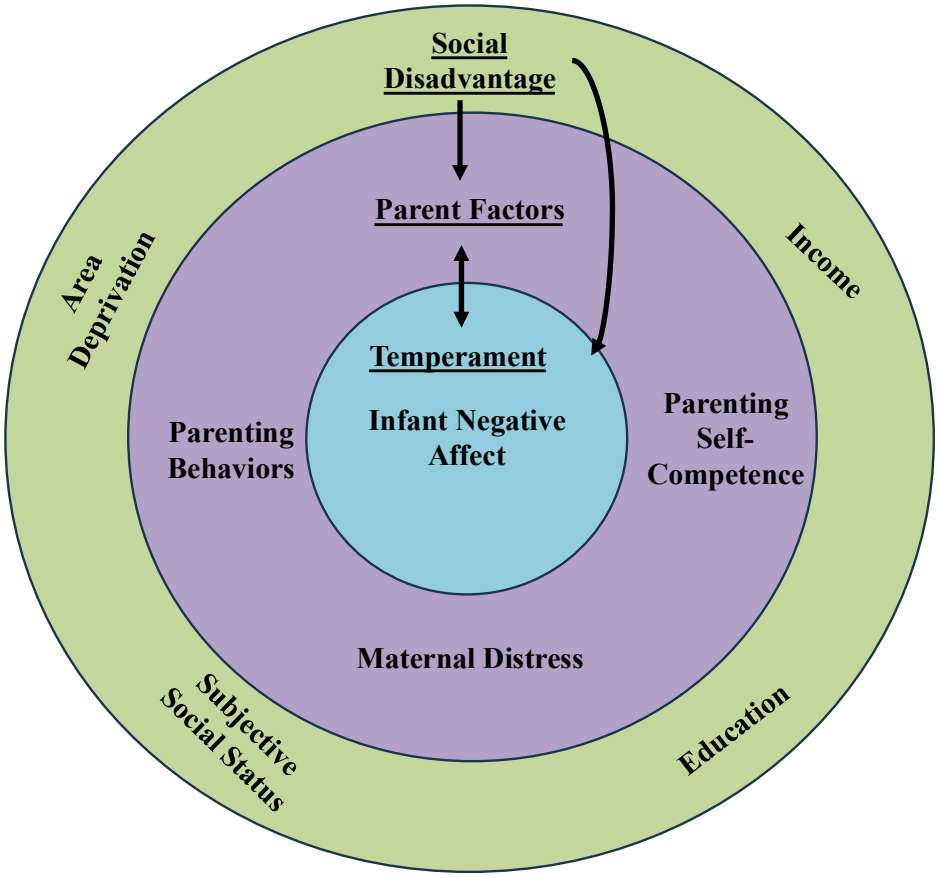
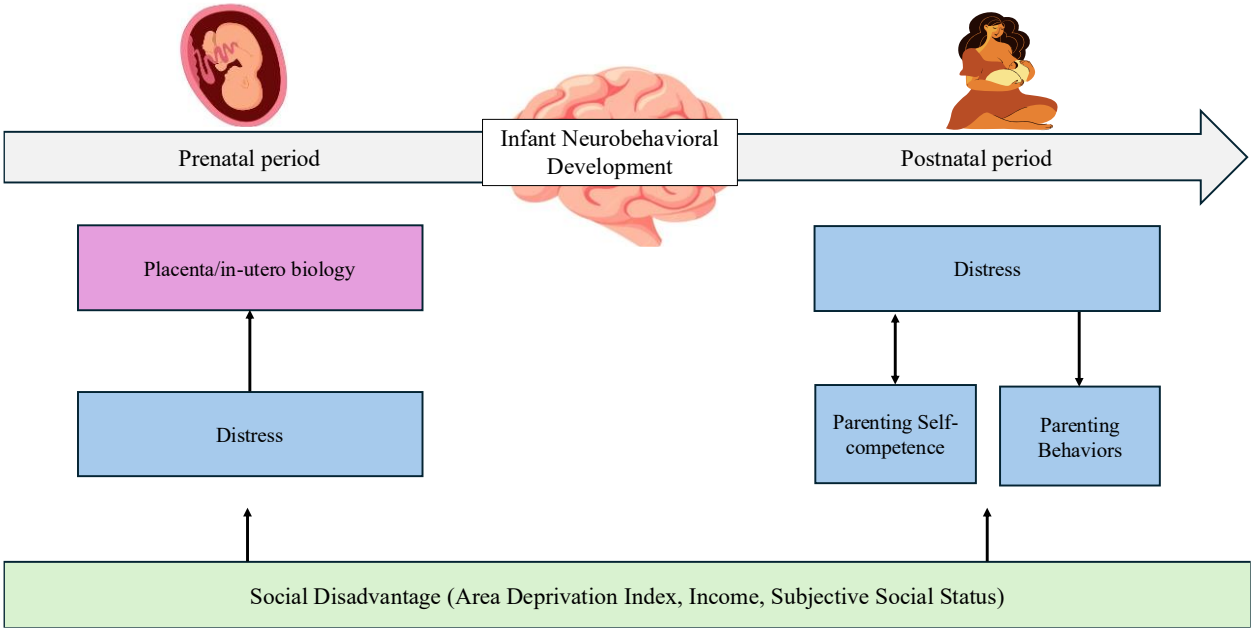


Figure 2: Theoretical Framework



Chapter 2: Understanding the Associations Among Social Disadvantage, Maternal Distress, and Infant Negative Affect

Introduction to Chapter 2

The prevalence and severity of youth mental health challenges has increased markedly during the last decade (Deng et al., 2023; Tkacz & Brady, 2021), prompting the American Academy of Pediatrics (and other organizations) to declare a national emergency in child and adolescent mental health (AAP-AACAP-Cha, 2021). While adverse childhood experiences are associated with a higher risk of mental and physical health consequences (Baldwin et al., 2023), more subtle factors, such as caregiver distress (e.g. depression, anxiety, and stress), also appear to have clinically actionable influences on child outcomes (Chang et al., 2023). Since early childhood psychopathology can be difficult to identify, understanding the early risk mechanisms and precursors of child mental health disorders could further enhance and transform prevention strategies.

Infant temperament is one well-studied avenue for capturing early psychopathology risk (Wu et al., 2022). Temperament refers to distinctive reactive and self-regulatory behavioral and emotional response styles across different contexts, which can be measured as traits in early life (Rothbart et al., 2002). Specifically, negative affectivity is among the most consistently identified temperamental markers of future psychopathology (Kozlova et al., 2020). In addition to heritable influences, psychosocial adversity and parental distress represent critical contexts for infant affective development and mental health risk (Lahti-Pulkkinen et al., 2024; Michelson et al., 2016; Nigg & Goldsmith, 1998).

However, questions remain as to the relative contribution of prenatal and early postnatal influences on developmental psychopathology, such as how perceived and objective

socioeconomic risk factors may contribute to the interplay of maternal and infant outcomes. By examining the associations between social disadvantage, maternal mental health, and infant affective development, this study aimed to provide a more comprehensive and nuanced understanding of how early environmental and psychological factors intersect to shape developmental outcomes.

Social disadvantage and maternal and infant outcomes

A robust literature argues that social disadvantage is important in shaping the well-being of parents and children (Arditti et al., 2010; Belsky et al., 2007; Bouvette-Turcot et al., 2016; Martins et al., 2023). Social disadvantage broadly encompasses several domains that capture socioeconomic status (e.g. income, education, poverty levels, neighborhood deprivation, health insurance status, etc.). In the United States, approximately 7 million families and 11 million children were living in poverty in 2023 (U.S Census Bureau, 2025). The Family Stress Model (Masarik and Conger, 2017) argues socioeconomic disadvantage is disruptive to family functioning through its influence on parental psychological distress (Conger et al., 2000; Zietz et al., 2022). This distress can lead to altered caregiving behaviors that have implications for children's emerging emotional reactivity and regulation, including less parental engagement, responsiveness, and increased harshness (Masarik & Conger, 2017; Reich et al., 2023). The Family Stress Model emphasizes the role of the family as a dynamic system that adapts to stressors in ways that either buffer or intensify risk for the child. This model serves as a conceptual foundation for understanding how social disadvantage is transmitted to children through their parents' psychological well-being and the subsequent effects on temperament development. This study seeks to understand the influence of both objective and subjective

measures of socioeconomic risk through its effect on maternal distress and subsequent influence on infant temperament.

Socioeconomic Status (SES). There is a robust and growing body of work that demonstrates the effects of SES (e.g. income, education, and occupation) on the family system and child temperament development. Lower SES is associated with increased negative affectivity and decreased regulatory behaviors in infancy and early childhood (Bornstein et al., 2015; Conejero & Rueda, 2018; Möwisch et al., 2025; Strickhouser & Sutin, 2020). These associations appear to be stable over time (Strickhouser & Sutin, 2020). SES is theorized to influence infant temperament partially through parental mood (Hong et al., 2024; Jansen et al., 2009). SES has been linked with maternal depression (Goyal et al., 2010; Kohen et al., 2008; Szurek-Cabanas et al., 2024), maternal anxiety (Cooklin et al., 2014; Miao et al., 2024; Santiago et al., 2011), and to child externalizing behaviors and poorer cognitive ability via its contributions to parental stress (Miller et al., 2018; Smith et al., 2022). Prior work has focused on objective SES measures, including personal finances, educational attainment, and income.

Qualities of the neighborhood may also be important in shaping parental mood and infant temperament development through forces that are extrinsic to the family. *Area deprivation* refers to geographic social class inequities, related to income, education, home ownership, infrastructure, and overcrowding in the individual's community (Kind et al., 2014; Singh, 2003). Area deprivation has been associated in initial studies with poorer health outcomes, such as the prevalence and mortality rates of cancer (Fairfield et al., 2020) and poorer child mental health even when genetic factors are considered (Dash et al., 2023). Area deprivation measures capture broader social contexts beyond individual characteristics to reflect community-level socioeconomic disadvantage. Yet, their specific effects on maternal mental health and child

temperament remain understudied. Investigating the role of area deprivation could reveal critical distinctions between individual and community-level influences on maternal psychological states and child development.

Subjective Social Status. *Subjective social status* (one's perception of their social standing in comparison to others in their community) is distinct from other measures of socioeconomic status (Singh-Manoux et al., 2005) and is also associated with one's own mental and physical health (Demakakos et al., 2008; Euteneuer, 2014). Higher subjective social status is associated with psychological well-being in mothers of young children, particularly among underrepresented racial or ethnic groups (Michelson et al., 2016). Lower parental subjective social status is associated with child behavioral problems, possibly through higher levels of parental stress and parenting behaviors (Roy et al., 2019).

Summary. While various metrics of social disadvantage are associated both with child mental health risk and maternal distress (Belsky et al., 2007; Demakakos et al., 2008; Guardino & Dunkel Schetter, 2022; Kohen et al., 2008; Santiago et al., 2011; Werner et al., 2007), few studies have simultaneously considered their distinct or additive influence on maternal mental health or on infant outcomes prospectively. We joint test subjective and objective (income, ADI) disadvantage as predictors of postnatal maternal distress and infant negative affect at 6 months. This design allows us to isolate distinct versus shared pathways and to evaluate whether maternal distress carries indirect effects from disadvantage to infant temperament.

Infant temperament as a key early risk marker

Temperament is associated with future psychological challenges through its influence on emotional development and its complex interactions with other risk factors (Kostyrka-Allchorne et al., 2020; Morales et al., 2022; Muris & Ollendick, 2005; Nigg et al., 2020). Rothbart's

hierarchical, reactivity-regulation model of temperament identifies three higher-order dimensions of temperament: 1) surgency (associated with extraversion and positive affectivity), 2) effortful control, and 3) negative affect or affectivity (Evans & Rothbart, 2007; Rothbart & Derryberry, 2013). Later in development, temperament is understood in the context of regulatory mechanisms such as effortful control (and related constructs like personality conscientiousness in older youth) (Einziger et al., 2018; Martel et al., 2014; Nigg, 2017). However, in infancy, negative affectivity is an important marker due to its early emergence, as other higher order dimensions are still in very beginning stages of development and infants remain dependent on parents for regulation.

Negative affectivity comprises fearfulness, sadness, distress to limitations (e.g. distress when physically restricted or otherwise constrained), and rate of recovery from distress (also called falling reactivity) (Rothbart et al., 2002); prenatal anxiety and depression differentially predict these components, underscoring the value of examining them separately. For example, pregnancy-related anxiety was associated with more infant *fearfulness* and *rate of recovery from distress* (Nolvi et al., 2016), while prenatal depression was associated with greater *sadness* in infants (Gustafsson et al., 2018). This suggests that the specificity of these effects on negative affect is important, yet few studies have investigated how postnatal maternal distress influences individual negative affect subscales, highlighting a need for more research into the distinct manifestations of infant emotional reactivity.

Maternal pre- and postnatal distress and infant temperament

Prenatal and postnatal maternal distress are related to infant temperament via different mechanisms. While prenatal distress influences the intrauterine environment via the release of stress related hormones (Graham et al., 2022), the association between postnatal distress and

infant temperament (Erickson et al., 2017; Howland et al., 2020; Sutin et al., 2022) reflect bi-directional, behavioral, and psychological processes between the caregiver and infant (Brooker et al., 2015; Cooper-Vince et al., 2014). For example, caregivers who are under greater distress may exhibit less sensitive and responsive parenting behaviors, which may reinforce child negative affect and behaviors. (Choe et al., 2013; Eisenberg et al., 2015; Hunter et al., 2021). These bidirectional associations contribute to infant temperament development, potentially leading to increased negative affect and challenging behaviors which in turn influence parental mood and behavior. Because postnatal symptoms often follow prenatal symptomatology (Pesonen et al., 2005), considering both periods is necessary to avoid misattributing effects to the postnatal period alone (Daalderop et al., 2023; Erickson et al., 2017; Lahti-Pulkkinen et al., 2024).

The Present Study

Despite extant research examining associations between social disadvantage and mental health and the well-founded link between maternal distress and infant temperament, few studies have examined how social disadvantage relates to infant negative affectivity and how postpartum maternal distress (i.e., anxious and depressive symptomology and stress), contributes to this association. The present study examined whether subjective and objective disadvantage relate to infant negative affect at 6 months and whether postnatal maternal distress carries indirect effects from disadvantage to infant temperament in a large cohort (n=302) of mother–infant dyads, testing the following hypotheses:

Hypothesis 1: Social disadvantage (lower income, greater area deprivation, lower subjective social status) will be associated with greater infant negative affectivity. Hypothesis 2: Greater postnatal maternal distress (6 months postpartum) will be associated with greater infant

negative affectivity (controlling for prenatal maternal distress). Hypothesis 3: subjective and objective social disadvantage will be associated with greater postnatal maternal distress. Hypothesis 4: Postnatal maternal distress will mediate the association between subjective or objective social disadvantage and child negative affectivity at 6 months.

Method

Participants

Participants were drawn from an ongoing, prospective, longitudinal study of pregnant women and their offspring (blinded for review). Pregnant women receiving prenatal care at an academic medical center located in the Pacific Northwest and its affiliated clinics who consented to be contacted for research studies were identified via screening medical records and then were contacted to assess interest and eligibility. Recruitment was augmented with fliers and by social media advertisements in the greater metropolitan area. For this study, 302 mother-infant dyads were studied from the second trimester of pregnancy to 6 months of infant age. Sample demographics are depicted in **Table 1**. Most of the mothers identified as Non-Hispanic, White (*n*= 221; 72.5%), with racial and ethnic demographics representative of the geographic area from which participants were recruited. There were 153 female children (50.7%) and 149 male children (49.3%).

Exclusionary criteria included pre-existing chronic health conditions that influence inflammation (e.g. type I diabetes, polycystic ovarian syndrome, and autoimmune conditions), infant genetic abnormalities or health conditions, current reported substance use, and medications/medical conditions that may affect inflammation. Women who delivered prior to 28 weeks' gestation were discontinued from the study. This study was conducted according to

Declaration of Helsinki guidelines and was approved by the academic medical center's Institutional Review Board. All participants provided written informed consent.

Procedures

The study began enrollment in 2018 (blinded for review). Due to the Covid-19 pandemic of 2020, changes to collection methods for behavioral methods were implemented to safeguard well-being of participants. Participants were subsequently given the choice to participate from home using videoconferencing software. Remote participants joined the online video link and were guided through the different tasks by a research assistant. Still Face and Gentle Arm Restraint tasks were video and audio recorded and coded asynchronously. Therefore, visit location was included as a covariate in analyses that included measures collected remotely.

Measures

Maternal Pre- and Postnatal Distress.

Maternal distress was captured in the second trimester of pregnancy and at 6 months postpartum using measures of anxiety [(State-Trait Anxiety Inventory (Spielberger et al., 1983), Beck Anxiety Inventory (Beck et al., 1993)], depression [(Center for Epidemiologic Studies Depression Scale (CESD) (Radloff, 1977), Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987)] and stress [(Perceived Stress Scale (PSS) (Cohen et al., 1983))]. A confirmatory factor analysis (CFA) (Hoyle, 2000) supported combining these measures into a single latent variable for distress (**Figures 1a** and **1b**). Fit indices indicated that these models fit the data well (Prenatal maternal distress: Fit statistics: χ^2=7.41, df =5, p=.19; CFI=.995; TLI=.991, RMSEA=.04); Postnatal maternal distress Fit statistics: χ^2=7.60, df =5, p=.18; CFI=.997; TLI=.994, RMSEA=.046).

Social Disadvantage.

Measures of social disadvantage included the geospatially-coded *Area Deprivation Index* (Fan et al., 2021) (coded at 6 months postpartum), and the maternal-completed *Macarthur Sociodemographic Questionnaire* collected in the second trimester.

The *Area Deprivation Index* (ADI) was derived from participants' home addresses using geospatial coding and contains information pertaining to educational attainment, employment levels, median family income, income disparity, homeownership, home values/rent costs, percentage living below the federal poverty level, single parent households, crowding, and amenities representing the census tract where the participant resides. A 17-factor weighted sum of ADI was calculated at 6 months postpartum. The calculations were completed using the 2014 Census' American Community Survey (ACS, 2014) from which census tracts were obtained and matched to participants' addresses. The ADI is publicly available and has been validated in nation-wide cohorts (Fan et al., 2021). Higher ADI scores indicate greater levels of socioeconomic disadvantage within a neighborhood (**Table 1.**).

Subjective social status was assessed in the second trimester of pregnancy using the *MacArthur Sociodemographic Questionnaire* (Demakakos et al., 2008). Participants ranked themselves on a social hierarchy ladder in comparison to others in their community, with 1 being the lowest rung and 10 the highest. Objective socioeconomic status was calculated by assigning a mean income to each bracket of reported household income (Question: Which of these categories best describes your total combined family income for the past 12 months? [Less than $5,000], [$5,000-$11,999], [$12,000-$15,999], [$16,000-$24,999], [$25,000-$34,999], [$35,000-$49,999], [$50,000-$74,999], [$75,000-$99,999], [$100,000-$199,999], [$200,000-$299,999], and [$300,000 and greater]). These values were divided by household size, obtained by asking, "How many people are currently living in your household, including yourself?" (**Table 1**).

Infant temperament.

***Ratings*.** Mothers completed the Infant Behavior Questionnaire Revised (IBQ-R) (Gartstein & Rothbart, 2003) when infants were 6 months old. The IBQ-R is a widely used parent-report measure of infant behavior with adequate reliability and validity (Parade & Leerkes, 2008; Putnam et al., 2014; Rothbart, 1981). This paper focuses on the subscales of negative affect: distress to limitations, sadness, fearfulness, and rate of recovery from distress. Rate of recovery from distress warrants inclusion because the length of time a child is distressed may influence maternal mood and child affect. Building on research that suggests that these individual dimensions are associated with different developmental outcomes (Gustafsson, et al., 2021; Nigg, 2006), we consider each subscale separately (blinded for review).

Observational measures. Laboratory measures of infant behavior were collected, including the Gentle Arm Restraint task (GAR) (Goldsmith & Rothbart, 1999) and the Still Face Paradigm (SFP) (Tronick et al., 1978) at 6 months infant age. The GAR task is designed to elicit infant frustrative anger across three segments. For the first segment, parents stood behind their infant's highchair as their child played with an attractive toy. Once 30 seconds elapsed, the toy was placed on the highchair tray and mothers were instructed to hold their child's arms gently at their sides for 30 seconds. Mothers were instructed to not interact with the child during the restraint period. Following the restraint period, the child was again permitted to play with the toy.

The Still Face Paradigm, measures negative response/distress (Mesman et al., 2009), during a play episode, still face episode, and a reunion episode. In the first episode, the infant sat facing their mother and engaged in a game of peek-a-boo. After 2 minutes, the mother was instructed to turn away from their child for 15 seconds. Facing the child again, the mother sat

with a neutral face for 2 minutes (the still face episode). Mothers then turned away for another 15 seconds, followed by a 2-minute period in which they reinitiated interactions with their child (the reunion episode).

Coding. Video recordings of the SFP and GAR task were coded in 5 second epochs by an independent team of 3 coders that were blinded to the study hypotheses. Utilizing a modification of a previously established coding scheme (Holochwost et al., 2014; Moore et al., 2009) and Observer XT 16 (Noldus Information Technology, v.16), each epoch was coded for the following: body distress, facial distress, and vocal distress. A percentage of the cases from each task (25% GAR and 35% SFP) were randomly selected and tested for interrater reliability. Interrater reliability was 81.41-87.97% for vocal distress, 85.59-90.14% for facial distress, and 85.19-87.97% for bodily distress.

The total number of epochs during which each type of distress was observed was divided by the total number of epochs for that portion of the task, creating variables capturing the proportion of the task the child engaged in any a) facial, b) vocal, and c) bodily distress. Proportions were created separately for GAR and SFP. A CFA supported our *a priori* decision to use the three SFP variables as indicators of an infant distress latent variable and the three GAR variables as indicators of an infant frustration/anger latent variable. CFA results showed significant factor loadings ($p<.0001$) greater than .74 in magnitude, confirming the appropriateness of a latent infant distress variable (SFP Factor loadings: Bodily distress: .76, $p<.0001$, Facial distress: .96, $p<.0001$, Vocal distress: .96, $p<.0001$, see **Figure 2a**) (GAR: Bodily distress: .78, $p<.0001$, Facial distress: .87, $p<.0001$, Vocal distress: .74, $p<.0001$, see **Figure 2b**). The variance of each latent variable was significant ($p<.0001$), suggesting inter-individual variability in latent distress scores.

Covariates

Initial models were run without covariates (see **Table 2**). Sensitivity analyses considered child sex, child age, maternal age, assessment location (lab or home), and maternal ethnicity/race. This approach was utilized to agnostically yet systematically identify secondary factors affecting results. Maternal age was recorded at the time of childbirth. Maternal race and ethnicity were captured via a demographic questionnaire completed during the second trimester of pregnancy.

Analysis

Analyses were conducted using structural equation modeling (SEM) in Mplus v8 (Muthén & Muthén, 1998-2017), utilizing the robust maximum likelihood estimator, which can accommodate non-normal data distributions. Model fit was examined using the comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean squared error of approximation (RMSEA); CFI and TLI values ≥0.90 and RMSEA values <0.08 indicate adequate model fit (Hu & Bentler, 1999). Missing data was handled using Full Information Maximum Likelihood and all results are reported using standardized effect sizes (betas) to facilitate interpretation and comparison of effect sizes. Non-independence of observations (i.e., participants followed across a second pregnancy (n=5), was handled using the Mplus *Cluster* command. Following current best practices (Hayes, 2009; Preacher, 2015), in cases where we hypothesized that there would be mediation, we proceeded to test for indirect effects even in the absence of a significant direct association.

Hypotheses 1 was tested by regressing 6-month infant negative affect (fearfulness, sadness, distress to limitations and rate of recovery from distress subscales) onto income (second trimester), area deprivation (at 6 months postpartum), and subjective social status (second

trimester). Hypothesis 2 was tested by regressing 6-month infant fearfulness, sadness, distress to limitations and rate of recovery from distress onto maternal distress at 6 months postpartum. Hypothesis 3 was tested by regressing maternal distress at 6 months postpartum onto income, area deprivation, and subjective social status. Finally, hypothesis 4 was tested using a SEM in which infant negative affect subscales were regressed on maternal distress, subjective social status (second trimester), income (second trimester), and the ADI (at 6 months postpartum). Maternal distress was also regressed on subjective social status, income, and the ADI. ADI, income, and subjective social status were allowed to covary. Indirect effects of social disadvantage variables (subjective social status, income, and ADI) on child negative affect via postnatal maternal distress were tested using the Mplus *model indirect* command and by examining bootstrapped 95% confidence intervals (95% CI). The results for infant behavioral outcomes were evaluated separately for parent-rated (Infant Behavior Questionnaire-Revised) and lab-observed child negative affect measures (Still Face Paradigm/Gentle Arm Restraint). Prenatal distress was included as a covariate in each of these models to isolate the effect of postnatal distress on infant temperament. Due to the small sample of people identifying as members of an underrepresented racial or ethnic group (n= 81) all participants who identified as a racial/ethnic minority were grouped together.

Results

Hypothesis 1: Social disadvantage will be associated with increased infant negative affectivity at six months.

Parent Ratings of Infant Negative Affect (IBQ-R).

The model assessing the association between social disadvantage and parent-reported infant negative affect fit the data well (RMSEA=0.04, CFI=0.98, TLI=0.92). Postnatal ADI was

negatively associated with parent-rated distress to limitations (β=-0.14, p=0.02, [95% CI=-0.27, -0.02]), such that greater ADI was associated with lower infant distress to limitations. ADI was not associated with infant fearfulness (β=-.06, p=0.32, [95% CI=-0.19, 0.07]), sadness (β=-.06, p=.34, [95% CI=-0.19, .07]), or rate of recovery from distress (β=0.06, p=0.34, [95% CI=-0.07, 0.19]). Subjective social status was not associated with infant fearfulness (β=-0.04 p=0.61 [95% CI=-0.16, 0.09]), sadness (β=-0.04 p=0.53 [95% CI=-0.16, 0.08]), distress to limitations (β=-0.10 p=0.07 [95% CI=-0.21, 0.07]), or rate of recovery from distress (β=-0.09 p=0.12 [95% CI=-0.03, 0.22]). Income was not associated with infant fearfulness (β=-0.01 p=0.88 [95% CI=-0.13, 0.11]), sadness (β=-0.01 p=0.93 [95% CI=0.11, 0.13], distress to limitations (β=-0.09 p=0.17 [95% CI=-0.22, 0.03]), or rate of recovery from distress (β=0.04 p=0.55 [95% CI=-0.09, 0.17]).

Laboratory-observed Infant Negative Affect (GAR and SFP).

Social disadvantage was not associated with negative affect during the GAR (ADI: β=0.02, p=0.71, [95% CI=-0.10, 0.15]; Subjective social status: β=0.001, p=0.99, [95% CI=-0.13, 0.13]; Income: β=-0.01, p=0.79, [95% CI=-0.15, 0.11]). Social disadvantage was not associated with infant negative affect during the SFP (ADI: β=-0.03, p=0.64, [95% CI=-0.15, 0.09]; Subjective social status: β=0.08, p= 0.25, [95% CI=-0.05, 0.20]; Income: β=-0.08, p=0.28, [95% CI=-0.22, 0.06]).

Hypothesis 2: Postnatal maternal distress will be associated with increased infant negative affectivity, when controlling for prenatal maternal distress.

Parent ratings of Infant Negative Affect (IBQ-R).

The model assessing the association between postnatal maternal distress and parent-reported infant negative affect demonstrated good model fit (RMSEA=0.05, CFI= 0.94, TLI=0.93). Prenatal and postnatal distress were moderately correlated (r = 0.614, p<.01).

Postnatal maternal distress was positively associated with greater parent-rated infant fearfulness (β=0.23, p=.019, [95% CI=0.04, 0.42]), Sadness (β=0.25, p=.003, [95% CI=0.08, 0.41]), and distress to limitations (β=0.28, p=.001, [95% CI=0.12, 0.45]) and negatively associated with infant rate of recovery from distress (β=-0.30, p<.001, [95% CI=-0.45, -0.15]). Parents reporting higher levels of distress reported higher levels of infant fearfulness, sadness, distress to limitations, and slower rates of recovery from distress. Hypothesis 2 was partially supported as higher postnatal maternal distress predicted increased parent-rated negative affectivity.

Laboratory-observed Infant Negative Affect (GAR and SFP).

Postnatal maternal distress was not associated with negative affect during the GAR (β=0.10, p=0.27, [95% CI=-0.09, 0.27]) nor negative affect during the SFP (β=0.05, p=0.61, [95% CI=-0.15, 0.25]).

Hypothesis 3: Social disadvantage will be associated with increased postnatal maternal distress.

Subjective social status was negatively associated with postnatal maternal distress (β=-0.19, p=.004, [95% CI=-0.32, -0.06]), with mothers who reported lower subjective social status reporting higher postnatal maternal distress (see **Figure 3**). ADI (β=0.06, p=0.28, [95% CI=-0.05, 0.18]) and income (β=-0.06, p=0.34, [95% CI=-0.18, 0.06]) were not associated with postnatal maternal distress. Hypothesis 3 was partially supported as subjective social status was related to maternal distress in the postnatal period.

Hypothesis 4: Postnatal maternal distress will mediate the effect of social disadvantage on child negative affectivity at 6 months.

The model examining whether maternal postnatal distress mediated the association between social disadvantage and infant negative affect demonstrated good model fit

(RMSEA=.05, CFI=.94, TLI=.92). We found evidence that the effects of subjective social status on infant sadness ($\beta_{indirect}$= -.05, p=.05, [95% CI=-0.11, -0.01]), distress to limitations ($\beta_{indirect}$= -0.05, p=0.04, [95% CI=-0.12, -0.01]), and rate of recovery from distress ($\beta_{indirect}$= 0.06, p=0.03, [95% CI=0.01, 0.12]) was indirectly operating via increased maternal postnatal distress (see **Figure 3**).

Discussion

In a large prospective cohort, subjective, not objective, disadvantage predicted greater postnatal maternal distress and related to greater infant fearfulness, sadness, distress to limitations, and slower rate of recovery from distress. Findings held when accounting for prenatal distress. In contrast to our predictions, area deprivation was negatively associated with infant distress to limitations, such that greater area deprivation was associated with reduced distress to limitations in infants at 6 months old. This pattern is partially consistent with the Family Stress Model (Masarik & Conger, 2017), which provides a useful framework for understanding the cascading effects of socioeconomic disadvantage on early child outcomes through parental distress. Our findings build on FSM by highlighting subjective social status as a distinctly meaningful dimension of disadvantage that contributes to maternal psychological well-being and, consequently, child temperamental development.

Negative affect, a well-established marker of future psychopathology (Kostyrka-Allchorne et al., 2020), is shaped by both genetics and early life experiences, including prenatal and early postnatal exposures (Morales et al., 2022; Nigg & Goldsmith, 1998; Rothbart & Derryberry, 2013; Werner et al., 2007). The association between maternal distress and infant temperament is theorized to be bidirectional (Brooker et al., 2015; Tan & Smith, 2022). Specifically, maternal expression of negative emotions may predict child negative affect though

biological and behavioral mechanisms, while a child's temperament plays a role in shaping mothers' emotional expressivity (Tan & Smith, 2022). Children who exhibit greater negative affect may experience more difficulty adapting to their environment, which may foster negative emotions in the caregiver and result in decreased support of the child (Bates & Pettit, 2007). Consistent with recent literature (Chang et al., 2023; Howland et al., 2020; Lahti-Pulkkinen et al., 2024; Sutin et al., 2022; Takegata et al., 2021), this study highlights the influence of maternal postnatal distress on infant temperament and emphasizes the potential for targeting subjective social status during pregnancy as a means of reducing postnatal maternal distress, which may produce a protective effect on infant risk for negative affect.

We consider the role of the maternal distress latent variable in both parent-reported and laboratory-observed measures of infant temperament. Further, while other studies have examined the association between maternal distress and infant temperament, few studies examined the different components of negative affect. Disentangling the role of maternal distress on the components of negative affect increase the specificity of conclusions that can be drawn about the influence of maternal distress and potential modifiable aspects of infant negative affect. Importantly, our findings lend additional support to the notion that maternal distress is an important risk factor for infant socioemotional outcomes and should be considered as a target for future intervention studies.

Social disadvantage has previously been linked to child socioemotional outcomes. Low SES has been associated with increased negative affect and decreased self-regulation in children and infants (Bornstein et al., 2015; Möwisch et al., 2025; Strickhouser & Sutin, 2020). In line with the Family Stress Model, socioeconomic status is thought to influence infant temperament through disruptions to the caregiver's mental wellbeing (Hong et al., 2024; Jansen et al., 2009;

Masarik & Conger, 2017; Smith et al., 2022). Subjective social status in this study predicted greater maternal distress when infants were 6 months old (**Figure 3**). This finding aligns with the results of other studies examining the influence of subjective social status on maternal distress and allostatic load (Guardino & Dunkel Schetter, 2022; Michelson et al., 2016; Roy et al., 2019). However, income and area deprivation were not associated with maternal distress in this sample. Though other studies have found that lower income is associated with increased maternal distress (Arditti et al., 2010; Goyal et al., 2010; Miao et al., 2024), the literature on area deprivation is more limited. Other studies have found mixed results regarding the relation between area deprivation and adult mental health (Mohan & Barlow, 2023; Skapinakis et al., 2005), an area requiring future clarification. In the present study, this lack of associations may be due to the unique contribution of subjective social status on maternal distress in the context of other highly correlated socioeconomic variables. It is also possible that the association between income and ADI becomes non-significant when the overlapping variance between all measures of social disadvantage are controlled for or that resources or access to social support available to mothers residing in an area with higher ADI may buffer the effects of income and area deprivation. Subjective status uniquely emerging as a predictor of maternal distress beyond income and ADI, underscores why studies relying solely on income can underestimate risk pathways to infant temperament (Hurwich-Reiss et al., 2019).

Furthermore, we found an indirect association between subjective social status and infant temperament via increased postnatal maternal distress. However, there was no direct effect of income or subjective status on infant negative affect. This contrasts with other studies that established a link between social disadvantage and mental health and behavioral challenges in children (Peverill et al., 2021; Roy et al., 2019). The lack of association between infant negative

affect and income or subjective social status may be because social disadvantage has a greater effect in older children and adults than in infants, which may be related to differences in awareness of their socioeconomic position. However, area deprivation in this study was negatively associated with distress to limitation (with greater area deprivation associated with lower infant distress to limitations), which is the opposite direction than was hypothesized. Presently, there is a dearth of studies examining area deprivation index as a predictor of infant negative affect, so further work is necessary to clarify this association. It may be that factors of the household environment that are protective (e.g. tertiary caregivers, social support, etc.) might be more present in households in highly deprived areas. Perhaps aspects of the immediate environment (e.g. things that the infant is exposed to in the household, such as enriching stimuli) are somehow protective of effects of the external environment. Alternatively, or additionally, families that are highly resourced in ways not captured here may have moved to areas with higher area deprivation due to recent volatile housing prices limiting their purchase of bigger homes in better resourced neighborhoods. However, it is also possible that increased area deprivation may be shaping the parental behaviors these infants are exposed to and therefore have adapted to, leading to differences in distress tolerance. Parenting behaviors have previously been established as a mediator of the effect of social disadvantage on child development (Kohen et al., 2008; McFadden & Tamis-Lemonda, 2013; Whittle et al., 2017), a variable not included here, but likely contributing to these associations. Finally, counter to hypotheses, we did not observe associations between SES, postnatal distress, and observational measures of negative affect. This may be because observational measures of negative affect are less naturalistic and therefore may fail to accurately capture the temperament of infants in our study.

Taken together, these findings suggest that subjective perceptions of status should be considered alongside objective SES in models of early emotional development as a distinct predictor of maternal distress and, indirectly, of infant affect.

Strengths and limitations

This study has several strengths, including a relatively large sample size for observational studies (*N*=302). The use of geospatial coding to examine associations among area deprivation and infant temperament and maternal distress is innovative, as is the simultaneous consideration of multiple indices of objective and subjective measures of socioeconomic adversity using powerful statistical modeling techniques. While other studies use one or few self-reported measures of maternal distress and infant temperament, our use of multiple assessments of maternal distress (including measures of stress, depression, and anxiety) was a strength, though we are not the first to use such an approach (Lahti-Pulkkinen et al., 2024).

Prenatal and postnatal maternal distress were moderately correlated; to address concerns of multicollinearity, we conducted sensitivity analyses excluding prenatal distress and separately controlling for child sex and age (**Table 2 and Table 3)** which yielded consistent results, suggesting that multicollinearity is unlikely to have substantially biased our findings. The use of both laboratory-observed and parent-rated measures of infant negative affect is an additional strength, as it allows us to draw conclusions about different facets of negative affectivity. Parent ratings provide a global gauge of child behavior across multiple time periods and situations, yet there is some concern these may be influenced by parental mood or other biases (Hayden et al., 2010; McGrath et al., 2008), creating a source-variance confound across independent and dependent variables. However, some methodological studies have shown that parental ratings of temperament are not significantly biased by current or former depression, anxiety, or substance

use in the parent (De Los Reyes et al., 2015; Olino et al., 2020). In contrast, observational measures have the virtue of standardized observation in a controlled setting yet may not always capture a "typical" infant reaction. As few studies utilize both observational measures and parent-report, incorporating both assessment methods will facilitate comparisons between behaviors occurring in naturalistic and experimental settings.

Several limitations should be acknowledged. Participants identified predominately as White and non-Hispanic and generally reported above national average household incomes, potentially limiting the generalizability of these results to more diverse and/or disadvantaged populations. However, since the effects of area deprivation were seen in White, non-Hispanic, and higher-income individuals, the results reported here may underestimate effects in diverse and disadvantaged populations. Future studies should seek to clarify these effects. Another limitation to consider is that SES was measured during a limited window, and financial circumstances often change in the perinatal period (e.g., parental leave, changes in employment). Maternal distress was comprised of several anxiety and depression measures, potentially obscuring distinct effects of anxiety or depression. Notably, the reliance on self-report for many measures may inflate effect sizes relative to observational measures (Hayden et al., 2010). Parents experiencing higher symptoms of depression or anxiety may perceive their children as exhibiting greater negative affect. Thus, it is not surprising that parent-reported and laboratory-observed behavioral measures tend to correlate only moderately (Planalp et al., 2017; Rothbart et al., 2000; Stifter et al., 2008). While a strength of our study was that we considered multiple assessments of SES and of child negative affect across contexts and raters, an important caution is that our study did make several comparisons, and the possibility of Type I error cannot be excluded. Findings should therefore be interpreted with caution until replicated. Lastly, this study did not include

measures of parenting behaviors, a key influence in the development of child emotional and behavior outcomes (Wu et al., 2022). Harsh-intrusive parenting behaviors are associated with diminished emotional regulation in toddlers (Mortensen & Barnett, 2019) and increased risk for internalizing disorders (e.g. depression and anxiety)(Hunter et al., 2021). Parenting has been established as a mediator of the effect of social disadvantage on antisocial behavior (Odgers et al., 2012), prefrontal cortical development (Whittle et al., 2017), and conduct problems (Dodge et al., 1994).

Future Directions

This study contributes to a growing literature on social disadvantage, maternal distress, and their indirect effects on infant negative affect. However, further research is warranted. Social disadvantage has been shown to shape parenting behaviors (Cooper-Vince et al., 2014; Lahtela et al., 2023), a critical influence on child development (Jiang et al., 2023). Future work ought to consider how environmental changes interact with distress and influence parenting behaviors (a variable not included in this study). While this study focused primarily on mediation, SES has previously been examined as a moderator of the link between child negative affectivity and higher externalizing behavior problems (Padilla et al., 2020). Future work may consider further exploration of the moderating role of SES on parent and child outcomes. Additionally, research into the differences between maternal and paternal parenting would benefit from further exploration. Future work may consider including other variables related to parental mental health (e.g. feelings of parenting competency, self-efficacy, and social support) and how they mediate the effect of social disadvantage on negative affect. Furthermore, discrimination has an indirect negative effect on child socioemotional development by worsening maternal mental health (Bécares et al., 2015) and so future research may further explore the role of discrimination.

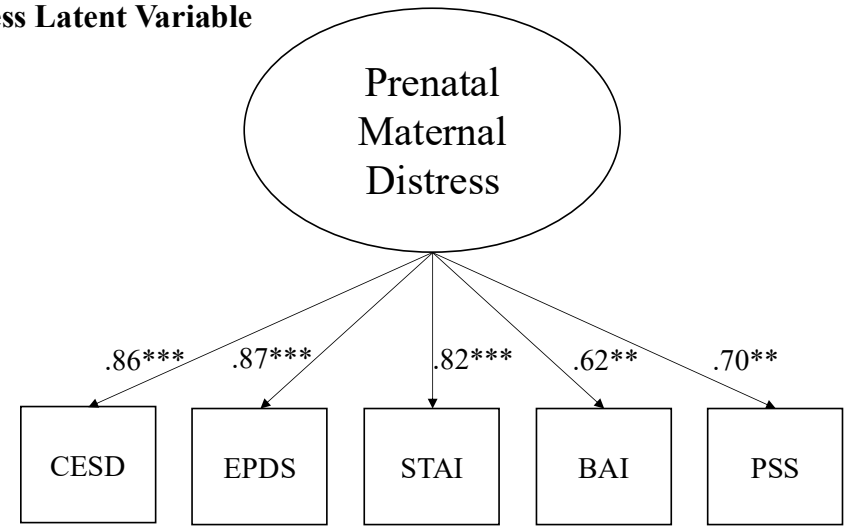
Future studies would also benefit from the inclusion of negative affect captured at multiple timepoints over infancy and early childhood, as infant expressions of negative affect may change over time (Tan & Smith, 2022). Finally, although sample demographics were representative of the area in which data was collected, an extension of this project into a larger, more diverse sample would be a logical follow-up to evaluate generalizability of findings.

Conclusion to Chapter 2

Subjective social status emerged as a modifiable leverage point: Our findings reinforce prior understanding of the predictive association between maternal distress and infant negative affect, while also highlighting the contributions of subjective social status with maternal distress as an indirect pathway through which social status influences infant temperament. Addressing perceived status and reducing maternal distress may aid in altering early socioemotional trajectories. Integrating subjective status measures alongside income and ADI can sharpen risk detection and intervention targeting in perinatal care.

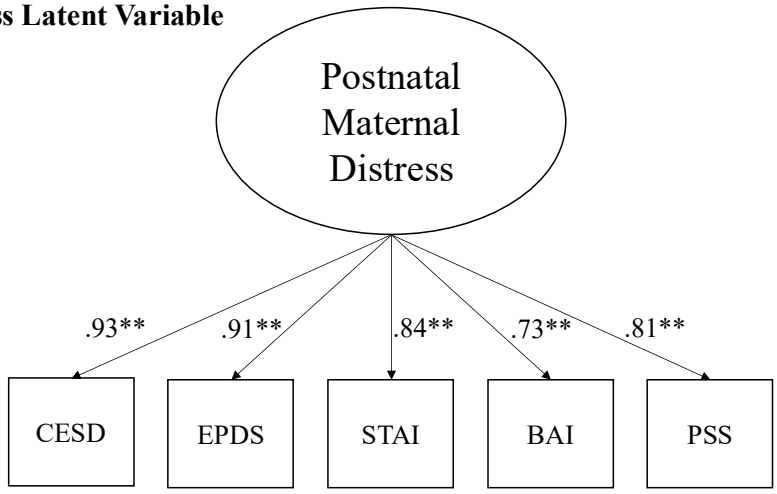
Figures and Tables for Chapter 2

Figure 1a: Confirmatory Factor Analysis for Creation of Prenatal Maternal Distress Latent Variable



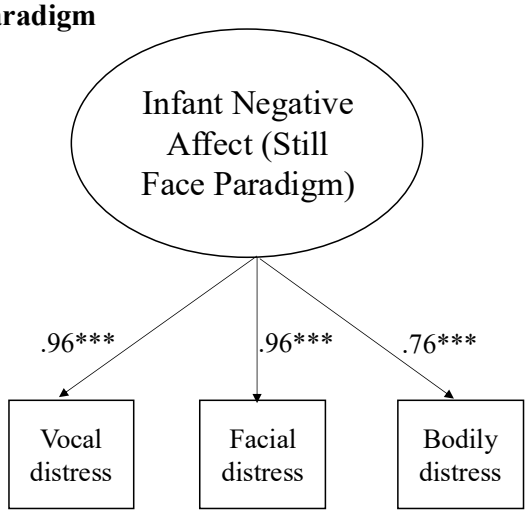
Note: **p<.01 CESD= Center for Epidemiologic Studies Depression Scale; EPDS=Edinburgh Postnatal Depression Scale; STAI= State-Trait Anxiety Inventory; BAI= Beck Anxiety Inventory; PSS= Prenatal Stress Scale. All measures were collected in the second trimester of pregnancy. Model fit was adequateχ^2 (df =5)= 7.41, p<.001. CFI=.995, TLI = .991 RMSEA=.04

Figure 1b: Confirmatory Factor Analysis for Creation of Postnatal Maternal Distress Latent Variable



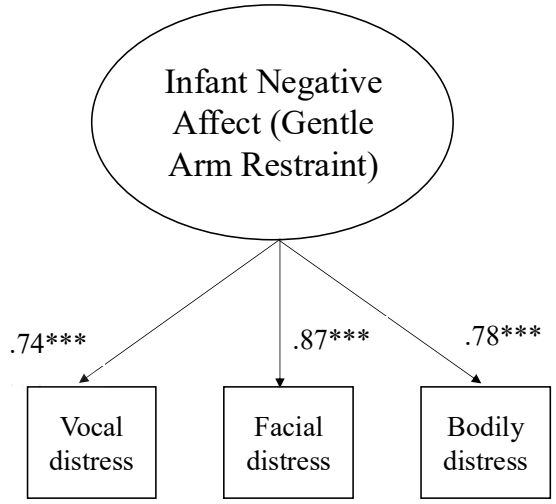
Note: **p<.01 CESD= Center for Epidemiologic Studies Depression Scale; EPDS=Edinburgh Postnatal Depression Scale; STAI= State-Trait Anxiety Inventory; BAI= Beck Anxiety Inventory; PSS= Prenatal Stress Scale. All measures were collected 6 months postpartum Model fit was adequate, χ^2 (df =5)= 7.6, p<.001. CFI=.997, TLI = .994 RMSEA=.04.

Figure 2a : Confirmatory Factor Analysis for Infant Negative Affect Variable from Still Face Paradigm



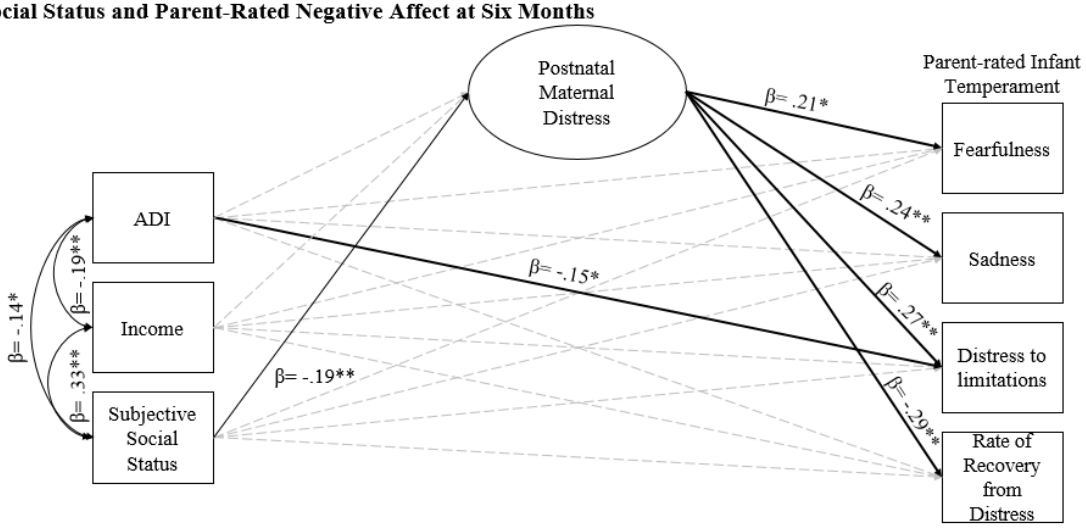
Note: ***p<.001

Figure 2b: Confirmatory Factor Analysis for Infant Negative Affect Variable from Gentle Arm Restraint



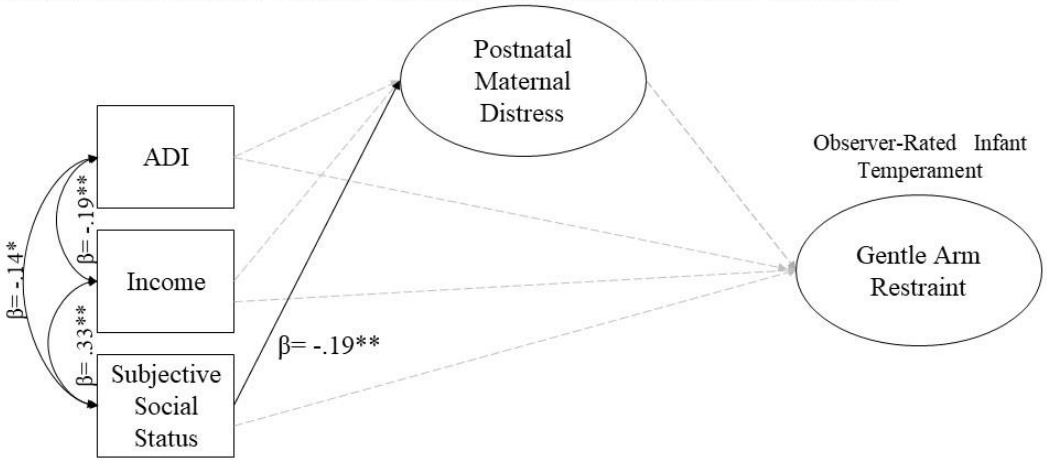
Note: ***p<.001

Figure 3: Mediation Model Testing Whether Postnatal Maternal Distress Mediated the Association between Subjective Social Status and Parent-Rated Negative Affect at Six Months



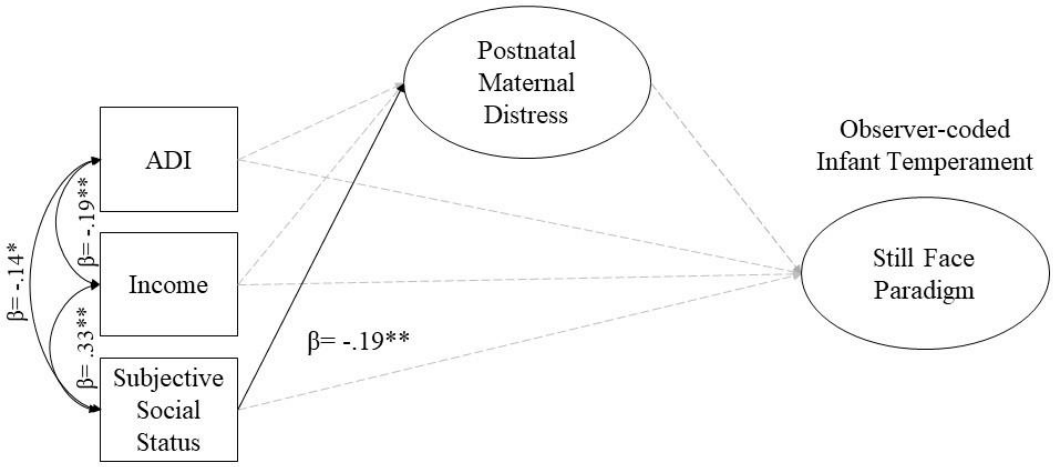
Note: **p<.01, *p<.05. ADI=area deprivation index. Area Deprivation Index was calculated at 6-months infant age, income and subjective social status were measured in the second trimester of pregnancy. Model fit was adequate, χ^2 (df = 125)= 242.637, p<.001. CFI=.94, TLI = .92 RMSEA=.05. There was a significant indirect effect of subjective social status to Sadness (β=-.048, p=.04), Distress to Limitations (β=-.054, p=.02), and Recovery from Distress (β=-.058, p=.02). Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Figure 3a: Mediation Model Testing Whether Postnatal Maternal Distress Mediated the Association between Subjective Social Status and Negative Affect in Gentle Arm Restraint at Six Months



Note: **p<.01, *p<.05. ADI=area deprivation index. Area Deprivation Index was calculated at 6-months infant age, income and subjective social status were measured in the second trimester of pregnancy. Model fit was adequate, χ^2 (df =84)= 163.985, p<.001. CFI=.95, TLI = .93 RMSEA=.05. The there was no indirect effect of ADI, subjective social status, or income to infant negative affect as measured in the Gentle Arm Restraint task. Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Figure 3b: Mediation Model Testing Whether Postnatal Maternal Distress Mediated the Association between Subjective Social Status and Negative Affect in Still Face Paradigm at Six Months



Note: **p<.01, *p<.05. ADI=area deprivation index. Area Deprivation Index was calculated at 6-months infant age, income and subjective social statues were measured in the second trimester of pregnancy. Model fit was adequate, χ^2 (df=90)=178.607, p<.001. CFI=.94, TLI = .93 RMSEA=.05. The there was no indirect effect of ADI, subjective social status, or income to negative affect as measured in the Still Face Paradigm. Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Table 1.

Sample Demographics

	N	Mean	Min	Max	Std. Dev.
Maternal Age	300	32.71	18.48	40.99	4.2
Infant Age at Timepoint (Weeks)	260	26.47	22.43	39.71	2.5
Subjective Status	284	6.9	2	10	1.5
Postnatal Area Deprivation	284	89.92	37.51	112.07	13.61
Income by Household	272	$57,082	$1250	150,000	$36,182
Child Sex	**Total**	**%**			
Female	153	50.7			
Male	147	49.3			
Location of Visit for GAR and STP					
In-Person	158	65.3%			
Remote	84	34.7%			
Total *N*	242				
Infant Behavior Questionnaire Revised					
Total *N*	260				
Race					
Asian	24	7.9			
Black	4	1.3			
Hispanic	25	8.2			

Pacific Islander	1	.3
Native American	2	.7
Other	3	1
Multiracial	32	10.5
Hispanic or Non-white	81	26.6
White non-Hispanic	221	72.5

Table 2.

Unadjusted Analyses of Direct Effect Models

Direct Effects		**β**	***p***	**95% CI**	
Area Deprivation Index					
	Sadness	-0.06	0.28	-0.19	0.05
	Distress to limitations	**-0.15**	**0.01**	**-0.27**	**-0.03**
	Fearfulness	-0.06	0.30	-0.19	0.06
	Rate of Recovery from Distress	0.06	0.34	-0.06	0.18
	Negative Affect Composite	**-0.12**	**0.04**	**-0.23**	**-0.002**
	Still Face Paradigm	-0.031	0.623	-0.155	0.093
	Gentle Arm Restraint	0.024	0.709	-0.104	0.152
	Maternal Distress	0.07	0.19	-0.039	0.19
Income					
	Sadness	-0.03	0.62	-0.16	0.07
	Distress to limitations	-0.11	0.07	-0.22	0.005
	Fearfulness	-0.04	0.53	-0.17	0.07
	Rate of Recovery from Distress	0.03	0.57	-0.02	0.21
	Negative Affect Composite	-0.07	0.24	-0.202	0.05
	Still Face	-0.043	0.557	-0.186	0.100
	Gentle Arm Restraint	-0.018	0.793	-0.149	0.114
	Maternal Distress	-0.07	0.23	-0.204	0.05

Subjective Social					
Status					
	Sadness	-0.04	0.47	-0.15	0.09
	Distress to limitations	-0.11	0.06	-0.24	0.01
	Fearfulness	-0.04	0.47	-0.16	0.08
	Rate of Recovery from Distress	0.09	0.12	-0.09	0.16
	Negative Affect Composite	-0.104	0.06	-0.21	0.005
	Still Face	0.031	0.638	-0.099	0.162
	Gentle Arm Restraint	0.001	0.986	-0.132	0.134
	Maternal Distress	**-0.24**	**<.001**	**-0.379**	**-0.113**
Maternal Distress					
	Sadness	**0.21**	**<.001**	**0.09**	**0.33**
	Distress to limitations	0.**27**269	**<.001**	**0.15**	**0.38**
	Fearfulness	0.11109	0.11	-0.02	0.24
	Rate of Recovery from Distress	**-0.31**	**<.001**	-0.41	-0.21
	Negative Affect Composite	0.31	**<.001**	0.201	0.43
	Still Face	0.077	0.310	-0.071	0.224
	Gentle Arm Restraint	0.117	0.065	-0.007	0.242

β = standardized coefficient. 95% CI= 95% confidence interval. *p*= p value. Bolded values are statistically significant $\alpha = .05$.

Table 3.

Direct Effect Models Adjusted for Child Sex and Age

Direct Effects		**β**	***p***	**95% CI**	
Area Deprivation Index					
	Sadness	-0.056	0.404	-0.185	0.075
	Distress to limitations	**-0.127**	**0.040**	**-0.248**	**-0.005**
	Fearfulness	-0.063	0.332	-0.189	0.066
	Rate of Recovery from Distress	0.064	0.318	-0.061	0.189
	Negative Affect Composite	-0.108	0.082	-0.229	0.013
	Still Face Paradigm	-0.041	0.513	-0.165	0.082
	Gentle Arm Restraint	0.022	0.742	-0.107	0.151
	Maternal Distress	0.084	0.153	-0.031	0.199
Income					
	Sadness	-0.027	0.671	-0.151	0.097
	Distress to limitations	-0.102	0.119	-0.231	0.026
	Fearfulness	-0.034	0.589	-0.153	0.098
	Rate of Recovery from Distress	0.042	0.526	-0.086	0.172
	Negative Affect Composite	-0.106	0.288	-0.195	0.058
	Still Face	-0.053	0.455	-0.193	0.087
	Gentle Arm Restraint	-0.021	0.758	-0.153	0.111
	Maternal Distress	-0.068	0.310	-0.199	0.063

Subjective Social					
Status					
	Sadness	-0.049	0.420	-0.166	0.069
	Distress to limitations	**-0.115**	**0.043**	**-0.222**	**-0.005**
	Fearfulness	-0.041	0.525	-0.167	0.082
	Rate of Recovery from Distress	0.096	0.129	-0.027	0.216
	Negative Affect Composite	-0.106	0.054	-0.214	0.002
	Still Face	0.036	0.582	-0.093	0.166
	Gentle Arm Restraint	0.002	0.975	-0.132	0.137
	Maternal Distress	**-0.251**	**>.01**	**-0.384**	**-0.118**
Maternal Distress					
	Sadness	**0.219**	**>.01**	**0.103**	**0.335**
	Distress to limitations	**0.267**	**>.01**	**0.150**	**0.384**
	Fearfulness	0.100	0.141	-0.033	0.233
	Rate of Recovery from Distress	**-0.319**	**>.01**	**-0.417**	**-0.220**
	Negative Affect Composite	**0.318**	**>.01**	**0.202**	**0.434**
	Still Face	0.080	0.292	-0.069	0.228
	Gentle Arm Restraint	0.120	0.057	-0.004	0.244

β = standardized coefficient. 95% CI= 95% confidence interval. *p*= p value. Bolded values are statistically significant $\alpha = .05$.

Chapter 3: Mediating Social Risks on Infant Negative Affect: Exploring the Role of Maternal Competence, Distress, and Intrusive Parenting

Introduction to Chapter 3

As already noted, negative affectivity and its regulation (Gartstein & Rothbart, 2003) has long been studied as a key predictor of future mental and physical health outcomes for children (for a review see (Kostyrka-Allchorne et al., 2020)). Infant negative affectivity has been linked to increased risk of developing a psychological disorder (Kostyrka-Allchorne et al., 2020), such as anxiety and ADHD (Nigg, 2006). While genetics play a role in the development of early temperament, environmental factors (such as socioeconomic status, parental mood, and parenting behaviors) also play an important role. Given the importance of early temperament for subsequent behavioral development, understanding the role of potentially modifiable environmental experiences in the development of negative affect continues to be an important area of study. The principal aim of this study was to explore how intrinsic factors that are unique to the family, such as maternal mood, parent self-competence, and parenting behaviors may mediate or moderate the influence of extrinsic factors (such as socioeconomic status) on the development of infant negative affect.

Perinatal Environmental Influences on Infant Negative Affect

Social disadvantage and the influence on child development. Social disadvantage (as measured by socioeconomic status, area deprivation index, and subjective social status) has a key influence on parental and offspring well-being. Greater social disadvantage is associated with poor childhood and lifelong outcomes (Kohen et al., 2008; Santiago et al., 2011). For example, early experiences of childhood poverty are associated with the development and severity of

mental health disorders in later adulthood (McLaughlin et al., 2011). Socioeconomic disadvantage is also associated with abnormal neural development in the early years of life. (Chin-Lun Hung et al., 2015). Children of mothers with higher educational attainment demonstrate positive socio-emotional and cognitive development (Farah et al., 2006; Koutra et al., 2012; Noble et al., 2007). Social disadvantage in infancy has also been linked to academic challenges and difficulties with self-regulation (O'Connor et al., 2019). These findings collectively underscore the profound and multifaceted impact of social disadvantage on developmental trajectories, mental health, and long-term life outcomes.

Subjective Social Status. Subjective social status measures one's perception of their social standing relative to others (either in their community or broader society). Although, less studied than objective measures of social disadvantage, subjective social status is considered distinct from other measures of social status (Singh-Manoux et al., 2005). It has been linked to psychological well-being in mothers of young children (Michelson et al., 2016). Lower parental subjective social status is associated with higher child behavioral problems, possibly due to higher levels of parental stress and alterations to parenting behaviors (Roy et al., 2019). The inclusion of both objective socioeconomic status (income, education, area deprivation) and subjective social status (SSS) in this study provides greater nuance in understanding how access to resources and perceptions about social positioning (through parents) can influence child development.

Maternal distress and Infant Negative Affect. Maternal distress (the combination of depression, anxiety, or other reported felt stress) has been linked to poor emotional regulation in offspring (Erickson et al., 2017). Maternal distress is an important construct to consider as it is not only associated with shaping fetal development in the prenatal period through mechanisms

such as nutrition, gut microbiome, and the immune system (Monk et al., 2019)), but also because of its role in the development of parental behaviors (Choe et al., 2013). In fact, the relationship between maternal distress and infant temperament (Erickson et al., 2017; Howland et al., 2020; Sutin et al., 2022) is thought to be a bidirectional process between the infant and the caregiver that is driven through behavioral and psychological mechanisms (Brooker et al., 2015; Cooper-Vince et al., 2014). Unsurprisingly, more maternal distress is associated with less sensitive parenting, which in turn reinforces child negative behaviors and affect (Choe et al., 2013; Eisenberg et al., 2015; Hunter et al., 2021). In turn, child negative affect may then influence parental mood and behaviors and add to parent distress. Therefore, maternal distress is an important factor to consider for its potential to influence both the prenatal and postnatal environment and thus child psychosocial risk.

Parenting Behaviors and Infant Negative Affect. Parenting behaviors are well studied as influential factors in offspring development. There are several dimensions of parenting behavior that have been studied at length, ranging from parental sensitivity, warmth, and involvement to more maladaptive behaviors such as intrusiveness, harshness, and coercion. The quality of these parenting behaviors has been demonstrated to be critical for long-term socioemotional development, and is considered a key predictor of future psychopathology (Jiang et al., 2023). Attachment (the developmental process through which children bond with their caregivers) is one mechanism through which parenting behaviors can aid in the development of emotional regulation skills. This bond is important in shaping how children respond to stress and seek comfort. When in distress, infants engage in proximity-seeking behaviors towards their caregivers (Health, 2015). Sensitivity to a child's needs, desires, and signals is crucial for the establishment of a secure attachment between infant and caregiver.

Parent behaviors have been long understood to interact with child temperament in a bidirectional relationship. Parenting behaviors will elicit certain behaviors from the child, and vice versa (Eisenberg et al., 2015). Sensitive parenting behaviors describe a parents ability to promptly and appropriately identify and respond to their child's needs and desires while considering their autonomy (Ainsworth et al., 1974). Sensitive parenting has been associated with social functioning, academic achievement, and language development (Cooke et al., 2022). Parent sensitivity may decrease the risk of child externalize and internalizing problems, though the evidence is mixed according to a meta-analytic review (Cooke et al., 2022).

By contrast, harsh-intrusive parenting combines elements of harshness—such as coercive, aggressive, or punitive behaviors—with intrusiveness, which involves over-controlling and limiting a child's autonomy and psychological development. These behaviors can be either verbal or physical in nature and often elicit negative responses from the child (Jiang et al., 2023). Given the degree to which children are dependent on their parents, some level of intrusive/parent directed behaviors are normative, particularly during early toddlerhood when children become more capable of interacting with the environment around them. This can result in an uptick in intrusive parenting (Zeytinoglu et al., 2017). However, harsh-intrusive behavior is associated with an increased risk of harmful effects for offspring. Harsh-intrusive parenting is associated with diminished growth of emotional regulation in toddlers (Mortensen & Barnett, 2019). Higher levels of harsh intrusiveness is linked to increased risk for the development of an internalizing disorder such as anxiety and depression (Hunter et al., 2021; Wood, 2006). Controlling parenting strategies are associated with increased severity of ADHD symptoms in the child, in both the inattentive and hyperactive categories (Keown, 2012).

Given the critical role played by parenting behaviors in child development, further understanding of how intrusive and sensitive parenting interacts with other key factors (such as social disadvantage, maternal distress, and parent self-competence) is important for informing crucial intervention periods.

Parent Self-Competence and Infant Negative Affect. Parents are crucial participants in the development of emotional regulation in their offspring (Rainford, 2022), which is related to measures of temperament in early life. Parental self-competence (e.g. the parent's perception of their level of competence in parenting) is known to influence parenting behavior (Coleman & Karraker, 1998; Ercegovac et al., 2013). Lower parental self-competence has been linked to maternal postpartum depression and more negative perceptions of the child (Denis et al., 2012). The relationship between mood and self-competence is likely bidirectional, as depression is thought to undermine a parent's attunement to their child and increase negative perceptions of their own parenting (Dix & Meunier, 2009). Parental self-efficacy, a facet of self-competence, has been linked to infant behaviors such as falling reactivity (e.g., the rate at which the infant recovers from peak distress) and sadness. It has also been shown to mediate the relationship between maternal emotional regulation and infant negative affect (Hamzallari et al., 2022). Parental self-efficacy has also been considered an important factor in the bidirectional relationship between parental mental health and child development more broadly (Albanese et al., 2019). However, the relationship between parental self-competence (a construct including self-efficacy, competence, and satisfaction) and infant temperament (and specifically negative affect) is less well known.

The Present Study

While the independent effects of distress, self-efficacy, and parenting behaviors on child negative affect are established, consideration of maternal distress, parenting behaviors, and parental self-efficacy as potential mediators or moderators of social disadvantage are understudied. The principal aim of this study was to determine whether the influence of social disadvantage on infant negative affectivity (a risk indicator for later psychopathology) is moderated or mediated early postnatal maternal distress, parenting behaviors, or parental self-competence. Parental self-competence, maternal distress, parenting behaviors, and social disadvantage have not been previously examined together within a single cohort to evaluate their complex interplay. Thus, we sought to integrate these elements into our conceptual framework to clarify the critical mechanistic elements involved. This study examined associations among these variables in a large sample (*n*=302) of mothers and their 6-month-old infants, testing the following hypotheses:

Aim 1. (Preliminary Simple Effects). Evaluate the Direct Effects of Distress, Parental Self-Competence, Parenting Behavior, and Social Disadvantage on Child Negative Affect. Hypothesis 1.1: Children whose parents express greater parental self-competence and less maternal distress at 6 months of age will exhibit improved negative affect regulation at 6 months of age.

Hypothesis 1.2: Children whose parents exhibit more sensitive and less intrusive parenting behaviors (at 6-month infant age) will exhibit better negative affect regulation at 6 months of age.

Hypothesis 1.3: Social disadvantage (subjective social status, objective SES, area deprivation index) will be associated with increased child negative affectivity at 6 months of age.

Aim 2: (Mediation) Determine Whether the Influence of Social Disadvantage on Child Negative Affectivity is Mediated by Perceptions of Parenting Self-Competence, Maternal Distress or Parenting Behaviors (i.e., Sensitive/Intrusive Parenting). Hypothesis 2.1: Mothers experiencing greater social disadvantage (e.g. lower subjective social status, higher area deprivation, and lower SES) will exhibit lower self-competence, and higher distress.

Hypothesis 2.2a: The effect of social disadvantage (objective SES, subjective social status) on infant negative affectivity will be mediated by parental self-competence, maternal distress, and parenting behaviors (at 6 months infant age).

Hypothesis 2.2b Serial mediation: The effect of social disadvantage (objective SES, subjective social status) on infant negative affectivity will be mediated by distress-associated differences in self-competence and harsh-intrusive parenting behaviors.

Aim 3: (Moderation) Determine Whether (a) Maternal Distress, Self-competence, or (b) Parenting Behaviors Moderate the Effect of Social Disadvantage on Infant Negative Affect. Hypothesis 3.1: The effect of social disadvantage (objective SES, subjective social status) on infant negative affectivity will be moderated by parental self-competence and maternal distress.

Hypothesis 3.2: The effect of social disadvantage (objective SES, subjective social status) on child negative affectivity will be moderated by sensitive/intrusive parenting behaviors at 6 months of age.

Method

Participants and Procedures

The cohort is the same as in Study 2. The study began enrollment in 2018. Participants are from an ongoing prospective, longitudinal study of pregnant women and offspring. Pregnant women receiving prenatal care at Oregon Health & Science University who consented to be contacted for possible research studies, were identified via screening of electronic medical records and contacted via email or telephone to assess interest and eligibility. Recruitment was augmented with recruitment fliers on the hospital campus and by social media advertisements. All potential volunteering participants were then screened for eligibility via telephone. In the data utilized here, 302 offspring and their birthing parent (297) were studied in the 2nd trimester of pregnancy and again at 6 months postpartum. Statistical controls were placed to address sibling pairs in the sample. Exclusionary criteria included pre-existing chronic health conditions, miscarriages and stillbirths, genetic abnormalities or health conditions in the infant, current maternal substance use, certain medications/medical conditions that would affect ancillary studies in this sample, and extremely premature births (less than 28 weeks) (Sullivan et al., 2024; Wood et al., 2025; Wood et al., 2023).

Measures

Infant Negative Affect. As in Chapter 2, infant temperament was measured using caregiver ratings using the 201 item **Infant Behavior Questionnaire** completed at 6 months of age which generates a negative affect composite variable. The IBQ is a widely used parent-rated measure of infant negative affect (Gartstein & Rothbart, 2003; Gustafsson et al., 2021; Rothbart, 1981).

Maternal Distress. *Maternal distress* was measured utilizing the following self-report ratings of anxiety and depression at 6 months: the 20-item **Center for Epidemiologic Studies Depression Scale** (CESD)(Radloff, 1977), the 10-item **Edinburgh Postnatal Depression Scale**

(Cox et al., 1987) the 10-item **Perceived Stress Scale** (PSS) (Cox et al., 1987; Davis et al., 2007), the 40-item **State-Trait Anxiety Inventory** (Spielberger et al., 1983), and the 21-item **Beck Anxiety Inventory** (Beck et al., 1993). A confirmatory factor analysis (CFA) (Hoyle, 2000) supported combining these measures into a single latent variable for distress. Significant factor loadings of at least .30 were retained in the final latent distress variable. Fit indices indicated that the final models fit the data well (Postnatal maternal distress Fit statistics: $\chi 2$= 7.60, df =5, p=.18; CFI=.997; TLI=.994, RMSEA=.046).

Parenting Self-Competence. Caregiver feelings of self-competence were assessed using the 17-item **Parenting Sense of Competence Scale** (efficacy, interest, and satisfaction subscales); mothers completed this at 6 months postpartum. This scale generated a total "competency" score comprised of the three subscales. For the purposes of the proposed project, the total score was used.

Parenting behaviors. Parenting behaviors was captured by laboratory observation using the **Caregiver-Child Free Play task** at 6 months infant age (Kochanska et al., 2001), in which the caregiver is asked to play with the child for a 10-minute period as they normally would when they have free time. The first five minutes are play without toys, while the last five minutes included the introduction of toys. The play portion with no toys was utilized in these analyses. The tasks were video-recorded and parenting behavior during the free play task was coded by research assistants using scales adapted from the NICHD Study of Early Childcare (Cooper-Vince et al., 2014). These scales included behavior dimensions of: sensitivity/supportive presence, detachment/disengagement, intrusiveness, stimulation of cognitive development, positive regard for the child, and negative regard for the child (Cox et al., 1999; Mills-Koonce et al., 2008; Network, 1999; Propper et al., 2008; Propper et al., 2007). Two outcome variables

were selected for analyses: Sensitive parenting behaviors and Harsh-Intrusive parenting behaviors. Interrater reliability was assessed using intraclass correlations (ICC Single). Values between .75 and .9 are considered good (Koo & Li, 2016). Sensitive parenting in the no toy condition had an intraclass correlation of .76, while harsh-intrusive parenting behaviors yielded inter-rater reliability of .78.

As in Chapter 2, due to the Covid-19 pandemic of 2020, changes to collection methods for behavioral methods were implemented to safeguard the wellbeing of participants. Participants were given the option to participate from home using videoconferencing software or to participate in the laboratory setting. Therefore, visit location was included as a covariate in analyses that included measures collected remotely.

Social Disadvantage. Measures for social disadvantage included (a) the geo-coded **Area Deprivation Index** (coded at 6 months postpartum) (Fan et al., 2021). The Area Deprivation Index (ADI) was derived from addresses using geospatial coding and contains information pertaining to educational attainment, employment levels, median family income, income disparity, homeownership, home values/rent costs, percentage living below the federal poverty level, single parent households, crowding and amenities. A 17-factor weighted sum of ADI was calculated at 6-month infant age. The ADI was updated with the most recently provided address at the 6-month timepoint to address participants who moved. The calculations were completed using the 2014 Census' American Community Survey (ACS, 2014) from which census tracts were obtained and matched to the address of participants. The ADI is publicly available and has been validated in nation-wide cohorts (Fan et al., 2021).

Subjective Social Status. Identically to chapter 2, a subjective social status variable was created using the MacArthur Sociodemographic Questionnaire (Demakakos et al., 2008)

obtained in the 2nd trimester only. This measure differs from the others in terms of timepoint in which it was collected (i.e. 2nd trimester versus 6-months of child age), and it is assumed that the measures of social status obtained from this measure is relatively stable and accurately represent social status when the child is 6-months of age. Participants were asked to rank themselves on a social hierarchy ladder in comparison to others in their community, with 1 being the lowest rung and 10 the highest.

Objective Socioeconomic Status. Objective socioeconomic status was also calculated in the second trimester of pregnancy from the MacArthur Sociodemographic Questionnaire by assigning a mean income to each bracket of reported household income (Question: Which of these categories best describes your total combined family income for the past 12 months?) and dividing this mean by household size (Question: How many people are currently living in your household, including yourself?). Mothers were also asked to report their total years of education, income and total years of education. These variables were then included with the Area Deprivation index to create a latent variable capturing Objective Socioeconomic status.

Table 1. Measures at Each Timepoint

Measures	***Construct***	*R= Parent-Rated O= Observational*	2nd trimester	6 months
Center for Epidemiologic Studies Depression Scale	Maternal Distress	R	X	X
Edinburgh Postnatal Depression Scale	Maternal Distress	R	X	X
State-Trait Anxiety Inventory	Maternal Distress	R	X	X
Beck Anxiety Inventory	Maternal Distress	R	X	X
The Perceived Stress Scale	Maternal Distress	R	X	X
Parenting Sense of Competence Scale	Parental Self-efficacy	R		X
Area deprivation index	Social Disadvantage	O		X
Macarthur Sociodemographic Questionnaire	Social Disadvantage	R	X	
Free-Play interaction	Parenting sensitivity/intrusiveness	O		X
Infant Behavior Questionnaire	Negative Affect	R		X

Data Reduction

Initial checks were conducted to evaluate missingness, test the reliability of the measures discussed, and to check the distribution or need for data transformation. Correlations between the variables of interest were calculated to determine if combining them as a latent construct or

factor score would be appropriate. Confirmatory factor analyses were completed to create latent variables for key constructs and generated the following latent variables: **Maternal Distress** (CESD, PSS STAI, BAI) at 6 months child age and **Objective Socioeconomic Status** (Years of Education, Income Divided by Household Size, Area Deprivation Index). These models were evaluated by the following indices: TFI, CFI, and RMSEA (McDonald, 2010; McDonald & Ho, 2002). Significant factor loadings of at least .30 were retained in the final latent distress variables. Fit indices indicated good model fit (Postnatal maternal distress Fit statistics: $\chi 2= 7.60$, df =5, p=.18; CFI=.997; TLI=.994, RMSEA=.046; Objective Socioeconomic Status factor loadings: ADI β=-0.408, p<.01, Income β= 0.466, p<.01, Education β= 0.597, p<.01. The CFA for objective socioeconomic status resulted in a saturated model and did not produce meaningful fit statistics.

The remaining variables (parent self-competence, subjective social status, sensitive parenting, and harsh-intrusive parenting) were considered to capture distinct constructs.

Covariates

Covariates were handled nearly identically as in Chapter 2. Here, child sex, maternal age at delivery, child age, maternal ethnicity/race, parity, child sex, and visit location were considered as initial covariates for all model analyses. Due to the limited racial/ethnic diversity in the sample, race and ethnicity were combined into one variable with two levels: White and Black/Indigenous/People of Color (BIPOC). Determinations on the inclusion of specific covariates were contingent on significant correlations (p values below .05) to the outcome variable. Covariates that were not statistically significant were omitted to preserve model parsimony and statistical power. Given the moderate sample size of the model and the relatively modest number of variables, the analyzes were adequately powered for the number of parameters in the models.

Analyses

Analyses were completed using structural equation modeling executed in MPlus Version 8 (Muthén & Muthén, 1998). Missing data was addressed using Full information maximum likelihood estimation (FIML) and child relatedness was addressed by statistically controlling for siblings present in the sample by utilizing the CLUSTER command in MPlus.

Aim 1 (Direct Effects). Hypothesis 1.1 (*Children whose mothers express greater parental self-competence and less distress at 6 months of age will have lower negative affect at 6 months of age*.) and Hypotheses 1.2 (*Children whose mothers exhibit more sensitive less intrusive parenting behaviors at 6-month infant age will exhibit better negative affect regulation at 6 months of age.*) were tested using an SEM in which Child Negative Affect (at 6 months of age) was regressed on Maternal Distress (at 6 months postpartum), Parent Self-competence (6 months), Sensitive Parenting and Harsh-Intrusive Parenting (at 6 months), Parent Self-competence, maternal distress, and parenting behaviors were allowed to covary.

Hypothesis 1.3 (*Social disadvantage will be associated with increased child negative affectivity at 6 months of age*) was tested by regressing child Negative Affect onto Subjective Social Status (2nd trimester) and Objective Socioeconomic Status (6 months). Social Status, and Objective SES were allowed to covary. Significant associations identified from these preliminary analyses determined which variables were included in the analyses in Aim 2 and Aim 3.

Aim 2 (Mediation). Hypothesis 2.1a (*Parents experiencing greater social disadvantage will exhibit lower self-efficacy, and higher distress.*) was tested using an SEM in which Maternal Distress (6 months postpartum) and Parent Self-Competence (6 months postpartum) were regressed onto Subjective Social Status (2nd trimester), and Objective Socioeconomic Status (6

months). Subjective Social Status (2nd trimester and Objective Socioeconomic Status (6 months) were allowed to covary. Maternal Distress and Parent Self-Competence were allowed to covary.

Hypothesis 2.2a (*The effect of social disadvantage on infant negative affectivity will be mediated by parental self-competence, maternal distress, and parenting behaviors)* was tested by regressing Child Negative Affect (6 months) onto Maternal Distress (6 months), Parent Self-Competence (6 months), Parenting Behaviors (6 months) and onto Subjective Social Status (2nd trimester and Objective Socioeconomic Status (6 months). Then, Maternal Distress, Parent Self-Competence, and Parenting Behaviors were regressed onto Subjective Social Status and Objective Socioeconomic Status (6 months). The mediation effects of Maternal Distress, Parent Self-competence, and Parenting Behaviors were examined with Child Negative Affect as the outcome and Subjective Social Status and Objective Socioeconomic Status as the independent variables. Hypothesis 2.2b (*The effect of social disadvantage on infant negative affectivity will be mediated by distress-associated differences in self-competence and harsh-intrusive parenting behaviors.)* was tested in the same model as 2.2a. The serial mediation effect of Maternal Distress was tested by regressing Parent Self-Competence and Parenting Behaviors onto Maternal Distress.

Aim 3 (Moderation). Hypothesis 3.1 (*The effect of social disadvantage on infant negative affectivity will be moderated by parental self-efficacy and maternal distress*) and 3.2 (*The effect of social disadvantage on child negative affectivity will be moderated by sensitive/intrusive parenting behaviors at 6 months of age)* were tested in the structure outlined above for hypothesis 2.2 except now testing for moderation. Child Negative Affect was regressed onto Subjective Social Status (2nd trimester and Objective Socioeconomic Status (6 months). Social Status and Objective Socioeconomic Status will be allowed to covary. Self-

competence, maternal distress, and parenting behaviors at 6 months were each included as moderators one at a time in separate models.

Results

Direct Effects

Hypothesis 1.1: Children Whose Mothers Express Greater Parental Self-Competence and Less Distress at 6 months of Age will Exhibit Lower Negative Affect at 6 Months of Age. The model assessing the association between parental self-competence, maternal distress, and infant negative affect demonstrated good model fit (RMSEA = 0.04, CFI = 0.97, TLI = 0.96). Maternal distress was not associated with infant negative affect (β= 0.118, p = 0.08 CI= -0.014, 0.25). Parent self-competence was negatively associated with infant negative affect (β= -0.335, p<0.01, CI= -0.458, -0.211) such that infants whose mothers reported higher self-competence exhibited lower negative affect (see **Figure 1**).

Hypothesis 1.2: Children Whose Mothers Exhibit More Sensitive, Less Intrusive Parenting Behaviors (at 6-Month Infant Age) will Exhibit Less Negative affect at 6 Months of Age. Hypothesis 1.2 was tested in the same model as hypothesis 1.1. Maternal distress, self-competence, and sensitive and harsh parenting behaviors were allowed to covary. Sensitive parenting behaviors were not associated with infant negative affect (β= 0.016, p= 0.796, CI= -0.108, 0.14). Harsh-intrusive parenting behaviors were positively associated with infant negative affect (β= 0.114, p= 0.049, CI= 0.001, 0.227). Infants whose mothers engaged in less harsh-intrusive parenting behaviors exhibited less negative affectivity (see **Figure 1**).

Hypothesis 1.3: Social Disadvantage (Subjective Social Status, Objective SES, Area Deprivation Index [ADI]) will be Associated with Increased Child Negative Affectivity at 6

Months of Age. The model assessing the association between objective social status (ADI, income, education), subjective social status, and infant negative affect demonstrated subpar model fit (RMSEA = 0.06, CFI = 0.942, TLI = 0.856). Therefore, this relationship was examined in the mediation model used to test hypothesis 2.2. This model fit the data well (RMSEA = 0.03, CFI = 0.983, TLI = 0.974, see below). Neither objective (β= 0.143, p= 0.395, CI= -0.187, 0.473) nor subjective social status (β= -0.034, p= 0.681, CI= -0.195, 0.127) were associated with infant negative affect at 6 months of age (See **Figure 3**).

Mediation

Hypothesis 2.1: Parents Experiencing Greater Social Disadvantage (e.g. Lower Subjective Social Status, Higher Area Deprivation, and Lower SES) will Exhibit Lower Self-Efficacy, and Higher Distress. The model assessing the association between objective social status (ADI, income, education), subjective social status and maternal distress and parent self-competence demonstrated good model fit (RMSEA = 0.03, CFI = 0.985, TLI =0.96). Higher objective social status was associated with less postnatal maternal distress (β= -0.308, p= 0.013, CI= -0.551, -0.066) but not with self-competence (β= -0.115, p= 0.345, CI= -0.342, 0.113). Conversely, higher subjective social status was associated with higher postnatal maternal self-competence (β= 0.256, p= 0.002, CI= 0.092, 0.42) but not with maternal distress (β= -0.134, p= 0.142, CI= -0.312, 0.045) (see **Figure 2**).

Hypothesis 2.2a: The Effect of Social Disadvantage (Objective SES, Subjective Social Status,) on Infant Negative Affectivity will be Mediated by Parental Self-Competence, Maternal Distress, and Parenting Behaviors. The model examining self-competence, maternal distress, and harsh-intrusive parenting as mediators of the relationship between objective social status (ADI, income, education), and subjective social status and infant

negative affect demonstrated good model fit (RMSEA = 0.03, CFI = 0.96, TLI = 0.95) (see **Figure 3**). Objective socioeconomic status was associated with maternal distress (β= -0.307, p=0.012, CI= -0.546, -0.068), self-competence (β= -0.278 p=0.005 CI= -0.472, -0.083), and harsh-intrusive parenting behaviors (β= -0.224, p=0.029 CI= -0.424, -0.023), but not infant negative affect (β= 0.192 p=0.252 CI= -0.136, 0.52), such that more socioeconomic status predicted less maternal distress, more self-competence, and less harsh-intrusiveness. Subjective social status was only associated with self-competence (β= 0.179, p=0.027, CI= 0.02, 0.337), and not maternal distress (β= 0.179, p=0.027, CI= -0.301, 0.06), harsh-intrusive parenting behaviors (β= 0.076, p=0.321, CI= -0.074, 0.07), or infant negative affect (β= -0.055, p=0.510, CI= -0.218, 0.108). Higher subjective status was associated with more self-competence. Self-competence (β=-0.299, p<.01, CI= -0.441, -0.157) and harsh-intrusiveness (β= 0.133, p=0.027, CI= 0.015, 0.251) were each associated with infant negative affect, while maternal distress was marginally significant (β= 0.167, p= 0.05 CI= 0, 0.334). More self-competence and less harsh-intrusiveness was associated with decreased infant negative affect.

Although some mediation effects did not reach conventional levels of statistical significance using a parametric test, a bootstrapped 95% confidence interval yielded significant results in several cases. This suggests that the observed effect may be reliable under fewer distributional assumptions. Given that bootstrapping is more robust to violations of normality and heteroscedasticity, the following results are interpreted as meaningful. Both p-values and bootstrapped confidence intervals are provided here to provide a fuller picture of the underlying effect. Self-competence was also found to partially mediate the association between subjective social status (β= .-0.053, p= 0.079, CI= -0.132, -0.012) and objective socioeconomic status (β= 0.083, p= 0.037, CI= 0.029, 0.191) on infant negative affectivity. Harsh-intrusive parenting

partially mediated the association between objective socioeconomic status (β= -0.030, CI=-0.103, -0.001) but not subjective social status (β= 0.010, CI= -0.007, 0.054) on negative affect. Maternal distress also partially mediated the association between objective socioeconomic status (β= -0.051, p= 0.257 CI= -0.184, -0.001) but not subjective social status (β= -0.020, p= 0.385 CI=-0.075, 0.009) on negative affect. Overall, 2.2a was partially supported.

Hypothesis 2.2b Serial mediation: The Effect of Social Disadvantage on Infant Negative Affectivity Will Be Mediated by Distress-Associated Differences in Self-Competence and Harsh-Intrusive Parenting Behaviors. The model testing the serial mediation effect of maternal distress on self-competence and harsh-intrusive parenting behaviors was the same as the model testing hypothesis 2.2a (see prior for fit statistics. For this hypothesis, maternal distress was included as a serial mediator for the association between social disadvantage, self-competence, harsh-intrusive parenting behaviors, and their influence on infant negative affectivity. Maternal distress was associated with self-competence (β= -0.545, p<0.01 CI= -0.683, -0.407) but not harsh-intrusive parenting (β= 0.013, p=0.895, CI= -0.174, 0.199), such that more distress was associated with less self-competence. There was an indirect serial mediation effect of objective socioeconomic status on infant negative affect through maternal distress and self-competence (β = -0.050, p = .257, CI= -0.134, -0.011). The indirect serial mediation effect of subjective social status on infant negative affect through maternal distress and self-competence was not statistically significant. (β =-0.020, p = .275, CI= -0.059, 0.011). Similarly, both objective socioeconomic status (β= -0.001, p= 0.928 CI= -0.010, 0.009). and subjective social status (β= 0, p= 0.947 CI= -0.008, 0.003) indirect effects on infant temperament were not serially mediated through maternal distress and harsh-intrusive parenting (see **Figure 3**).

Moderation

Hypothesis 3.1: The Effect of Social Disadvantage (Objective SES, Subjective Social Status) on Infant Negative Affectivity will be Moderated by Parental Self-Competence and Maternal Distress. Moderating analyses with latent variables did not generate model fit statistics, therefore, the Bayesian Information Criterion (BIC) is reported instead. An analysis examining the moderating effect of maternal distress on the associations between objective or subjective social status and infant negative affect was conducted (BIC= 14942.031). Infant negative affect was not associated with objective (interaction β= 0.203 , p=0.189, CI= -0.1, 0.505) nor subjective socioeconomic status (interaction β= -0.093, p=0.242, CI= -0.248, 0.063). Maternal distress was not a significant moderator for objective (interaction β= -0.014, p= 0.878, CI= -0.192, 0.164) nor subjective social status (interaction β= -0.014, p= 0.878, CI= -0.192, 0.164) (see **Figure 4)**.

A model with self-competence as a moderator was also tested (BIC= 6753.358). Infant negative affect was not associated with objective (interaction β= 0.073, p= 0.592, CI= -0.194, 0.340) nor subjective socioeconomic status (interaction β= -0.416, p= 0.118, CI= -0.009,). Self-competence was not a significant moderator for the relationship between objective (interaction β= 0.006, p= 0.940, CI= -0.166, 0.138) nor subjective (interaction β= 0.490, p= 0.143, CI= -0.166, 1.146) social status and infant negative affect. Overall, 3.1 was not supported.

Hypothesis 3.2: The Effect of Social Disadvantage (Objective and Subjective Social Status) on Child Negative Affectivity will be Moderated by Sensitive/Intrusive Parenting Behaviors at 6 Months of Age. An analysis examining the moderating effect of intrusive parenting on the associations between objective and subjective social status on infant negative affect was tested (BIC= 6788.256). Infant negative affect was not associated with objective

(interaction β= -0.150, p= 0.253, CI= -0.307, 0.108) nor subjective socioeconomic status (interaction β= -0.135, p= 0.6, CI= -0.283, 0.172). Harsh-intrusive parenting was not a significant moderator for objective (interaction β= -0.153, p= 0.296, CI= -0.277, 0.103) nor subjective (interaction β= 0.226, p= 0.604, CI= -0.045, 0.073) social status.

A separate model examining sensitive parenting behaviors as a moderator of the relationship between social disadvantage and infant negative affect was also conducted (BIC= 7070.922). Infant negative affect was not associated with objective (interaction β= -0.131, p= 0.366, CI= -0.416, 0.154) nor subjective socioeconomic status (interaction β= 0.333, p= 0.504, CI= -0.643, 1.308). Sensitive parenting was not a significant moderator of the effect of objective (interaction β= 0.021, p= 0.891, CI= -0.279, 0.321) nor subjective (interaction β= -0.394, p= 0.501, CI= -1.542, 0.754) social status on infant negative affect. 3.2 was not supported.

Discussion of Chapter 3 results

Chapter 3 sought to examine whether the association between social disadvantage and infant negative affect is mediated or moderated by maternal distress, self-competence, and parenting behaviors. First, we predicted that parents experiencing greater social disadvantage—defined by lower subjective social status and higher objective social status (area deprivation, education, and income)—would exhibit lower self-efficacy and higher distress. The results revealed distinct associations between objective and subjective measures of social status and maternal outcomes.

Objective social status was associated with harsh-intrusive parenting, postnatal maternal distress and self-competence, such that more objective socioeconomic status was related to decreased harsh-intrusiveness, decreased maternal distress, and decreased self-competence. This suggests that mothers with lower objective socioeconomic resources experience more distress

during the postnatal period, and those with lower resources also exhibit more harsh-intrusive parenting. This supports other findings in the literature, reinforcing the risk that low socioeconomic status poses to maternal mental health (Bouvette-Turcot et al., 2016; Guardino & Dunkel Schetter, 2022; Ruyak et al., 2022), parenting behaviors (Cooper-Vince et al., 2014; Ispa et al., 2004) and subsequently child outcomes (Belsky et al., 2007; Dodge et al., 1994; Peverill et al., 2021). Lower subjective social status was associated with lower maternal self-competence but not with maternal distress. The link between subjective social status and parental self-competence is currently understudied in the literature, though research into social disadvantage more broadly and its effect on self-efficacy (a feature of self-competence) indicates mixed results on the effect of socioeconomic status on parental self-efficacy (Fang et al., 2021). While some argue for a correlation between socioeconomic resources and higher self-efficacy (Gessulat et al., 2023), other studies have found that not all low-socioeconomic status parents report low efficacy, arguing for the importance of individual resilience and community support (Fang et al., 2021). Indeed, this study saw a difference in objective vs subjective measures and their subsequent effect on parental self-competence. While more subjective status appeared to be associated with increased self-competence, more objective socioeconomic status was associated with decreased self-competence.

Together these findings suggest that lower objective socioeconomic status may serve as a risk factor for increased postnatal distress and increased parent intrusiveness, while subjective perceptions of social status play a critical role in fostering parental self-competence. This distinction highlights the importance of considering both objective and subjective measures of social disadvantage when examining parental psychological outcomes.

The crucial mediational hypotheses were partially supported. Maternal distress was not associated with infant negative affect, contrary to hypotheses. While the association between distress and negative affect is well established (Howland et al., 2020; Lahti-Pulkkinen et al., 2024; Sutin et al., 2022), few other studies have considered these effects in conjunction with self-competence and parenting behaviors in the manner described. However, self-competence and harsh-intrusive parenting behaviors *were* associated with infant negative affectivity, such that parents who feel more competent and those who exhibit less intrusive behaviors reported lower levels of infant negative affect. Maternal distress, self-competence, and harsh-intrusive parenting partially mediated the relationship between objective socioeconomic status and infant negative affect. Self-competence additionally mediated the association between subjective social status and infant negative affect. This suggests that mothers who perceive themselves as having higher social standing may feel more competent in their parenting role, which in turn reduces infant negative affectivity. Although other mediational and moderating effects did not materialize, there was also evidence of serial mediation. Specifically, maternal distress through self-competence mediated the association between objective socioeconomic status and infant negative affect, such that lower objective socioeconomic status was associated with more distress, which in turn predicted lower self-competence and ultimately higher infant negative affect. This finding highlights maternal psychological wellbeing as a mechanism through which socioeconomic disadvantage may influence early child emotional outcomes. In contrast, no significant serial mediation was found for the path involving maternal distress and harsh-intrusive parenting. Although it was unsurprising that harsh-intrusive parenting was associated with infant negative affect (Jiang et al., 2023; Mortensen & Barnett, 2019; Yan et al., 2019), it was not associated with or mediated by maternal distress. These findings suggest that while distress may affect

parenting self-rated competence, its effects on observed parenting behaviors are less clear at this early developmental stage.

Implications

The findings from Chapter 3's study highlight several important considerations for how social disadvantage influences early developmental outcomes through parental factors and behaviors. The associations between both subjective and objective measures of social disadvantage on maternal psychological factors and parenting behaviors emphasizes the importance of addressing and researching social disadvantage using a multidimensional approach. While the mediating effects of maternal distress self-competence, and harsh-intrusiveness continues to reinforce the demand for economic support and resources for families of young children, the mediating effect of parental self-competence in the association between subjective status and infant temperament underscores the potential value of interventions that focus on enhancing parents' perceived competence rather than solely addressing objective indicators of disadvantage such as income or education.

Additionally, the association between harsh-intrusive parenting behaviors and infant negative affectivity highlights the continued importance of promoting positive parenting practices during infancy—a critical period for emotional development, regardless of social status. Efforts to reduce intrusive parenting behaviors may help mitigate negative emotional outcomes in infants, particularly among families experiencing lower SES.

Strengths and Limitations

This study benefitted from several strengths. First, it benefits from a relatively large sample size for an observational study (N=302). The inclusion of both subjective and objective measures of social disadvantage is underutilized in temperament research, as is the use of geo-

spatially coded area deprivation. This study also benefits from the use of both self-report and laboratory coded measures, as wells as robust statistical analyses.

However, we also acknowledge several limitations as in Chapter 2. First, though the sample was representative of the area in which the data was collected, thus participants identified predominately as White and non-Hispanic, and generally reported above national average household income. This potentially limits generalizability to populations experiencing significant disadvantage. Another limitation is that objective socioeconomic variables were combined into a latent variable, potentially obscuring the distinct contributions of education, income, and area deprivation. Lastly, the use of self-report for some of the measures might inflate effect sizes relative to observational measures (Hayden et al., 2010).

Future Directions

Future work may consider how social disadvantage and its interaction with maternal distress, self-competence, and parenting behaviors may influence other facets of child development (e.g. psychopathology, emotional regulation, prosocial behavior). Differences in sensitive vs harsh parenting across caregivers (primary, secondary, and tertiary) and their effects may also be explored. Future studies should consider the evolution of infant negative affect throughout childhood and include characterization of child temperament at different timepoints across development, as well as including objective measures of infant data (e.g. physiological or behavioral data). Furthermore, utilizing data from other caregivers (e.g. fathers, grandparents, etc.) would broaden our understanding on how distress, self-competence, and parenting behaviors may differ across relational contexts. While the data collected was representative of the geographic region, extending this project to a larger, more diverse sample would increase the generalizability of these findings.

Conclusion

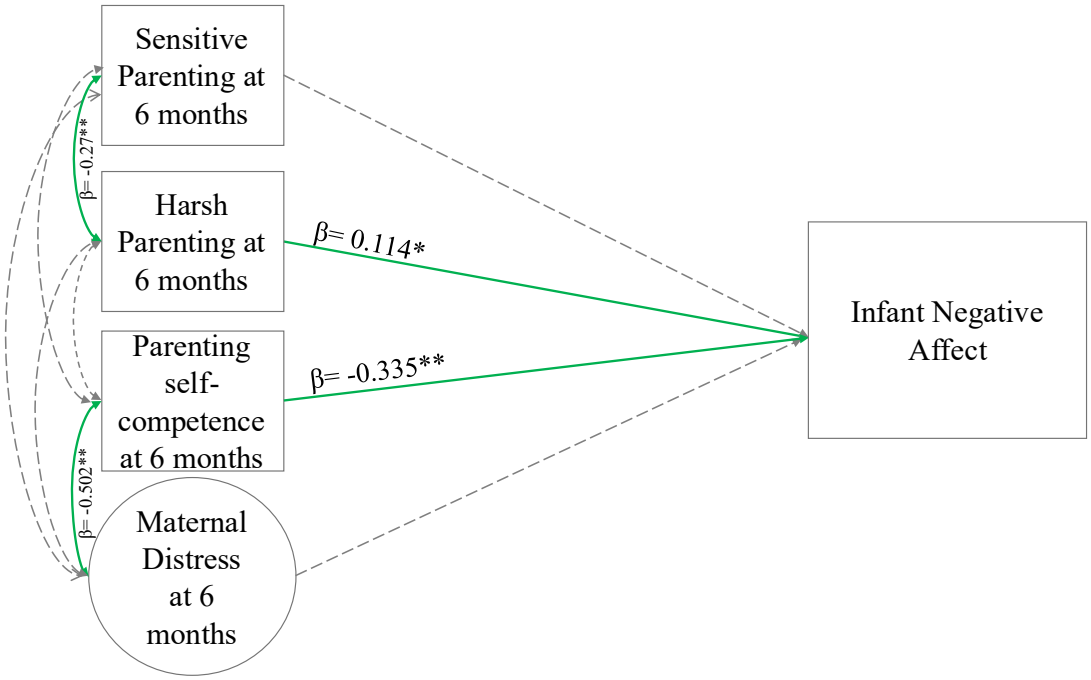
Infant negative affect continues to be a critical factor for intervention due to its influence on child emotional, psychological, and developmental trajectories (Gustafsson et al., 2021; Kostyrka-Allchorne et al., 2020; Kozlova et al., 2020). In summary, this study highlights the differential impact of objective versus subjective measures of social disadvantage on parental psychological outcomes and early child temperamental development. These results illustrate the importance of addressing both psychological factors (e.g., perceived competence) and behavioral factors (e.g., intrusive parenting) when designing interventions aimed at supporting under-resourced families.

Figures and Tables for Chapter 3

Table 1. Measures at Each Timepoint

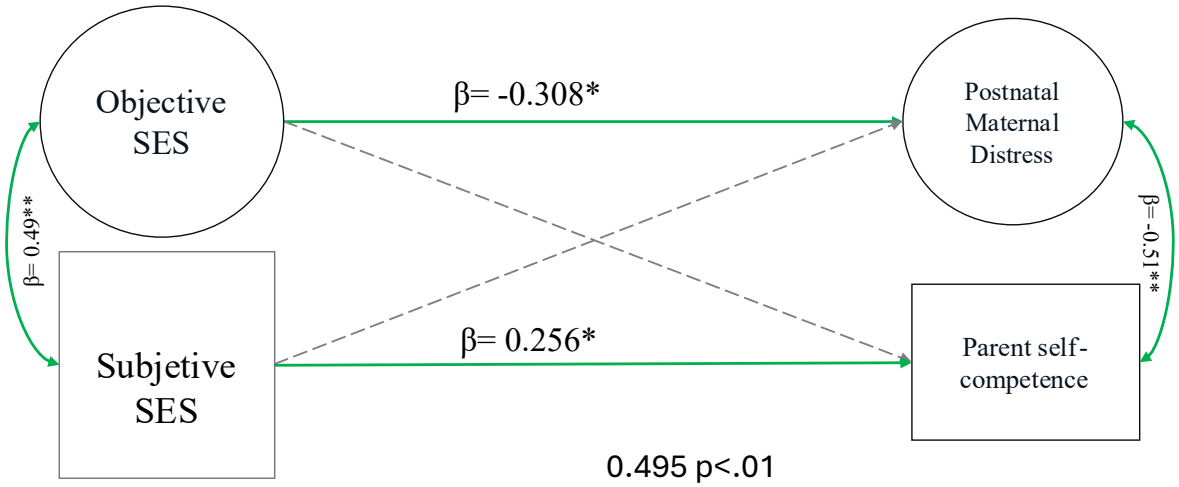
Measures	***Construct***	*R= Parent-Rated* *O= Observational*	2nd trimester	6 months
Center for Epidemiologic Studies Depression Scale	Maternal Distress	R	X	X
Edinburgh Postnatal Depression Scale	Maternal Distress	R	X	X
State-Trait Anxiety Inventory	Maternal Distress	R	X	X
Beck Anxiety Inventory	Maternal Distress	R	X	X
The Perceived Stress Scale	Maternal Distress	R	X	X
Parenting Sense of Competence Scale	Parental Self-efficacy	R		X
Area deprivation index	Social Disadvantage	O		X
Macarthur Sociodemographic Questionnaire	Social Disadvantage	R	X	
Free-Play interaction	Parenting sensitivity/intrusiveness	O		X
Infant Behavior Questionnaire	Negative Affect	R		X

Figure 1. Model Testing The Direct Effects of Maternal Distress, Parenting Self -Competence, and Sensitive and Harsh Parenting Behaviors at on Infant Negative Affect at 6 months of age



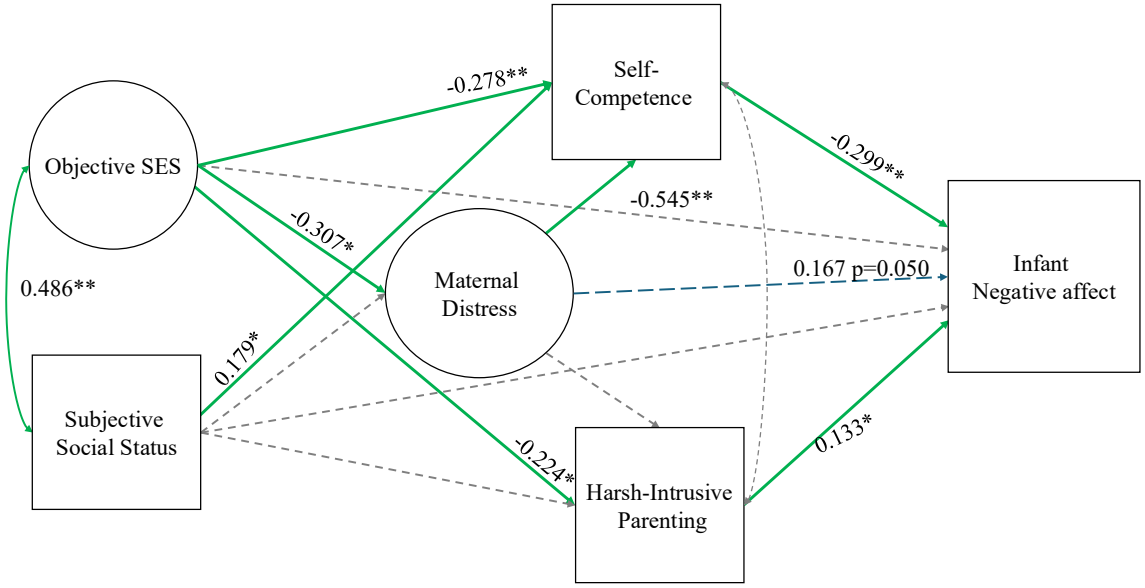
Note: **p<.01, *p<.05. Model fit was adequate, χ_2 (df = 60)= 95.297, p<.001. CFI=.97, TLI = .96 RMSEA=.04. Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Figure 2. Model Testing The Direct Effects of Social Disadvantage on Maternal Distress and Parenting Self -Competence at 6 Months Postpartum



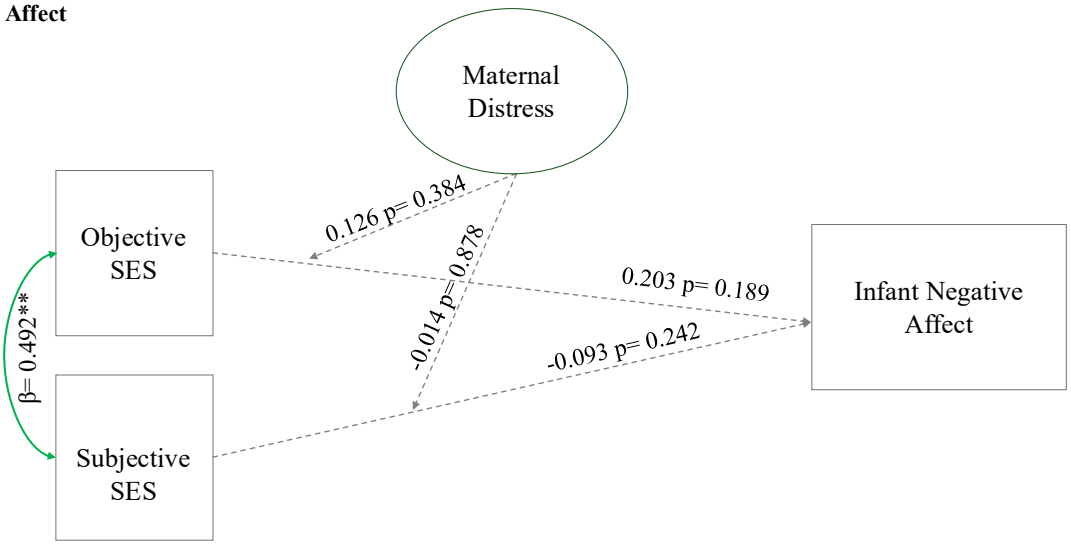
Note: **p<.01, *p<.05. Objective socioeconomic status and subjective social status were collected in the 2nd trimester of pregnancy. Area Deprivation was collected at 6 months infant age. Model fit was adequate, χ_2 (df = 55) =1199.993, p<.001. CFI=.98, TLI = .97 RMSEA=.03. Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Figure 3. Model Testing the Effect of Social Disadvantage on Infant Negative Affect Mediated By Distress-Associated Differences in Self-competence and Harsh-intrusive parenting behaviors.



Note: **p<.01, *p<.05. Objective socioeconomic status(except ADI) and subjective social status were collected in the 2nd trimester of pregnancy. Self-competence, maternal distress, harsh-intrusive parenting, and infant negative affect were measured at 6 months postpartumModel fit was adequate, $\chi 2$ (df = 85)= 1353.121, p<.001. CFI=.96, TLI = .95 RMSEA=.03. There was a significant indirect effect of subjective social status to infant negative affect through parent self-competence (β= -0.053, 95% CI= -0.132, -0.012) and of objective status to negative affect through maternal distress (β=0.051 , 95% CI= -0.184, -0.001), self-competence (β=0.083 , 95% CI= 0.029, 0.191), and harsh-intrusive parenting (β= -0.030, 95% CI= -0.103, -0.001). There was also a serial mediation effect from objective SES through maternal distress, toself competence and negative affect (β=-0.050, 95% CI= -0.134, -0.011). Covariates included in the models as described in the text but are not depicted in thefigure to increase readability.

Figure 4. Model Testing Maternal Distress As a Moderator of the Association Between Social Disadvantage and Infant Negative Affect



Note: **p<.01, *p<.05. Objective socioeconomic status and subjective social status were collected in the 2nd trimester of pregnancy and 6 months postpartum. Area Deprivation was calculated at 6 months postpartum. Maternal distress did not moderate the associations between social disadvantage and infant negative affect. Covariates included in the models as described in the text but are not depicted in the figure to increase readability.

Chapter 4: General Discussion

Mental health problems in children have continued to rise in recent years at concerning rates (Deng et al., 2023; Tkacz & Brady, 2021). Identifying risk factors and critical windows for intervention is important for the prevention of childhood psychopathology and its lifespan sequelae. Temperament measures of negative affectivity in very early childhood are correlated with future mental health conditions (Kozlova et al., 2020; Nigg, 2006). Therefore, understanding the individual and interactive contributors to early negative affect development can inform early risk identification and prevention. Utilizing data from a large, prospective cohort of mothers and their infants, this dissertation sought to clarify our understanding of the individual and interactive effects of social disadvantage, parent psychological factors (self-competence, maternal distress), and parenting behaviors on infant negative affectivity. The results highlighted key pathways through which social risk factors relate to infant negative affect development. Considerations for future directions, policy change, and targeted interventions are discussed.

Integrated Findings from Chapters 2 and 3

Social Disadvantage and Infant Temperament

Low socioeconomic status is a risk factor for childhood psychological, social, and health difficulties (Belsky et al., 2007; Chin-Lun Hung et al., 2015; Santiago et al., 2011). In the first study (Chapter 2), neither income nor subjective social status were associated with any of the subscales of infant negative affectivity (e.g. sadness, fear, distress to limitations, or rate of recovery from distress). In contrast to the hypotheses, worse area deprivation was associated with lowered distress to limitations. We are not aware of other studies that examined the association between area deprivation and infant negative affect, and so further research is

necessary to clarify the nature of this association. There could be other factors in the immediate environment not captured here that may be both protective and more prevalent in "highly deprived" households (e.g. social support, access to tertiary caregivers). The second study (Chapter 3) similarly did not discover any direct effect of subjective social status nor objective socioeconomic status (e.g. income, education, area deprivation) on 6-month infant negative affect. This contrasts with prior work linking social disadvantage to mental and behavioral challenges in young children (Peverill et al., 2021; Roy et al., 2019). This may be due to how social disadvantage influences children at different ages. It is possible that social disadvantage may exert a greater influence on children who are old enough to demonstrate awareness of their social positioning. Alternatively, the sample skew toward higher SES may have also contributed, as these effects may be more detectable in samples where substantial poverty is present.

The Role of Maternal Distress

Social disadvantage has been well-established as a risk factor for maternal mental health (Arditti et al., 2010; Daalderop et al., 2023; Michelson et al., 2016) but so is perception of social status relative to others. In chapter 2, higher subjective status was linked to lower maternal distress. Contrary to what was hypothesized, area deprivation and income were not linked to maternal distress. However, in Chapter 3, maternal distress was linked to subjective social status in bivariate correlations, but the relationship was no longer significant when parent self-competence was included in the model. Instead, higher socioeconomic status (income, area deprivation, and education) was associated with decreased maternal distress. These findings partially align with the literature, as objective measures have previously been linked to increased maternal distress in the perinatal period (Daalderop et al., 2023), while subjective social status is thought to have related but distinct effects on psychological wellbeing compared to objective

measures of socioeconomic status (Demakakos et al., 2008; Euteneuer, 2014; Scholaske et al., 2020).

Maternal distress has been widely studied as a predictor of child emotional development, and is associated with increased internalizing and externalizing symptoms in offspring, as well as temperament development (Erickson et al., 2017; Howland et al., 2020; Sutin et al., 2022). Results from Chapter 2 aligned with prior studies and found that maternal distress was associated with subscales of infant negative affectivity (e.g. sadness, fearfulness, distress to limitations, and rate of recovery from distress). However, this association was not present in Chapter 3 when parent self-competence was included in the mediation model. Maternal distress partially mediated the association between subjective social status and infant negative affect in Chapter 2, however, this effect also disappeared when parent self-competence was included as a mediator in Chapter 3. This may be due in part due to multicollinearity in the model, as maternal distress and self-competence are highly correlated. This shared variance may suppress the contribution of maternal distress. These mixed findings may reflect the differential pathways by which social disadvantage influences infant negative affectivity, such that subjective status may be less influential on maternal distress than objective resources. Although maternal distress was not associated with infant negative affect in Chapter 3, a serial mediation pathway emerged in which lower objective socioeconomic status predicted higher distress, which in turn was associated with lower self-competence, ultimately predicting higher infant negative affect. This highlights maternal distress as an important risk factor through its indirect effect on negative affect through self-perceived competence.

As for moderation effects, Chapter 3 did not find a moderating effect of maternal distress on the association between social disadvantage and negative affect.

The Role of Parent Self-Competence

Parent self-competence is thought to be a protective factor that buffers risk for child and parent well-being (Albanese et al., 2019). Self-efficacy (a better-studied and related construct) has been linked to less maternal distress and infant's faster recovery from distress (Albanese et al., 2019; Hamzallari et al., 2022; Haslam et al., 2006). Maternal distress is thought to be related to self-efficacy (Law et al., 2019). The results from Chapter 3 indicated that higher parental self-competence was linked to decreased infant negative affect at 6 months of age. Higher subjective status was associated with higher self-competence. Conversely, higher objective socioeconomic status associated with decreased self-competence. This may be due to sample characteristics or could point to differences in the way high resourced families develop perceptions of their self-competence. Self-competence partially mediated the effect of subjective status on infant negative affect but did not moderate this effect. These results are partially reflective of the current literature. Few studies have examined the link between subjective status and self-competence, though studies provide evidence that other measures of socioeconomic status (e.g. education, income) are linked to self-competence and self-efficacy (Coleman & Karraker, 2003; Gessulat et al., 2023; Peacock-Chambers et al., 2017). However, a recent systematic review highlights that there are mixed results with not all low-income families report lower self-efficacy (Fang et al., 2021). Therefore, these results continue to suggest that subjective status and objective socioeconomic status are distinct constructs that exert different influences on self-competence.

The Role of Parenting Behaviors

Parenting behaviors are considered a primary mechanism through which child emotional well-being is shaped (Mortensen & Barnett, 2019). Harsh-intrusive parenting behaviors are associated with increased internalizing and externalizing symptoms in early childhood (Hunter et

al., 2021; Keown, 2012; Wood, 2006). As described in Chapter 3, I found that as expected, harsh-intrusive parenting behaviors (but not sensitive parenting) was associated with increased infant negative affectivity. Objective socioeconomic status (but not subjective status) was negatively associated with harsh-intrusive parenting behaviors, such that greater socioeconomic resources were linked to decreased harsh-intrusive parenting (when controlling for the contributions of maternal distress and self-competence). This builds on prior studies linking lower socioeconomic status to harsh-intrusive parenting (Hoff et al., 2002; Jiang et al., 2023; Tamis-LeMonda et al., 2004). Importantly, harsh-intrusive parenting was found to mediate (though not moderate) the relationship between objective status and infant negative affect in Chapter 3. This adds to a growing literature on the mediating effects of parenting behaviors on the association between socioeconomic risk and child behaviors (Choi & Becher, 2019) and contributes by exploring these effects in very early infancy.

Understanding Differential Pathways to Infant Temperament

The two studies comprising this dissertation sought to examine the interplay between social disadvantage, parent psychological factors (maternal distress, self-competence), parenting behaviors, and infant negative temperament. While neither paper established a consistent direct effect between social disadvantage and infant temperament, both highlighted the importance of social disadvantage on parent well-being and behaviors, and in turn emphasized the effect of these on negative affectivity. Of these effects, the differential pathway of social disadvantage through maternal distress and self-competence raises important questions for future work. Chapter 3 found a serial mediation in which lower objective socioeconomic status predicted higher maternal distress, which in turn was linked to lower parental self-competence, ultimately predicting greater infant negative affect. This model highlights that the association between

maternal distress and self-competence is not simply as co-mediators, but rather as part of a sequential pathway through which objective disadvantage exerts influence on infant temperament. This aligns with the conceptual framework outlined in the introduction. The Family Stress Model (Conger et al., 2000), which posits that economic hardship influences child outcomes indirectly by altering parental psychological functioning and parenting behaviors, was supported by the findings demonstrating an effect of social disadvantage on maternal distress Increased distress in turn was associated with increased negative affect, which maps cleanly onto the serial link outlined in the FSM, the serial mediation model that highlighted how maternal distress and self-competence may serve as key psychological mechanisms linking social disadvantage to infant temperament development.

Greater objective socioeconomic status was linked to less maternal distress, less harsh-intrusiveness and less self-competence. By contrast, subjective status was only linked to self-competence which may point to the distinct contributions of concrete resources (e.g. income, education, area deprivation) to maternal psychological distress and harsh-intrusive parenting behaviors, while subjective social status may be more influential in the development of parental self-competence through its role in the formation of a parenting self-concept. This lends support to a social ecology framework of negative affect development, similar to the Ecological Systems theory (Bronfenbrenner, 1999). These findings illustrate the importance of both distal (e.g. social disadvantage) and proximal factors (e.g. parenting behaviors, self-competence, and maternal distress). The findings in Chapter 2 showing that area deprivation is related to improved infant distress to limitations may also have important implications for future work, as it may point to the importance of intrinsic family resources not otherwise captured by this project that may be more common among those living in areas of higher deprivation (e.g. social support, presence of

tertiary caregivers, non-financial resource). Taken together, these results support Cichetti's framework for understanding developmental psychopathology as resulting from a variety of intersecting and varied factors. Temperament, particularly the development of negative affect, appears to be influenced by the dynamic relationship between social, psychological, and environmental factors. While the proposed framework (**Figure 1 and Figure 2**) incorporates these relationships, some modifications are indicated. Namely, these theories do not account for the serial pathway from economic disadvantage, through maternal distress, to parenting self-competence and ultimately onto infant negative affect. This association is novel contribution to our understanding of the pathways through which social disadvantage may shape negative affect development.

Implications for Policy and Intervention

Given the central role of maternal distress, self-competence, and parenting behaviors as mechanisms or buffers to infant negative affectivity, there are several implications for policy and interventions. One area of intervention is targeting parent-level factors, such as perinatal mental health. Perinatal mental health challenges are incredibly common, with 1 in 5 women in the US reporting some mental health difficulties in pregnancy through the first year postpartum (Ayers et al., 2025). Interventions in perinatal mental health are most effective when implemented using a multi-modal approach. Few women receive adequate treatment for mental health conditions (Cox et al., 2016). Disparities in treatment are worse for people of color and those of low socioeconomic status (Howell et al., 2005). These findings should be used to increase screening processes and improve access to treatment for people in pregnancy and through the first years of a child's life. Evidence-based therapeutic modalities such as Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), and Dialectical Behavioral Therapy

(DBT) are established as the gold standard for treating anxiety, depression, and other perinatal mental health disorders. Psychopharmacotherapy can be used in tandem with therapy to improve outcomes (Ayers et al., 2025). Coupled with skills training and psychoeducation, therapy can also be used to enhance parental self-competence. Finally, policy initiatives supporting integrative care initiatives can improve continuity and comprehensiveness of care perinatally (WHO, 2022).

Given the established effect of harsh-intrusive parenting behaviors on infant negative affect, efforts to improve parenting practices are another important implication for intervention. Parenting practices can be improved through social learning programs, skill-based interventions, and psychoeducation. These programs can also jointly increase parent self-efficacy by emphasizing a parent's strengths and managing their expectations (Milani & James, 2018). Parent-Child Interaction (PCIT) is an evidence-based intervention designed to reduce harmful parenting practices through live coaching (Thomas et al., 2017).

Lastly, these findings underscore the need to target proximal and distal socioeconomic risk factors. Traditional metrics (e.g. income) may be insufficient for predicting risk in early infancy. Rather, utilizing multidimensional metrics for socioeconomic risk may yield more targeted suggestions for providing resources to families. Increased financial resources initiatives, such universal basic income, have been found to effectively diminish stressors related to economic hardship and improve parent and child well-being (Ellwood-Lowe et al., 2025). Rental subsidies have been associated with improved educational outcomes and reduced behavioral challenges in children from low-income families (Tan et al., 2014). Finally, policies that expand access to family leave result in improved family dynamics and a reduction in stress and maladaptive behaviors. These policies and interventions have demonstrated positive effect

on both parent and child outcomes, in part through their reduction of parental distress (Ellwood-Lowe et al., 2025).

Strengths and Limitations

This dissertation benefitted from several strengths. First, access to a large longitudinal cohort allowed for the testing of a complex and rigorous theoretical framework. These studies also utilized parent-reported and objective methods of measurement for multiple variables. The use of parent-reported and objective measures of infant temperament is useful for drawing conclusions about the different facets of negative affectivity displayed across naturalistic and laboratory settings. The inclusion of area deprivation in these studies is also innovative, as geospatially coded measures of socioeconomic risk are underutilized in studies about early developmental risk. Additionally, the use of both objective and subjective measures of social disadvantage aid in identifying overlapping yet distinct constructs of psychosocial risk. This allows for more specific and targeted conclusions around the specific aspects of social disadvantage and how they may differentially affect maternal and child well-being. This thesis included data collected at different timepoints, which strengthens predictive claims.

However, a few limitations exist. First, the sample collected although representative of the Portland metropolitan area was comprised of participants who largely identified as White non-Hispanic and reported household incomes that were above the national average. This limits the generalizability of these findings to more racially/ethnically diverse populations. Given that effects of social disadvantage were still present for this sample, it is likely that the results reported in Chapters 2 and 3 underestimate the potential relationships between social disadvantage and infant negative affectivity. Additionally, social disadvantage was captured as a snapshot of the families standing prenatally and at 6 months postpartum. The perinatal period is

often characterized by changes in financial circumstances (e.g. parenting leave, increase in expenses etc.), which may not have been fully captured here. Lastly, many of the measures included were self-reported which may inflate effect sizes relative to observational measures (Hayden et al., 2010). For example, parents who rate themselves highly on depression or anxiety measures may also perceive their child more negatively regardless of displayed temperament. There was also no data included regarding fathers and their parenting behaviors or other sources of maternal support, which has become a large area of research and is important to explore as contributions to the social ecology of temperament (Choi & Becher, 2019).

Future Directions

This dissertation has contributed to the literature on social disadvantage, parent psychological factors (e.g. maternal distress and self-competence), parenting behaviors, and their interplay and effects on infant negative affect. However, gaps in the literature remain. Future studies may choose to examine the bidirectional relationship between distress and self-competence and examine how it changes over time. Future work would benefit from including and further exploring the associations between objectively observed and parent-rated infant temperament. This could improve our understanding of how temperament is captured in naturalistic versus laboratory settings.

Social support (not captured here) is also considered a key protective factor against social risk factors, and can increase distress tolerance in parents (Morford et al., 2022). Future work might consider including social support to understand the buffering effects for infant temperament development. Furthermore, differences in parenting behaviors and their effects on infant temperament across primary, secondary, and tertiary caregivers are understudied. The sample utilized in this thesis was comprised of predominantly White individuals. Therefore,

attempts to replicate in more ethnically, racially, and socioeconomically diverse sample are warranted. Replication in culturally diverse samples would also create opportunities for exploring other protective factors associated with collectivist cultures, such as the presence of other caregivers, sharing of financial resources, and attitudes and beliefs that strengthen psychological resilience. Relatedly, future work might consider including factors related to the family dynamic, such as the presence and relationship between siblings, as siblings are known to shape parenting behavior and provide an additional source of behavioral feedback for the individual (Dunn, 2013). Lastly, while the primary focus of this body of work was infant negative affect, future research could be conducted on other aspects of infant temperament, such as surgency or effortful control. Furthermore, future studies may benefit from examining how social disadvantage, maternal distress, self-competence, and parenting behaviors shape other aspects of child behavioral development such as cognitive functioning in childhood (such as executive functioning).

Conclusion

The studies presented in this thesis expand our current understanding of the complex pathways through which social disadvantage, maternal psychological well-being, and parenting behaviors influence the development of infant negative affectivity. This dissertation calls for a nuanced approach to understanding the risk factors associated with negative affectivity that considers the mediating role of maternal psychological (e.g. mental health, self-competence) and behavioral (e.g. sensitivity, intrusiveness) influences. While the results of the studies suggest that social disadvantage is indirectly associated with infant negative affectivity, the differential impact of subjective and objective forms of social status on parent-level factors suggested that both environmental resources and perceived social standing shape early child emotional

outcomes in distinct ways. The studies conducted benefitted from the use of multi-modal measures and a rigorous analytic framework. There are several implications of these research findings, including the importance of targeted programs addressing perinatal mental health, increasing parental self-competence, improving parenting behaviors and addressing socioeconomic risk. Social policies should address both structural inequalities and provide family-level support to meet material and non-material resource needs. Implementing these interventions in the perinatal period may protect infants against future psychopathology risk. Future research should expand upon these findings by replicating this approach in a more diverse population and by exploring their effects on other domains of infant temperament and early cognitive development. Further examination of the role of social support and culturally based attitudes would add to our understanding of other protective factors at play.

This body of work contributes to a growing literature on the dynamic and complex interplay of social, psychological, and behavioral factors on early emotional development. Addressing these risk factors in a holistic fashion could pave a path forward in the reduction of early emotional difficulties and promote healthier developmental trajectories.

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