

Regular Article

Interparental mutually responsive orientation during pregnancy impacts toddler socioemotional development by promoting parent-infant relational dynamics

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Abstract

Child socioemotional difficulties emerge as early as infancy, increase over time, and place children at risk for future internalizing and externalizing symptoms. The aim of the present study was to investigate pathways that originate within the interparental relationship during pregnancy and unfold during infancy that mitigate risk for toddler socioemotional difficulties and to examine the differential effects of these pathways for children with varying degrees of temperamental fearfulness. Specifically, we examined whether dyadic *mutually responsive orientation* (MRO; i.e., a system of attunement, reciprocity, cooperation, and warmth) observed in the prenatal interparental relationship and in both mother-infant and father-infant relationships predicted child socioemotional functioning at age 2. Findings revealed a significant direct effect of observed prenatal interparental MRO on mother-infant and father-infant MRO. Results also demonstrated an indirect effect of prenatal interparental MRO on socioemotional functioning via father-infant MRO. Temperamental fearfulness did not interact with interparental MRO, mother-infant MRO, or father-infant MRO to impact socioemotional functioning. Taken together, findings suggest high interparental MRO during pregnancy contributes to similar relational qualities in the parent-infant relationship and mitigates the risk for toddler socioemotional difficulties. Further, results underscore the importance of integrating fathers into prevention and intervention efforts when they are part of the family system.

Keywords: Mutually responsive orientation; parent-infant; prenatal interparental; socioemotional development; temperamental fearfulness

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Introduction

Child socioemotional difficulties (e.g., tantrums for long periods of time, trouble falling and staying asleep, minimal interest in playing with parents and peers, resistance to following instructions) emerge as early as infancy and persist (Briggs-Gowan et al., 2006). Deficits in social and emotional functioning during early childhood are often associated with functional difficulties (e.g., school readiness; Harrington et al., 2020) and can place children at risk for future internalizing and externalizing symptoms during later childhood and adolescence (Bornstein et al., 2010; Meagher et al., 2009; Winsper & Wolke, 2014). In the present study, we aimed to identify salient familial pathways, anchored in the interparental relationship during pregnancy, contributing to socioemotional functioning during early childhood with the goal of informing prevention and intervention efforts targeting the earliest stages of development. Consistent with *family systems theory* (Minuchin, 1985) and the *spillover hypothesis* (Erel & Burman, 1995), we

examined whether a warm, responsive, and attuned bond between parents during pregnancy resulted in these same relational qualities emerging during mother-infant and father-infant interactions and if these adaptive familial relationship dynamics subsequently reduced risk for child socioemotional difficulties during toddlerhood.

Prenatal interparental relationship quality shapes the family system during early childhood

Theory and research recognize the robust impact of interparental relationship dynamics on child development. For example, the emotional security hypothesis (Davies & Cummings, 1994) and converging literature (Harold & Sellers, 2018) suggest that children's exposure to interparental conflict threatens children's sense of security about the interparental relationship and broader family system, ultimately undermining children's well-being. Yet, the majority of research linking interparental dynamics to child socioemotional development has been conducted with school-age children and adolescents. Efforts to identify *prenatal* interparental relationship processes that set the stage for optimal family and child functioning have the potential to enhance prevention

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strategies that can be implemented long before child socioemotional difficulties manifest.

Consistent with *family systems theory* (Minuchin, 1985), the interparental relationship acts as a “driving force” in family functioning in dual-parenting households (Cox & Paley, 2003; Minuchin, 1985). Empirical literature demonstrates that the interparental relationship during pregnancy sets the tone for the postnatal family emotional climate (Hazen et al., 2021), parent-child interactions (Gallegos et al., 2017; Stapleton & Bradbury, 2012), and the health of individual family members, including the child’s emotional well-being (Phillips & Brock, 2024; Ramsdell & Brock, 2020). In line with a family systems perspective, the *spillover hypothesis* (Erel & Burman, 1995) highlights that dysregulated expressions of negative thoughts and feelings in the interparental relationship spills over into the parent-child relationship, undermining the ability of parent-child dyads to develop healthy relationship dynamics (Krishnakumar & Buehler, 2000). Further, evidence suggests that prenatal negativity between couples (i.e., tense and emotionally negative communication) predicts parents’ emotional withdrawal from their infant during routine caregiving interactions (Gallegos et al., 2017). Taken together, this work suggests that functioning in the interparental relationship prior to the birth of the child may set the stage for the larger family environment, including functioning in parent-child dyads and child adjustment during the formative first few years of life.

Research linking the interparental relationship to parent-child relationship quality and child adjustment has largely focused on the conflict between parents (e.g., Brock & Kochanska, 2016; Harold & Sellers, 2018; Krishnakumar & Buehler, 2000; Rhoades, 2008). Although informative, this research overlooks other qualities of the interparental relationship that have the potential to promote healthy family dynamics and individual well-being (Cox et al., 1989; Knopp et al., 2017; Kouros et al., 2014; Ramsdell & Brock, 2020; Zemp et al., 2019). For example, Cox and colleagues (1989) found if parents demonstrated and reported a close, confiding relationship during pregnancy, mothers engaged in greater observed sensitive parenting and fathers reported more positive attitudes toward their 3-month-old infants and their parenting role. Additionally, a recent meta-analysis (van Eldik et al., 2020) suggested general interparental relationship quality (e.g., dyadic cohesion, positive affect, satisfaction) impacted child adjustment to a similar degree as interparental conflict, and recent work suggests that low interparental intimacy might actually be a better indicator of risk for toddler emotional distress than interparental conflict (Phillips & Brock, 2024). Further, couples researchers increasingly recognize that focusing on specific relational behaviors without consideration of underlying, dyadic relationship qualities provides a restricted view of couple functioning (Karney & Bradbury, 2020; Leonhardt et al., 2022). Taken together, the current body of literature suggests examining the enduring, underlying dyadic qualities of the interparental relationship might also prove informative for understanding how the interparental relationship impacts family functioning.

One enduring relational quality worth closer examination is the degree to which there is a *mutually responsive orientation* (MRO) between couples. MRO is grounded in work on communal relationships (Clark, 1984), mutuality and reciprocity (Maccoby & Martin, 1983), and attachment theory (Bowlby, 1969) and refers to the degree to which members of a dyad have a mutually cooperative, attuned, warm relationship that allows them to navigate interactions in a connected and regulated manner. Although MRO has traditionally been examined in parent-child

relationships, these same qualities are conducive to a high-quality interparental relationship, and emerging research demonstrates strong MRO between couples bolsters a couple’s ability to navigate life challenges and promotes intimate relational health and psychological well-being (Brock et al., 2020; Lorenz et al., 2020; Ramsdell et al., 2024).

Importantly, MRO represents how relationship partners operate at a dyadic level and is not reducible to the behaviors and emotions of individual members (Askan et al., 2006). In relationships characterized by high MRO, couples appear aware and attuned to one another’s emotional experiences and needs, facilitating reciprocity, balance, and coordination of efforts. Couples high in MRO display productive “back and forth” communication that promotes ease and connectedness between partners. In contrast, each partner could possess “textbook” communication or conflict resolution skills but ultimately have low MRO because they struggle to apply those skills in a way that allows them to come together to meet the needs of each other and the moment. Consequently, MRO is more than the sum of each person’s contributions and skills and instead taps into whether the couple can flexibly adjust to ongoing demands while maintaining connection, reciprocity, and warmth.

Considered in the context of the broader family, interparental MRO during pregnancy has the potential to impact the emotional climate of the family, which plays a central role in a child’s emotional health (Morris et al., 2007; Thompson, 2015). An established system of attunement, reciprocity, coordination, and warmth between parents during pregnancy is expected to foster a secure postpartum environment for the child that promotes adaptive engagement with and expression of emotions and thoughts, as well as prosocial behavior. Strong prenatal interparental MRO might also spill over into parenting interactions, such that parents are more likely to be responsive and sensitive to their children and work toward establishing a mutually responsive parent-child relationship if these qualities are also characteristic of the interparental relationship. Conversely, low prenatal interparental MRO might contribute to a chaotic and unpredictable home environment, thereby undermining parents’ abilities to foster a warm, supportive, mutually responsive relationship with their children.

Parent-child mutually responsive orientation and child socioemotional development

Primary caregivers serve as external regulators for children during infancy and toddlerhood (Bridgett et al., 2015; Thompson, 2015), contributing to children’s ability to express internal experiences in a safe and secure environment and develop adaptive self-regulation strategies (Boldt et al., 2020; Godleski et al., 2020; Zeytinoglu et al., 2017). MRO (Kochanska, 1997) has also been identified as a key dyadic quality of parent-child relationships that contributes to the emotional and behavioral health of children, including self-regulation abilities and rule-compatible behavior during early childhood (Kim & Kochanska, 2012; Kochanska et al., 2007; Kochanska, Aksan, et al., 2008), as well as internalizing symptoms during middle to late childhood (Brock & Kochanska, 2015).

Considered in the context of socioemotional development, strong parent-child MRO may serve as a foundation from which a child trusts and expects that their parent will be attuned and responsive to their needs and aid them in appropriately expressing and managing emotional experiences (Kim & Kochanska, 2012; Kochanska et al., 2019). At the same time, this relationship leads

the child to feel motivated to cooperate with the parent and internalize their values and standards for behavior (Kochanska et al., 2005; Kochanska, 2002; Kochanska, Aksan, et al., 2008). High parent-child MRO might also increase the child's positive mood (Kochanska, 2002). As such, a relationship high in MRO sets the stage for positive, mutually receptive, and cooperative parent-child interactions that ultimately result in greater self-regulation capacity, pro-social behavior, and potentially greater positive affect (Brock & Kochanska, 2015; Kim & Kochanska, 2012; Kochanska et al., 2019; Kochanska, Aksan, et al., 2008; Kochanska & Murray, 2000). Conversely, low parent-child MRO characterized by dyadic unresponsiveness, negative affect, and uncoordinated routines is thought to diminish the dyad's ability to navigate interactions in a constructive manner, thereby limiting the child's opportunities to practice essential regulatory processes and develop important interpersonal competencies (e.g., socio-emotional communication and interaction). Further, mutually negative and adversarial interactions undermine the child's willingness to abide by and internalize parents' rules, negatively impacting socialization outcomes.

Although parent-child MRO is an established correlate of self-regulation and rule-compatible behavior (i.e., compliance with instruction) during toddlerhood and preschool age (e.g., Kim & Kochanska, 2012; Kochanska et al., 2007, 2019), less attention has been paid to the predictive utility of MRO for broad socioemotional functioning. Understanding MRO's impact on broad socioemotional development, anchored in early childhood, represents an important next step given pediatricians, educators, and interventionists utilize broadband screening tools to detect emerging socioemotional deficits that would benefit from early intervention. Additionally, research examining family cascades leading to child maladjustment has largely focused on the mother-child relationship, overlooking and likely underestimating the father's role in child development. Research increasingly underscores that children develop meaningful relationships with both mothers and fathers, and it is expected that these unique relationships will have significant and independent effects on children's development (Cabrera et al., 2018). Thus, there is a critical need for investigations that isolate the unique effects of mother-child and father-child MRO in emerging socioemotional functioning.

The moderating role of temperamental fearfulness

Although investigations of the early family environment hold promise for understanding developmental pathways leading to early socioemotional difficulties, the innate, biologically based characteristics conferring risk for child psychopathology should not be overlooked (Eisenberg et al., 2009; Lengua & Wachs, 2012; Rothbart & Bates, 2006; Sanson et al., 2004). According to the principle of multifinality, the same risk factor may lead to or be associated with different outcomes depending on the systems in which it operates (Cicchetti & Rogosch, 1996). In particular, a *diathesis-stress framework* (Monroe & Simons, 1991) proposes that some individuals possess characteristics (e.g., temperament traits) that increase their vulnerability to stressors in their environment. The "vulnerability" (i.e., diathesis) must be activated by an adverse environmental event (i.e., stress) for maladaptive functioning or psychopathology to develop. In support of this framework, child development research demonstrates that negative family processes, including low emotional intimacy in the interparental relationship, parenting unresponsiveness, and insecure attachment, can

increase the adverse effects of a child's innate risk (e.g., Brock & Kochanska, 2018; Kochanska & Kim, 2013; Phillips & Brock, 2024). The *differential susceptibility framework* (Belsky & Pluess, 2009) expands on the diathesis-stress model by suggesting that children traditionally conceptualized as being at elevated risk for psychopathology might be susceptible to both negative and positive aspects of their environment. In other words, the characteristics that make children more vulnerable to harsh circumstances may also be the characteristics that allow them to benefit disproportionately in supportive circumstances. Indeed, research demonstrates that children who possess innate "risk" factors achieve better outcomes than their low-risk peers to the extent that they are exposed to an adaptive family environment, including low interparental conflict, positive parenting practices, and secure parent-child relationships (Brock et al., 2017; Hentges et al., 2015; Slagt et al., 2016).

Temperamental fearfulness is a key indicator of sensitivity to the environment (Belsky & Pluess, 2009; Kiff et al., 2011; Kochanska et al., 2007; Kopala-Sibley et al., 2016; Lionetti et al., 2023). During infancy and toddlerhood, temperamental fearfulness captures negative affect in situations involving novelty, threat, or loss (Gartstein & Rothbart, 2003; Goldsmith & Lemery, 2000). Research demonstrates that temperamental fearfulness interacts with permissive and harsh parenting to impact early childhood internalizing problems (Gilliom & Shaw, 2004; Kiff et al., 2011; Williams et al., 2009). Further, although temperamental fearfulness can increase children's rule-compatible behavior (Kiff et al., 2011; Rothbart, 2007), fearfulness predicts *less* compliance within the context of power-assertive and punitive parenting (Kochanska et al., 2007). When parent-child interactions are negative, fearfulness might contribute to children's overarousal, making it difficult for them to internalize their parents' messages resulting in behavioral difficulties (Kochanska et al., 2007; Lionetti et al., 2023). Notably, considerably less research has examined how the interaction between supportive family processes and temperamental fearfulness impacts young children's socioemotional functioning.

To determine whether the interaction between temperamental fearfulness and family processes conforms to the differential susceptibility or diathesis-stress framework, it is imperative that researchers examine family processes along a continuum of maladaptive to adaptive (see Roisman et al., 2012 for a review). MRO – both between intimate partners and in parent-child dyads – captures the full continuum of maladaptive to adaptive relationship dynamics and is ideally suited to determine whether interactions between family processes and temperamental fearfulness are more indicative of diathesis-stress or differential susceptibility. Specifically, examining MRO enables the detection of differential susceptibility effects that include positive outcomes for sensitive children in the context of highly adaptive, positive relationships while mitigating the risk of incorrectly retaining a diathesis-stress model due to a restricted range of the environmental variable (i.e., only capturing the maladaptive, negative end of the continuum).

The present study

The overarching aim of the present study was to investigate pathways originating with the interparental relationship during pregnancy and unfolding during the first year of life in emerging child socioemotional functioning. Building upon past research and theory, we observed MRO in the interparental relationship during

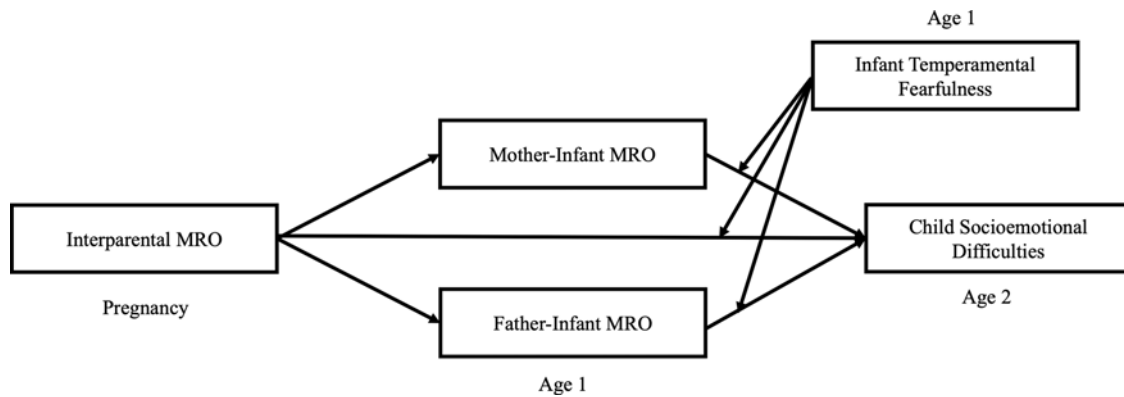


Figure 1. Proposed conceptual model. MRO = mutually responsive orientation.

pregnancy and in both mother-infant and father-infant relationships at age 1 as predictors of socioemotional functioning at age 2. Additionally, we observed temperamental fearfulness during infancy as a moderator of these pathways. Consistent with family systems theory (Cox & Paley, 2003; Minuchin, 1985) and emerging literature documenting the critical role of couple dyadic relationship quality in promoting child adjustment (van Eldik et al., 2020), we predicted that higher levels of interparental MRO during pregnancy (i.e., coordinated routines, harmonious communication, mutual cooperation, positive emotional ambience) would be associated with fewer child socioemotional difficulties at age 2. Further, consistent with the spillover hypothesis (Erel & Burman, 1995), we predicted that both mother-infant and father-infant MRO would function as unique mechanisms through which strong prenatal interparental MRO reduces toddler socioemotional difficulties. Lastly, research demonstrates that prenatal interparental relationship quality sets the tone for the emotional climate of the family during postpartum, including interparental (Hazen et al., 2021; Ramsdell et al., 2024) and parent-child relationship functioning (Gallegos et al., 2017; Stapleton & Bradbury, 2012), and children are differentially sensitive to these family dynamics (Hentges et al., 2015; Phillips & Brock, 2024; Slagt et al., 2016). Thus, in the context of this literature and in accordance with differential susceptibility theory (Belsky & Pluess, 2009), we predicted that the negative association between interparental MRO and socioemotional difficulties, as well as parent-infant MRO and socioemotional difficulties, would be stronger for children who are higher in temperamental fearfulness. We also expected the indirect pathway linking interparental MRO to parent-infant MRO to child socioemotional difficulties to vary in magnitude as a function of infant temperamental fearfulness. See Figure 1 for a depiction of this conceptual model.

Consistent with literature demonstrating that stress associated with economic hardship undermines the quality of romantic and parent-child relationships and, in turn, confers risk for child socioemotional difficulties (Conger et al., 2010), we included low socioeconomic status as a covariate in all analyses. We also included minoritized racial/ethnic identity as a covariate given that racial discrimination may adversely impact romantic relationship dynamics (Rice et al., 2023) and early childhood mental health (Berry et al., 2021). In line with past research demonstrating sex differences in parent-child MRO (Kochanska, 1997) and child socioemotional outcomes (Kim & Kochanska, 2012), we also

controlled for child sex. Finally, we controlled for parental separation status consistent with work suggesting that parental separation is associated with greater child socioemotional difficulties (Stadelmann et al., 2010).

The proposed study incorporates several strengths that represent conceptual advancements in research on the role of family systems in early childhood socioemotional development. First, by examining the longitudinal pathways linking the interparental relationship during pregnancy to child socioemotional functioning at age 2, the present study has the potential to identify at-risk families at the earliest stage of intervention for child socioemotional difficulties. Second, research examining the interparental relationship and its influence on child socioemotional difficulties primarily focuses on conflict behaviors; yet emerging research suggests that understanding underlying, general qualities of the interparental relationship might also prove informative. The examination of interparental MRO allows for an assessment of the underlying dyadic nature of the relationship and its impact on parent-infant relationship quality and child socioemotional health. Third, research examining the role of parent-child MRO in socioemotional development has focused on individual components of functioning (e.g., self-regulation, rule-compatible behavior); although this aids in specificity, healthcare settings do not often screen for these specific difficulties. The present study builds on these findings by examining MRO's impact on broad socioemotional development, which is more routinely screened for in early childhood settings relative to specific symptoms. Fourth, mother-child relationships are often examined without considering fathers when they are part of the family system; in contrast, the present investigation examines the unique roles of mothers and *fathers* in the earliest stages of development. Lastly, measuring temperamental fearfulness allows for the identification of family pathways of greatest consequence for children who are at innate risk for maladjustment.

Method

Participants and procedures

All procedures were approved by the University of Nebraska-Lincoln Institutional Review Board and data collection took place in Lincoln, NE. Participants were recruited through flyers and brochures that were broadly distributed to businesses and clinics frequented by pregnant individuals (e.g., obstetric clinics).

Eligibility criteria included (a) 19 years of age or older (legal age of adulthood where the research was conducted), (b) English speaking, (c) pregnant at the time of the initial appointment (but not necessarily the first pregnancy to increase generalizability of results), (d) both partners are biological parents of the child (to control for genetic effects of parent on child), (e) singleton pregnancy, and (f) in a committed intimate relationship and cohabiting.

One hundred sixty-two cohabitating mixed-sex couples enrolled in the study during pregnancy. Three couples were excluded from the final sample, due to either ineligibility or invalid data, resulting in a sample of 159 couples (159 women and 159 men). All participants identified as cisgender (i.e., either cisgender woman or cisgender man). Couples had dated an average of 81.90 months ($SD = 49.59$) and cohabited an average of 61.00 months ($SD = 41.80$). The majority of couples were married (84.9%). Most women were in the second (38.4%) or third (58.5%) trimester of pregnancy. On average, couples had one child living at home ($SD = 1.18$); 57.9% reported that they had no children and, therefore, were experiencing the transition into parenthood for the first time. Participants primarily identified as non-Hispanic/Latino, White (83.6% of women; 85.5% of men); 5.7% of mothers and 1.9% of fathers identified as Hispanic/Latino, White; 0.6% of mothers and 3.8% of fathers identified as Black or African American; 2.5% of mothers and 2.5% of fathers identified as Asian; 0.6% of mothers and 0.6% of fathers identified as American Indian or Alaskan Native; 0% of mothers and 0% of fathers identified as Native Hawaiian or Other Pacific Islander; and 6.9% of mothers and 5.7% of fathers identified as more than one race. Approximately one in four couples included a partner who identified as an ethnic or racial minority, with 15.1% of the sample representing multiracial households. On average, women were 28.67 years of age ($SD = 4.27$), and men were 30.56 years of age ($SD = 4.52$). Annual joint income ranged from less than \$9,999 to more than \$90,000 with a median *joint* income of \$60,000 to \$69,999, and most participants were employed at least 16 hrs per week (74.2% of women; 91.8% of men). Nearly half (49.1%) of couples were at or below the median household income in their state of residence (i.e., median household income of \$59,566). Modal education was a bachelor's degree (46.5% of women; 34.6% of men). Sexual orientation, disability status, and planned versus unplanned pregnancy were not assessed. Participant characteristics are also reported in Table 1.

During the follow-up assessments scheduled after childbirth, one mother reported a miscarriage and another family reported that the target child had been diagnosed with Down syndrome (i.e., trisomy 21). To focus the analyses on typically developing children, those two families were excluded for a final sample of 157 families in the present investigation. Fifty percent of parents reported their child was a girl. This report is based on available data from 149 families who reported child sex; eight families did not participate in subsequent waves of data collection and, as such, child sex information was not obtained for these families.

There were three waves of data collection. The initial wave took place during pregnancy (completed 2016–2017), and both partners attended a 3.5-hr laboratory appointment during which they completed behavioral observation tasks to assess interparental MRO. The second wave of data collection occurred when the target child turned 1 year of age (completed 2017–2019). Specifically, families were invited to attend a 3.5-hr laboratory visit, whereby mother- and father-infant dyads completed behavioral observation tasks to assess MRO between parent and infant. Mother-infant and

Table 1. Demographic characteristics

Parental characteristics at study entry (N = 159)	Maternal <i>M</i> (SD) or %	Paternal <i>M</i> (SD) or %
Age at study entry	28.67 (4.27)	30.56 (4.52)
Race and ethnicity		
Non-Hispanic/Latino, White	83.60%	85.50%
Hispanic/Latino, White	5.70%	1.90%
Black or African American	0.60%	3.80%
Asian	2.50%	2.50%
American Indian or Alaska Native	0.60%	0.60%
Native Hawaiian or Other Pacific Islander	0%	0%
More than one race	6.90%	5.70%
Education		
Did not complete high school	1.90%	1.90%
GED	1.30%	1.90%
High school diploma	3.80%	6.90%
Vocational, technical, or associate's	6.30%	13.20%
Some college	13.80%	17.00%
Bachelor's degree	46.50%	34.60%
Master's degree	19.50%	14.50%
Doctorate	6.90%	10.10%
Employed	74.20%	91.80%
Family characteristics at study entry		
Length of relationship (in months)	81.90 (49.59)	
Length of cohabitation (in months)	61.00 (41.80)	
Trimester of pregnancy		
First	3.10%	
Second	38.40%	
Third	58.50%	
Number of children	0.79 (1.18)	
First-time parents	57.90%	
Married	84.90%	
Low-income status	49.10%	

Note. Approximately one in four couples included a partner who identified as an ethnic or racial minority, with many couples (15.1% of the sample) representing multiracial households. Few families (14%) were below the poverty line in this community sample. All participants identified as cisgender (i.e., either cisgender woman or cisgender man). Sexual orientation, disability status, and planned versus unplanned pregnancy were not assessed.

father-infant behavioral observation tasks were completed within the same visit, and the order in which parent-infant dyads completed procedures was counterbalanced. Additionally, during the age 1 visit, children completed the well-established *Laboratory Temperament Assessment Batteries* (Lab-TAB) to assess temperamental fearfulness. Lastly, the third wave of data collection occurred when the target child turned 2 years of age (completed 2018–2020). During this assessment, both parents were invited to complete the *Ages and Stages Questionnaire: Social-Emotional, Second Edition* (ASQ:SE-2), to assess emerging emotional and socio-behavioral difficulties that confer risk for internalizing and externalizing symptoms (Feeney-Kettler et al., 2010). Notably, in

cases where couples had separated or divorced during the age 1 or age 2 assessment, each parent was invited to complete the lab visit with their child to increase the generalizability of our findings and retain at-risk families. Parents were compensated \$100 (\$50 to each parent) for the initial pregnancy appointment, \$200 (\$100 to each parent) for the family assessment at age 1, and up to \$200 (\$100 to each parent) for the final assessment at age 2. At each time point, families completed additional procedures that were outside of the scope of the proposed project.

Measures

Interparental mutually responsive orientation (pregnancy)

MRO was assessed and coded following the same procedures outlined in Brock et al., 2020 (see publication for further details). Interparental dyads were observed during pregnancy for 30 min in standardized, naturalistic, interactive contexts: planning a vacation together (10 min), mother support task (10 min; mother discusses with father something she would like to change about herself), and father support task (10 min; father discusses with mother something he would like to change about himself). A team of four coders viewed video interactions of interparental dyads during the aforementioned contexts and coded MRO. Coders viewed all contexts (i.e., vacation task, mother support task, father support task) for a given interparental dyad but did not code all dyads. Interactions were coded on a 5-point scale for each context (1 = *very low MRO*, 3 = *moderate MRO*, 5 = *very high MRO*). Dyads were coded as having high MRO if they displayed coordinated routines and good teamwork, harmonious communication and responsiveness to one another's viewpoints, mutual cooperation (i.e., willing and receptive stance toward each other), and a positive and warm emotional atmosphere. Dyads were coded as having low MRO if they exhibited a lack of routines (e.g., unsure how to proceed with a task together, disorganized teamwork), little engagement or hostile communication with one another, lack of responsiveness and difficulty cooperating to resolve conflict, and a negative emotional ambience. Scores from the vacation task and support tasks were significantly correlated (r s ranged from 0.46 to 0.77, $p < .001$) and, as such, were aggregated across contexts for a robust score of interparental MRO. MRO scores demonstrated adequate interrater reliability (single measures intraclass correlation coefficient [ICC] = .71 for vacation task; average measures ICC = .77 for maternal support task and .82 for paternal support task), and previous research has documented excellent convergent and divergent validity (Brock et al., 2020).

Parent-infant mutually responsive orientation (child age 1)

To assess parent-infant MRO, dyads were observed at age 1 for approximately 20 min, in standardized, naturalistic, interactive contexts: play (5 min; experimenter spills toys from a basket and invites parent and infant to play), snack (10 min; parent and infant have a snack together), and cleanup (5 min; parent and infant are asked to place toys back in basket). A second team of coders, distinct from the team who coded interparental MRO during pregnancy, viewed the video interactions of the parent-infant dyads and coded MRO using the well-validated coding system developed by Kochanska (e.g., Kochanska et al., 2015). When possible, coders did not code more than one interaction from the same family (e.g., mother-infant and father-infant) to ensure maximum objectivity. As previously mentioned in coding interparental MRO, interactions were coded on a 5-point scale for each of the observed contexts (1 = *very low MRO*, 3 = *moderate*

MRO, 5 = *very high MRO*). See above for characteristics of high versus low MRO. Scores from play, snack, and cleanup tasks were significantly correlated (r s ranged from .22 to .54, $ps < .001$), and as such, these scores were aggregated into one score for each parent. Parent-infant MRO scores demonstrated adequate interrater reliability (single measures ICC = .70).

Temperamental fearfulness (child age 1)

At age 1, temperamental fearfulness was assessed using the *Laboratory Temperament Assessment Batteries locomotor version* (Lab-TAB; Goldsmith & Rothbart, 1999). The infant was exposed, with their mother present (who sits behind the infant and remains neutral), to 4 masks for 10 s each. A team of coders, distinct from the interparental and parent-infant MRO coding teams, viewed video recordings of the mask paradigm and rated discrete facial, bodily escape, and vocal expressions of fear during two epochs (5–6 s) for each mask presented. Facial fear was rated on a scale of 0 (*none*) to 3 (*strong*, in all three facial regions); escape behavior, 0 (*none*) to 3 (*vigorous escape behavior*); and vocal fear, 0 (*none*) to 5 (*full intensity cry or scream*). Each of the fear indicators demonstrated adequate interrater reliability (average measures ICCs = .86 for facial fear, .78 for escape behavior, and .98 for vocal fear). In accordance with standard Lab-TAB scoring procedures and data aggregation methods (e.g., Kochanska et al., 2004; Planalp et al., 2017), three component scores were computed from the coders' final ratings for each indicator of fear (facial, escape, vocal): a mean score (i.e., an average score across epochs), a peak score (i.e., a max score across epochs), and a latency score (i.e., number of epochs until first occurrence of fear). Mean, peak, and latency scores for each indicator of fear were standardized to ensure all components were on the same metric and then aggregated to create composite scores for facial fear, escape behavior, and vocal fear. Lastly, facial fear, escape behavior, and vocal fear composite scores were aggregated to create a single robust score of temperamental fearfulness and demonstrated good internal consistency ($\alpha = .82$). Higher scores indicate a greater fear response.

Coder training and assessment of interrater reliability across behavioral observation systems

A stringent training protocol was followed to ensure valid and reliable codes for each behavioral coding paradigm discussed above. First, each coding team read numerous articles to strengthen their understanding of the conceptual underpinnings of the construct. Second, each coder within a team watched and coded interactions and then discussed as a group to gain consensus. Third, when a consistent pattern of agreement was observed among the coders, the team proceeded with coding approximately 20% of the available cases to establish reliability (ICCs $\geq .70$). Lastly, to prevent coder drift, each coding team continued to participate in consensus meetings while establishing reliability and single coding the remaining cases.

Child socioemotional difficulties (child age 2)

At age 2, each parent completed the *Ages and Stages Questionnaire: Social-Emotional, Second Edition* (ASQ:SE-2; Squires et al., 2015), a screener of child socioemotional difficulties. The ASQ:SE has demonstrated strong reliability and validity at age 2 (Squires et al., 2015) and captures core components of emotional, behavioral, and social functioning that confer risk for internalizing and externalizing symptoms (Feeney-Kettler et al., 2010). Parents reported how frequently the child engaged in specific behaviors using the following response scale: *often or always* (score = 0), *sometimes*

(score = 5), and *rarely or never* (score = 10). Parents also indicated *if this is a concern* (score = 5). Items were aggregated for a total score of socioemotional difficulties (i.e., higher scores indicate greater socioemotional difficulties), and demonstrated adequate internal consistency ($\alpha = .70$, $\omega = .74$). Maternal and paternal reports were significantly correlated ($r = .29$, $p = .003$). Given research suggesting that aggregating scores from multiple reporters produces a less biased and more reliable estimate of the construct (Kuo et al., 2017; Lengua et al., 2008) and a significant correlation, maternal and paternal reports were aggregated to create a robust score of infant socioemotional difficulties. Additionally, this approach results in greater statistical power and a more parsimonious estimate (Hoyt, 2000) of child functioning.

Demographic characteristics

During pregnancy, parents completed a questionnaire that assessed demographic and pregnancy characteristics, such as income, racial and ethnic identity, week of pregnancy, and whether parents were transitioning to parenthood for the first time. Low income was coded as 1 = *at or below median state income* (< \$60,000/year; 47.8% of sample) or 0 = *above state median household income* (> \$60,000/year). This cutoff converges with federal guidelines for defining “low income” for a family of four (i.e., household income less than double the federal poverty line), which is often used to determine eligibility for government assistance and reflects a lack of resources. When adjusting for number of persons in the household, low income was nearly identical to the non-adjusted variable ($r = .98$). The low-income variable used in this study has demonstrated excellent criterion validity across a range of parenting outcomes (e.g., significant correlations ranging from .17 to .44 with parental stress measures and .20 with parental psychopathology). Racial and ethnic minority status was coded as 1 = *one or both parents identified as an ethnic or racial minority group* (i.e., a proxy for disadvantage resulting from systemic barriers and marginalization stress) or 0 = *both parents identified as non-Hispanic/Latino, White*. During subsequent waves of data collection, parents reported on the characteristics of the target child (e.g., child sex) and whether the couple had separated or divorced.

Data analytic plan

Theoretically meaningful demographic and family characteristics were selected as control variables to include in all models, including child sex, separation status, low-income status, and identifying as a racial/ethnic minority (Berry et al., 2021; Conger et al., 2010; Kim & Kochanska, 2012; Kochanska, 1997; Rice et al., 2023; Stadelmann et al., 2010). Additionally, bivariate correlations among the remaining demographic/family characteristics and primary study variables were examined prior to testing study hypotheses. No other control variables were identified as theoretically meaningful or significantly correlated with predictors and outcomes.

Hypotheses were tested using path analysis in Mplus (Muthén & Muthén, 2017). A parallel mediation model was tested such that mother-infant and father-infant MRO were examined as unique mechanisms linking prenatal interparental MRO to toddler socioemotional difficulties. Additionally, observed temperamental fearfulness was modeled as a moderator, such that the paths linking interparental, mother-infant, and father-infant MRO to socioemotional difficulties were allowed to vary as a function of temperamental fearfulness. Maximum likelihood estimation was used to address missing data (Enders, 2010). Covariance coverage ranged

from .52 to 1.00. A nonparametric resampling method (bias-corrected bootstrap) with 10,000 resamples drawn was performed to derive the 95% confidence intervals for direct and indirect effects (Preacher et al., 2007). Bias-corrected bootstrapped confidence intervals were used to determine significant effects (both direct and indirect) as they are robust to violations of univariate and multivariate normality. To account for the interdependence of data, the residual variances of mother- and father-infant MRO were covaried. Further, to test for indistinguishability of paths across parents (whether interparental MRO had an equal effect on mother-infant and father-infant MRO; whether mother-infant and father-infant MRO had an equal effect on socioemotional difficulties), a series of nested model comparisons evaluating the relative fit of a model with equality constraints to one with effects freely estimated was tested. If a chi-square test was significant at $p < .10$ and the fit of the model was not improved by constraining the paths, then we retained the model with the paths free to vary across parents. The following criteria were applied to establish adequate global model fit: CFI above .95; RMSEA and SRMR under .05.

Results

Descriptive statistics and correlations

Descriptive statistics and correlations among key variables and covariates are reported in Table 2. As expected for a community sample, average levels of MRO across dyads (interparental, mother-infant, and father-infant) were relatively high. Father-infant dyads demonstrated lower levels of MRO relative to mother-infant dyads, $t(94) = -2.82$, $p < .01$. Interparental MRO, mother-infant MRO, and father-infant MRO were significantly correlated in the anticipated directions (r s ranged from .21 to .27). Broad socioemotional impairment was significantly related to interparental MRO ($r = -.23$) and father-infant MRO ($r = .26$). However, socioemotional impairment was not associated with mother-infant MRO ($r = -.09$) or temperamental fearfulness ($r = .14$). Additionally, temperamental fearfulness was not associated with family relationship variables or socioemotional difficulties (r s ranged from $-.15$ to $.17$). All variables were sufficiently distinct, and thus, there were no concerns about multicollinearity (r s < .70; Tabachnick & Fidell, 1996) or poor discriminant validity (r s < .80; Brown, 2015).

Path analyses

The final model results are reported in Table 3 and depicted in Figure 2. The model demonstrated excellent global fit ($\chi^2(4) = 2.512$, $p = .643$; CFI = 1.000; RMSEA = .000, 90% CI [0.000, 0.097]; SRMR = .004). Interactive effects (interparental MRO $\times$ temperamental fearfulness, mother-infant $\times$ temperamental fearfulness, father-infant MRO $\times$ temperamental fearfulness) were examined to determine which interactions should be retained in the final model. Contrary to our hypothesis, the interaction between temperamental fearfulness and prenatal interparental MRO as a predictor of early childhood socioemotional difficulties was not significant, 95% CI $[-6.232, 10.545]$. Similarly, the interactions between fearfulness and mother-infant MRO, 95% CI $[-12.414, 11.730]$, and fearfulness and father-infant MRO, 95% CI $[-16.547, 10.534]$, as predictors of socioemotional difficulties were not significant.

Next, in favor of parsimony, the nonsignificant interactions (interparental MRO $\times$ temperamental fearfulness, mother-infant $\times$ temperamental fearfulness, father-infant MRO $\times$ temperamental fearfulness) were excluded from the final model, and temperamental

Table 2. Descriptive statistics and correlations among interparental MRO, parent-infant MRO, temperamental fearfulness, child socioemotional difficulties, and control variables

	1	2	3	4	6	7	8	9	10
1. Interparental MRO (pregnancy)	–								
2. Father-infant MRO (1 year)	.27**	–							
3. Mother-infant MRO (1 year)	.21*	.29**	–						
4. Temperamental fearfulness (1 year)	–.15	.17	.09	–					
6. Socioemotional difficulties (2 years)	–.23*	–.26*	–.09	.14	–				
7. Child sex	.08	.26**	.07	.03	–.12	–			
8. Couple separation	–.14	–.10	.03	–.04	.11	–.19*	–		
9. Racial/ethnic minority	–.19*	–.07	–.20*	.20*	.11	.01	.08	–	
10. Low income	–.16	.02	–.22*	.05	.07	.02	–.03	.20*	–
Mean	3.48	3.70	3.90	0.00	27.90	0.50	0.03	0.22	0.47
SD	0.84	0.55	0.56	0.65	17.01	0.50	0.18	0.42	0.50
N	150	97	102	100	121	149	157	157	157

Note. MRO = mutually responsive orientation. Temperamental fearfulness scores were standardized. Child sex (1 = girl, 0 = boy) reflects whether the parent reported the child as “girl” or “boy” during the first month postpartum. Couple separation (1 = yes, 0 = no). Low income (1 = yes, 0 = no) reflects whether the family reported their joint family income at or below median state income. Racial/ethnic minority (1 = yes, 0 = no) reflects whether at least one parent identified as an ethnic or racial minority (i.e., proxy for disadvantage resulting from systemic barriers and marginalization stress). * $p < .05$; ** $p < .01$.

fearfulness was retained as a covariate. Nested model comparisons revealed the effect of prenatal interparental MRO on parent-infant MRO did not vary for mother-infant and father-infant dyads, $\chi^2(1) = 1.133$, $p = .287$. However, the effect of father-infant MRO on socioemotional difficulties at age 2 was significantly larger than the effect of mother-infant MRO, $\chi^2(1) = 2.938$, $p = .087$. Further, the fit of the model was not improved by constraining the paths from mother-infant and father-infant MRO to socioemotional difficulties. As such, the model was specified to constrain the paths from interparental MRO to parent-infant MRO and to allow the paths from parent-infant MRO to socioemotional difficulties to vary across dyads. The final model had excellent global fit ($\chi^2(1) = 1.125$, $p = .289$; CFI = .996; RMSEA = .028, 90% CI [0.000, 0.216]; SRMR = .021).

Interparental MRO was significantly related to both mother-infant MRO, 95% CI [0.055, 0.256], and father-infant MRO, 95% CI [0.055, 0.256], such that higher levels of interparental MRO during pregnancy engendered a greater MRO between parent and infant. Father-infant MRO was uniquely associated with socioemotional difficulties, 95% CI [–15.734, –0.621] in the anticipated direction, and the indirect pathway of interparental MRO on socioemotional difficulties via father-infant MRO was significant, 95% CI [–3.153, –0.165]. However, mother-infant MRO did not predict socioemotional difficulties, 95% CI [–5.593, 8.486], nor was an indirect pathway present, 95% [–0.780, 1.559]. The model accounted for 15.9% of the variance in father-infant MRO, 14.6% in mother-infant MRO, and 14.0% in child socioemotional difficulties. Prenatal interparental MRO was no longer significantly associated with socioemotional difficulties at age 2 when controlling for parent-infant MRO and temperamental fearfulness, 95% CI [–7.277, 1.425].

Discussion

The present study investigated the role of early family pathways – originating with the interparental relationship during pregnancy and unfolding during the first year of life – in emerging toddler

socioemotional difficulties. Consistent with the hypotheses, there were significant direct effects of observed prenatal interparental MRO on father-infant and mother-infant MRO. Further, results demonstrated an indirect effect of prenatal interparental MRO on toddler socioemotional functioning via father-infant MRO. Interparental MRO no longer exerted unique effects on child socioemotional difficulties at age 2 once parent-infant MRO was accounted for, highlighting father-infant MRO as a salient mechanism in child socioemotional development. Contrary to expectations, temperamental fearfulness did not interact with interparental MRO, father-infant MRO, or mother-infant MRO to impact socioemotional difficulties. What follows is a discussion of the primary findings, placed within the context of existing theory and research.

Consistent with the hypotheses, MRO observed between parents during pregnancy was an important factor in mitigating risk for low MRO in the parent-infant relationship. These results are consistent with a family systems perspective (Cox & Paley, 2003; Minuchin, 1985), spillover hypothesis (Erel & Burman, 1995), and related research (Gallegos et al., 2017; Stapleton & Bradbury, 2012) suggesting that, in dual-parenting households, the interparental relationship serves as the cornerstone of family functioning and can promote or undermine parents’ abilities to develop healthy relationship dynamics with their children. The present study results also expand the current body of literature which largely focuses on conflictual behaviors between parents (e.g., Brock & Kochanska, 2016; Harold & Sellers, 2018; Krishnakumar & Buehler, 2000; Rhoades, 2008), by demonstrating dyadic relationship quality – reflecting an established system of reciprocity, cooperation, and teamwork – is also informative for understanding how the prenatal interparental relationship impacts the family environment. In particular, strong interparental MRO during pregnancy might spill over into parenting interactions in early childhood, such that parents who routinely practice sensitivity, attunement, and reciprocity with their partners are more likely to draw on these same principles when interacting with their infants, which, in turn, lays the foundation for a mutually

Table 3. Results of final path analysis

Direct effects	<i>b</i>	<i>SE</i>	95%CI
<i>Outcome: Child socioemotional difficulties</i>			
Interparental MRO	−2.73	2.19	[−7.277, 1.425]
Father-infant MRO	−8.01	3.84	[−15.734, −0.621]
Mother-infant MRO	1.41	3.65	[−5.593, 8.486]
Temperamental fearfulness	4.61	2.95	[−1.157, 10.376]
Child sex	−1.84	3.15	[−8.009, 4.442]
Couple separation	5.18	12.83	[−20.774, 29.699]
Racial/ethnic minority	1.28	4.51	[−7.992, 9.735]
Low income	1.59	3.32	[−4.776, 8.153]
<i>Outcome: Father-infant MRO</i>			
Interparental MRO	0.15	0.05	[0.055, 0.256]
Temperamental fearfulness	0.18	0.09	[0.000, 0.350]
Child sex	0.25	0.10	[0.052, 0.452]
Couple separation	−0.03	0.27	[−0.528, 0.538]
Racial/ethnic minority	−0.08	0.16	[−0.393, 0.211]
Low income	0.05	0.11	[−0.170, 0.243]
<i>Outcome: Mother-infant MRO</i>			
Interparental MRO	0.15	0.05	[0.055, 0.256]
Temperamental fearfulness	0.14	0.10	[−0.054, 0.332]
Child sex	0.08	0.11	[−0.140, 0.291]
Couple separation	0.45	0.19	[0.147, 0.931]
Racial/ethnic minority	−0.23	0.13	[−0.495, 0.029]
Low income	−0.17	0.11	[−0.402, 0.043]

Note. Unstandardized primary model results, with specified equality constraints, for predictive paths. Although temperamental fearfulness did not interact with interparental, father-infant, or mother-infant MRO to predict child socioemotional functioning, it was retained and controlled for in the final model. Child sex, couple separation, racial/ethnic minority, and low income were included as covariates in the model. Correlations were modeled between exogenous predictors (father-infant and mother-infant MRO). Bias-corrected confidence intervals (CIs) based on 10,000 bootstrapped samples were calculated to determine the significance of effects. If a CI did not contain zero, the effect was significant; significant effects are bolded.

responsive parent-child relationship. Further, given that parents' intrapersonal resources (e.g., their emotional and cognitive bandwidth) may be taxed during infancy and toddlerhood, strong MRO might serve as an interpersonal resource for parents that allows them to preserve critical intrapersonal resources needed to provide attuned and supportive parenting to their child.

Results identified father-infant MRO as a unique, primary mechanism through which the prenatal interparental relationship impacted child socioemotional adjustment. These results also align with family systems theory (Cox & Paley, 2003; Minuchin, 1985) and spillover hypothesis (Erel & Burman, 1995), as well as emerging literature documenting the importance of the father-infant relationship for child development (Gallegos et al., 2017; Hazen et al., 2021; Ramsdell & Brock, 2020). Additionally, they extend prior literature that links father-infant MRO to components of socioemotional functioning (i.e., rule-compatible behavior, self-regulation) at age 2 and 4, respectively (Kochanska et al., 2007; Kochanska, Aksan, et al., 2008), by suggesting the

dyadic relationship between father and infant also contributes to broad emotional and socio-behavioral functioning during toddlerhood.

It is notable that, in the present study, father-infant MRO, but not mother-infant MRO, was associated with toddler socioemotional functioning. Prior research has demonstrated the importance of mother-infant MRO in self-regulation during toddlerhood and middle childhood (Kim & Kochanska, 2012; Kochanska, Aksan, et al., 2008). Though unexpected, there are several possible explanations. First, higher levels of MRO were observed, on average, in mother-infant dyads relative to father-infant dyads. Significant findings could emerge in clinical samples comprised of mother-infant dyads exhibiting greater dysfunction. Second, a significant correlation was observed between mother-infant MRO and father-infant MRO. Consistent with a family system's perspective, which emphasizes the interrelated nature of the family, a strong MRO in the mother-infant relationship might promote similar processes in the father-infant relationship. Lastly, fathers and mothers may play a unique role in child outcomes depending on the context in which they are observed (Grusec & Davidov, 2010). Specifically, the literature suggests that fathers tend to provide sensitive and supportive encouragement for exploration, as well as gentle challenges during play – consistent with the nature of the tasks observed in this study – which promote necessary skills for adjusting to demands and regulating affect and behavior. On the other hand, mothers may impact important regulatory skills and social competence by providing comfort and security in the face of distress (Leerkes et al., 2009). Thus, it may be that MRO manifests in unique ways for father-child and mother-child dyads across different types of interactions (e.g., non-distressing, playful vs. distressing tasks). In the present study, parent-infant MRO was observed in primarily non-distressing tasks. Given mothers may play a more central parenting role in times of distress, perhaps mother-infant MRO would have been associated with child socioemotional functioning if the dyad had been observed during tasks explicitly designed to elicit distress.

It was also surprising that temperamental fearfulness did not interact with interparental MRO, mother-infant MRO, or father-infant MRO to impact socioemotional difficulties. Fearfulness has been identified as a key indicator of sensitivity to the environment (Belsky & Pluess, 2009; Fox et al., 2007; Kopala-Sibley et al., 2016; Lionetti et al., 2023) that impacts a range of socioemotional outcomes (Gilliom & Shaw, 2004; Kiff et al., 2011; Kochanska et al., 2007). Perhaps the measurement of temperamental fearfulness in the present study (i.e., in a singular context) impacted our null findings. Emerging research examining the interaction between parenting and temperament highlights the importance of observing temperament across a range of contexts (e.g., risky, challenging, exploratory, aversive, interpersonal, and rewarding) to capture a comprehensive and robust measure of sensitivity to environmental stimuli (Hentges et al., 2022). Further, environmental sensitivity literature points to the utility of capturing more nuanced, subtle forms of fearfulness (e.g., inhibition, reticence, pausing and then approaching; Lionetti et al., 2019). Taken together, it is possible that the assessment of temperamental fearfulness across multiple contexts, as well as subtle expressions of fearfulness, may reveal that interparental MRO and mother- and father-infant MRO do interact with temperamental fearfulness to impact child socioemotional outcomes.

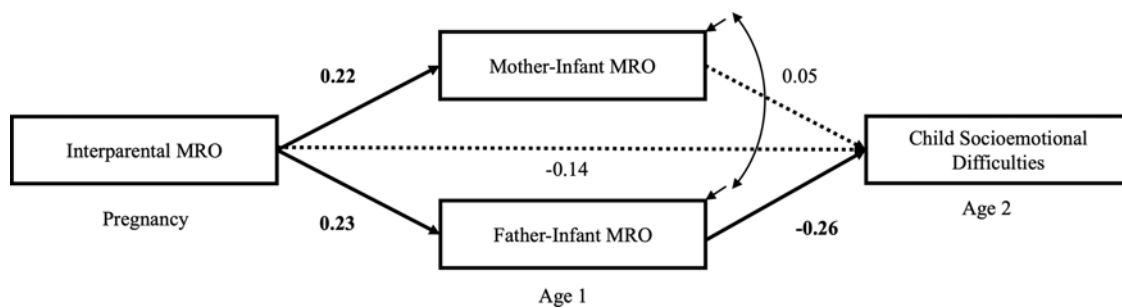


Figure 2. Standardized model results for child socioemotional difficulties, with specified equality constraints. Although temperamental fearfulness did not interact with interparental, father-infant, or mother-infant MRO to predict child socioemotional difficulties, it was retained and controlled for in the final model. Child sex, couple separation, racial/ethnic minority, and low income were included as covariates in the model. Correlations were modeled between exogenous predictors (father-infant and mother-infant MRO). Bias-corrected confidence intervals (CIs) based on 10,000 bootstrapped samples were calculated to determine the significance of effects. If a CI did not contain zero, the effect was significant; significant paths are bolded.

Limitations and future directions

The results of the present study should be viewed within the context of several limitations. The sample comprised US mixed-sex couples who were biological parents of the target child; future research should examine similar processes in sexual and gender minority couples and couples navigating the transition as adoptive parents. Additionally, approximately half of the sample comprised families who were already parenting children in the home when the target child was born. Future research that incorporates observations of parent-child MRO across siblings and collects information on interparental functioning before the birth of the prior sibling, as well as whether the interparental dyad received services to enhance functioning in the interparental relationship and/or with the sibling, would aid in understanding whether the impact of prenatal MRO on parent-child MRO depends on sibling order and whether parent-child MRO with older siblings impacts subsequent MRO with younger siblings. Further, most families identified as White and non-Hispanic/Latino, had achieved a high level of education, and reported a household income above the poverty line, which limits the generalizability of our results. Therefore, study aims should be pursued in a more ethnically and racially diverse sample and with families experiencing more severe forms of economic adversity.

In the present study, interparental and mother-infant dyads were rated as having lower MRO when at least one parent identified as a racial or ethnic minority, and low-income status was also associated with lower mother-infant MRO. There are several potential explanations for these findings. For instance, racial and ethnic minority parents may experience particularly harmful forms of stress that stem from a social environment that marginalizes and discriminates on the basis of race and ethnicity (Myers, 2009). Relatedly, families from low socioeconomic backgrounds are more likely to experience daily stressors due to financial insecurity and reduced access to resources (e.g., high-quality healthcare; Myers, 2009). Thus, the elevated levels of stress experienced by racially minoritized and socioeconomically disadvantaged families may result in greater stress spillover (i.e., stress undermines relationship functioning; Nomaguchi & Milkie, 2020), which influences parents' capacity to attend to relationships with their partner and child(ren) (Taraban & Shaw, 2018) and, in turn, impacts child adjustment (Cooke et al., 2022). While stress spillover might explain these results, it is also

important to acknowledge parents from diverse backgrounds may have differing norms for interacting with one another and their children and navigating problems together. Indeed, interactions traditionally viewed as maladaptive might actually be protective and culturally adaptive (Dunbar et al., 2017), and our measurement of MRO may not have been sensitive to capturing these culturally adaptive interactions and behaviors. Notably, extant theory and research on attachment and caregiving have focused on predominantly White middle-class families and have treated White participants as the norm. Thus, applying traditional observational coding schemes to racially and ethnically diverse families may result in researchers overlooking and misinterpreting parenting behaviors that may actually be sensitive and adaptive when accounting for the unique contextual factors faced by these families (e.g., discrimination, systemic racism, economic inequities; Stern et al., 2022). As described by Stern and colleagues (2022), it is also possible that our coders demonstrated implicit bias when rating dyads that were racially or ethnically diverse. In sum, it remains unclear whether the MRO coding scheme is valid across different racial and ethnic groups, and future research is needed to understand whether the construct of MRO adequately captures unique cultural norms.

Despite these limitations, there are several implications for future research. The present study adds to prior research demonstrating the importance of parent-child MRO for child development by identifying *prenatal interparental MRO* as an important factor influencing the development of parent-child MRO and subsequent socioemotional functioning. Specifically, an established system of attunement, reciprocity, coordination, and warmth between parents during pregnancy sets the stage for MRO between both mother-infant and father-infant dyads during the first year postpartum. Considering MRO's influence on the parent-child relationship, as well as prior research that identifies MRO as vital to healthy couple functioning (Brock et al., 2020; Lorenz et al., 2020; Ramsdell et al., 2024), future research is needed to understand what precipitates strong MRO between partners. For example, perhaps reflective functioning, mindfulness, and psychological flexibility are important individual characteristics of each partner that facilitate the development of MRO in the dyad.

Further, empirical investigations aimed at understanding the mechanisms linking interparental MRO to parent-child MRO are warranted. MRO in the interparental relationship might spill over into parents' interactions with their infant, such that couples who

exhibit higher MRO might demonstrate higher parenting reflectivity and be more likely to approach their infant in a responsive and sensitive manner. Additionally, strong MRO between partners might promote couples' smooth navigation of daily interactions and stressors, allowing parents to reserve critical intrapersonal resources needed to provide attuned and supportive parenting to their child. Indeed, the literature suggests that warm and responsive parenting is likely to engender an open and willing stance in the child, which, in turn, contributes to the development of MRO between parent and child (Kochanska, 2002; Kochanska, Barry, et al., 2008).

Another important step for future research is to understand why father-infant MRO, but not mother-infant MRO, was linked to early levels of socioemotional functioning. As previously discussed, although MRO is thought to be an underlying, dyadic quality of the parent-child relationship, it is possible that it manifests in unique ways across different types of interactions (e.g., distressing vs. non-distressing) and dyads. As such, future research would do well to observe MRO in both distressing and non-distressing tasks to understand whether there are differential outcomes depending on the observed context (distressing vs. non-distressing) and the parent-child dyad (mother-child vs. father-child). Additionally, unmodeled mechanisms may link mother-child MRO to socioemotional functioning, representing an important avenue for future research. It may be that mother-child MRO sets the stage for a cascade that unfolds via specific emotional socialization behaviors to impact broad emotional and socio-behavioral functioning.

Lastly, in the present study, family processes did not interact with temperamental fearfulness to impact socioemotional development; future research is needed to understand if these effects do emerge under certain conditions. The field of differential susceptibility, which suggests children have unique responses to similar environmental stimuli due to biobehavioral differences in reactivity, holds promise for answering these questions. Due to debate regarding how to best assess sensitivity to context, there are numerous paths forward. For example, perhaps temperamental fearfulness measured across multiple contexts, instead of a single context, is a better indicator of environmental sensitivity (Hentges et al., 2022). Further, it may be that capturing more nuanced, subtle forms of fearfulness (e.g., reticence, pausing before approaching; Lionetti et al., 2019) across contexts leads to a better understanding of children's functioning. Alternatively, assessing a child's behavioral profile (e.g., high behavioral inhibition, avoidance, fearfulness, worry, and lower activity in novel contexts) might prove more informative for identifying children's susceptibility to their environment (Hentges et al., 2022).

Clinical implications

Results highlight the utility of enhancing interparental MRO during pregnancy to set the stage for optimal functioning in the parent-infant relationship and mitigate risk for child socioemotional difficulties. The transition to parenthood represents an ideal time to promote healthy couple relationship functioning (Saxbe et al., 2018). Pregnant couples frequently interact with medical providers and may be more inclined to participate in prevention and intervention programs because many parents already seek childbirth education during pregnancy. A number of couple relationship education programs have been developed for pregnant and new parents (e.g., *Becoming a Family*, *Bringing Baby Home*, *Building Strong Families*; Cowan & Cowan, 2000; Shapiro &

Gottman, 2005; Wood et al., 2014). Although these programs have demonstrated small, significant impacts on couple communication, parenting, and child adjustment (see Cowan & Cowan, 2014 for a review), researchers have suggested the need for more efficacious treatments (Bradbury & Lavner, 2012; Cowan & Cowan, 2014; Pinquart & Teubert, 2010). Bradbury and Lavner (2012) propose that investigators and providers may not be targeting the most essential variables producing treatment effects and suggest communication with the intent to promote security might be more important to relational well-being than the specifics of communication (e.g., specific words or behaviors). The process of MRO, which underscores the degree to which couples are attuned to one another and approach interactions as a team, may converge with the notion of communicating with the intention to build security. Research pinpointing the principles that foster strong MRO may allow for increased efficacy of couple prevention programs during pregnancy.

Additionally, in family systems comprised of fathers, results underscore the importance of building a strong relational foundation between father and infant to promote early childhood adjustment. Notably, current prevention programs aimed at promoting parent-child relationships are largely focused on supporting and educating mothers (Cabrera et al., 2018), with few exceptions (e.g., *Supporting Father Involvement*; Cowan et al., 2009). And, interventions that are not intended for a specific parent are often conducted with the mother instead of the father in dual-parenting households (Tully et al., 2018). Our results reinforce the need for providers and community agencies (e.g., home visiting programs) to engage fathers and fully integrate them into prevention and intervention efforts when they are part of the family system. Fathers and children might also benefit from programs that emphasize fostering principles underlying strong parent-child MRO. Taken together, future research is required to understand best practices for engaging fathers and to identify how clinicians can effectively impart the principles underlying MRO to promote healthy parent-infant relationships and ultimately mitigate risk for child socioemotional difficulties.

Conclusions

Efforts to identify factors present before a child is born, which ultimately set the stage for optimal family and child functioning, have the potential to enhance prevention strategies that can be implemented long before a child's socioemotional difficulties manifest. Research linking the interparental relationship during pregnancy to parent-child relationship quality and child adjustment has largely focused on conflict between parents, without consideration of underlying, dyadic qualities of the couple's relationship. This study revealed that high MRO between pregnant couples set the stage for strong mother- and father-infant MRO. Further, father-infant MRO emerged as a key mechanism through which prenatal interparental MRO contributed to fewer child socioemotional difficulties during toddlerhood. Together, these findings underscore the importance of supporting parents in establishing a system of attunement, reciprocity, teamwork, and warmth prior to the birth of the child to enhance parent-infant and child socioemotional functioning.

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This study complied with Transparency and Openness Promotion Guidelines. PI Rebecca L. Brock (rebecca.brock@unl.edu) should be contacted to request access to research materials, analysis code, and data. Data management and analysis procedures were preregistered (<https://osf.io/hprk8>). We made no deviations from that plan. Because we had prior knowledge of the data from this study, we did not preregister our hypotheses.

The data in the present study are part of a larger longitudinal project. Some of the data have been published/presented elsewhere (e.g., Brock et al., 2020; Ramsdell et al., 2024). This is the first article in the current sample to examine the role of interparental MRO during pregnancy in emerging mother-infant and father-infant interactions and child socioemotional functioning during toddlerhood.

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