DYADIC CO-REGULATION AS A PROTECTIVE FACTOR AMONG FAMILIES EXPERIENCING HOMELESSNESS: CONTRIBUTIONS TO THE DEVELOPMENT OF INFANT REACTIVITY AND SELF-REGULATION

By

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THESIS ABSTRACT

Dyadic Co-Regulation as a Protective Factor Among Families Experiencing Homelessness: Contributions to the Development of Infant Reactivity and Self-Regulation

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Experiences of family homelessness during early childhood, particularly during the periods of infancy and toddlerhood, can pose significant risks to healthy psychosocial development. Resilience research on early child development emphasizes children's self-regulatory abilities and the quality of caregiving they receive as important factors in predicting adaptive functioning. The current study examined the experiences of families with infants (from birth to 12 months old) living in emergency family homeless shelters and how certain experiences related to developmental outcomes. This study tested hypotheses linking parent internalizing symptomatology, parent-infant dyadic co-regulation, and infants' temperamental reactivity and self-regulation. Further, the potential, mediating role of dyadic co-regulation as a protective factor for homeless infants' developmental outcomes was assessed. In this sample (n = 21), increased maternal internalizing symptomatology was significantly related to greater infant reactivity. However, while both infant reactivity and infant self-regulation were related to one another, maternal internalizing symptomatology did not seem to correlate with

infants' self-regulatory capacities to the same extent. Two independent mediation analyses assessed the mediating role of dyadic co-regulation for both the outcomes of infant reactivity and infant self-regulation and produced null results overall. This research makes a first attempt at filling a current gap in the literature concerning risk and resilience with respect to experiences of homelessness for families with an infant living in emergency housing.

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Positive parenting behavior and children's ability to self-regulate have been robustly linked to positive developmental outcomes (Belsky & de Haan, 2011). These factors are especially important for individuals in contexts of high adversity like family homelessness (Luthar, 2006; Masten, Miliotis, Graham-Bermann, Ramirez, & Neemann, 1993; McLoyd, 1998). Adverse experiences associated with family homelessness and poverty during infancy and toddlerhood threaten healthy development directly by challenging children's ability to self-regulate and cope with stressors. Adversity also indirectly influences the child's family system through disrupting parents' ability to provide adequate caregiving (David, Gelberg, & Suchman, 2012). Family homelessness and associated risks can have detrimental effects on developmental outcomes across domains. However, many children avoid negative outcomes and, therefore, demonstrate resilience (e.g., Buckner, 2008; Cutuli & Herbers, 2014; Haber & Toro, 2004; Herbers, Cutuli, Monn, Narayan, & Masten, 2014; Luthar, 2006; Masten et al., 1993; Rutter, 2013).

Children who show resilience function well despite being exposed to risk (Rutter, 2013). Resilience occurs because of positive factors in the lives of children and families, called promotive or protective factors. A close relationship with a competent adult, such as a parent, and good self-regulation skills are consistently linked to resilience (Luthar, 2006). As such, early childhood interventions aimed at promoting positive development of at-risk children commonly target these factors (Cutuli & Herbers, 2014). Past research suggests these factors are important among kindergarten-aged children and among youth experiencing family homelessness (Buckner, Mezzacappa, & Beardslee, 2003; Herbers, Cutuli, Supkoff, Narayan, & Masten, 2014; Masten et al., 2012; Obradović, 2010). However, no work has tested links between these factors among

infants in homeless families, despite early childhood being a period of rapid development and plasticity.

The current study tested links between parent internalizing symptoms, dyadic co-regulation, and infant reactivity and self-regulation among very young children staying in emergency housing for families experiencing homelessness. There were two goals. First, I tested for a positive association between parent internalizing symptomatology and reactivity and a negative association between parent internalizing symptomatology for emerging self-regulation among young children (age 0 to 1). Second, I tested for a protective effect of dyadic co-regulation observed during parent-child interaction sessions. I hypothesized that dyadic co-regulation mediated the relation between parent internalizing symptomatology and infant reactivity and self-regulation. Results may have implications for furthering developmental science on the processes of positive adaptation and resilience, as well as applied implications.

Developmental Psychopathology and Emerging Self-Regulation

Infancy and toddlerhood, commonly conceptualized from birth through age three, constitute periods of rapid growth and developmental change. Perspectives examining multiple interactions between developing systems, environmental factors and contexts, and the aggregation of multiple experiences and interactions over time allow for better understanding of human development from its earliest stages (Blair & Raver, 2012; Lewis, Lamey, & Douglas, 1999). From a developmental psychopathology perspective, it is during periods of rapid growth or change that emerging or developing systems are most susceptible to disruptions and influences, both positive and negative, which subsequently result in responses considered either adaptive or maladaptive dependent on the context of such experiences. These responses ultimately contribute to shaping the resultant typical or atypical aspects of one's developmental trajectories through time (Cicchetti & Tucker, 1994). Further, developing systems are most malleable during such periods of rapid change and growth. Theoretical explanations for processes of resilience

emphasize that although developmental change can and does occur throughout the life course, plasticity is greatest in early childhood. Thus, understanding how adversity impacts development in infancy is especially important.

Reactivity and self-regulation. The constructs of reactivity and self-regulation have been studied from numerous theoretical perspectives and disciplines. Although difficult to disentangle at times, both reactivity and regulation can be conceptualized as distinct, yet related processes. Reactivity deals with one's somatic, endocrine, and autonomic reaction(s) to stimuli present in the surrounding environment. Regulation, however, refers to processes that serve to modulate reactivity through both attentional and behavioral mechanisms (Braungart-Rieker & Stifter, 1996).

Reactivity, particularly temperamental reactivity, is seen as a response to a change in one's environment; the environment can refer to either one's external or internal environment. Further, temperamental reactivity, especially in infancy, can be measured as a function of latency, duration, and intensity of different responses observed. Responses can be seen along domains of emotional, orienting, and motoric reactions. Relatedly, yet conversely, self-regulation is best defined as a set of processes that modulate reactivity, as can be demonstrated by processes of effortful control and executive attention (Rothbart, Sheese, Rueda, & Posner, 2011).

Self-regulation is best viewed as a multidimensional construct encompassing motivational, cognitive, behavioral, and affective components (Grolnick & Farkas, 2002). Broadly, self-regulation is defined as an individual’s ability to both monitor and modulate cognitive, emotional, and behavioral processes as a means to achieve some goal and/or to adapt and meet specific cognitive and social demands within one’s surrounding contexts (Berger, Kofman, Livneh, & Henik, 2007). Berger and colleagues (2007) suggest that emotional self-regulation is distinguishable from other forms of self-regulation. For example, cognitive self-regulation is distinguishable from emotional self-regulation (Berger et al., 2007). Subsequently,

both emotional and cognitive self-regulation may or may not encompass what is observed as regulation of overt behaviors, according to Berger and colleagues (2007).

A related construct, both to the conceptualization of self-regulation and this study, is emotion regulation. Emotion regulation concerns the capacity to regulate one's emotions and the behaviors that are inherently influenced by emotional reactions. Paralleling self-regulation, the development of emotion regulation is influenced by multiple sources of dynamic processes operating in a bidirectional manner between individual to contextual levels of analysis (McClelland, John Geldhof, Cameron, & Wanless, 2015). Eisenberg and Spinrad (2004) further define emotion-related self-regulation as:

> the process of initiating, avoiding, inhibiting, maintaining, or modulating the occurrence, form, intensity, or duration of internal feeling states, emotion-related physiological, attentional processes, motivational states, and/or the behavioral concomitants of emotion in the service of accomplishing affect-related biological or social adaptation or achieving individual goals. (pp. 338)

The authors provide this definition of emotion-related self-regulation in an attempt to disentangle conceptualizations of emotion functioning as a regulator from conceptualizations of emotion serving a regulating function, which are often grouped together as a conceptualization of a unitary construct which may be too broad (Nancy Eisenberg & Spinrad, 2004).

As Rothbart and Bates (2006) suggest, self-regulation refers to processes like inhibitory control and self-soothing, both contributing to the modulation of reactivity. In this way, the ability to self-regulate, and the multiple processes that support this ability, are better conceptualized as a group of monitoring mechanisms.

Rothbart, Sheese, Rueda, and Posner (2011) assert that there is a shift in infant's self-regulation that occurs early in development. Primarily, this transition occurs as infants transition from one set of regulatory networks to the next. First, regulation occurs predominantly via control mechanisms, which work mainly through areas related to orienting mechanisms (frontal eye field and parietal areas). Caregivers, sensitive to infants' signals and bids, are able to use these networks in trying to soothe the infant by presenting them with novel objects (i.e., distraction). In

this way, by presenting these novel objects, caregivers are able to influence the developing connections between these regulatory networks, further acting as a mechanism through which the control and orienting networks become connected to the executive network, which can be seen later in development as stronger self-regulation skills.

Duration of looking, related to self-regulation and measurable by three months of age, reflects how much information is processed by an individual. This strategy, along with others such as gaze aversion and self-stimulation, are strategies employed by infants serving to control levels of attention and arousal (Thompson, 1998). Further, these strategies may also be beneficial in contexts of parent-child interactions (Sumner & Spietz, 1995), as infants are then able to demonstrate more alert states, and subsequently maximize opportunities for interaction within the dyad.

Although infants are able to employ strategies such as these in order to regulate their own reactions and behaviors, such strategies are fairly limited during the first year of life (Gartstein, Bridgett, Young, Panksepp, & Power, 2013). However, this makes sense, given that during the first year of life, the caregiver plays a large role in the regulation of infants' states. Thus, during this period of development, there are multiple factors and key players relating to the development of self-regulatory capacities. This is in part due to the movement of self-regulation from primarily external regulation provided by caregivers, to increased dyadic co-regulation, and lastly, to infants' internalization of regulatory strategies. In turn, infants are then able to employ such strategies in other settings beyond parent-child interactions.

Self-regulation is shown to be predictive of overall cognitive functioning (Berger et al., 2007) and implicated in aspects of developmental domains of competence such as school readiness (Blair, 2002) and academic success (Blair & Diamond, 2008). In addition, positive effects related to self-regulation (Shipman & Zeman, 2001; Tarullo, Obradović, & Gunnar, 2009) have been observed across homeless children (Herbers, Cutuli, Supkoff, et al., 2014; Masten et al., 2012), other high-risk groups of children (Masten & Narayan, 2012), as well as in low-risk or

normative groups of children (van Lier & Deater-Deckard, 2015). Moreover, for school-age children, the effects of cumulative risk factors have been reported to negatively relate to the development of self-regulatory abilities, specifically, those related to aspects of effortful control (Bridgett & Mayes, 2011; Lengua, Honorado, & Bush, 2007).

Parenting and the Parent-Infant Relationship

During infancy and toddlerhood, the parent or primary caregiver plays an essential role in the child's emerging self-regulation. As Schore (1996) suggests, primary caregivers provide external regulation for their infant during a sensitive period of development from birth until age two. Amid this period, infants' brains undergo rapid developmental growth and change as a function of the experiences and interactions encountered. A related fundamental role of the primary caregiver is to provide security and protection to their infant, ultimately ensuring survival. The central tenants to Bowlby's attachment theory posit these fundamental roles of caregivers (Bowlby, 1969). Guided by Bowlby's attachment theory, research in developmental science suggests that caregivers' behaviors contribute to the development of self-regulatory capacities in children.

Aspects of parenting. Parenting is an important age-salient developmental task valued by young adults who are invested in providing the best opportunities for their children (Cutuli & Herbers, 2014; Luthar, 2006). There is much variation in both the quality of parenting and how parent-child relationships are characterized for parents experiencing homelessness. For some parents exposed to risks associated with poverty and homelessness, it can be difficult to provide their children with responsive parenting and discipline that is not harsh. However, some parents within these same contexts appear to demonstrate resilient functioning as they are able to engage in caregiving behaviors that are both warm and supportive (Perlman, Cowan, Gewirtz, Haskett, & Stokes, 2012).

Herbers and colleagues (2014) emphasize the importance of the role parents play for emerging self-regulation of children not only in all families generally, but also especially for those embedded in adverse contexts like homelessness. Positive caregiving behaviors, both sensitive and responsive to children's signals and bids, operate as critical mechanisms allowing for a shift in regulatory processes from external, dyadic co-regulation provided by caregivers, to the emerging and developing self-regulation of children (Ainsworth, 1985; Berger et al., 2007; Bowlby, 1969; Bridgett, Burt, Edwards, & Deater-deckard, 2015; Cicchetti, Ackerman, & Izard, 1995; Evans & Porter, 2009; Herbers, Cutuli, Supkoff, et al., 2014; Schore, 1996; Sroufe, 2000).

Many believe that early environments, including the experiences occurring therein, directly impact brain development (Gunnar, Fisher, & The Early Experience Stress, and Prevention Network, 2006). Moreover, early environmental experiences, particularly those that are positive and occurring within early caregiving relationships, can make positive contributions to brain development (Glaser, 2000; Schore, 1996). Taken together with research pointing to the connections between the development of executive functions and brain structures, cognitive development, specifically development of self-regulatory capacities, seems to be sensitive to caregiving influences (Bernier, Carlson, & Whipple, 2010). This claim can be traced back many years, as Kopp (1982) was one of the first to suggest that early caregiving experiences are the primary mechanism through which children develop their self-regulatory capacities.

Although there is wide variability in what is considered positive parenting behavior and such behavior may appear different across cultures and contexts, three dimensions of parenting behaviors are suggested to promote the development of self-regulation and later executive functions, namely, parental sensitivity, scaffolding, and mind-mindedness (Carlson, 2003). Parental sensitivity refers to responding to infants' signals and bids in an appropriate and consistent manner. Scaffolding concerns how caregivers provide developmentally appropriate strategies for problem solving that children are later able to carry forward to other experiences. Lastly, mind-mindedness, affords children a language shared between themselves and their

caregiver, which supports the move from external regulation to self-regulation. Taken together, these parenting behaviors illustrate some of the ways in which early environmental caregiving experiences serve the development of self-regulation. Thus, one argument is that the progression of developing self-regulatory abilities moves from being primarily external to the child, as a function of regulation provided by the caregiver, to self-regulation, as children gradually internalize a set of regulatory strategies based on their earlier experiences (Harrist & Waugh, 2002). Research examining this argument lends support to the idea that early caregiving experiences support the development of self-regulation, which contributes to homeostatic parent-child interactions, which afford children an environment in which their self-regulation and other aspects of brain development can thrive (Bernier et al., 2010). Indeed, the authors suggest this process to be bi-directional in nature.

Dyadic co-regulation. Fogel (1993) defines co-regulation as a social process through which individuals change their actions in response to the concurrent and anticipated actions of the other partner in such dynamic interactions. In applying this to parent-infant interactions, both parents and infants make adjustments to their own actions based on the expectations they have for their partner's reaction, thus showing dyadic co-regulation within these parent-infant interactions (Evans & Porter, 2009).

As Sroufe (1997) asserts, the parent-infant relationship has a critical role in contextualizing experiences during development and also that individual patterns of emotional regulation are built upon earlier patterns of regulation experienced with this parent-infant relationship. Early experiences of regulation within the parent-infant relationship are a starting point of a developmental cascade whereby individual patterns of self-regulation build upon earlier experiences of dyadic co-regulation within the parent-infant relationship, and have effects on other outcomes throughout development (for example, as would be in the case of dyadic co-regulation impacting self-regulation, in turn impacting academic achievement, which could also influence parenting quality later in adulthood; for further details on developmental cascades, see:

Masten & Cicchetti, 2010). Parental responsiveness can be used to index positive parenting within parent-infant dyads. Further, positive parenting and, thus, parental responsiveness are associated with positive developmental outcomes for all children. This may also be especially so for children experiencing adversity, particularly family homelessness (Cutuli & Herbers, 2014). Likewise, child responsiveness in parent-child interactions may indicate characteristics of children and be useful in indexing aspects of infants' social-emotional functioning. Relatedly, child responsiveness may also exert influence on the type of caregiving that children receive. Moreover, both parent and infant responsiveness relate and may function like other dyadic processes, such as co-regulation between a parent and their infant. Here, both members of the parent-infant dyad are capable of impacting each other's functioning. If both the parent and the child are making positive contributions to the relationship, the relationship and each individual member of the dyad may benefit. Co-regulation in the parent-child relationship provides a strong and important foundation for the development of self-regulation and a host of other skills.

Risk and Resilience in the Context of Homelessness

Approximately 36% of people experiencing homelessness in the United States on a given night in 2015 were individuals in homeless families with children, accounting for roughly 206,286 people (U.S. Department of Housing and Urban Development, 2015). About 23% of all persons experiencing homelessness were under the age of 18, and about 30% of those staying in shelter were under 18.

Masten and colleagues (1993) suggest that children experiencing homelessness are best conceptualized as falling at the high end of a continuum of poverty-related risk. Children in families experiencing homelessness are at an increased risk for experiencing problems related to physical health, conduct and emotional issues, and academic achievement in comparison to their housed counterparts (Buckner, 2008; Obradović, 2010; Samuels, Shinn, & Buckner, 2010). Poverty-related risks can have deleterious contributions for all children with a low socioeconomic

status (SES). This also applies to homeless children and families, whose experiences are enmeshed in a larger context of acute, chronic, and cumulative adversities. Likely, this contributes to a differentiation between children in homeless families compared to counterparts in families combatting poverty yet experiencing housing stability (Kilmer, Cook, Crusto, Strater, & Haber, 2012). In comparison to poor yet stably housed children, homeless children and families face higher rates of adverse risks besides those of extreme poverty. Such risks attributed to experiences of homelessness include: residential instability, increased rates of stressful and highly traumatic episodes of life events, exposure to violence both within the communities and families in which they are nested, and exposure to mental illnesses and substance use issues of their parents (Gewirtz, Forgatch, & Wieling, 2008; Masten et al., 1993; Samuels et al., 2010).

It is important to note that although moving to a family shelter may be viewed as a potential relief from the hardships such families may be enduring, it may also present certain difficulties that these families are suddenly confronted with. This move to shelter often involves severing ties with familial and social support structures, disturbances related to child care and school services, as well as many challenges related to adjusting to the shelter environments, which are often crowded and do not allow for privacy (Samuels et al., 2010). Being exposed to adversities regarding homelessness in families can affect a child directly as well as indirectly, with the negative effects of adversity impacting the family level system and having particular impacts on the child's caregiver.

Gartstein, Bridgett, Young, Panksepp, and Power (2013) note that caregivers' internalizing problems may also contribute to the development of children's' self-regulatory abilities (notably, those central to effortful control), by hindering the developmental progression of children's' self-regulatory capabilities (moving towards children being better able to self-regulate, independently). Further, Gartstein, Bridgett, Young, Panksepp, and Power (2013) suggest that this may be related to the overall "goodness of fit" being compromised within parent-child dyads, in which parents with increased experiences of internalizing symptoms and/or stress

find it more difficult to respond with demands and expectations that are appropriate, to their children with poorer or less developed self-regulatory skills and/or higher negative emotionality.

As discussed, infancy and toddlerhood constitute a period of rapid developmental growth. Thus, this experience of homelessness during such a period of increased plasticity as infancy can threaten developmental competence across many domains of functioning. Grounded in past studies and developmental theories, experiences of homelessness have the potential to negatively impact the development of emerging self-regulatory capacities of children during these developmental stages of infancy and toddlerhood, which have been shown to be highly relevant in respect to further developmental outcomes through the life span. However, resilience does occur: many children and families experiencing homelessness show competent functioning despite experiencing risk (e.g., Cutuli & Herbers, 2014; Herbers, Cutuli, Monn, et al., 2014; Luthar, 2006; Narayan, Sapienza, Monn, Lingras, & Masten, 2015; Obradović, 2010).

The Current Study

Given the conceptualization of infancy as a sensitive period for organization of developing systems marked by increased sensitivity to influences that may contribute to developmental trajectories both negatively and positively (Cicchetti & Tucker, 1994), research on experiences of family homelessness and how adversity may contribute to subsequent developmental outcomes is particularly salient. In other words, this perspective highlights infancy as a period of increased plasticity, in which different experiences encountered during this time have increased impact, for good or ill. Relatedly, aspects of dyadic co-regulation concerning positive parenting and children's self-regulation are both emphasized as protective or promotive factors in the resilience literature (Luthar, 2006). Thus, further research on families with infants experiencing homelessness may provide a more nuanced understanding of processes like dyadic co-regulation capable of promoting adaptive functioning among families with young children at very high levels of risk. Previous studies demonstrate how effective parenting contributes to

fostering skills related to self-regulation that are important for positive adaptation among young children (ages 4 to 6) overcoming adversity, and this is in part, via processes of dyadic co-regulation (Herbers, Cutuli, Supkoff, et al., 2014). However, there is notable paucity of similar empirical research focused specifically on families with infants experiencing homelessness. Therefore, this study sought to make a contribution to the growing area of research in developmental science that focuses on resilience among families experiencing homelessness.

Research Questions and Hypotheses

This study aimed to address the following questions: a) what is the relation between maternal internalizing symptomatology and both temperamental reactivity and emerging self-regulatory capacities among infants (ages 0-1) in homeless families residing in emergency shelters, and b) whether dyadic co-regulation within the parent-infant relationship mediated the influence of maternal internalizing symptomatology on infants' reactivity and self-regulatory capacities consistent with a protective effect. The main independent, or predictor variable, was Maternal Internalizing Symptomatology as measured by the Hopkins Symptom Checklist (HSCL-25; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). The dependent variables were Infant Reactivity and Infant Self-regulation; each was examined separately. Dyadic co-regulation was tested as a mediator. Due to insufficient power because of the sample size being small, no demographic variables were included in mediation analyses as control variables.

Hypotheses. This study investigated whether dyadic co-regulation between mothers and infants currently experiencing homelessness mediated the relation between mother-reported internalizing symptomatology and infants' reactivity and self-regulation.

First, I predicted that mother-reported internalizing symptoms would be related to greater infant reactivity and decreased infant self-regulation. Second, I hypothesized that this original association between maternal internalizing symptomatology and infant reactivity and infant self-regulation, would be at least partially mediated by dyadic co-regulation. In this way, mothers'

reports of internalizing symptoms would have an indirect effect, through dyadic co-regulation, that ultimately contributed to infant reactivity and self-regulation, respectively. When this indirect effect was taken into account, I expected for there to be a reduced amount of variance accounted for in outcomes concerning infant reactivity and infant self-regulation.

Preliminary Studies

This work was part of a larger study examining family functioning for families currently residing in emergency housing with a child between the ages of 0 to 12 months. The larger study aimed to better understand parenting and the processes of resilience across multiple domains of functioning among families with small children experiencing homelessness.

Method

Participants

This study drew data from an ongoing investigation examining the effectiveness of parenting interventions and well-being in families experiencing homelessness with an infant aged 0 to 12 months. All dyads stayed at a temporary emergency housing program serving families experiencing homelessness in Philadelphia. Parents were eligible to participate if they were residents of the housing program at the time of recruitment, they were fluent in English, and they had an infant aged 0 to 12 months not previously diagnosed with any developmental disorder that would prevent them from participation in study procedures. If a parent met all eligibility criteria and have more than one infant within age range, the youngest child was selected for participation and included in analyses.

Demographics. A total of 21 parent-infant dyads completed the study (see Table 1). All primary caregivers were mothers (n = 21) and the biological parent of the infant participating in the study. The time spent in shelter for the dyads ranged from 30 to 420 days (M = 144.143, SD = 94.197).

Mothers' ages ranged from 21 to 41 years of age (M = 28.571, SD = 5.202). Seventeen mothers (81%) identified as African American, 2 (9.5%) as White, 1 (4.8%) as Hispanic/Latino, and 1 (4.8%) as members of another group. The majority of mothers (90.5%) were never married. Regarding highest level of education achieved, 17 (81%) had more than a High School degree, with the remaining 4 (19%) having achieved less than a High School degree. Lastly, 13 (61.9%) mothers reported being unemployed at the time of study participation, while 8 (38.1%) had either full-time or part-time employment.

Regarding infants, ages ranged from 1 to 12 months of age (M = 5.524, SD = 3.444). Thirteen infants (61.9%) were male with the remaining 8 infants (38.1%) being identified as

female by mothers. Lastly, concerning infants' ethnicity, 17 (81%) were identified by mothers as African American, 1 (4.8%) as White, and 3 (14.3%) as members of another group.

Procedures

Dyads completed study procedures on-site at the emergency housing program where they were staying. Data was collected using a structured parent interview, a 15-minute parent-child interaction session, and a set of tasks focused on infants' capabilities. Upon completion of each visit, families received a $30 gift card as honorarium for their participation.

Parent interview. Parents responded to questions from a structured interview administered by a trained researcher. All questions were read aloud to minimize issues related to parent literacy and to help ensure that parents understood all questions and response options. The parent interview took approximately 45 minutes to complete.

***Maternal internalizing symptomatology*.** The parent reported on their own internalizing symptoms via the Hopkins Symptom Checklist - 25 (HSCL-25; Derogatis et al., 1974). Research assistants administering the parent interview instructed parents to listen to each item that was read aloud and "decide how much the symptom bothered or distressed you in the last week, including today; you can tell me (1) *not at all*, (2) *a little*, (3) *quite a bit*, or (4) *extremely*." Example items asked within the symptom checklist included: "feeling fearful," "difficulty falling asleep, staying asleep," and "thoughts of ending your life" (see Appendix A for a copy of the measure). Maternal endorsements of internalizing symptoms were summed to create a composite score of parent internalizing symptomatology. Higher scores indicated more emotional distress and internalizing symptoms, whereas lower average scores indicated less emotional distress and internalizing symptoms.

Child assessment. All child sessions were video recorded with the parent present. The child completed two brief episodes from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999a, 1999b), which in conjunction with the included coding

schemes, constitute a validated measure of infant temperamental characteristics using relatively simple stimuli and conditions similar to the experiences that many children typically encounter throughout the life course. Research assistants administered the two Lab-TAB episodes, "Masks" and "Task Orientation (Blocks)," which are described in further detail in the measures section of this manuscript. Each episode took approximately three minutes to administer.

***Infant reactivity and self-regulation*.** The Lab-TAB (Goldsmith & Rothbart, 1999b, 1999c), is a well-developed, standardized measure of children's temperament through a variety of emotion-eliciting episodes that may be conducted in laboratory or field settings. For the purposes of this study, procedures originated from the Prelocomotor Version 3.1 (Goldsmith & Rothbart, 1999c) and Locomotor Version 3.1 (Goldsmith & Rothbart, 1999b) Lab-TAB manuals, designed for use with infants 6 months of age and 12 months of age, respectively. Other researchers have demonstrated successful use of Lab-TAB procedures (i.e., "Masks") to study temperamental and inhibitory characteristics of young children ranging from 9 to 33 months old (Aksan & Kochanska, 2004); initial psychometrics properties of the measure can be found elsewhere (i.e., Gagne, Van Hulle, Aksan, Essex, & Goldsmith, 2011).

Infants' reactivity and self-regulation were measured using selected procedures from the Lab-TAB ("Masks" and "Blocks" episodes). Each episode was developed and chosen with regards to simplicity and appropriateness for use in developmental research. Both episodes required a minimal amount of materials requiring transport that were constructed keeping in mind the safety of participants and research staff as well as the settings in which the research project was conducted. Additionally, the overall amount of time needed to administer the episodes, including set up and clean up, was approximately 10 minutes. No additional research staff above the research assistant that was already conducting the interview was required. Each episode required the families to be videotaped for later coding.

Infant reactivity- Lab-TAB: "Masks" episode. This episode was designed to elicit fear-based temperamental reactivity amongst infants up to 12 months of age in a non-social context

using non-intrusive stimulation (Goldsmith & Rothbart, 1999a, 1999b). During this episode the infant was seated in their parent's lap, in front of a table upon which a gray enclosure was set up.[1] Once settled, the research assistant gave the mother instructions for the episode and showed her a picture of the masks to be used, emphasizing that the session would be discontinued if too distressing for the child. The episode began once the child was oriented towards the opening of the enclosure following a knock produced by the research assistant. Once the child was oriented and his/her attention was focused, the research assistant pulled back the curtain of the enclosure, revealing a mask that was presented to the child for 10 seconds before the curtain was closed once more. There was a five-second pause between each presentation of the masks and prior to the subsequent displays, the researcher knocked behind the opening of the enclosure in order to orient the child's attention. The masks presented during the episode included an evil witch, an old man, a glow-in-the-dark vampire, and a gas mask, in this order (see Figure 1). The full set of instructions followed during the administration of the episode are referenced in Appendix B.

Videos were coded using the standardized, validated Lab-TAB coding scheme. Variables included: a) latency to first fear response; b) intensity of facial fear; c) intensity of distress vocalizations; d) intensity of bodily fear; e) intensity of escape; f) baseline state; and g) parent behavior. The coding sheet for this episode is shown in Appendix C. The coding of these variables allowed for a derived measure of infants' reactivity in response to the "Masks" episode (i.e., *Masks Reactivity*).

Infant reactivity- Lab-TAB: "Task Orientation (Blocks)" episode. In this episode, the infant was given an opportunity to manipulate a set of blocks, allowing for a variety of responses.

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[1] Typically, the infant would be securely seated in a high chair in front of the enclosure, with the mother seated to the left. One of the challenges in conducting research with parent-infant dyads within homeless shelters is the availability of resources. Although many shelter providers do have high chairs, they are for use during feeding times, and it would be insensitive to the needs of families to use the high chairs in each shelter for these administrations. Moreover, not all shelters have the same model and type of high chair. Thus, to decrease a potential source of measurement error and to accommodate the demands of conducting this research within shelters, the practical decision to have the child sit on their parent's lap was necessary.

As suggested in both manuals, motivation primarily accounts for the differences in the amount of manipulation of the blocks. The Blocks episode provided an opportunity to elicit expressions of Motivation, which are further equated with the emotion of Interest. In particular, the parameter of duration of time spent manipulating and exploring the blocks, was of interest as an index of the extent to which infants were interested in exploring objects in their immediate environments (Goldsmith & Rothbart, 1999a, 1999b).

During this episode the infant was seated in the mother's lap in front of a table. Once settled, the researcher gave the mother instructions for the episode followed by the introduction of the blocks with which the child was to play with. Once the blocks were presented to the child, the research assistant left the room for three minutes. The full set of instructions followed during the administration of the episode are referenced in Appendix D.

Videos were coded in order to measure infants' reactivity using the standardized, validated Lab-TAB coding scheme for the "Blocks" episode. Variables included: a) intensity of facial interest; b) duration of looking; c) latency to look away; d) manipulation of stimuli; e) parent behavior; and f) baseline state. The coding sheet for this episode is shown in Appendix E. The coding of these variables allowed for a derived measure of infants' reactivity in response to the "Blocks" episode (i.e., *Blocks Reactivity*).

Infant self-regulation. Infants' self-regulation was measured using the supplementary self-regulation coding scheme appended to the Lab-TAB manuals (see Appendix F). This coding scheme was applied to both the "Masks" and "Blocks" episodes, and scores were summed across each of the six behavioral domains. Within each episode, the following behaviors were coded across each trial: a) duration of attention; b) gaze aversion; c) distraction toward object; d) approach; e) withdrawal; f) looks to mother (parent); g) looks to experimenter; h) exploring; i) struggling/resisting; j) control; k) playing; l) self-stimulation; and m) tension release. Finally, duration of attention, measured the amount of time the child looked at the stimulus, and was scored on a four-point scale. Specifically, for the "Masks" episodes, duration of attention was

measured on the following scale: (0) *not at all*, (1) *1 – 4 seconds*, (2) *5 – 8 seconds*, (3) *9 – 10 seconds*; and for the "Blocks" episodes, duration of attention was measured on the following scale: (0) *not at all*, (1) *1 – 19 seconds*, (2) *20 – 49 seconds*, (3) *50 – 60 seconds*. Disengagement of attention, consists of two behaviors, specifically, gaze aversion and distraction toward object; each was coded dichotomously, either present or absent. Gaze aversion, refers to instances where the child looked away from the stimulus, without focusing on any particular object, whereas Distraction toward object, refers to instances when the child looked at an object unrelated to the episode. Approach and withdrawal behaviors, concern behavioral instances where the child either approached and got closer to, or withdrew and distanced themself from the stimulus, respectively. Each was coded as either present or absent. Behaviors categorized as social strategies included looks to mother and looks to experimenter; both behaviors were coded as either present or absent. Four behaviors were coded, either as present or absent, referring to instances where the child was dealing with the stimulus. Specifically, these four behaviors included exploring, struggling/resisting, control, and playing. Exploring, concerned instances in which the child attended to the stimulus but also inspected it with concentration, in order to understand how the specific stimulus worked. Struggling/resisting, included behaviors such as the child pulling, kicking, arching his/her back, or pushing, etc. Control behaviors included those seen if the child tried to control the situation by attempting to move stimulus; for example, by pushing the stimulus away. Playing, refers to behavioral instances in which the child played with stimulus in an appropriate manner. Lastly, redirected action, concerns two sets of behaviors, namely, self-stimulation and tension release, each of which was coded as present or absent. Self-stimulation was coded when the child used a body part to engage in repetitive manipulation, as in the example of sucking their thumb. Tension release, was coded in instances where the child engaged in high-energy behavior that had no apparent instrumental focus, as exemplified by screaming or fast kicking of the legs.

Coding and statistical considerations for Lab-TAB data. I coded all videos of the Lab-TAB episodes as the single coder. First, I coded Infant Self-regulation for all participants. Following this, I coded all videos for Infant Reactivity. This was done to minimize observer bias from concurrently assessing behaviors within the episodes that may be a function of behavioral reactions that the infants displayed, which could potentially reflect levels of regulation or modulation.

The following coding and statistical considerations were derived from the information and suggestions found in the Lab-TAB Prelocomotor and Locomotor (Versions 3.1) manuals (Goldsmith & Rothbart, 1999a, 1999b):

The *dimensions* or aspects of temperamental reactivity that were selected included: a) fear/sadness, and b) interest/persistence. These dimensions corresponded to the *episodes*, "Masks," and "Task Orientation (Blocks)," respectively. A series of masks and a set of three blocks were presented in multiple *trials* to the infant within the "Masks" and "Blocks" episodes, respectively. All episodes were divided into shorter time intervals, referred to as *epochs*, for coding purposes. Infant *responses*, such as smiling, reaching, manipulation, or crying, were coded within the epochs or trials. Some of the infant responses, such as the presence of a startle response were coded dichotomously, based on whether the behavior was observed in the video recording. For the majority of other infant responses, coders timed or rated response *parameters*, according to the authors' guidelines in the manual. Examples of response parameters coded included observations of latency to responses, duration of behaviors, and intensity of responses.

The level of analysis was carried out at the level of single episodes. For each single episode, descriptive statistics (e.g., mean, SD, minimum, maximum, skewness, and kurtosis) were computed using the raw data (which included behavioral counts, latencies, intensities, peak intensities of responses, and averages). The histograms for all variables were plotted and then reviewed, to determine whether any transformation (e.g., sqrt(x), 1/sqrt(x), and 1/x) of the data would significantly help normalize distributions. I then formed composite variables for use in

study analyses once data reduction was completed. Lower and higher order composites were moved in order to be combined with other data resulting from other episodes or procedures.

Parent-child interaction. For the parent-child interaction session, dyads were video-recorded while playing together with a standardized selection of age-appropriate toys. Prior to beginning the free play session with their child, parents received instructions from research assistants to "play with their child as they normally would," and research assistants then left the room for a duration of 15-minutes. These video recordings were later coded as an observational measure of behaviors of both parents and children, and the quality of the parent-child relationship more globally.

Dyadic co-regulation. Dyadic co-regulation was assessed by coding parent-child interactions during the free play session. All dyads were presented with a bin, which included a play mat for the dyad to use while on the ground, and a standardized set of ten age-appropriate toys for the parent and infant to play with (e.g., a ring stacker, a shape sorter, a plush doll). Video recordings of the interaction sessions were coded for observations indexing patterns of parent-infant interaction and the quality of the dyad's relationship. Specifically, interactions within the parent-child relationship were assessed for dyadic measures reflecting a dyadic co-regulation.

Two coding schemes were utilized to code dyadic behavior: 1) the Mutually Responsive Orientation Scale (MRO; Kochanska, personal communication, October 6, 2016); and 2) the Parent Child Interaction System (PARCHISY; Deater-Deckard, 2000; Deater-Deckard, Pylas, & Petrill, 1997). MRO and PARCHISY differ initially, with respect to the age range of the intended population when the measures were first developed. While MRO was originally developed for use with samples consisting of parent-child dyads where children ranged in age from 7-25 months old, PARCHISY, was initially designed as a research tool used for dyads with children aged 3-12 years (Funamoto & Rinaldi, 2015). However, both MRO and PARCHISY have been used with infant samples and are reported to have high reliability in the literature, which further strengthened the use of both the coding scales in the current study. The MRO coding scheme was

used to measure mutual responsiveness in mother-child and father-child relationships consisting of children aged seven months and again at 15-months (Aksan, Kochanska, & Ortmann, 2006), and reported within the literature to be reliable with a Cronbach's α = .92 (Funamoto & Rinaldi, 2015). While originally intended for use with parent-child dyads with children 3-12 years old, the developer of the PARCHISY acknowledges that although the measure was not created specifically for infant samples, it can be used in studies with infants (Deater-Deckard, personal communication, October 4, 2016). For example, Madigan, Plamondon, Browne, and Jenkins (2016) used PARCHISY in their study examining the stability and variability in maternal behavior during mother-child interactions at four time-points when children were aged 2, 18, 36, and 54 months, respectively, with a newborn included in their first assessment period. Furthermore, alongside the MRO scale, PARCHISY was reported within the literature to be reliable with a Cronbach's $\alpha \geq .80$ (Funamoto & Rinaldi, 2015).

Mutually Responsive Orientation (MRO) scale. MRO is a measure of dyadic mutuality, consisting of a single, global code that is based on four subscales: Coordinated Routines; Harmonious Communication; Mutual Cooperation; and Emotional Ambiance. Lotzin et al. (2015) identify the MRO coding scheme in their meta-analysis as one of ten parent-child observational tools demonstrating four of five validity domains. The validity domains assessed included: test content, response process, internal structure, relations to other variables, and consequences (for further details, see Lotzin et al. 2015). However, no observational tool included in their meta-analysis demonstrated validity evidence in all five validity domains (Lotzin et al. 2015).

In assessing the parent-infant relationship for the current study, raters coded MRO as an overall construct while simultaneously taking into account the entire context of the parent-infant interaction and considering all four dimensions making up the subscales (see Appendix G). For MRO, raters assigned a score based on the entire context of interactions, on a scale ranging from 1 (*very untrue of dyad, very low MRO, poor relationship*) to 5 (*very true of dyad, very high MRO, excellent relationship*).

To say that a dyad had a high mutually responsive orientation is akin to saying that within the parent-infant relationship, both members of the dyad, together, develop and adopt routines that are coordinated, smooth, and flow easily (Aksan et al., 2006). Moreover, Aksan et al. (2006), describe how differences in MRO within the parent-child relationship are fairly evident in the emotional ambiance that surrounds the dyad; they quickly and effectively de-escalate negative affect, partners mutually show clear instances of humor and affection, and experience joyful moments together. Further, the authors of the updated MRO coding scheme, which was used in the current study, stress that the revisions address prior limitations referring to how labor intensive the previous coding system was (Kochanska, Aksan, Prisco, & Adams, 2008). Specifically, the authors highlight how, rather than making inferences based on the behaviors and emotions of both members in the parent-child dyad, researchers using the updated code are able to capture an explicit measure of interaction quality at the dyadic level.

Parent Child Interaction System (PARCHISY) scale. The PARCHISY (Deater-Deckard, 2000; Deater-Deckard et al., 1997) is an observational measure consisting of various coding schemes that consider multiple aspects of parent-child interactions. Using the coding system allowed for coding of observed behaviors during parent-child interactions at three different levels, in which the unit of analysis (UA) differs: 1) seven codes are at the parent UA; 2) eight codes are at the child UA; and 3) three codes at the dyadic UA. The current study used the PARCHISY to assess parent-infant interactions at the dyadic level, along the domains of: reciprocity, conflict, and cooperation. For each dyadic code, raters assigned a score based on the entire context of the parent-child interaction, on a scale ranging from 1 (*no instances*) to 7 (*occurring throughout the whole task*). Further information on the scales used for each of the three dyadic codes, including details for each anchor point of the scales, can be found in Appendix H.

For analyses, scores for dyadic reciprocity, conflict (reversed), and cooperation, were combined to create a mutuality subscale for the dyad. For this mutuality subscale, higher scores

were indicative of dyads with levels of higher, more optimal levels of reciprocity, conflict (reversed), and cooperation.

The coding manual for PARCHISY includes examples of behaviors to guide in assigning a score for the dyad along each measured domain. Reciprocity was assessed on the basis of shared positive affect, eye contact, and a "turn taking" (i.e., conversation-like) quality of interaction between both members of the dyad. Conflict included minor or major disagreement as evidenced by mutual or shared negative affect. Specific examples provided included arguing and tussling over toys. Lastly, cooperation was defined as explicit agreement and discussion, about how to proceed with and complete a given task.

Planned Coding of Observational Measures

While observational measures are generally preferred for assessing the parent-child relationship in comparison to other methods, a certain level of caution must be exercised in order to minimize the amount of potential bias that can negatively impact the reliability and validity of the measured constructs. First, it is important to appropriately operationalize the constructs of interest and to ensure that the coding scheme(s) used measure the construct that is intended to be measured in a reliable way. Thus, both MRO and PARCHISY were selected on the basis of their reported reliability and validity for assessing aspects of dyadic co-regulation present in the parent-child relationship (Aspland & Gardner, 2003; Funamoto & Rinaldi, 2015; Lotzin et al., 2015). Relatedly, in order to increase the confidence that both coding schemes were valid with respect to the construct they were selected to measure, I examined this assumption by including the codes for MRO and PARCHISY along with average scores from the HSCL-25, in a zero-order correlation matrix (see Table 1 for means, standard deviations, and bivariate correlations). This allowed me to analyze whether all observational measures were related to one another and similarly hung together within construct space, and also related to maternal internalizing

symptomatology in a similar manner. Lastly, as further described below, steps were taken to ensure reliability between coders wherever possible.

Given that observational measures included assessments of dyadic co-regulation through the parent-child interaction along with assessments of infant reactivity and infant self-regulation through coding of the Lab-TAB episodes, I had two independent teams of raters. Independent raters, who had not met the families and were otherwise blind to the specific hypotheses and other observational measures coded in the present study, coded all of the parent-child interactions for measures of dyadic co-regulation. Four research assistants (undergraduate or graduate students in psychology at Rutgers University-Camden or Villanova University) were trained in coding for *mutual responsiveness* (MRO), *dyadic reciprocity*, *dyadic conflict*, and *dyadic cooperation* (PARCHISY). Additionally, I served as the primary and sole coder for measures of *Infant Reactivity* and *Infant Self-regulation* (Lab-TAB). For measures of *Dyadic Co-regulation*, training to reliability was accomplished through the use practice cases of parent-child interaction videos from a pilot sample consisting of infants up to 12 months old that participated in previous cohorts of the larger study that I sampled from. All raters were trained to reliability with an ICC $\geq$ .70, and once initial reliability was established, 100% of real cases were double-coded to establish inter-rater reliability for the sample on each independent measure, with an expected ICC $\geq$ .70. Finally, discrepancies between raters with a rater difference score > 1 point on the respective coding scale were discussed by the raters in order to reach consensus and resolve any discrepancy. ICC's for the individual coding scales used to assess Dyadic Co-regulation were as follows: MRO ICC = .602, PARCHISY-Dyadic Conflict ICC = .470, PARCHISY-Dyadic Cooperation ICC = .716, and lastly, PARCHISY-Dyadic Reciprocity ICC = .828.

Statistical Analyses

I used a series of hierarchical linear regressions to test each hypothesis. First, I analyzed the relation between *Maternal Internalizing Symptomatology* and *Infant Reactivity* and *Infant*

Self-regulation. Second, I tested whether *Dyadic Co-regulation* acted as a mediating mechanism through which *Maternal Internalizing Symptomatology* indirectly affected *Infant Reactivity* and *Infant Self-regulation*, respectively.

Hypothesis testing. I used two separate multiple regression models in order to conduct a mediation analysis. The purpose of these two separate multiple regression models was to test the extent of which dyadic co-regulation within the parent-infant relationship acted as a mediating mechanism. The first model (see Figure 2) tested for mediation between the relation between the independent variable of *Maternal Internalizing Symptomatology* and the dependent variable of *Infant Reactivity*. Relatedly, the second model (see Figure 3) tested for the degree to which *Dyadic Co-regulation* mediated the relation between *Maternal Internalizing Symptomatology* and the dependent variable of *Infant Self-regulation*. Due to insufficient power because of the sample size being small, no demographic variables were included in the mediation analyses as control variables.

To strengthen the validity of these analyses, an approach that is widely recommended in the social sciences literature was used. This approach included a bootstrapping method that is designed for use with small samples (Hayes, 2013; Preacher & Hayes, 2008). First, in each separate model, I took *Infant Reactivity* and *Infant Self-regulation*, and regressed these variables onto *Maternal Internalizing Symptomatology*, respectively. Following this, I regressed both *Infant Reactivity* and *Infant Self-Regulation* onto *Dyadic Co-regulation* (a composite variable with two indicators- MRO scores, and scores from the three dyadic codes (reciprocity, conflict (reversed), and cooperation) from the PARCHISY) and separately regressed *Dyadic Co-regulation* on *Maternal Internalizing Symptomatology*, for each respective model. Lastly, I regressed *Infant Reactivity* and *Infant Self-regulation* onto *Dyadic Co-regulation* and *Maternal Internalizing Symptomatology* together, for each model, respectively. For each mediation analysis, the indirect effect was calculated using 5000 bootstrapped samples using the PROCESS macro (Hayes, 2013).

Results

Descriptive bivariate correlations are shown in Table 2. Along with the predictor variables (i.e., maternal internalizing symptomatology and dyadic coregulation) and outcome variables of interest (i.e., infant reactivity and self-regulation), potential covariates were included in the initial descriptive bivariate correlations. Potential covariates included infants' age, sex, and ethnicity, mothers' age, ethnicity, education status, employment status, and marital status, and lastly, how many days the dyad had spent in shelter at the time of study participation.

Infants' reactivity and self-regulation were significantly correlated with one another in the positive direction ($r = .737$, $p < .001$), which was expected. Additionally, maternal internalizing symptomatology was significantly and positively correlated with infant reactivity ($r = .543$, $p = .011$). In contrast, however, maternal internalizing symptomatology was not significantly correlated with infant self-regulation ($r = .343$, $p = .128$).

There were no significant associations found between study variables and both infants' gender and ethnicity, respectively. However, significant associations between infants' age and study variables emerged. Infants' age was significantly associated with both infants' reactivity ($r = .727$, $p < .001$), and self-regulation ($r = .673$, $p = .001$), respectively. Moreover, a significant and positive relation between infants' age and maternal internalizing symptomatology ($r = .446$, $p = .043$) was found. There was also a significant relation between maternal age and dyadic coregulation ($r = .481$, $p = .027$), such that dyads with higher mean levels of dyadic coregulation observed consisted of mothers that were older. Lastly, the amount of days spent in shelter was found to be positively associated with maternal internalizing symptomatology, however, this relation was not significant ($r = .426$, $p = .054$).

Maternal Internalizing Symptomatology

All mothers participating in the study completed the HSCL-25, measuring experiences of maternal internalizing symptomatology within the past week. For analyses, an average of the 25

items was calculated, where higher average scores were indicative of greater experiences of maternal internalizing symptomatology during the past week. Maternal endorsements on the HSCL-25 ranged from 1.08 to 2.36, translating to "(1) - *Not at all*" to "(2) - *A little*" on the Likert scale responses. On average, maternal internalizing symptomatology (M = 1.638, SD = 0.387), did not reach the clinical cut-off level, 1.75 (see Sandanger et al., 1998). However, of the 21 mothers included in the study sample, 10 mothers, accounting for 47.6% of the study sample, experienced internalizing symptomatology above clinical cut-off levels.

Dyadic Coregulation

A team of raters coded the 15-minute parent-child interaction videos using four observational scales, one scale consisting of the Mutually Responsive Orientation (MRO) scale (Kochanska, personal communication, October 6, 2016), and the remaining three consisting of the Dyadic Conflict, Dyadic Cooperation, and Dyadic Reciprocity scales adapted from the PARCHISY (Deater-Deckard, 2000; Deater-Deckard et al., 1997). Means, standard deviations, and correlations between all four scales are presented in Table 3. To create the Dyadic Coregulation composite score, the three scales adapted from the PARCHISY (i.e., Dyadic Conflict (reverse-coded), Dyadic Cooperation, and Dyadic Reciprocity) were summed together. This composite variable was significantly and positively associated with the measure of MRO (r = .844, $p < .001$), thus both were summed together to create the overall composite measure of Dyadic Coregulation, with higher values indicating higher levels of co-regulation observed within the dyad. The lower and upper limits of values that dyads could have on the Dyadic Coregulation composite were 4 and 26, respectively, which should be taken into account when interpreting means and standard deviations.

Infant Reactivity

To create the Infant Reactivity composite score, the coded observations from both the Lab-TAB "Masks" and "Blocks" episodes were used. Masks Reactivity was calculated using the

following coded variables, according to the procedure outlined in the Lab-TAB manual (Goldsmith & Rothbart, 1999a, 1999b): Intensity of Facial Fear, Intensity of Vocal Distress, Intensity of Bodily Fear, Intensity of Escape Behavior, and Presence of Startle Response. Episode-level ratings of these variables were first intercorrelated and then summed together to represent the level of reactivity displayed by infants during the Lab-TAB "Masks" episode (see Table 4 for bivariate correlations). Blocks Reactivity was calculated using the following coded variables, according to the same procedure outlines in the Lab-TAB manual: Intensity of Facial Interest, Intensity of Manipulation of Stimuli, and Duration of Looking. Episode-level ratings of these variables were first intercorrelated and then summed together to represent the level of reactivity displayed by infants during the Lab-TAB "Blocks" episode (see Table 5 for bivariate correlations). In order to compute the Infant Reactivity composite score, the Masks Reactivity and Blocks Reactivity scores were summed together (see Table 6 for means, standard deviations, and bivariate correlations).

Infant Self-Regulation

To create the Infant Self-regulation composite score, the coded observations from the Emotion Regulation Appendix of the Lab-TAB manual, during both the "Masks" and "Blocks" episodes were used. The scale items from the Emotion Regulation Appendix of the Lab-TAB manual are as follows: Duration of Attention, Gaze Aversion, Distraction, Approach, Withdrawal, Looks to Mother, Looks to Experimenter, Exploring, Struggling/Resisting, Control, Playing, Self-Stimulation, and Tension Release. Masks Regulation was computed as the sum of the 13-item scale during the Lab-TAB "Masks" episode (see Table 7 for bivariate correlations). Similarly, Blocks Regulation was computed using the same procedure, summing across the 13-item scale during the Lab-TAB "Blocks" episode (see Table 8 for bivariate correlations). In order to create the Infant Regulation composite score, the Masks Regulation and Blocks Regulation scores were summed together (see Table 9 for means, standard deviations, and bivariate correlations.

Testing Study Hypotheses

Two separate multiple regression models were used in order to conduct a mediation analysis. Using the two separate multiple regression models allowed for testing the extent of which dyadic co-regulation within the parent-infant relationship acted as a mediating mechanism. The mediation of Dyadic Co-regulation between the association among the independent variable of Maternal Internalizing Symptomatology and the dependent variable of Infant Reactivity was examined in the first model. Similarly, the second model examined the degree to which Dyadic Co-regulation mediated the relation between the independent variable of Maternal Internalizing Symptomatology and the dependent variable of Infant Regulation. No covariates were included in either models due to insufficient statistical power.

Infant reactivity. To test the hypothesis that the relationship between Maternal Internalizing Symptomatology and Infant Reactivity is mediated by Dyadic Co-regulation, four regression analyses were conducted, each testing an independent path for the hypothesized mediation model (see Figure 4 for model and Table 10 for regression model output). First, to test the effect of Maternal Internalizing Symptomatology on Infant Reactivity, Path C in Figure 4, Infant Reactivity was regressed onto Maternal Internalizing Symptomatology. Maternal Internalizing Symptomatology was significantly related to Infant Reactivity (B = 4.400, β = 0.543, p = .011). As Maternal Internalizing Symptomatology increased, Infant Reactivity was expected to increase as well. Next, to test the effect of Maternal Internalizing Symptomatology on Dyadic Co-regulation, Path A in Figure 4, Dyadic Co-regulation was regressed onto Maternal Internalizing Symptomatology. Here, Maternal Internalizing Symptomatology was not significantly associated with Dyadic Co-regulation (B = -1.556, β = -0.225, p = .327). The third step was to test the effect of Dyadic Co-regulation on Infant Reactivity, Path B in Figure 4. Infant Reactivity was regressed onto Dyadic Co-Regulation. Dyadic Co-regulation was not significantly related to Infant Reactivity (B = -0.144, β = -0.123, p = .595). Lastly, the effect of Maternal

Internalizing Symptomatology on Infant Reactivity was examined controlling for the effect of Dyadic Co-regulation, Path C' in Figure 4. In this final regression, Infant Reactivity was regressed onto Maternal Internalizing Symptomatology and Dyadic Co-regulation. Maternal Internalizing Symptomatology was significantly associated with Infant Reactivity (B = 4.398, β = -0.001, p = .015), such that greater Maternal Internalizing Symptomatology was related to decreased Infant Reactivity. However, Dyadic Co-regulation was not significantly related to Infant Reactivity (B = -0.001, β = -0.001, p = .996). To calculate the indirect effect of Maternal Internalizing Symptomatology through Dyadic Co-regulation, the PROCESS macro by (Hayes, 2013) was used. The indirect effect was calculated using 5000 bootstrapped intervals. The indirect effect was not significant B(Dyadic Co-regulation) = 0.002, *Boot95%CI* [-1.172, 1.574].

Infant self-regulation. To test the second hypothesis of whether the relationship between Maternal Internalizing Symptomatology and Infant Self-Regulation is mediated by Dyadic Co-regulation, four regression analyses were conducted, each testing an independent path for the hypothesized mediation model (see Figure 5 for model and Table 11 for regression model output). First, Path C in the model (see Figure 5), the direct effect of Maternal Internalizing Symptomatology on Infant Self-Regulation was examined. Infant Self-Regulation was regressed onto Maternal Internalizing Symptomatology. No significant relationship was found (B = 3.045, β = 0.343, p = .128). Path A in the model (see Figure 5), the effect of Maternal Internalizing Symptomatology on Dyadic Co-regulation was examined next. Dyadic Co-regulation was regressed onto Maternal Internalizing Symptomatology and no significant association was found (B = -1.556, β = -0.225, p = .327). The third step was to test the effect of Dyadic Co-regulation on Infant Self-Regulation, corresponding to Path B in Figure 5. Here, Infant Self-Regulation was regressed onto Dyadic Co-regulation. The effect of Dyadic Co-regulation on Infant Self-Regulation was nonsignificant (B = 0.316, β = 0.247, p = .281). Lastly, the effect of Maternal Internalizing Symptomatology on Infant Self-Regulation was examined controlling for the effect of Dyadic Co-regulation, Path C' in Figure 5. For this final regression, Infant Self-Regulation was

regressed onto Maternal Internalizing Symptomatology and Dyadic Co-regulation. No significant relation was found for Maternal Internalizing Symptomatology (B = 3.726, β = 0.419, p = .064), and Dyadic Co-regulation (B = 0.437, β = 0.341, p = .126), respectively. The indirect effect of Maternal Internalizing Symptomatology through Dyadic Co-regulation was calculated with 5000 bootstrapped intervals, using the PROCESS macro by (Hayes, 2013). No significant indirect effect was found *B*(Dyadic Co-regulation) = -0.681, *Boot 95%CI* [-3.630, 0.723].

Discussion

The ability to self-regulate one's self and experiences of positive parenting early in development are two consistently reported factors that are influential for children's displays of resilience. Previous studies report on how effective parenting contributes to fostering skills related to self-regulation that are important for positive adaptation among young children (ages 4 to 6) overcoming adversity, and this is in part, via processes of dyadic co-regulation (Herbers, Cutuli, Supkoff, et al., 2014). This study was interested in examining similar processes in action but at a slightly earlier time in development. In particular, families with infants experiencing homelessness were of interest. Two hypotheses were tested in this study. The first hypothesis examined the relations between mother-reported internalizing symptoms and both infant reactivity and self-regulation. The second hypothesis examined in the study, concerned whether experiences of dyadic co-regulation in interaction between mothers and infants currently experiencing homelessness mediated the relation between mother-reported internalizing symptomatology and infants' reactivity and self-regulation.

Regarding the first hypothesis, results of this study indicated that early experiences of adversity, namely exposure to maternal internalizing symptomatology, were related to infants' reactivity. This finding is in line with previous research suggesting that maternal internalizing symptoms can have negative influence on early parent-child relationships with consequences for the development of children. In this sample, increased maternal internalizing symptomatology was significantly related to greater infant reactivity. However, while both infant reactivity and infant self-regulation were related to one another, maternal internalizing symptomatology did not seem to correlate with infants' self-regulatory capacities to the same extent. Thus, the first hypothesis, namely that mother-reported internalizing symptoms would be related to greater infant reactivity and decreased infant self-regulation was at least only partially supported. The mediation analysis for both the outcome of infant reactivity and infant self-regulation produced

null results overall. The indirect effect of maternal internalizing symptomatology on both infant reactivity and infant self-regulation, through dyadic co-regulation was nonsignificant in each model.

In this study, it was found that greater maternal internalizing symptomatology was significantly related to greater infant reactivity, despite the relation between maternal internalizing symptomatology and infant self-regulatory capacities not being significant. Linkages between maternal internalizing symptomatology and infant reactivity and self-regulatory capacities are well documented in the literature. These links are argued to exist due to a variety of potential mechanisms, that are not yet fully understood. Thus, although it is plausible that increased maternal internalizing symptomatology negatively affects infant development resulting in greater reactivity, it is also possible that infants who are more temperamentally reactive (and also possess poorer self-regulatory capacities) due to a number of other possible factors, provide further challenges to mothers who may already be struggling to adequately cope with the new experiences inherent in parenthood. As such, further research is required to disentangle the direction of effects related to the relations observed. Additionally, while infant reactivity and self-regulatory capacities may certainly be affected directly by factors related to maternal characteristics or risks, it is possible that these linkages may also be due to other exogenous factors, including behavioral genetic, environmental, and/or epigenetic influences. For example, it is possible for increased reactivity and dysregulation be intergenerationally transmitted from the mothers' parents to her, and once the mother herself becomes a parent, genes begin to be expressed affecting caregiving behaviors, subsequently biologically embedding greater risk for infants' developing reactivity and self-regulatory capacities (Deater-Deckard & Panneton, 2017).

Study Strengths and Limitations

A strength of this study included the use of objective and validated measures for assessing dyadic co-regulation within the interactions of the parent-infant dyad. It is often

difficult to study behaviors of infant reactivity and self-regulation as they occur in everyday life for young children experiencing adversity like homelessness. The Lab-TAB (Goldsmith & Rothbart, 1999a, 1999b) provides a more objective measure of infant reactivity and self-regulation in comparison to parents' retroactive reporting of infant reactivity and their ability to regulate.

Several limitations to this study require acknowledgment. First, the sample size is quite small. The size of the study's sample limits the statistical power to find effects capable of potentially supporting the study hypotheses. Moreover, since the sample size was so small, no potential covariates were included in the mediation analyses, despite the emergence of significant bivariate correlations with demographic information and key study variables. It will be important for future investigations aimed at understanding the effects of early adversity on infants' reactivity and self-regulation through dyadic co-regulation, to do so with larger samples of parent-infant dyads experiencing homelessness. Moreover, future investigations should examine such associations longitudinally, rather than cross-sectionally, as was done in this study. Indeed, the likelihood that mediation can attempt to reveal causality is especially questionable in cross-sectional designs and this limitation must be addressed in future studies aiming to address the gap remaining in the literature following this study. Another major limitation of this investigation was the lack of reliability coding for the main outcome variables of infant reactivity and self-regulation. This methodological flaw should be rectified in future studies as it allows for great uncertainty with respect to the interpretation of results.

Conclusion

In conclusion, this study makes some initial contributions to the literature. Past research suggests factors like early positive caregiving experiences and competent self-regulatory functioning are important among kindergarten-aged children and among youth experiencing family homelessness. However, prior to this study, links between these factors among infants in

homeless families have not been investigated, despite infancy being a period of rapid development and plasticity. While there was support for the hypothesis that increased maternal internalizing symptomatology may negatively relate to aspects of infant development, namely, with respect to infants' reactivity, this study was not able to address ways in which this association could unfold with respect to dyadic co-regulation experienced in early interactions. Moreover, whether similar links exist and the process by which they unfold is also still unclear with respect to infants' emerging self-regulatory capacities within the context of family homelessness. This investigation provides a valiant first attempt at studying the potential, mediating role of dyadic co-regulation as a protective factor for infants' developmental outcomes of reactivity and self-regulation. However, there still exists a current gap in the literature concerning risk and resilience with respect to experiences of homelessness for families with an infant living in emergency housing.

Table 1

Bivariate Correlations Among and Descriptive Statistics For Dyadic Interaction Codes and Maternal Internalizing Symptomatology

Variables	*M* (*SD*)	1.	2.	3.	4.	5.
1. Mutually Responsive Orientation	2.53 (0.54)	--				
2. Dyadic Conflict	4.51 (1.09)	.70**	--			
3. Dyadic Cooperation	3.06 (0.95)	.72**	.53*	--		
4. Dyadic Reciprocity	2.69 (0.98)	.43†	.08	.31	--	
5. Maternal Internalizing Symp.	1.64 (0.39)	-.12	-.09	-.30	-.16	--

Notes. $N = 21$. For Dyadic Conflict, values represented were reverse scored to align the scale direction with the other coded measures. Symp. = Symptomatology

** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 2

Bivariate Correlations Among and Descriptive Statistics For Key Study Variables

Variables	*M* (*SD*)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Maternal Internalizing Symp.	1.64 (3.44)	--												
2. Dyadic Co-regulation	12.79 (2.68)	-.23	--											
3. Infant Reactivity	6.31 (3.14)	.54*	-.12	--										
4. Infant Self-regulation	15.69 (3.44)	.34	.25	.74**	--									
5. Days In Shelter	144.14 (94.20)	.43†	-.35	.17	-.01	--								
6. Infant Age	5.52 (3.44)	.45*	-.03	.73**	.67**	.31	--							
7. Infant Sex		-.03	-.06	-.22	-.31	.21	-.17	--						
8. Infant Ethnicity		-.34	.11	-.02	-.00	-.04	.10	.29	--					
9. Parent Age	28.57 (5.20)	.10	.48*	-.15	-.04	.11	-.11	-.38	-.17	--				
10. Parent Ethnicity		.03	.19	.37	.39	-.08	.21	-.15	-.34	.14	--			
11. Parent Education		.08	.12	-.38	-.19	.03	-.15	.13	-.46*	.21	.09	--		
12. Parent Employment		-.24	-.07	-.36	-.21	-.02	-.35	-.01	.29	.38	-.15	.13	--	
13. Parent Marital Status		-.14	-.21	.16	-.01	.08	.34	.08	.31	-.44*	-.21	-.26	-.26	--

Notes. $N = 21$. For Infant Sex, 0 = female, 1 = male. For Infant Ethnicity, 0 = Other, 1 = African American, 2 = White, 3 = Hispanic/Latino. For Parent Ethnicity, 0 = Other, 1 = African American, 2 = White, 3 = Hispanic/Latino. For Parent Education, 0 = greater than high school, 1 = less than high school. For Parent Employment, 0 = employed, 1 = unemployed. For Parent Marital Status, 0 = divorced, 1 = never married. Symp. = Symptomatology

** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 3

Bivariate Correlations Among and Descriptive Statistics For Parent-Child Interaction Codes

Variables	*M* (*SD*)	1	2.	3.	4.
1. Mutually Responsive Orientation	2.53 (0.54)	--			
2. Dyadic Conflict	4.51 (1.09)	.70**	--		
3. Dyadic Cooperation	3.06 (0.95)	.72**	.53*	--	
4. Dyadic Reciprocity	2.69 (0.98)	.43†	.08	.31	--

Notes. $N = 21$. For Dyadic Conflict, values represented were reverse scored to align the scale direction with the other coded measures.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 4

Bivariate Correlations Among and Descriptive Statistics For Infants' Masks Reactivity Codes

Variables	*M* (*SD*)	1.	2.	3.	4.	5.
1. Facial Fear	1.10 (0.57)	--				
2. Bodily Fear	0.92 (0.40)	.64**	--			
3. Vocal Distress	0.41 (0.54)	.10	.34	--		
4. Escape Behavior	0.77 (0.42)	.43	.49*	.16	--	
5. Startle Response	0.24 (0.19)	.40	.10	.01	.47*	--

Notes. $N = 21$.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 5

Bivariate Correlations Among and Descriptive Statistics For Infants' Blocks Reactivity Codes

Variables	*M* (*SD*)	1.	2.	3.
1. Facial Interest	0.73 (0.57)	--		
2. Manipulation of Stimuli	1.06 (1.03)	.85**	--	
3. Duration of Looking	1.08 (0.77)	.88**	.76**	--

Notes. $N = 21$.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 6

Bivariate Correlations Among and Descriptive Statistics For Infants' Episode-Level Reactivity Scores

Variables	*M* (*SD*)	1.	2.
1. Masks Reactivity	3.44 (1.45)	--	
2. Blocks Reactivity	2.87 (2.22)	.43†	--

Notes. $N = 21$.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 7

Bivariate Correlations Among Infants' Masks Self-Regulation Codes

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Duration of Attention	--												
2. Gaze Aversion	-.36	--											
3. Distraction	-.81**	.58**	--										
4. Approach	.33	.18	-.01	--									
5. Withdrawal	.09	.29	.27	.44*	--								
6. Look to Mother	.04	.11	.20	.32	.51*	--							
7. Look to Experimenter	.01	.11	.05	-.35	-.01	-.19	--						
8. Exploring	.23	.27	.02	.85**	.47*	.26	-.34	--					
9. Struggling/Resisting	-.15	-.08	.09	.32	.38	.24	-.18	.26	--				
10. Control	-.08	-.16	.02	-.03	-.01	-.30	.42	-.17	.35	--			
11. Playing	.23	.18	-.01	.63**	.19	.13	-.32	.73**	.11	.05	--		
12. Self Stimulation	-.36	.03	.15	-.43	-.30	-.10	-.13	-.33	-.06	-.05	-.15	--	
13. Tension Release	.05	-.58**	-.19	-.04	-.11	-.30	-.21	-.03	.33	.19	.02	.08	--

Notes. $N = 21$.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 8

Bivariate Correlations Among Infants' Blocks Self-Regulation Codes

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Duration of Attention	--												
2. Gaze Aversion	.54*	--											
3. Distraction	-a	-a	--										
4. Approach	.67**	.83**	-a	--									
5. Withdrawal	.38	.77**	-a	.57**	--								
6. Look to Mother	-.52*	-.47*	-a	-.56**	-.19	--							
7. Look to Experimenter	-a	-a	-a	-a	-a	-a	--						
8. Exploring	.80**	.54*	-a	.68**	.34	-.50*	-a	--					
9. Struggling/Resisting	-.11	.19	-a	-.02	.33	.05	-a	-.20	--				
10. Control	.79**	.68**	-a	.80**	.49*	-.62**	-a	.87**	-.11	--			
11. Playing	.67**	.46*	-a	.62**	.23	-.56**	-a	.71**	-.17	.74**	--		
12. Self Stimulation	-.24	-.09	-a	-.12	.12	.09	-a	-.44*	.51*	-.29	-.29	--	
13. Tension Release	-.11	.05	-a	-.09	-.13	.17	-a	-.11	.21	-.14	-.01	.10	--

Notes. $N = 21$. -a denotes cases in which a bivariate correlation was unable to be computed due to at least one variable being a constant. Occurrences of an infant looking to the experimenter during the administration of the Lab-TAB Blocks episode was constant as the experimenter was instructed to leave the room for the duration of the task after providing mothers with instructions. Distraction was also coded as a constant as all infants remained engaged in the task; brief diversions in infants' attention were noted, however they did not persist for durations of time that would be codable under the coding instructions for the Distraction code.

** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 9

Bivariate Correlations Among and Descriptive Statistics For Infants' Episode-Level Self-Regulation Scores

Variables	*M* (*SD*)	1.	2.
1. Masks Regulation	6.64 (1.65)	--	
2. Blocks Regulation	9.04 (2.18)	.61**	--

Notes. $N = 21$.
** $p \leq .01$ * $p < .05$ † $p < .06$.

Table 10

Summary of Mediation Analysis Predicting Infant Reactivity

	β	*SE*
Model Step 1: Predicting Infant Reactivity		
Maternal Internalizing Symptomatology	0.543	1.560
	R^2 = 0.295*	
Model Step 2: Predicting Dyadic Co-regulation		
Maternal Internalizing Symptomatology	-0.225	1.547
	R^2 = 0.051, *ns*	
Model Step 3: Predicting Infant Reactivity		
Dyadic Co-regulation	-0.123	0.266
	R^2 = 0.015, *ns*	
Model Step 4: Predicting Infant Reactivity		
Maternal Internalizing Symptomatology	0.543	1.644
Dyadic Co-regulation	-0.001	0.238
	R^2 = 0.295*	

Note. N = 21.
* p < .05.

Table 11

Summary of Mediation Analysis Predicting Infant Self-Regulation

	β	*SE*
Model Step 1: Predicting Infant Self-regulation		
Maternal Internalizing Symptomatology	0.343	1.914
	R^2 = 0.118, *ns*	
Model Step 2: Predicting Dyadic Co-regulation		
Maternal Internalizing Symptomatology	-0.225	1.547
	R^2 = 0.051, *ns*	
Model Step 3: Predicting Infant Self-regulation		
Dyadic Co-regulation	0.247	0.285
	R^2 = 0.061, *ns*	
Model Step 4: Predicting Infant Self-regulation		
Maternal Internalizing Symptomatology	0.419	1.888
Dyadic Co-regulation	0.341	0.273
	R^2 = 0.295†	

Note. N = 21.
* p < .05 † p < .10.

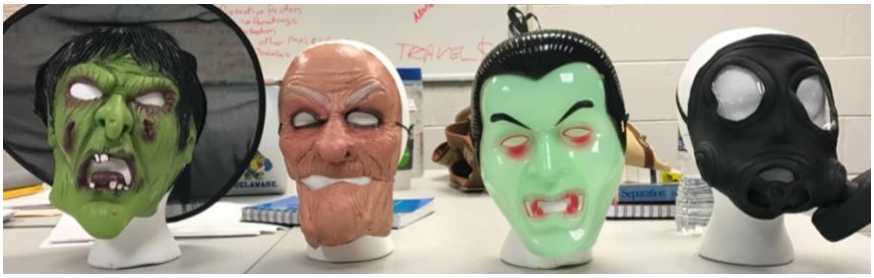

Figure 1. Masks used during administration of Lab-TAB "Masks" in order of presentation.

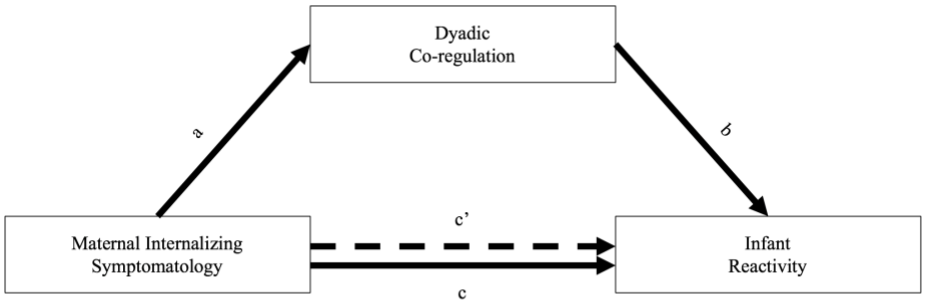

Figure 2. Simple mediation model for hypothesis related to *Infant Reactivity*

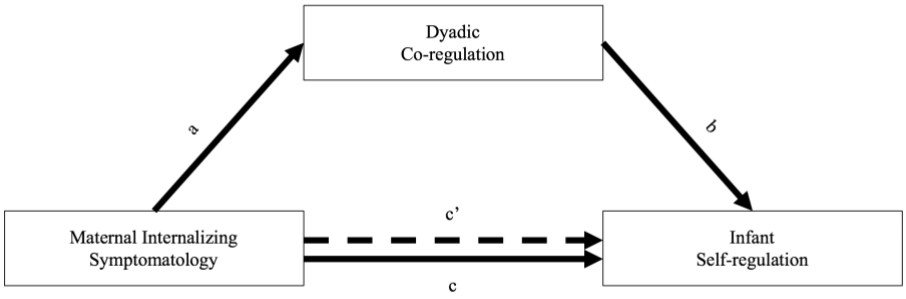

Figure 3. Simple mediation model for hypothesis related to *Infant Self-regulation.*

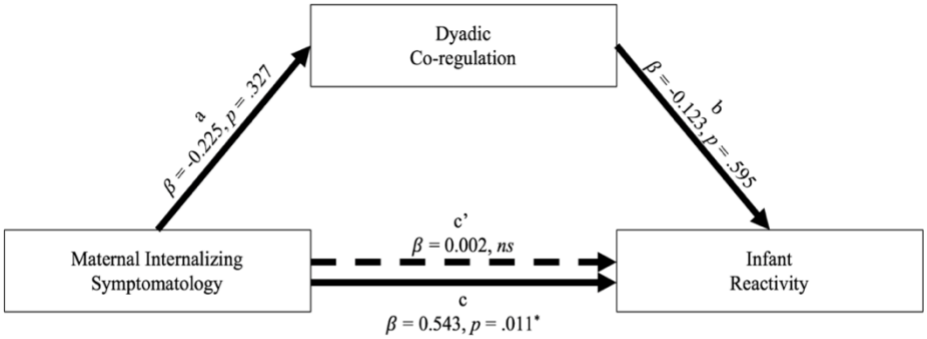

Figure 4. Simple mediation model for hypothesis related to *Infant Reactivity*.

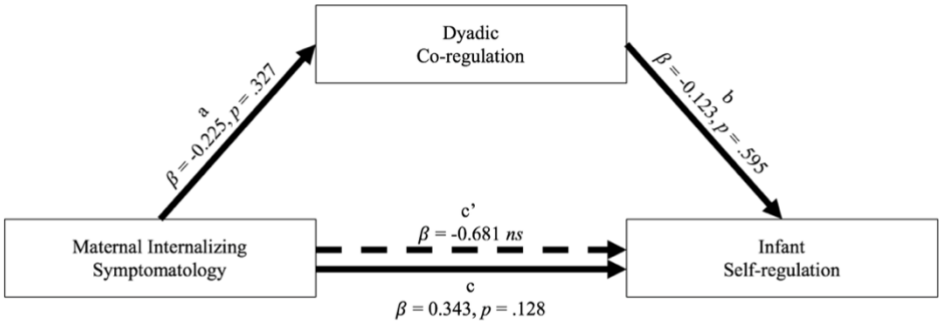

Figure 5. Simple mediation model for hypothesis related to *Infant Self-regulation.*

Appendix A

Hopkins Symptom Checklist – 25

ID #:_____

PACT Time 1

"For this last form, I am going to read some symptoms or problems that people sometimes have. Please listen to each one and decide how much the symptoms bothered or distressed you in the last week, including today. You can tell me (1) not at all, (2) a little, (3) quite a bit, or (4) extremely."

	1	2	3	4
	Not at all	A little	Quite a bit	Extremely
1. Suddenly scared for no reason				
2. Feeling fearful				
3. Faintness, dizziness, or weakness				
4. Nervousness or shakiness inside				
5. Heart pounding or racing				
6. Trembling				
7. Feeling tense or keyed up				
8. Headaches				
9. Spells of terror or panic				
10. Feeling restless, can't sit still				
11. Feeling low in energy, slowed down				
12. Blaming yourself for things				
13. Crying easily				
14. Loss of sexual interest or pleasure				
15. Poor appetite				
16. Difficulty falling asleep, staying asleep				
17. Feeling hopeless about the future				
18. Feeling blue				
19. Feeling lonely				
20. Thoughts of ending your life				
21. Feeling of being trapped or caught				
22. Worrying too much about things				
23. Feeling no interest in things				
24. Feeling everything is an effort				
25. Feelings of worthlessness				

Appendix B

- EC 1,3. MASKS Rationale
    - Previous research has indicated that the incongruity inherent in viewing a mask elicits fear in some children. This episode provides such an opportunity for the expression of fear in a non-social context with relatively mild, non-intrusive stimulation.
- Physical setting
    - The child (C) is placed in a high chair in a gray enclosed booth. Her/his mother (M) stands behind and to C's right, about 1 m from C. M is outside C's visual field when C orients toward the curtain. C is secured in the high chair by a seat belt. Videotaping takes place through a camera opening in the enclosure. A curtain hangs in front of the main opening of the enclosure where the masks will be presented so that the masks are hidden from C's view until their presentation. The masks are an evil queen (from Snow White), an old man, glow-in-the-dark vampire, and a gas mask.
- Procedure
    - M places C in the highchair, which is already in the gray enclosure. Once positioned, E draws C's attention to the curtained opening by knocking on the wall of the enclosure. The trial begins when C's attention is focused. E then lifts the curtain and displays a mask. After 10 s the mask is removed, and the curtain is left down for 5 s before the next mask is displayed. The sequence of display of the masks is as follows: evil queen, old-man, glow-in-the-dark vampire, and gas mask.
- Camera instructions
    - Because C is in the gray enclosure, it is only possible to videotape C's face and part of the upper torso. It is important to get a clear picture of the face and upper body at all times. The camera remains stationary.
- Scoring
    - This episode consists of four trials each divided into two epochs. Each trial begins with a knock and is followed by two five second epochs. The period between trials during which the experimenter is changing masks is not coded. Start coding once the child has made eye contact with the mask. Epochs where the child has not noticed the masks should be considered missing. The epochs are coded by indicating the occurrence of the specified behavior, or by rating the intensity of the behavior. When an intensity rating is requested, the highest intensity observed should be coded.
- Variables to be coded:
    - a) Latency to first fear response.
    - b) Intensity of facial fear.
    - c) Intensity of distress vocalizations.
    - d) Intensity of bodily fear.
    - e) Intensity of escape.
    - f) Baseline state.
    - g) Parent behavior.

Appendix C

Mask Scoring
EC: 1,3

Subject #_____
Subject Name _____
Visit 1 or 2 Tape # _____
Counter # _____
DOB _____

Scorer _____
Date Scored _____
Episode Order _____
Experimenter Code _____
DOV _____

Latency To Fear Response
T1 _____
T2 _____
T3 _____
T4 _____

Latency To Sadness Response
T1 _____
T2 _____
T3 _____
T4 _____

5 s epochs	Trial 1			Trial 2			Trial 3			Trial 4		
Time Begin/End			Avg.			Avg.			Avg.			Avg.
Intensity of facial fear (0-3)												
Intensity of facial sadness (0-3)												
Intensity of vocal distress (0-5)												
Intensity of bodily fear (0-3)												
Presence of startle response 0=no 1=yes												
Intensity of escape behavior (0-3)												

Baseline state_____
Missing episode code _____

Parent behavior_____
# of observed epochs _____

Masks
Version 3.10

Appendix D

- EC 4,1. TASK ORIENTATION (BLOCKS) Rationale
  - This episode provides an opportunity for the child to manipulate a set of blocks. Blocks can facilitate a wide variety of responses. All children are capable of many of these responses; therefore, the primary determinant of differences in amount of manipulation of the blocks is motivation. In this episode, motivation is equated with the emotion of interest and, in particular, with its duration parameter, persistence.
- Physical Setting
  - The child (C) is seated in a highchair at a medium sized table (82 cm X 137 cm). The mother (M) is seated at the table approximately 1 m away from C. The familiar experimenter (E) sets the blocks in front of C before leaving the room.
- Procedure
  - E escorts M and C into the room and asks M to secure C in the highchair. Once M and C are both seated, E presents the toys to C by saying, "Here are some blocks for you to play with." E then addresses the mother, "I'll be back in 3 minutes" and leaves the room. M has been instructed prior to the start of the episode that if C tries to engage M's attention, M is to remain as uninvolved as possible. E returns after 3 minutes and the episode is terminated.
- Camera Instructions
  - In this episode the camera is positioned so that C's face and hands are in the frame. It must be possible to discern whether blocks are thrown off the table or simply dropped.
- Scoring
  - This episode lasts 3 minutes and is divided into 1 minute intervals, each of which is subdivided into 10 second epochs. The epochs are coded by indicating the occurrence of the specified behavior, or by rating the intensity of the behavior. When an intensity rating is requested, the highest intensity observed should be coded.
- Variables to be coded:
  - Intensity of facial interest.
  - Duration of looking.
  - Latency to look away.
  - Manipulation of stimuli.
  - Parent behavior.
  - Baseline state.

Appendix E

Task Orientation (Blocks)

EC: 4,1

Subject #__________________ Scorer ___________

Subject Name ______________ Date Scored ________

Visit 1 or 2 Tape # _________ Episode Order ______

Counter # ________ Experimenter Code _____

DOB ________ DOV _______

Latency to look away from blocks ________ s

Epochs

Interval 1	1	2	3	4	5	6	Avg.
Time (Begin/End)							______
Duration of Looking (0-3)							______
Manipulation of Stimuli (0-3)							______
Intensity of facial interest (0-2)							______

Epochs

Interval 1	1	2	3	4	5	6	Avg.
Time (Begin/End)							______
Duration of Looking (0-3)							______
Manipulation of Stimuli (0-3)							______
Intensity of facial interest (0-2)							______

Epochs

Interval 1	1	2	3	4	5	6	Avg.
Time (Begin/End)							______
Duration of Looking (0-3)							______
Manipulation of Stimuli (0-3)							______
Intensity of facial interest (0-2)							______

Parent behavior_______ Missing episode code ________

Baseline state_______ # of observed epochs ________

Task Orientation (Blocks)
Version 3.10

Appendix F

SELF-REGULATION CODING SCHEME

I. Duration of attention: amount of time child is looking at the stimulus, scored on an intensity scale (or could use real time)

II. Disengagement of attention

Gaze aversion: child looks away from stimulus without focusing on any particular object - this behavior is extremely brief in duration (score as present or absent)

Distraction toward object: child looks at an object that is unrelated to the episode - this is usually for a longer duration than gaze aversion (score as present or absent)

III. Approach/Withdrawal: child approaches or withdraws self from stimulus (can be scored as present or absent, or on an intensity scale). When using an intensity scale, we recommend using approach and withdrawal as separate scales.

IV. Social Strategies

Looks to mother: child looks to mother - it is possible to distinguish between the types of looks, for example, positive and negative affect or social referencing and information seeking (score as present or absent)

Looks to experimenter: child looks to experimenter (score the same as looks to mother

V. Dealing with the stimulus (these behaviors can be combined into a composite)

Exploring: child not only attends to the stimulus but inspects it with concentration in an attempt to understand how it works (score as present or absent)

Struggling/resisting: child pulls, kicks, arches his/her back, pushes etc. (score as present or absent)

Control: child controls situation by attempting to move stimulus, (e.g., push it away) (score as present or absent)

Playing: child plays with stimulus in an appropriate manner (score as present or absent)

VI. Redirected action

Self-stimulation: child uses a body part to engage in repetitive manipulation (e.g., sucking thumb) (score as present or absent)

Tension release: child engages in high-energy behavior with no apparent instrumental focus (e.g., screaming or fast kicking of the legs) (score as present or absent)

Appendix G

The coder watches the entire context, focusing on the dyad rather than on either individual. Then, for that context, the coder assigns one overall rating, on the scale 1-5:

"This dyad has MRO"

- Descriptions of the anchor points
  - 1 Very untrue of dyad; very low MRO, poor relationship.
    - All or some (but very strong) of the following clearly present, observed often and/or of high intensity: adversarial, disconnected, unresponsive, hostile, affectively negative.
    - The following extremely rare: mutually responsive, coordinated, harmonious, in sync, attuned to each other, mutually cooperative, affectively positive.
  - 2 Quite/rather untrue of dyad: low level of MRO, not a very good relationship.
    - One or more of the following can be observed: adversarial, disconnected, unresponsive, hostile, affectively negative.
    - The following rarely seen: mutually responsive, coordinated, harmonious, in sync, attuned to each other, mutually cooperative, affectively positive.
  - 3 Dyad fluctuates between low and high MRO or dyad is average (neither high nor low)
  - 4 Quite/rather true of dyad, reasonable MRO, reasonable relationship.
    - One or more of the following can be observed: mutually responsive, coordinated, harmonious, in sync, attuned to each other, mutually cooperative, affectively positive.
    - The following rarely seen: adversarial, disconnected, unresponsive, hostile, affectively negative.
  - 5 Very true of dyad; very high MRO, excellent relationship.
    - All or some (but very strong) of the following clearly present, observed often and/or of high intensity: mutually responsive, coordinated, harmonious, in sync, attuned to each other, mutually cooperative, affectively positive.
    - The following extremely rare: adversarial, disconnected, unresponsive, hostile, affectively negative.

- To arrive at the rating, consider the following dimensions and definitions:
  - Coordinated Routines
    - Low: Routines are a source of conflict. Seemingly no routines present, or if present, very choppy and rough.
    - High: the dyad displays coordinated activity and settles comfortably into routine activities that become scripted over time. Easy and comfortable coordination reflects implicit shared procedural expectations.
  - Harmonious Communication
    - Low. Dyad participates in very little or no communication.
    - High: Both verbal and nonverbal aspects of communication flow smoothly. Interaction flows smoothly, is harmonious. Communication flows effortlessly and has a connected back- and-forth quality. Dialogue and exchanges promote intimacy and connection.
  - Mutual Cooperation
    - Low: Dyad is unable to accept roles (e.g., frequent autonomy struggles and/or resistance) Conflicts escalate, get out of hand
    - High: Dyad effectively resolves potential sources of conflict; partners are open to each other's influence. Subtle influences are sufficient for cooperation. Mother and child adopt a receptive, willing stance toward each other's influence. Mother and child are psychologically in tune with each other.
  - Emotional Ambiance
    - Low: Dyad engages in clear bouts of negative affect. Negative ambience permeates interaction. Positive affect is basically absent.
    - High: Dyad enjoys an emotionally positive atmosphere, indicating clear pleasure in each other's company. Dyad effectively addresses occurrences of distress and negative affect. Overall emotional ambiance is positive and warm. Dyad engages in clear bouts of joy. There are natural displays of affection. Expressions of affection are a source of pleasure for both.

Appendix H

PARCHISY - Dyadic codes

Reciprocity: shared positive affect, eye contact, a "turn taking" (ie. conversation-like) quality of interaction

(1) no evidence of reciprocity

(2) one or two instances of reciprocity - either shared affect or eye contact

(3) a few/several instances of reciprocity (either shared affect or eye contact)

(4) moderate levels of reciprocity; evidence of both shared affect and eye contact; some evidence of "conversation-like" interaction

(5) clear evidence of reciprocity; one or two episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns" between mother and child;

(6) substantial reciprocity involving numerous episodes of intense shared positive affect coupled with eye contact that is sustained for several "turns"; only one or two instances of non-reciprocity

(7) highly integrated and reciprocal - constant shared positive affect and eye contact that never loses "turn taking" quality

Conflict: minor or major disagreement - mutual or shared negative affect; arguing, tussling over toy, etc.

(1) no evidence of conflict during task

(2) one or two instances of conflict

(3) a few/several instances of conflict

(4) moderate amounts of conflict - about half of interaction is conflictual

(5) conflicted interaction throughout, with a few/several instances of no conflict

(6) substantial conflict throughout, with only one or two instances of no conflict

(7) highly conflicted interaction for entire task

Cooperation - defined as explicit agreement and discussion, about how to proceed with and complete task (eg. "Shall we do this next?" and child says "Yes")

(1) no evidence of cooperation during task

(2) one or two instances of cooperation

(3) a few/several instances of cooperation

(4) moderate amounts of cooperation - appears during about half of interaction

(5) cooperative interaction throughout, with a few/several instances of lack of explicit cooperation

(6) substantial cooperation throughout, with only one or two instances of lack of explicit cooperation

(7) highly cooperative interaction for entire task

References

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