DISSERTATION

PARENT-CHILD INTERACTIVE PROCESSES IN EARLY CHILDHOOD: IMPLICATIONS FOR VULNERABLE FAMILIES

Submitted by

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ABSTRACT

PARENT-CHILD INTERACTIVE PROCESSES IN EARLY CHILDHOOD: IMPLICATIONS FOR VULNERABLE FAMILIES

The current studies examined the relation between family risk and parent-child interactive processes during early childhood. *Study 1* used a cumulative risk model to examine how child maltreatment (CM) risk related to mother-child rupture and repair processes at age three (*N*=138 dyads). Rupture and repair were assessed using dynamic systems-based modelling of second-by-second behavioral patterns during a mother-child problem-solving task. Group-based analyses indicated that high- and low-risk families did not differ in the frequency of their repairs or the average time taken to repair a dyadic rupture. In both groups children were more likely to rupture than mothers and mothers were quicker to repair than children. Survival analyses indicated that higher risk predicted less time-to-event for mother ruptures (e.g., higher risk predicted quicker mother ruptures) but was not related to time-to-event for child rupture, child repair, or mother repair. *Study 2* examined effects of mother and father psychopathology on parent-child repair and flexibility during a problem-solving task at age three (*N*=25 families). Actor Partner Interdependence Models (APIM; Kenny et al., 2006) were used. Results indicated that father-child dyads were significantly quicker to repair their ruptures than mother-child dyads. Contrary to hypotheses, results indicated no significant actor effects for parental psychopathology on repair proportion, repair speed, or flexibility. These studies highlighted the utility of analyzing moment-to-moment interaction patterns between parents and young children as well as the importance of taking a systemic and comprehensive assessment of family risk.

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CHAPTER I

LITERATURE REVIEW

Parent-child interaction has received considerable attention in the field of child development and for good reason: Research has consistently found that the ways in which parents and children play, solve problems, and spend time together are intimately connected to children's current and future well-being (Chaplin, Cole, & Zahn-Waxler, 2005; Eisenberg, Zhou, Spinrad, Valiente, Fabes, & Liew, 2005; Harrist & Waugh, 2002). Throughout early childhood, the parent-child relationship serves as the context by which children learn to manage their own emotional and behavioral experiences (Morris, Silk, Steinberg, Myers, & Robinson, 2009). Parent-child interactions have commonly been examined regarding their content (e.g., teaching, compliance) or overarching qualities (e.g., parental warmth or monitoring); however, recent research indicates that the *process* of interactions, also termed the dyadic structure, is also a meaningful contributor to child development (Harrist & Waugh, 2002; Howe & Lewis, 2005; Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011). Research on dyadic processes allows researchers to move beyond the question of "*What* is happening during interactions?" and explore "*How* is it happening?"

In healthy parent-child relationships, parents are able to predict, notice, and respond to their children's needs on a consistent and sensitive basis (e.g., Clark & Ladd, 2000; Davidov & Grusec, 2006; Skuban, Shaw, Gardner, Supplee, & Nichols, 2006; Tronick, 1989). This stable pattern of responsiveness is critical to the process of coregulation in which the child's experiences are regulated through interactions with the parent as young children lack the necessary capacities to regulate independently (Feldman, Greenbaum, & Yirmiya, 1999; Lunkenheimer et al., 2011; Tronick & Reck, 2009). Over time, coregulatory processes lay the

groundwork necessary for children to internalize and strengthen their own regulatory abilities. One way in which this coregulation is manifested in parent-child interactions is through the process of rupture-and-repair (Tronick & Reck, 2009; Tronick, 1989), as illustrated in the following two examples:

Scenario 1: A mother and her daughter are sitting in their playroom looking around at their toys. The mother selects a new puzzle from the shelf and sets it down in front of them to complete. The puzzle is challenging, and the mom will need to provide guidance in order for the daughter to complete the puzzle. At the start, the daughter is motivated to complete the puzzle and follows mom's directions consistently (e.g., "place the red piece first, then the green one"); however, after a few minutes, the daughter grows tired of building the puzzle and begins to build her own designs with the puzzle pieces instead of following mom's directions. Mom becomes upset, interpreting her daughter's behavior as a failure of her own ability to parent and withdraws from the interaction. Sensing her mother's frustration, the daughter attempts to re-engage the mom in the puzzle; however, the mother refuses to continue playing with the puzzle, saying sarcastically, "Oh, now you want to play with me? Well too bad, I'm going to play my own game!" and grabs a new toy. The mother and daughter play separately for a few minutes until the mother gets up and leaves the room.

Scenario 2: A mother and her daughter are sitting in their playroom looking around at their toys. The mother selects a new puzzle from the shelf and sets it down in front of them to complete. The puzzle is challenging, and the mom will need to provide guidance in order for the daughter to complete the puzzle. At the start, the daughter is motivated to complete the puzzle and follows mom's directions consistently (e.g., "place the red piece first, then the green one"); however, after a few minutes, the daughter grows tired of building the puzzle and begins to build

her own designs with the puzzle pieces instead of following mom's directions. Mom recognizes that her daughter is probably feeling a bit frustrated at the difficulty of the puzzle and reflects this saying, "Are you getting a little tired of working on this hard puzzle?" The daughter responds, "Yes," and mom says, "You've been doing such a good job so far, I'm proud of how intensely you've been working." Mom then suggests, "How about we pretend that we're building this puzzle as a house for your doll, would that be fun?" Mom's new idea renews her daughter's interest in the puzzle, and the two continue building it together.

These two interactions had much in common and represented common parent-child interactions during early childhood. Both scenarios began with a period of "togetherness" when the mother and daughter were focused and attending to the task at hand (e.g., completing the puzzle). This period could be captured by a variety of slightly different terms in the literature, including synchrony (Feldman, 2007), matched goal orientation (Jameson, Gelfand, Kulcsar, & Teti, 1997), and coordination (Tronick & Cohn, 1989). Following this period, the mother continued to work to complete the puzzle, and the daughter became disengaged and tried building her own designs, no longer listening to her mother's instructions. This period could be referred to as mismatch, miscoordination, or rupture (e.g., Feldman et al., 1999; Lindsey, Cremeens, Colwell, & Caldera, 2009; Tronick & Reck, 2009).

After the rupture, the two stories diverged. In scenario one, the initial rupture was followed by a secondary rupture where the mother refused to re-engage with the daughter and eventually left the interaction altogether. However, in scenario two, the mother responded to the daughter's disengagement by matching her daughter's change in direction; instead of trying to remain focused on the puzzle, the mother joined the daughter in her distress by reflecting her feelings, complimenting her, and redirecting the daughter's attention with a positive and helpful

idea. The daughter was then able to re-engage with the puzzle, and thus the pair returned to a mutually adaptive state. This transition represented the core meaning of repair. The definition and measurement of repair has varied across populations, tasks, and contexts; however, repair broadly represents the movement from a maladaptive state (e.g., mismatch, rupture, miscoordination) towards an adaptive state (e.g., matched goals, coordination) (e.g., Biringen, Emde, & Pipp-Siegel, 1997; Tronick & Reck, 2009).

Aims of the Current Literature Review

To date, the majority of research on rupture and repair processes has been done either before (e.g., Tronick, 1989) or after (Skowron, Kozlowski, & Pincus, 2010) the preschool period, representing a clear gap in our understanding of the function of such processes across childhood. Preschoolers' social and emotional growth creates opportunities for new types of interactions to occur inside and outside the family setting (Anthony et al., 2005; Denham et al., 2003). As interactions shift from being primarily parent-directed to those that are more collaborative in nature, the transition to preschool often presents new ways to negotiate episodes of negativity, stress, and miscoordination. Parent-child interaction patterns can influence relationships in other settings during the preschool years (e.g., child-peer relationships) (Black & Logan, 1995; Carson & Parke, 1996; Clark & Ladd, 2000; MacDonald & Parke, 1984; Schneider, Atkinson, & Tardif, 2001), highlighting the importance of understanding such processes during this developmental period.

As such, I hypothesized that the ability for parent-preschooler dyads to repair their interactions would positively contribute to child well-being at this age. The following literature review was designed to present the current state of the field of rupture and repair processes and

support further investigation of these processes during parent-preschooler interactions. This literature review aimed to address these following questions:

1. What is the current state of knowledge regarding repair processes during parent-child interactions?

2. As the majority of research about repair has been focused on infancy, what evidence suggests that it would be an important contributor to child development during the preschool years?

3. What next steps can be taken to better understand repair processes during parent-preschool child interactions?

Repair during Parent-Child Interactions: State of the Field

Across disciplines and developmental periods, the consistent reparation of stress, negativity, or conflict during interactions has positive implications for development. Broadly speaking, the ability to shift out of a negative state towards a positive one is a critical marker of healthy functioning across the lifespan. For example, the consistent movement towards positive well-being in the face of difficult life circumstances forms the core of resilience (Masten, 2001; Masten & Obradovic, 2006; Yehuda, Flory, Southwick, &Charney, 2006), whereas difficulty shifting away from negativity is a hallmark of depression and other mental health problems (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Papageorgiou & Wells, 2004; Sameroff & Rosenblum, 2006).

On a micro-interaction level, Tronick (1989) hypothesized that consistent repairs (e.g., the shift from a stressful or maladaptive interaction towards a mutually adaptive interaction) during parent-child interactions are one mechanism by which children can internalize that the world is a safe place, that their caregiver can be trusted, and that they have some agency in

altering the stressful experiences they face. Conversely, when negative experiences go consistently unresolved *or* when children do not receive adequate practice in resolving stressful interactions (e.g., their interactions are only positive), children may be at risk for developing internalizing symptoms such as hopelessness, self-doubt, or sadness (Biringen et al., 1997; Tronick, 1989).

Tronick and Gianino, (1986) found that infants in dyads that consistently repaired interactions tended to show higher levels of persistence in engaging their mothers during an experimental condition where the mother was told not to respond. The authors posited that this persistence was indicative of the child's internal working model that distress can be repaired and the belief that s/he has some power in altering the situation. Conversely, when children's repair attempts consistently failed or were ignored, children may be more likely to give up their efforts to repair their dyadic interactions and instead turn their focus to internally soothing their own distress. This second pattern, which paralleled the notion of "learned helplessness" (Seligman, 1975), may be representative of infants who have grown accustomed to interactive partners who are unresponsive to their bids for behavior change or resolution (Tronick & Gianino, 1986). Over time, the pattern of withdrawal during conflict, as opposed to active attempts to repair, could become problematic as children may utilize these learned strategies during their engagements with other caregivers, even when they are not warranted or effective (Tronick & Gianino, 1986).

Previous work on rupture and repair processes has been conducted in the context of two pivotal issues related to child development: maternal depression and child maltreatment. Both of these issues have consistently been found to compromise optimal child development (e.g., Carter et al., 2001; Cicchetti & Toth, 2005; Kane & Garber, 2004; Luoma et al, 2001; Petterson &

Albers, 2001). Furthermore, as between 10% and 30% of parents experience depression (Goodman, 2004; Paulson, Dauber, & Leiferman, 2006), and hundreds of thousands of children are maltreated, mostly by parents, each year (United States Department of Health and Human Services (DHHS), 2015), both conditions are serious public health concerns. Thus, gaining a deeper understanding of how to prevent future maltreatment as well as how to diminish the harmful effects of parental depression on child development should be top priorities in the field of child development.

Repair and parental depression: preparing for study 1. Past work has shown that maternal depression is negatively related to repair processes during interactions, such that depressed mother-child dyads take longer to repair and/or engage in fewer repairs compared to healthy dyads (Jameson et al., 1997; Reck,. 2004). In fact, Tronick (1989) suggested that rupture-repair processes may be one mechanism of the transmission of depression between depressed parents and their young children. He posited that when young children's primary dyadic experience is characterized by a consistent difficulty in repairing interactions, the child will be more likely to exhibit persistently negative affect (Tronick 1989; Tronick & Reck, 2009).

Regarding depression and repair, Tronick and Reck (2009) reported that mothers with high levels of depressive symptoms had longer periods of affective mismatch with their infants (e.g., when the child expresses positive affect, and the mother expresses negative affect) and fewer reparations after such occurrences. Reck et al. (2004) confirmed these patterns in a review of the adverse effects of maternal depression on interactions between mothers and young children. The authors presented a variety of studies indicating that maternal depression can compromise mothers' abilities to effectively respond to children's needs, which are likely to change frequently in the earliest stages of life. Likewise, an earlier study examined rates of

repair after interrupted interactions as well as interactive coordination between depressed and nondepressed mothers with their toddlers (Jameson, et al., 1997). In this study, coordination referred to times when either the mother or the child matched the "social and object-related goal of the other" (p. 550), and an interrupted interaction referred to any time the dyad moved away from this coordination. The results indicated that depressed mothers were less likely to repair interrupted interactions with their 13-29 month old children than were nondepressed mothers. Furthermore, dyads with depressed mothers showed lower rates of interactive coordination overall when compared to dyads with nondepressed mothers.

Collectively, these studies demonstrated that repair processes are impaired during mother-infant or mother-toddler interactions when the mother is depressed. One process that could explain these findings is that during the very earliest stages of life, parents have much more power and responsibility in ensuring the success of interactions with infants (Kochanska & Aksan, 2006; Tronick, 1989), who are still developing their social and regulatory capacities. Thus, when parents have trouble regulating their own negative emotions, which is a common symptom of depression (Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007), one may expect that their dyadic experiences also would be characterized by deficiencies in transitioning out of a stressful or negative state (e.g., repairing the interaction). However, preschoolers' abilities to contribute to and to alter social situations are more advanced than those of infants, which begs the question: Are repair processes impaired by parental depression during the preschool years?

Does parental depression affect repair with preschoolers? A review of related work. The previously presented research indicated that parental depression can affect repair processes during parent-child interactions with infants and toddlers. To our knowledge, there have been no

empirical studies testing the relation between parental depression and repair processes in the preschool age; however, a great deal of research has indicated that parent depression can have adverse effects on parent-child interaction patterns during the preschool period (e.g., Alpern & Lyonsruth, 1993; Lovejoy, 1991).

For example, in a recent study of 100 three year olds, Lunkenheimer, Albrecht, and Kemp (2013) tested the relation between maternal depressive symptoms and dyadic flexibility (e.g., the extent to which a mother-child dyad transitioned among dyadic affective states). Higher flexibility was thought to indicate that the dyad was able to effectively shift its emotional responses to meet the needs of the task at hand (e.g., the parent moving from a neutral to a positive state in order to gain child compliance). Higher levels of maternal depressive symptoms were related to lower affective flexibility in this sample, suggesting that maternal depressive symptoms contributed to dynamic processes between parents and preschoolers. Although flexibility and repair are distinct constructs, the occurrence of repair inherently requires the dyad to shift (e.g., move to a mutually adaptive state), and thus these findings could offer support for the hypothesis that higher symptomology restricts repair during interactions.

Furthermore, extant work has indicated that depressed parents and their young children are at-risk for engaging in compromised interactions including engaging in more negativity and conflict (Lovejoy, 1991; Kane & Garber, 2004) and less coordination (Jameson et al., 1997; Leadbeater, Bishop, & Raver, 1996). For example, Lovejoy (1991) found that depressed mothers and their children both showed more negativity during interactions compared to nondepressed mothers and their children, despite showing similar levels of mother-child reciprocity during interactions. Such findings highlight the importance of examining both

process- and content-oriented aspects of parent-child interactions with both parents in the context of parental depression.

Repair and parental depression: Concluding remarks. Together, the foundational work on the protective nature of repair processes during infancy combined with the strong evidence that parent-child dyadic interaction patterns remain important contributors to child well-being throughout early childhood warrant an investigation of repair processes during the preschool years. Further, the clear connection between parental depression and repair in infancy (Tronick, 1989) as well as the knowledge that parent-child interactions remain vulnerable to parental depression in preschool would suggest that parental depression is an important consideration in understanding repair processes during the preschool years. These questions were addressed in Study 1.

Finally, the vast majority of the work on parental depression and parent-child interactions during the preschool years has focused on mothers (Kane & Garber, 2004). This is problematic as fathers are spending more time with their children than in past generations (Bianchi, 2011). Fathers may engage in distinct styles of interaction with their children (see Lamb, 2010 for further discussion), and recent work has indicated that 10-25% of fathers experience depressive symptomology (e.g., Goodman, 2004; Paulson & Bazemore, 2010). This limitation was addressed in Study 1 by investigating both maternal and paternal depression as related to parent-child interactions.

Repair and Child Maltreatment: Preparing for Study 2

As previously mentioned, repair processes have also been investigated in the context of child maltreatment. Child maltreatment (CM) has widespread adverse consequences for children, families, and society as a whole. CM includes physical abuse (a nonaccidental injury

resulting from caregiver acts), sexual abuse (involving children in sexual activities for the satisfaction or financial gain of a caretaker), emotional abuse (use of verbal harassment to consistently threaten or intimidate a child), and neglect (the failure of caretakers to meet the basic needs of a child) (US Department of Health and Human Services, 2015). The U.S. Department of Health and Human Services (2013) estimated that 686,000 children were victims of at least one instance of maltreatment in 2012, with parents perpetrating the maltreatment in 81.5% of cases. CM can occur in all kinds of families; however, common risk factors for maltreatment include income, social isolation or difficulties, previous cases of maltreatmen,t and family structure (Berger, 2004; Brown, Cohen, Johnson, & Salzinger, 1998; Seng & Prinz, 2008).

Although some children are able to show resilience in the face of maltreatment (e.g., Cicchetti & Rogosch, 1997; Jaffee, Caspi, Moffitt, Polo-Tomas, & Taylor, 2007), many children's developmental trajectories are negatively influenced by the experience of maltreatment, including their social and emotional well-being (Cicchetti & Toth, 2005). The consequences of maltreatment extend beyond the individual child or family, with extant work showing significant financial burdens on societies as a result of both fatal and nonfatal instances of abuse (Fang, Brown, Florence, & Mercy, 2012). Furthermore, the negative ramifications of CM also extend past the time period (or instance) of maltreatment with past work showing adverse consequences for adolescent and adult survivors of earlier maltreatment (e.g., Lansford et al., 2002; Moeller, Bachmann, & Moeller, 1993; Silverman, Reinherz, & Giaconia, 1996).

Existing work has indicated that there may be differing profiles of parent-child interactions across maltreating and nonmaltreating families. Importantly, although the primary purpose of this review was to discuss the relation between repair processes and child

maltreatment, only a small number of studies have explicitly operationalized "rupture and repair" processes; thus, related work on micro parent-child interaction processes in the context of child maltreatment was also reviewed.

Repair processes related to risk for CM: Skowron et al. (2010). Skowron et al. (2010) examined rupture and repair processes in families with children aged 5-14 at differing risk for physical child maltreatment. High risk was determined by scoring above a clinical threshold on the Child Abuse Potential Inventory (CAPI; Milner, 1989. *See Skowron et al., 2010 for more information*). Mother-child interactions were coded during a series of 5-minute interactions known as the Wiltwick family tasks (see Szapocznik et al., 1991, for more information). Results indicated that high-risk and low-risk dyads experienced a similar number of ruptures (e.g., a negative behavior by either mother or child) during interactions, but that high-risk dyads had more difficulty repairing their interactions such that low-risk dyads repaired nearly 9 out of 10 ruptures (89.3%), but maltreating dyads repaired less than half of the ruptures.

Additionally, in families at low risk for abuse, children were more likely to initiate ruptures during the interactions, and mothers were more likely to initiate repairs. The opposite was true in families at high risk for abuse, with mothers being more likely to initiate ruptures, and children were more likely to initiate repairs (Skowron et al., 2010). These findings are informative as they suggested that high- and low-risk families experienced similar amounts of disruptions in their interactions, but that low-risk dyads may be demonstrating more effective repair processes. However, this research will need to be replicated and further explored at different developmental stages and with different populations.

Child maltreatment of preschoolers: Could repair predict risk? To my knowledge, Skowron et al. (2010) conducted the first empirical analysis of the relation between rupture and

repair processes and CM risk. Findings from this study provided a starting point to understand these relations; however, the limited sample size and broad age range (5-14 years old) make it imperative to conduct further assessments on the potential relation between repair processes and CM Risk. This was the focus of Study 2. A review of related work was provided here to assess the potential for CM risk to predict rupture and repair processes in families of preschoolers.

In a study comparing abusive versus nonabusive mother-preschooler dyads, sequential analyses were used to investigate real-time interaction patterns during a structured task completed by mothers and their young children (Timmer, Borrego, & Urquiza, 2002). Analyses indicated that interactions of mothers with abused children (average age 4.5 years) and mothers with nonabused children (average age 3.9 years) were similar across several interactional measures. However, analyses indicated that abusive mothers were seven times more likely to respond negatively to a child's acknowledgement (a one-to-two-word response to a parent question) than were nonabusive mothers. Although the authors did not make use of rupture and repair terminology, this could be seen as a mother-initiated "rupture" in the interaction. Furthermore, after an instance of child noncompliance (a child rupture), nonabusive mothers were three times more likely to respond to the child's question in a neutral manner than were abusive mothers. Conversely, abusive mothers were three times more likely to issue a command to their child after an instance of noncompliance. Although we cannot definitively refer to these sequences as "repair" or "rupture," the pattern of parent question → child noncompliance → parental command could represent a missed opportunity to repair the interaction, with the authors hypothesizing that the use of a command in the context of noncompliance may have been a parental attempt to gain back control over the child (Timmer et al., 2002).

Similar sequences were analyzed in interactions between maltreating and nonmaltreating mothers and their 2-4 year old children (Oldershaw, Walters, & Hall, 1986). Children in the nonmaltreating group complied with their mother's command more often than they did not (78% vs. 22%), but abused children were equally likely to show compliance and noncompliance (47% vs. 53%). In response to child compliance, control mothers provided some form of positive reinforcement and never responded with power-assertive or controlling acts (e.g., threat, humiliation, disapproval); abusive mothers, however, responded with power-assertive and positive reinforcement in equal amounts. In response to child noncompliance, abusive mothers used fewer positively oriented strategies (e.g., reasoning, bargaining, cooperation, modeling, approval) and more power-assertive strategies than nonabusive mothers.

Again, in the absence of a formal analysis of rupture and repair processes, strict conclusions cannot be made about these processes from Oldershaw et al.'s (1986) findings. However, the findings clearly demonstrated that in mother-preschooler interactions of maltreating families, both mothers and children created a higher proportion of ruptures (e.g., power assertive acts, noncompliance) than did the control families. Furthermore, nonabusive mothers were more likely to initiate repair-oriented strategies (e.g., reasoning, bargaining, cooperation) than were abusive mothers following a child-initiated rupture (e.g., noncompliance).

Repair and child maltreatment: Concluding remarks. Together these studies indicated that there may be differing profiles of rupture and repair processes among families at-risk for child maltreatment versus healthy, nonmaltreating families. Inconsistencies across studies could be attributed to varying sample characteristics as well as the measurement of maltreatment and/or risk for maltreatment. This work has suggested that families at-risk for

maltreatment may experience more frequent or prolonged ruptures during their interactions; however, less is known about the actual transitions out of ruptured or stressful states (e.g., repair) in such dyads. In Skowron et al. (2010), families at high and at low risk for maltreatment showed similar instances of ruptured interactions; however, families at high risk for maltreatment showed fewer repairs. Together the studies reviewed here suggested that it would be valuable to gain a better understanding of the parent-child mechanisms that may protect children from or, conversely, put them at greater risk for the experience of child maltreatment.

Conclusions and Future Directions

In conclusion, past work on rupture and repair processes within parent-child dyads during infancy and toddlerhood (e.g., Jameson et al., 1994; Tronick, 1989; Weinberg, Olson, Beeghly, & Tronick, 2006) has created a substantial foundation to move this work forward by examining repair processes in at-risk families of preschoolers. Previous theoretical and empirical work has suggested that repair is an essential mechanism by which parent-child dyads navigate the anxiety, stress, discomfort, and negativity that is inherent to all social relationships. Furthermore, this work indicated that although all families experience maladaptive episodes over the course of interactions, strong and consistent reparations of such instances may be one marker of healthy parent-child interaction patterns in early childhood (e.g., Tronick & Beeghly, 2011).

Finally, repair processes are closely tied to the overall well-being of both parents and children such that parental depression and child maltreatment have been shown to disrupt repair capacities in dyads that experience one or both of these risk factors (e.g., Skowron et al., 2010; Tronick, 1989). By further exploring these specific relationships, we can be better equipped to understand how repair may function as a protective mechanism for families at risk for experiencing poor outcomes during early childhood.

CHAPTER II

STUDY 1: ASSESSING CHILD MALTREATMENT RISK ON RUPTURE AND REPAIR PROCESSES DURING MOTHER-CHILD INTERACTIONS

Nearly 700,000 children are victims of child maltreatment (CM) each year in the United States, with 80-90% of cases being perpetrated by parents (US DHHS, 2015). For many children, CM has been shown to compromise self-regulation (Maughan & Cicchetti, 2002; Shields, Cicchetti, & Ryan, 1994), attachment security (Cyr, Euser, Bakermans-Kraneburg, & Van Ijzendoorn, 2010; Morton & Browne, 1998), and social relationships (Bolger, Patterson, & Kupersmidt, 1998; Parker & Herrera, 1996). For survivors, CM can have long-term adverse consequences for adolescent and adult well-being (Etter & Rickert, 2013; Houck, Nugent, Lescano, Peters, & Brown, 2009). As such, CM is a serious public health problem (Hammond, 2003; Skowron et al., 2010) and its prevention should be a top priority for those working on behalf of children and families.

Child abuse and neglect are preventable, multifaceted experiences that have systemic antecedents and consequences (Cicchetti & Toth, 2005). Risk for CM exists across multiple ecological levels including the child (e.g., age, ability, temperament), family (e.g., parent mental health, social support, maltreatment history), and community (e.g., neighborhood violence, cultural or religious norms) (Berger, 2004; Brown et al., 1998; Skowron et al., 2010). A significant body of work has indicated that the risk for CM is evident in the everyday interactions between parents and children, with maltreating families showing distinct, maladaptive patterns of interaction compared to healthy families (Bousha & Twentyman, 1984; Burgess & Conger, 1978; Oldershaw, Walters, & Hall, 1986; Timmer et al., 2002). The manifestation of

maltreatment risk in the daily interactions amongst family members represents a promising avenue for prevention work as well-developed and tailored family-based treatments have been successful in altering maladaptive interaction patterns in abusive families (Chaffin et al., 2004).

The broad aim of the current study was to investigate moment-to-moment mother-child interaction patterns to inform an understanding of how such patterns relate to family CM risk. Specifically, continuous-time survival analyses (SA) were used to assess the transition from a maladaptive (e.g., negative, stressful, or difficult) towards an adaptive (e.g., mutually positive, coordinated) state during parent-child interactions. This specific transition is commonly known as repair (e.g., Tronick, 1989) and maltreating families have been found to be less effective in making repairs during interactions (Skowron et al., 2010).

Repair Processes and Risk for Child Maltreatment

An interactive rupture refers to a stressful, negative, or mismatched affective or behavioral exchange between the parent and child, and repair is the transition back to a nonstressful, matched, or positive dyadic state (e.g., Birngen et al., 1997; Jameson et al., 1997; Tronick, 1989). Rupture and repair processes have long been of interest to developmental researchers (e.g., Tronick, 1989, Tronick & Gianino, 1987), with the majority of work being done on these processes during infancy and toddlerhood as related to maternal depression (Reck & Tronick, 2009; Tronick, 1989; Tronick & Gianano, 1987; Weinberg et al., 2006). Collectively, this work has demonstrated that parental depression compromises repair processes that in turn have negative implications for child development (e.g., Reck & Tronick, 2004; Tronick, 1989; Weinberg et al., 1997), indicating that impaired repair processes may serve as a risk factor for maladjustment in vulnerable families.

When parent-child dyads are unable to effectively and consistently repair their interactions, they may be at-risk for engaging in maladaptive interaction patterns, including coercive interaction cycles. Coercive cycles could be regarded as an absence of effective dyadic repair, where instead of initial ruptures (e.g., child noncompliance, parent frustration) being repaired to a mutually adaptive interaction, each partners' behaviors become increasingly polarized, leading to further reliance on extreme behavior (e.g., physical violence, disengagement) to "rectify" the situation (e.g., gain compliance or exert control). When coercive cycles are replicated over time, children may learn utilize their own avoidant or noncompliant behavior to escape parental directives, which may cue an increase in the parent's use of coercive behaviors (Chaffin et al., 2004). In some families, this cycle may escalate to violent behavior against the child and parents may come to (incorrectly) assume that violence is the only means to gain compliance (e.g., Cerezo & D'Ocon, 1995; Chaffin et al., 2004).

The contrasting phenomenon exists when parent-child dyads are able to regularly repair their dyadic ruptures. Tronick (1989) theorized that when parent-child interactions are characterized by the consistent repair of momentary stress or negativity, children learn that the world is safe, their caregiver is trustworthy, and that they have some agency in resolving stressful experiences. If repair processes were a distinguishing marker between maltreating and healthy families, one could hypothesize that families who show more consistent repairs during interactions would be at lower risk for engaging in maltreatment.

Skowron and colleagues (2010) confirmed such a hypothesis in their examination of rupture and repair processes in maltreating and nonmaltreating families with children aged 5-14 years old. All mother-child dyads experienced similar levels of interactive ruptures; however, families at higher risk for maltreatment had more difficulty repairing their interactions than

lower-risk families. These findings are consistent with previous work showing that nonmaltreating parents are more likely to engage in repair-initiating strategies (e.g., negotiation, compromise) in the face of child misbehavior (e.g., noncompliance) at higher rates than maltreating parents (Oldershaw et al., 1986). Work on parent-child interactions in maltreating families with young children that has indicated that maltreating mothers are more negative with their children (Burgess & Conger, 1978) even in the face of child neutral or positive behaviors (Oldershaw, Walters, & Hall, 1986; Timmer et al., 2002). Despite an absence of strict examination of rupture and repair processes, this work on parent-child interactions in maltreating families could suggest that interactions between parents and maltreated children are characterized fewer repairs than nonmaltreating families. This work indicates that further work is needed to better understand the relations between maltreatment, maltreatment risk, and parent-child interaction patterns.

Similar patterns have emerged through work on repair processes in families facing a variety of stressors. For example, in a family-based intervention with aggressive children Granic, O'Hara, Pepler, and Lewis (2007) found that postintervention, all families experienced similar frequencies of ruptures during their interactions. However, families who showed improvement after the intervention (e.g., decreased externalizing behaviors) exhibited an enhanced ability to repair their interactions, compared to families that did not improve after the intervention (Granic et al., 2007). Similarly, in work with depressed mothers and their infants, Tronick (1989) indicated that all mother-infant interactions consisted of relatively frequent dyadic ruptures; however, healthy (e.g., nondepressed) mother-child dyads repaired these interactions with more success than depressed mother-child dyads.

Skowron et al. (2010) presented initial evidence to suggest that families at higher risk for maltreatment exhibit problematic dyadic dynamics, such that children (instead of parents) take responsibility for repairing interactions with their parents. These researchers found that in high-risk dyads, mothers were more likely to initiate the rupture during the interaction and children were more likely to repair the interactions. In low-risk dyads, the opposite pattern emerged, such that children were more likely to rupture the interactions and mothers were more likely to repair them. For families at higher risk for maltreatment, these findings represent a problematic family dynamic as they could indicate that children are carrying the burden of monitoring and repairing parent-child interactions, which could help explain why these dyads showed less capability to consistently repair their interactions.

To my knowledge, Skowron and colleagues (2010) have conducted the only empirical assessment of real-time repair processes as related to family risk for maltreatment. Skowron's (2010) work may indicate that rupture and repair processes have become stable in maltreating families with older children; however, firm conclusions should not be drawn from this study alone due to the wide developmental range (ages 5-14) and small sample size. Further, as this work involved children age 5 and older, it is necessary to expand our understanding of repair processes to families with younger children. This is an especially salient gap in the literature as 47% of maltreated children are below the age of 5 (US DHHS, 2015). It might be expected that repair is an important marker of dyadic functioning before the age of 5 as past work has indicated that parent-child conflict significantly increases throughout the toddler and preschool years (e.g., Kuczynski, Kochanska, Radke-Yarrow, & Girnius-Brown, 1987; Laible & Thompson, 2002) and that families who struggle to manage difficult interactions during this developmental period may be at increased risk for engaging in maladaptive interaction cycles

(Scaramella & Leve, 2004). Further, prior work on repair processes in infancy and toddlerhood (e.g., Jameson et al., 1997; Tronick, 1989; Tronick & Reck, 2004) has found repair processes to be vulnerable to family risk factors such as maternal depression.

In sum, family risk for child abuse and neglect warrants significant attention in the field of human development research due to the preventable nature of maltreatment and the extensive repercussions of maltreatment across the lifespan. Maltreatment risk is evident in the daily interactions of parents and children, and may be manifested in repair frequencies as well as rupture and repair initiation during parent-child interactions (Skowron et al., 2010). However, it is unclear whether maltreatment risk relates to impaired repair capabilities during the preschool years. The current study aimed to fill this gap by investigating rupture and repair processes during mother-preschooler interactions.

The Current Study

The current study aimed to increase an understanding of how rupture and repair processes may be compromised by family risk for child maltreatment. The primary research question of interest was, do families at differing risk for CM engage in distinct rupture and repair processes in early childhood? As previously discussed, a clear gap in the literature exists related to these specific processes in at-risk families of preschoolers. As such, a comprehensive, multipart approach was used to assess the degree to which CM risk may have compromised these processes during mother-child interactions at age 3. Maltreatment risk has been assessed in a variety of ways across studies, including cases of reported CM to local agencies such as Child Protective Services or Child Youth Services (Stouthamer-Loeber, Loeber, Homish, & Wei, 2001), self-reports of parenting behaviors and beliefs (Skowron et al., 2010), and cumulative risk models (Begle, Dumas, & Hanson, 2010; MacKenzie, Kotch, & Lee, 2011). The current study

made use of a cumulative risk model based on the strength of such models to predict later maltreatment beyond individual risk markers (Begle et al., 2010; MacKenzie et al., 2011). Relying on only substantiated or confirmed CM cases can be problematic as substantiated cases may only capture a limited number of those children who are actually experiencing maltreatment (Gilbert et al., 2009; Leiter, Myers, & Zingraff, 1994). For these reasons, a cumulative model was best suited for the current study. Based on aforementioned work, the following research questions (RQ) were put forth in the current study:

RQ1: Does higher maltreatment risk relate to more frequent dyadic ruptures and less effective dyadic repairs during mother-child interactions? Repair effectiveness was operationalized both in the proportion of ruptures repaired as well as in the average time taken to repair each rupture (see Measures).

RQ2: Does higher maltreatment risk relate to the likelihood of ruptures and repairs during mother-child interactions? The likelihood of each event of interest was assessed with the amount of time between events using continuous-time survival analysis, such that likelihood to rupture indicated the time to rupture and the likelihood of repair represented the time taken to repair each rupture for that individual (see Measures).

Past empirical work on rupture and repair processes in high- and low-risk families has indicated that all parent-child dyads experience ruptures during their interactions (e.g., Tronick, 1989); however, the dyadic capacity to repair these ruptures may differ as a function of risk (e.g., Granic et al., 2007; Skowron et al., 2010; Tronick, 1989). Thus, for RQ1, it was hypothesized that there would not be a difference in the frequency of ruptures during mother-child interactions across families at differing levels of risk for CM, but that higher-risk dyads would be less effective in repairing these ruptures. The "effectiveness" of repair was assessed in two ways: the

proportion of repair (e.g., how likely was it that the rupture would be repaired in the next behavioral exchange?) and the amount of time taken to repair (e.g., how long did each rupture last?).

The second RQ was warranted based on past work indicating that maltreating families may demonstrate inappropriate family roles, such that children may adopt a parental or caregiving role during interactions with their parents (e.g., Dean, Malik, Richards, & Stringer, 1986; Howes, Cicchetti, Toth, & Rogosch, 2000; Macfie et al., 1999). Children becoming parentified (e.g., being expected to take on a parental role in the family; Broszormenyi-Nagy & Spark, 1973) has been found in other risk contexts as well, including families in which the parent is depressed, disabled, or abusing substances (Earley & Cushway, 2002). Together, this work has suggested that a variety of risk factors may impair a family's ability to maintain appropriate boundaries and roles in the family system. Skowron's micro-interaction processes align with these patterns, such that high-risk mothers were more likely to rupture the interactions and children more likely to repair (Skowron et al., 2010). Similar patterns have been observed in depressed mother-toddler interactions, with depressed mothers showing less frequent repairs in the face of their toddlers' ruptures (e.g., Jameson et al., 1997). These disrupted family roles are problematic in early childhood when children are still learning self-regulatory strategies from their caregivers and internalizing these strategies through their social interactions (Kochanska, Coy, & Murray, 2001; Lunkenheimer et al., 2013). It is developmentally appropriate for preschoolers to show noncompliance in response to parental demands (e.g., Powers, McGrath, Hughes, & Manire, 1994), and in healthy and adaptive parent-child interactions one should expect that parents are more likely to repair disrupted or negative interactions (Tronick, 1989).

For RQ2, CM risk was examined both in a continuous and dichotomized (e.g., high/low groups) fashion. It was hypothesized that higher cumulative risk for child maltreatment predicts slower times to child rupture and to mother repair, and quicker times to mother rupture and child repair. Further, it was hypothesized that in low-risk dyads, children are more likely than mothers to rupture, and mothers would be more likely to repair than children. The converse relationship was hypothesized in high-risk dyads, such that mothers are more likely to rupture than children and children would be more likely than mothers to repair.

Method

Participants

Data from 138 mother-child dyads were used in the current study. The current sample was a combined sample drawn from two separate longitudinal research projects investigating parent-child interaction processes as related to familial risk and preschoolers' social and emotional development. 96 families were drawn from the Parent Child Interaction Study (PCIS) and 42 were drawn from the Parenting Young Children Project (PYCP). Both studies were conducted in the same university laboratory and recruited families of preschoolers from the same local vicinity.

PCIS Families. Participants were 100 mother-child (46% male) dyads, with the following racial makeup: 86% White, 8% biracial, 3% Asian, and 3% "other race." Children were 41 months old (*SD* = 3 months) when they participated in the observed mother-child interaction task. On average, mothers' and fathers' education level was high (college graduate) and the average family income ranged from $50,000 to $59,000. Exclusion criteria included having a heart condition that could interfere with physiological data collection and/or if the child had been diagnosed with a pervasive developmental disorder. Four families were excluded from

the current analyses due to the dyad using a language besides English during their interaction (*n*=2) and equipment malfunction (*n*=2), resulting in a valid *n* of 96 dyads.

PYCP Families. PYCP participants were 42 mother-child (47% female) dyads with the following racial makeup: 85% White, 2.6% Black/African American, 5.1% Native American, 2.6% Asian, and 5.1% biracial. Children were an average of 37 months old (*SD* = 1 month) when they participated in the observed mother-child interaction task. On average, mothers' education level was at the junior college or associates level and the average family income was $25,000-$29,000. In the PCYP, families at risk for maltreatment were oversampled and all families had to meet one of the following markers of family-level risk: annual total income of 200% of the federal poverty line or less (based on number of people in the home), previous or current involvement with Child Protective Services, and/or use of welfare or social services in the past 3 years (e.g., food stamps, housing assistance). Exclusion criteria included children having a pervasive developmental disability, parents being below age 18 at birth, and/or the parent or child having a medical condition that would interfere with the collection of physiological information.

Procedure

Families from both projects were recruited through flyers and events in the local community, with PYCP recruitment efforts being targeted at agencies and events targeted towards low-income families. After expressing interest in the project, parents received a phone call telling them more about the project and completed a series of screening questions.

PCIS Procedure. When children were approximately 3 years old, dyads came to the laboratory to participate in individual and joint tasks that were videotaped in order to be coded. At this first session (T1), mothers filled out several questionnaires regarding parenting, child

behavior, and family well-being. Dyads participated in three dyadic tasks: a 7-minute free play task, a 4-minute cleanup task and a 6-minute challenging puzzle task, which is described in more detail below. This visit lasted 2 hours and families were paid $50. At T2, approximately 4 months later, parents and teachers were invited to complete the same surveys. Only data from T1 were used in the current study.

PYCP Procedure. At T1, parents gave their consent to participate in the project. Families were given the option to complete the T1 session in their home or at the university office. Also at T1, parents filled out multiple surveys regarding their own childhood, their parenting style, the target child's behaviors, and their current well-being. Families were paid $25 if one parent participated and $30 if both parents participated at T1, which took between 1 and 1½ hours. T1 data for the PYCP were not used in the current project. Approximately 6 months later, families were invited to the university laboratory for the T2 session. Separate T2 sessions were held for each parent; thus, single-parent families completed one session at T2 and two-parent families completed two sessions at T2. Two-parent families received $40 per parent at T2 and single-parent families received $50 at T2. Sessions lasted between 1½ and 2 hours. The T2 session involved the parent and child completing three dyadic tasks, as well as the child completing a series of individual tasks with the experimenter. Data from the T2 session were used in the current project.

Mother-Child Dyadic Tasks. In both the PCIS and the PYCP, mother-child dyads participated in three separate dyadic tasks. These tasks included the following: (a) a free play task, where dyads were given a bin of toys and were instructed to "play as you normally would" for 7 minutes; (b) a clean-up task that lasted 4 minutes, where dyads were told to clean up the toys and mothers were instructed to help using only their words; and (c) a challenging puzzle

task for 10 minutes, which is described further below. While the child completed the individual tasks with the experimenter, the parent filled out multiple questionnaires in a corner of the room.

Measures

Parent child challenge task (PCCT). The PCCT (Lunkenheimer et al., *under review*) is a three-part puzzle task created to assess parent-child interaction patterns during a challenging task. The PCCT is meant to mimic many interactions that parents and children may have on a daily basis. Mothers and children participated in the PCCT for a total of 10 minutes, during which they were instructed to complete three separate puzzle designs. During the PCCT, mothers were told to help their child as they normally would, but only using their words; the child was to actually put the puzzle together. Dyads were told that if they finished all three puzzle designs, the child would receive a prize. Two separate but highly similar puzzles were used: *Day and Night* (Smart Games, 2011) and *Castle Logix* (Smart Games, 2007). Both puzzle sets included a variety of wooden pieces and a guidebook with 48 unique puzzle designs that included multiple levels of difficulty (starter, junior, expert, and master). Three designs were selected from the *Day and Night* and the *Castle Logix* guidebooks. These designs increased in difficulty and were meant to be too difficult for children to complete on their own, meaning that the parent would need to actively support the children's attempts to complete the puzzles.

The PCCT involved three conditions. The first condition, PCCT-Baseline (PCCT-B), lasted 4 minutes and involved the parent and child working to put the puzzles together. After 4 minutes, the experimenter interrupted to tell the family that they only had 2 minutes left to finish; this portion is known as the PCCT-Challenge (PCCT-C). The PCCT-C was designed to present a mild challenge into the interaction, as the dyad believed that they had to complete all puzzles in

order to get a prize. In the PCIS, the challenge portion lasted for 2 minutes and in the PYCP the challenge portion lasted for 3 minutes; task time was controlled in the current analyses.

At the end of the PCCT-C, the experimenter returned to give the child a prize, regardless of whether or not the puzzles had all been completed. If children completed all three puzzles, they were congratulated by the experimenter. If children had not finished all three puzzles, the experimenter apologized saying "I'm sorry, I don't think we gave you enough time to finish all those puzzles. Here is a prize for working so hard." Children either received a coloring book or play dough as a prize. Dyads were instructed to play together with the prize as they normally would while the experimenter set up the next task. This session, known as the PCCT-Repair (PCCT-R) lasted for 3 minutes and was meant to assess the dyad's ability to return to a neutral or positive interaction after a mild challenge (e.g., PCCT-C). The PCCT-R condition was only included for the PYCP sample; the PCIS sample only completed the PCCT-B and PCCT-C conditions. As such, the current study made use of the PCCT-B and PCCT-C conditions.

Dyadic interaction coding system: Parent-child sessions were recorded and subsequently coded on a second-by-second basis using Noldus Observer XT 8.0 software using a dyadic interaction coding system (Lunkenheimer, 2009). Parent and child behaviors were coded by a trained set of coders on a second-by-second basis and were mutually exclusive of one another, such that at any given point in time, each person's behavior would be captured by one code. If the same behavior occurred multiple times in a row without interruption (e.g., three positive reinforcements), the original behavior was coded continuously during that interval. Two graduate and undergraduate coders were trained on the coding scheme and tested for reliability on 20% of the dataset in relation to a standard set by the principal investigator. Drift reliability was also assessed on an additional 15% of videos. Analyses of reliability were performed using

a standard three-second window in Noldus Observer XT 8.0. GridWare 1.15 software (Lamey, Hollenstein, Lewis, & Granic, 2004) was used to create State Space Grids (SSG) that tracked each dyad's movement between unique behavioral states throughout the interaction (see Table 1 for a full list of behaviors).

Table 1

Parent and Child Behavior Codes

Parent Adaptive	**Description**	**Example**
Proactive Structure	Parent encourages, guides or prompts the child to behave in a positive manner	"Let's pretend that the box is a house and help all the toys find their way back home"
Positive Reinforcement	Parent provides verbal support or praise	"Great job!"
Emotional Support	Parent is sharing positive emotions, expressions of endearment or empathy with child	"Are you feeling nervous?"
Teaching	Parent tells the child how something works or asks the child a question to let him/her have an opportunity to learn	"I think the blue coin might go in the blue slot"
Directives	Parent uses clear and/or firm commands for the child exhibit a certain response	"Don't throw that block"
Engagement	Instances when the interaction between the parent and child are mundane/passive	"What should we have for lunch?"
Parent Maladaptive		
Disengagement	Parent is not engaging with, is ignoring the child or seems "tuned out" during the interaction.	Parent ignoring child's request to play a game
Intrusion	Parent takes over the task and/or physically completes some of the task for the child	The parent cleaning up the toys during the Cleanup task
Negative Discipline	Parent (1) provides a directive with a negative consequence, (2) criticizes or (3) physically punishes child	"Clean up or I'll spank you"
Child Adaptive		
Compliance	Child clearly responded to the parent's bid for a behavior change	Following request to put the toys in the box
Persistence	Child sticks to a task after the initial set up	Child keeps putting toys away after an initial directive
Social Conversation	Child is having everyday conversation with the parent or is engaged but not responding to a particular direction from the parent	"Is Daddy going to play?"
Solitary or	Child is playing alone or playing a game next to the parent	Parent and child building

Parallel Play	who is playing her own game	two towers near one another
Child Maladaptive		
Noncompliance	Child doesn't cooperate with parent's bid for behavior change	Child picks up block after the parent asked child to leave blocks alone
Disengagement	Child is not staying on task after the framework for the task has been set up	Child continues playing after the parent has asked the child to put toys away
Emotional Dysregulation	Child's emotional outbursts (positive or negative) that aren't noncompliance	Child throwing a tantrum

Rupture and repair. A rupture was defined as any instance (no matter how small) in which the parent or the child transitioned into a maladaptive behavior (see Table 1). Thus, a "dyadic rupture" was defined as the movement to any maladaptive state (e.g., one or both members engaging in a maladaptive behavior). A dyadic repair was operationalized as the transition from a maladaptive state of interaction to a state of mutually adaptive behavior (e.g., both mother and child engaged in an adaptive behavior). At the individual level, child-initiated ruptures were operationalized as any time the child transitioned from an adaptive behavior to a maladaptive behavior, regardless of the mother's behavior. Similarly, a mother-initiated rupture was operationalized as any time the mother transitioned from an adaptive to a maladaptive behavior, independent of the child's behavior. At the individual level, a child-initiated repair was operationalized as any time the child transitioned from a maladaptive behavior to an adaptive behavior. Similarly, a mother-initiated repair was operationalized as any time the mother transitioned from a maladaptive behavior to an adaptive behavior.

These processes were assessed in multiple ways. First, the frequency of both ruptures and repairs were calculated through the use of State Space Grids (described below), such that multiple frequency variables were created for each dyad including dyadic ruptures, mother ruptures, and child ruptures. See Figure 1 for a visual illustration of these processes. The raw

number of repairs could have been calculated using SSG methodology as well; however, the raw frequency of repairs *independent of the number of ruptures* did not provide meaningful information related to the questions at hand. Rather, the *proportion* of repairs was determined to be a much richer marker of repair and was calculated by dividing the number of dyadic repairs by the total number of dyadic ruptures. Last, the average duration of dyadic and individual ruptures and repairs were calculated, such that two dyadic and four individual variables were created. Dyadic variables were calculated using SSGs and included the average duration of dyadic rupture (e.g., how long did ruptures last?) and the average duration of dyadic repair (e.g., what was the average length of time between ruptures?).

Continuous-time survival analysis (SA; see Singer & Willett, 2003) techniques were then used to calculate the survival times (e.g., time to event) to each of the four individual events of interest (e.g., mother rupture, mother repair, child rupture, child repair). Average time-to-events were only calculated for individuals and dyads who engaged in the event of interest; thus, if a child did not rupture, an average survival time to rupture could not be calculated. Similarly, if neither person in the dyad ruptured, an average time to repair could not be calculated. Due to its ability to account for censored data (e.g., instances when the event did not occur), a series of Cox regressions were used to assess the time-to-event for each outcome for all individuals, regardless of whether the individual had engaged in the event of interest.

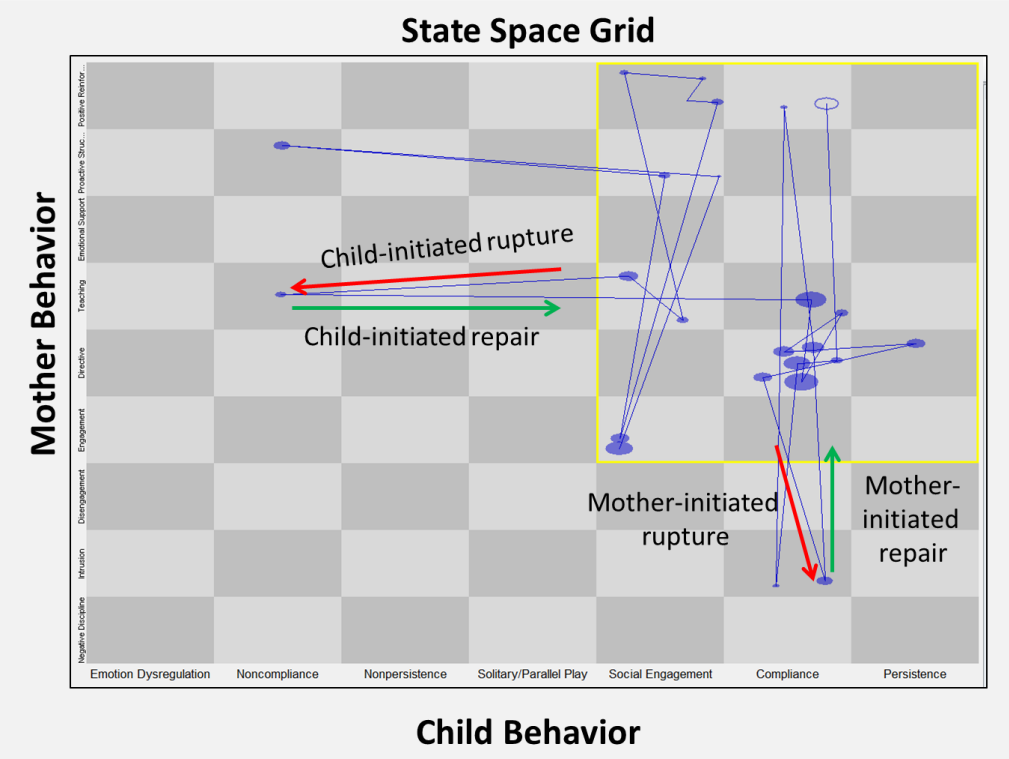


Figure 1: Examples of mother- and child-initiated ruptures and repairs

In the current study, a rupture was defined as the movement into a "maladaptive" state and repair as the movement back to a "mutually adaptive" state. However, it is important to note that the behaviors in the maladaptive region (e.g., child noncompliance, mother intrusion), especially for children, are not necessarily *maladaptive* in the context of preschoolers' social development. In fact, child noncompliance occurs with relative frequency in all parent-child dyads and should be expected at this age as children are asserting their own autonomy during play (Kochanska et al., 2001; Powers, McGrath, Hughes, & Manire, 1994). Thus, in the context of the current study, "maladaptive" behaviors were considered to be any behavior(s) that were not aligned with the goal of completing a difficult puzzle task.

Child maltreatment risk. A 10-item child maltreatment cumulative risk index was developed based on prior work in the cumulative risk literature (e.g., Begle et al., 2010; MacKenzie et al., 2011; Sameroff, Bartko, Baldwin, Baldwin, & Siefer, 1998). Cumulative risk

models have been shown to be strong predictors of maltreatment and have advantages over single-item assessments (Begle et al., 2010; MacKenzie et al., 2011). The 10 binary risk factors in the current study included: (1) family income, (2) child cognitive abilities, (3) financial stress, (4) life events, (5) child physical health, (6) family size, (7) child disruptive behavior, (8) maternal depression, (9) maternal education, and (10) harsh parenting. In line with Begle et al. (2010), families at the 75th percentile or higher on the risk end of the factor (e.g., highest percentile of behavior problems; lowest percentile of positive parenting practices) were given a score of 1. This method was used for the first seven risk factors. However, the final three risk factors were computed in a slightly different manner. First, maternal depression was dichotomized as "clinical" or "nonclinical" levels of depressive symptomology, giving a 1 to dyads where mothers were above the clinical cutoff. Second, due to the relatively high rates of education in the current sample, the lowest 25th percentile still included mothers who had some posthigh school education. Thus, the risk marker for education was adjusted slightly and the risk score of 1 indicated that maternal education was high school completion or less. Similar to MacKenzie et al. (2014), harsh parenting was dichotomized such that the risk score of 1 was given to families that reported any physical discipline strategies. This method created a risk sum score ranging from 0-10 for each family.

Extant work has suggested multiple cut-offs for considering families to be at "high-risk" for problematic outcomes based on cumulative risk scores (e.g., Sameroff et al., 1998; Gerard & Buehler, 2004). Mackenzie et al. (2014) used a three-group model for maltreatment risk, with 0-2 risk markers being low, 3-5 being medium, and 6 or more being high. A three-group split was not feasible in the current study due to a limited sample size; thus, a cut-off of 3 risk factors was used, such that families with 0-2 risk factors were considered "lower risk" and families with 3 or

more were considered "higher risk." The risk index in the current study was not designed to be an exhaustive list, as other studies have used other criteria such as parental history of abuse, marital status, child age, neighborhood safety, and parental self-efficacy. However, the cumulative risk approach has indicated that the overall risk load within a family may be more important than the specific risk factors considered (MacKenzie et al., 2014). Information on individual risk markers is listed below. Similar to Begle et al. (2010), a conservative approach to assessing risk was taken, such that if a family did not report information on a risk factor (e.g., family income), that family received a "0" for that risk marker.

Family demographics. Family demographic information, including family income, maternal education, and family size, was reported by mothers when the child was 3 years old. Income was reported by mothers selecting the appropriate income range for their family income (e.g., $4,999 or less; $5,000 to $9,999; $10,000 to $14,999; up to $90,000 or more). Maternal education was reported by the following categories: no formal schooling, 7th grade or less, junior high completed, partial high school, high school graduate/GED, partial college or specialized training, junior college/associates degree, standard college graduation, or graduate degree. Family size included the total number persons currently living in the home.

Child cognitive abilities. Child cognitive abilities were assessed through the Wechsler Preschool and Primary Scale of Intelligence third edition (WPPSI-III; Wechsler, 2002) receptive vocabulary (RV) task. The RV is a subtest of the WPSSI-III that involves the experimenter showing the child four pictures and asking the child to correctly identify the specified item (e.g., "show me the cup"). The task ended when the child incorrectly answered five items. Sum scores were standardized based on child age, with 10 representing the average score. The RV task has demonstrated high reliability (Wechsler, 2002).

Financial stress. Financial stress was assessed with the Financial Stress Questionnaire (FSQ; Conduct Problems Prevention Research Group, 1994). The FSQ is a nine-item questionnaire that assesses the respondents' perceptions if their ability to meet household financial demands. The first seven items include statements such as, "My family has enough money to afford the kind of home we should have" and "We have enough money to afford the kind of car we need." Responses were based on a 5-point Likert scale ranging from 1 (*Strongly Disagree)* to 4 (*Strongly Agree).* Higher scores indicated higher financial stress. The final two items are designed to be analyzed separately and were not included in the current study. Cronbach's alpha for the combined sample was .99.

Life events. The life events questionnaire (adapted from the Life Experiences Survey; Sarason, Johnson, & Siegel, 1978) was used to assess the number of life events that the family had experienced in the past two[1] years. Examples included "Major medical problems or accident," "You and your partner divorced," "Extended unemployment," and "Community violence." Mothers reported yes or no for each of the 27 events, and a score of 1 was given for a yes response. Scores were summed such that a family could report 0-27, with higher scores indicating more life events. Cronbach's alpha was 1.0 for the PYCP and .69 for the PCIS.

Maternal clinical depression. In the PYCP sample, mothers completed the Brief Symptom Inventory (BSI) at T1 and T2. The BSI asks respondents to rate on a scale from 0 (*Never*) to 4 (*Almost always*) how frequently they have experienced a variety of symptoms in the past week. The BSI includes a total of 53 items that assess the following domains of psychopathology: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Although depression was

[1] In the PCIS sample, a time period of two years was utilized ("Please circle YES for any of the events your immediate family has experienced in the past 2 years"). In the PYCP, a time period of 2.5 years was utilized.

the primary interest for the current risk marker, Derogatis and Melisaratos (1983) advised that clinically significant symptomology should be assessed using the Global Symptom Inventory (GSI; the average of all nine subscales). Specifically, the GSI should be transformed into T-scores, and any individual with a T-score greater than 63 is considered to meet the criteria for clinical range (Derogatis & Melisaratos, 1983). Cronbach's alpha for the combined sample was .93.

In the PCIS sample, mothers completed the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D is a 20-item measure that asks how often participants felt a certain way within the past week. Sample items include: "I did not feel like eating; my appetite was poor," "I felt sad," and "I had crying spells." Responses are based on a Likert scale ranging from "Rarely to none of the time (0-hours)" to "Most or all of the time (5-7 days)." Scores higher than 16 on the CES-D are considered to be in the clinical range. Cronbach's alpha for the combined sample was .72.

Child disruptive behavior. Behavior problems were assessed via mother report using the Child Behavior Checklist (CBCL/1.5-5; Achenbach & Rescorla, 2000). The 99 items are rated on 3-point scales from 2 (*very true or often true of the child*) to 0 (*not true of the child*). Items were summed to create subscales. The externalizing subscale reflects behavioral dysregulation in the form of poor attentional control and physically aggressive behavior. Cronbach's alpha for the combined sample was .89.

Child health. Child health was assessed via mother report using the CBCL (1.5-5; Achenbach & Rescorla, 2000) Somatic Complaints subscale. This subscale included items such as "Aches or pains without medical cause," "Constipated, doesn't move bowels (when not sick),"

"and "Diarrhea or loose bowels (when not sick)." Cronbach's alpha for the combined sample was .49 for this subscale.

Harsh parenting. Harsh parenting was assessed using an adapted version of the Conflict Tactics Scale – Parent Child version (CTS-PC; Straus, Hamby, & Warren, 2003). Some specific items on this scale were altered slightly to better fit the demographic of the current samples. The adapted version of the CTS-PC included two physical discipline subscales (minor and severe) that were combined in the current samples, such that a seven-item subscale was created that included any type of physical discipline (e.g., "Spanked him/her on the bottom with your bare hand," "Grabbed by the arms and shook him/her"). Cronbach's alpha for the combined sample was low, .37. The variable was dichotomized between no use of these strategies (risk score 0) and any use of these strategies (risk score 1).

Analytic Plan

Given that little prior research has examined second-by-second repair rates during parent-preschooler interactions, a series of preliminary analyses were computed to examine distribution properties of key variables prior to analyzing the proposed models. Descriptive analyses were used to examine repair and rupture across dyads, as well as the distribution of variables; transformations were used if necessary. A series of demographic variables was examined in relation to study variables to determine which variables should be controlled during analyses.

RQ1 used exported data from Gridware State Space Grids (Lamey et al., 2004), including frequencies of transitions between maladaptive and adaptive behavioral states and the average duration of rupture. The proportion of repair was calculated by dividing the total number of repairs by the total number of ruptures. Analyses of covariance (ANCOVA) were used to test

the effect maltreatment risk group on the individual and dyadic outcomes of interest controlling for any necessary covariates.

For RQ2, the main interest was in the likelihood of change in individual behavior (e.g., a mother- or child-initiated rupture or repair) and these individual likelihoods were compared within dyad members using 2 X 2 factorial ANOVAs and between dyads using Survival Analyses (*see* Singer & Willett, 2003). In the 2 X 2 factorial ANOVAs, the individual likelihood of rupture was assessed both in the event frequency (e.g., how many times did this child rupture?) and the average time taken to rupture during the interaction (e.g., on average, much time elapsed between child ruptures?). The likelihood of repair was calculated by averaging the duration of each rupture for each individual, answering the question: On average, how long did it take this individual to repair his/her rupture? The average duration of rupture and repair were only calculated for individuals who engaged in the behavior of interest.

Second, continuous-level survival analysis was used to analyze the second set of research questions (see Singer & Willett, 2003 for more information). SA can be used across a variety of contexts when the research interest is in describing *whether* and/or *when* an event occurred. Common elements of research that must be present to make use of SA include: a target event, a beginning time (whereby no one in the sample has experienced the event), and a meaningful metric for clocking time (Singer & Willett, 2003). SA methodology marks the onset and offset time of each behavior and then records the time between changes in these behaviors, known as the survival or hazard rate. Regarding the current analyses, SA was an appropriate method of analysis because SA can better account for censored data, or the *absence* of the event of interest (e.g., individuals or dyads that did not rupture or repair). Cox regressions (Cox, 1972), a commonly used survival model, can then be used to assess the effect of time-covarying and fixed

effects on the time-to-event (Singer & Willett, 2003). Separate continuous-level Cox Regression models were used for each of the four events of interest (e.g., mother rupture, mother repair, child rupture, child repair).

Results

Descriptive Analyses

Descriptive analyses indicated that for the current sample, cumulative risk scores ranged from 0 to 8, and families had an average of 2.6 risk factors (*SD*=1.65). There was a significant difference in the number of risk factors in families across the two studies, with PCYP families having 3.31 and PCIS families having only 2.24 risk factors, $t(136) = -3.67$, $p=.0001$. This was not unexpected, as the PCYP oversampled for high-risk families. Based on the cutoff of three risk factors, 52% of families (*N*=72) were in the low-risk group (0-2 risk factors). See Table 2a and 2b for information on cumulative risk variables across the two samples.

Table 2A

Risk Marker	*N (42)*	*M*	*SD*	Risk Cut-Off	Families with Risk
Family Income	37	$25,000-$29,999	-	≤ $19,999	29%
Child Cognitive Abilities	41	11.68	3.52	≤ 10	29%
Financial Stress	42	2.65	0.88	≥3.2	33%
Life Events	42	7.40	4.37	≥9	36%
Child Physical Health	40	1.03	1.03	≥2	31%
Family Size	42	4.36	1.68	≥5	36%
Child Disruptive Behavior	40	12.03	6.62	≥17	24%
Maternal Depression (yes/no)	40	-	-	< Clinical Threshold	10%
Maternal Education	41	Junior College/ Associates	-	High School/GED or less	12%

Physical Discipline (yes/no)	41	-	-	>0	80%

Risk Marker Information for the Parenting Young Children Project (PYCP) Sample

Table 2B

Risk Marker Information for the Parent-Child Interaction Study (PCIS) Sample

Risk Marker	*N(96)*	*M*	*SD*	Risk Cut-Off	Families with Risk
Family Income	96	$50,000 - $59,000	-	≤ $19,999	6%
Child Cognitive Abilities	94	13.00	2.98	≤ 10	19%
Financial Stress	96	2.31	1.00	≥3.14	17%
Life Events	96	5.04	3.11	≥9	10%
Child Physical Health	96	1.75	1.79	≥2	45%
Family Size	96	3.91	.87	≥5	20%
Child Disruptive Behavior	96	10.54	6.61	≥17	18%
Maternal Clinical Depression (yes/no)	96	-	-	Above clinical threshold	10%
Maternal Education	96	Standard College/ University	-	High School/GED or less	4%
Physical Discipline (yes/no)	96	-	-	>0	76%

Descriptive analyses indicated differences in key study variables based on child gender that were trending in significance. Mother-daughter dyads had fewer CM risk factors compared to mother-son dyads, $t(136) = -1.85$, $p=.07$, girls were faster to repair their own ruptures than boys, $t(99) = -0.39$, $p=.08$, and mother-daughter dyads were quicker to repair their dyadic ruptures than mother-son dyads, $t(119) = -1.99$, $p=.05$. Further, child age was positively correlated with the proportion of dyadic repairs, $r(136)=.20$, $p=.021$, and negatively correlated

with the number of dyadic ruptures, $r(136)=-.258$, $p=.002$, and the time taken to repair ruptures (e.g., older age was associated with quicker repairs), $r(136)=-.203$, $p=.017$. Thus, both child age and gender were included as covariates in the final analyses. Task time varied slightly across dyads in the current sample, primarily due to a slight adjustment of task procedures between studies (e.g., see Method section). Due to the nature of the outcomes of interest, task time was controlled in all analyses. Analyses also controlled for the puzzle used during the PCCT in order to account for any unintended differences in task experience related to the specific puzzle. See Table 3 and Table 4 for correlations between key study variables.

Table 3

Correlations between Risk Markers

	1	2	3	4	5	6	7	8	9	10
1. Income	-									
2. LE	-.385**	-								
3. C-WPPSI	.315**	-.048	-							
4. FSQ	-.501**	.452**	-.032	-						
5. M-EDUC	.472**	-.233**	.228**	-.174*	-					
6. PPL.Home	.100	.069	-.239**	.016	-.206*	-				
7. C-EXT	-.169	.163	-.221*	.104	-.155	.023	-			
8. C-SOM	-.009	.114	-.118	.014	-.062	-.104	.142	-		
9. PHYSICAL	-.132	.044	-.091	.111	-.036	.049	.221**	.078	-	
10. CUM.RISK	-.489**	.447**	-.428**	.446**	-.419**	.231**	.491**	.351**	.169*	-

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level (2-tailed)

Table 4

Correlations between Rupture and Repair Variables

	1	2	3	4	5	6	7	8	9	10
1. Cum.Risk	-									
2. Dyad.Rup	.038	-								
3. Rep.Prob.	.084	-.288**	-							
4. Rep.Speed	.041	.422**	-.605**	-						
5. Nm.C-Rup	.108	.937**	-.322**	.461**	-					
6. Nm.M-Rup	-.102	.496**	.194*	-.176	.257**	-				
7. C-Rep.TTE	-.033	.319**	-.520**	.896**	.313**	-.041	-			
8. M-Rep.TTE	-.052	.123	-.059	.071	.060	.209*	.030	-		
9. M-Rup.TTE	.098	-.292**	.031	.043	-.142	-.598**	.020	-.131	-	
10. C-Rup.TTE	.081	-.515**	.351**	-.224*	-.528**	-.110	-.152	-.074	.142	-

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level (2-tailed)

Notes: TTE (time-to-event); Rep(repair); Rup(rupture)

RQ1: Does higher maltreatment risk relate to more frequent dyadic ruptures and less effective dyadic repairs during mother-child interactions?

ANCOVAs were used to test group differences controlling for child age, child gender, task time, and PCCT puzzle. Results indicated that there was not a significant effect of maltreatment risk level on the number of ruptures, proportion of ruptures repaired in the next exchange (e.g., number of dyadic repairs divided by number of dyadic ruptures), or on the average time taken to repair a rupture. On average, low-risk dyads ruptured 14.58 times (*SD*=15.71) and high-risk dyads ruptured 15.65 times (*SD*=19.71), $F(1, 133) = 0.07$, $p=.790$. Low-risk dyads took 9.47 seconds to repair each rupture (*SD*=8.31) and high-risk dyads took 9.97 seconds to repair (*SD*=7.81), $F(1, 133) = 0.26$, $p=.614$. Low-risk dyads had a repair

proportion of .42 (*SD*=.32) and high-risk dyads had a repair proportion of .46 (*SD*=0.32), *F*(1, 133) = 1.01, *p*=.316.

RQ2: Does higher maltreatment risk relate to the individual likelihood of ruptures and repairs during mother-child interactions?

Individual rupture- and repair-initiation patterns related to CM risk were assessed using CM-risk as a continuous as well as a dichotomized (e.g., high, low) variable. Continuous-time survival analyses using the Cox regression model were used in Mplus (Muthén & Muthén, 1998-2011) to assess the relation of cumulative CM risk to the four outcomes of interest. Survival analyses are extremely useful when the event of interest centers on *whether* and/or *when* an event occurred based on a set of risk factors (Singer & Willett, 2003). Cox regressions can be particularly useful when assessing how both time-covarying and fixed covariates (e.g., covariates that do not change over time) are related to the time to the specified event and in accounting for those for which the event did not take place, known as censored data (e.g., families that did not rupture). The ability to account for censored data was particularly useful in the current models as not all mothers or children experienced the events of interest. In the current models, task time, puzzle time, child gender, and child age were included as fixed covariates.

Results indicated that cumulative CM risk significantly predicted time-to-event for mother rupture after controlling for the specified fixed covariates, β = -0.77, *p*=.003. These results indicated that higher CM risk predicted less time to mom rupture (e.g., quicker ruptures). CM risk did not significantly predict time to mother repair, β = 0.031, *p*=.828. Models testing CM risk on time to child events did not significantly predict time-to-event for child rupture, β = 0.058, *p*=.649, or child repair beyond the covariates, β = -0.042, *p*=.157 (see Table 5).

Table 5

Continuous-Time Survival Analyses using the Cox Regression Model

DV: Time to Mother Rupture		
	b	***SE***
CM Risk	-0.458*	0.151
Puzzle	-0.024	1.074
Task Time	-0.006	0.008
Child Gender	1.569*	0.510
Child Age	-0.125	0.113
DV: Time to Mother Repair		
	b	***SE***
CM Risk	0.052	0.242
Puzzle	0.728	0.203
Task Time	0.478^{+}	0.277
Child Gender	-0.084	0.242
Child Age	-0.038	0.283
DV: Time to Child Rupture		
	b	***SE***
CM Risk	0.099	0.218
Puzzle	-0.740**	0.164
Task Time	0.401*	0.191
Child Gender	0.372^{+}	0.202
Child Age	-0.473*	0.193
DV: Time to Child Repair		
	b	***SE***
CM Risk	-0.336	0.234
Puzzle	-0.306	0.253
Task Time	-0.251	0.264
Child Gender	-0.397^{+}	0.218
Child Age	0.424^{+}	0.224

**p<.001, *p<.05, $^{+}$$p$<.10

Note: Standardized coefficients are presented

Next, separate 2 X 2 factorial designs were used to test the main effects of interaction partner (e.g., mother, child) and CM risk (e.g., high, low) as well as the interaction between partner and CM risk for each of the three primary outcomes: (1) average individual time to repair (e.g., on average, how long did it take the individual to repair his/her rupture), (2) average individual time to rupture (e.g., on average, how much time elapsed between an individual's

ruptures), and (3) individual frequency of ruptures. These models only included individuals that had engaged in the event of interest (e.g., a child that did not rupture during the interaction was not included in the child rupture model). All models controlled for child age, child gender, task time, and PCCT puzzle.

Results indicated that there was a significant main effect for partner on repair time, such that in both the high- and low-risk groups, mothers were significantly more likely (e.g., quicker) to repair interactions than children, $F(1, 184) = 75.57$, $p=.000$ (see Figure 2). There was not a significant main effect for CM-Risk, $F(1, 184) = 0.92$, $p=.338$, or interaction effect for repair time, $F(1, 184) = 0.042$, $p=.839$. There was a significant main effect for partner in the number of ruptures during interactions, such that in both groups, children ruptured more frequently than mothers, $F(1, 268) = 9.92$, $p=.002$ (see Figure 3). The main effect for CM-risk, $F(1, 268) = .38$, $p=.538$, and the interaction effect, $F(1, 268) = .51$, $p=.475$, on rupture frequency were not significant. Consistent with the descriptive analyses, child age, $F(1, 268) = 9.85$, $p=.002$, child gender, $F(1, 268) = 4.26$, $p=.040$, task time, $F(1, 268) = 11.93$, $p=.001$, and puzzle type, $F(1, 268) = 9.26$, $p=.003$, were significant covariates in this ANCOVA, indicating that these covariates were significantly related to the number of ruptures regardless of risk group.

Last, there was not a significant main effect for partner $F(1, 185) = 0.00$, $p=.986$, CM-Risk, $F(1, 185) = .45$, $p=.503$, nor for the interaction term, $F(1, 185) = 0.12$, $p=.732$ on rupture time (e.g., average time between ruptures).

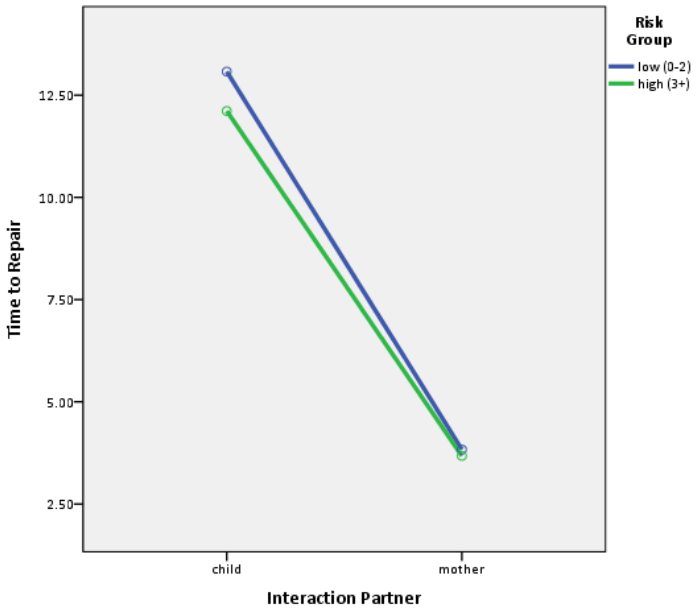


Figure 2: Mother and child repair time by CM risk

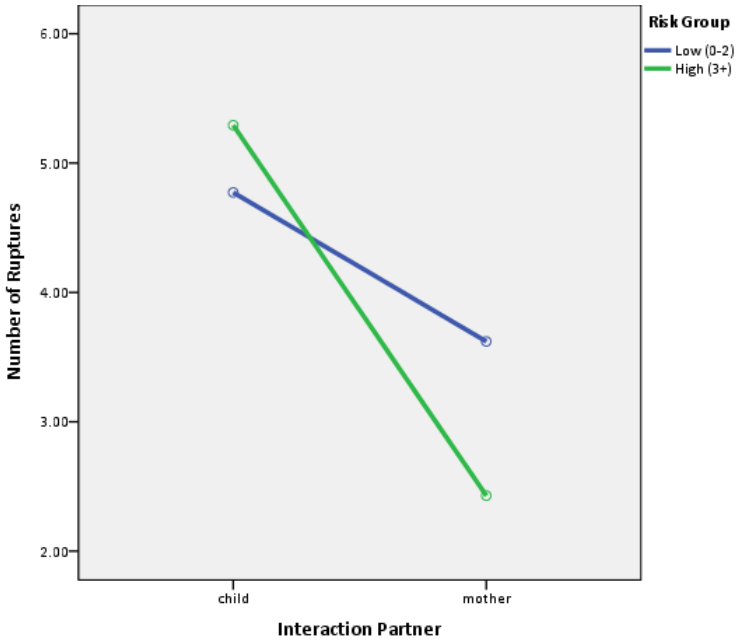


Figure 3: Mother and child rupture frequency by CM risk

Discussion

The primary goal of the current study was to determine whether child maltreatment risk is associated with mother-child rupture and repair processes in early childhood. The first step in examining these relations was to examine frequencies of rupture and repair between dyads at high- and low-risk for child maltreatment (CM) using a cumulative risk model. Based on prior work indicating that family risk can have a negative relation with repair processes (e.g., Skowron et al., 2010; Tronick, 1989), I hypothesized that all dyads would engage in a similar number of ruptures, but that low-risk dyads would show a higher capacity to repair their ruptures than high-risk dyads. This hypothesis was partially supported, with results indicating that all dyads showed a similar number of ruptures, regardless of risk status. This adds to literature suggesting that family risk may not necessarily translate to more ruptures during interactions (Granic et al., 2007; Skowron et al., 2010; Tronick, 1989). Furthermore, higher CM risk did not relate to a lower proportion of repairs nor slower time to repair at the dyadic level, as had been originally hypothesized. These findings were unexpected based on past literature suggesting that high-risk families may struggle to effectively repair their difficult or negative interactions (e.g., Skowron et al., 2010; Tronick, 1989).

The lack of significant differences in the frequency of rupture and the speed and proportion of repair between high- and low-risk groups was unexpected and deserves further attention. A cumulative risk model was used in the current study based on recent work suggesting cumulative risk to be a stronger predictor of maltreatment than an individual-risk model (Begle et al., 2010; MacKenzie et al., 2012). Similar to Begle et al. (2010), a cut-off of the 75th percentile was used to categorize risk in an individual dyad, such that if the dyad scored above the 75th percentile on the risk end of the marker (e.g., above the 75th percentile of life

events; lower than the 25th percentile in child cognitive abilities), the dyad received a "1" for that risk marker. However, because the majority of the current sample was comprised of a typical community sample (e.g., the PCIS sample), this method for assigning risk could have been biased by the sample itself. In other words, it could be that the assigned value of "risk" for each marker may have not been conservative enough based on the sample and, thus, the categorization of "high risk" as having three or more risk markers may not have allowed for a sufficient differentiation between dyads at high and low risk for CM.

The second step in assessing the relation of risk on these interactive processes was to investigate individual patterns of rupture and repair initiation during interactions. This step was warranted as a recent study found within-group differences in these processes, such that in high-risk families, mothers were more likely to rupture and children were more likely to repair while low-risk families showed the opposite pattern (Skowron et al., 2010). When assessing individuals that engaged in the behavior of interest (e.g., children that ruptured, mothers that ruptured), high- and low-risk dyads in the current study showed similar patterns of initiation for both rupture and repair: In both groups, children engaged in a higher number of ruptures than mothers, and mothers were "quicker" to repair their interactive ruptures than were children. These patterns aligned with what was expected in the low-risk group, but are contrary to past literature regarding high-risk groups (e.g., Jameson et al., 1997; Skowron et al., 2010).

As previously described, the restrictions of risk in the current sample may have also contributed to the unexpected similarities between the high- and low-risk groups on individuals' likelihood of rupture and repair. However, these analyses also only included individuals who had engaged in the event of interest (e.g., only children that ruptured had an average time-to-rupture). This not only restricted the sample size, but also could have affected the ability to most

accurately assess these processes. Specifically, it could be that maltreatment risk had implications for the presence of these events occurring *at all*, but that the absence of events was not captured in this set of the current analyses. For example, a child who took longer than the task time to rupture was not included in these analyses, when findings from Skowron et al. (2010) suggested that the decreased likelihood of child rupture was related to higher CM risk. Said differently, it could be that some children in high-risk families avoid rupturing as a way to keep themselves safe (e.g., Gershoff, 2002), indicating that the *nonevent* of child rupture, which was not assessed in these analyses, may have provided unique information on the relation between risk and rupture processes.

The final step taken in assessing the potential for CM risk to disrupt rupture and repair processes was to examine the time-to-event for each event of interest (e.g., child rupture, child repair, mother rupture, mother repair) on a continuous basis using survival analyses. Survival analyses had particular advantages in assessing the current questions of interest as these analyses can better account for censored data (e.g., individuals who did not engage in the event of interest) (Singer & Willett, 2003). Further, a cumulative risk score was used in these analyses as compared to high- and low-risk groups. Survival analyses did indicate a relation between risk and mother-initiated processes such that higher CM risk was related to less time to mother rupture (e.g., higher risk was associated with *quicker* mother ruptures). This replicates and extends past work that has found higher-risk mothers to be more likely to engage in maladaptive behaviors during interactions with their young children such as intrusion, harsh discipline, and disengagement (e.g., Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Overshaw et al., 1986), all of which were operationalized as "ruptures" in the current coding scheme. CM risk was not associated with time-to-event for mother repair, as had been originally hypothesized.

However, results indicated that CM risk did not relate to time-to-event for child rupture or repair. The absence of relation between CM risk and the likelihood of child ruptures and repairs was surprising given past findings that higher maltreatment risk may relate to decreased ruptures and increased repairs by children (Skowron et al., 2010). However, other work has also indicated that maltreatment also predicts higher levels of poorer self-regulation (Schatz, Smith, Borkowski, Whitman, & Keogh, 2008) and higher behavioral dysregulation (Lansford et al., 2002; Shields & Cicchetti, 1998). Thus, it could be that there are different individual or dyadic profiles, such that in some families maltreatment may relate to children's reduced engagement in negative behaviors (as suggested by Skowron et al., 2010) and that in other families, maltreatment relates to more of these behaviors during interactions (Gershoff, 2002). Thus, the relation between CM risk and child-initiated ruptures in the current work could have been distorted by assessing all children together as opposed to comparing across potentially distinct child profiles.

These results have important methodological implications in the assessment of parent-child interaction processes. Specifically, in taking a dichotomized risk approach (e.g., high and low risk) with only dyads and individuals that engaged in the behaviors of interest (e.g., children and mothers who ruptured), results indicated that CM risk did not relate to the individual or dyadic patterns of rupture and repair. However, survival analyses (SA) indicated that higher maltreatment risk was related to shorter time-to-event for mother rupture (i.e., higher cumulative risk predicted quicker ruptures by mothers). It could be that these analyses allowed for a more comprehensive investigation into the role of risk in these processes as SA better accounts for individuals that did not engage in the event of interest (i.e., "censored data"; Singer & Willett, 2003) and/or because cumulative risk was assessed on a continuous basis within these analyses.

These findings indicated that future work should be cognizant of using methodology that accounts for the nonoccurrence of these processes (e.g., dyads that did not rupture), especially as past work has indicated that the *lack of dyadic rupture* (e.g., only engage in positive behaviors) can have negative implications for children learning how to manage the inevitable occurrence of stress and difficulty during interactions (e.g., Biringen et al., 1997; Lieberman, 1994; Tronick, 1989).

Strengths and Limitations

The current study had several notable strengths. First, this study used observational data coded on a second-by-second basis that allowed for an investigation of the timing of specific mother-child interactive processes. The coding system allowed for the assessment of real-time interactive patterns that may not have been adequately captured through the use of global coding or self-report measures of parenting behaviors. Further, the combining of the PCIS and PYCP studies allowed for a cumulative risk assessment of a larger and more diverse sample of families of preschoolers. Last, the use of survival analyses was a key strength of this study, as it allowed for an examination of these processes beyond the frequency and duration. Utilizing SA in the current models allowed for a more precise investigation of how family-level risk (e.g., family, mother, and child factors) related to the timing of specific events during mother-child play (e.g., time to rupture and repair). This represented an important contribution to the literature by providing further evidence that maltreatment risk may relate to disrupted everyday, moment-to-moment interactions between mothers and their children. This is particularly important as interventions such as Parent-Child Interaction Therapy (McNeil & Hembree-Kigin, 2010) have been shown to be effective in altering the maladaptive patterns of behavior between abusing parents and their children (Chaffin et al., 2004).

The main limitations of the current study have already been addressed, including the potential that a 75th percentile cut-off for risk may not have been conservative enough to warrant the "high-risk" group to be composed of families with as few as three risk markers. Further, the potential that not being able to include mothers and children that did not rupture in the group-based analyses (e.g., high- vs. low-risk group) resulted in an incomplete assessment of these processes related to family risk should be considered in the design of future research. However, a final limitation that should be addressed was the combining two separate samples (i.e., PCIS and PYCP). Because the data collections were completed several years apart and were targeted towards different samples (e.g., community versus high risk), there were slight differences in the information collected. This had implications for my ability to assess the specific risk factors in the current study, such as maternal clinical distress being assessed through differing means (e.g., the CES-D for the PCIS; BSI for PYCP). Further, there were slight adjustments in session procedures across these two samples, such as the addition of the PCCT-R during the puzzle task. Thus, although the combining of these samples allowed for a wider range of family experiences, it also created some restrictions that would not have occurred through separate examinations of these samples.

Conclusions and Future Directions

The primary goal of the current study was further investigate how maltreatment risk related to micro-level mother-child interactive processes during the preschool years. Of specific interest to the current study was the ways in which family maltreatment risk related to the likelihood of both mothers and children to "rupture" (e.g., engage in a maladaptive behavior) and "repair" (e.g.. return to an adaptive behavior) during these interactions. These examinations were warranted as past work has indicated that maltreating families (and families at higher-risk

for CM) may have difficulty repairing once their interactions have become disrupted in some way (e.g., Chaffin et al., 2004; Skowron et al., 2010). In some cases, the inability for parent-child dyads to successfully repair their interactions could lead to the occurrence of maltreatment (Cerezo & D'Ocon, 1995, Reid & Taplin, 1978).

Future work should be especially attentive to the methodological considerations of the current study. Specifically, the examination of these processes using continuous-time survival yielded different findings than the examination of these processes through average event durations and frequencies, such that evidence of CM risk affecting these processes was only evident through survival analyses. Further, these results provided preliminary evidence to warrant future work investigating the prevalence of *nonruptured interactions* between parents and children as related to CM risk. A final note regarding future work on these processes is the potential for investigating both affective and behavioral dynamics of rupture and repair. Specifically, some of the foundational work on rupture and repair processes during parent-child interaction focused on the affective nature of these events (e.g., Tronick, 1989; Tronick & Gianano, 1986) and found that maternal depression related to less successful repairs during interactions. The current study focused on the behavioral dynamics of these processes, as much of the work on child maltreatment has focused on parent and child behaviors during interactions, such as coercive interactions and parental discipline (Gershoff, 2002; McFadyen-Ketchum, Bates, Dodge, & Pettit, 1996; Urquiza & McNeil, 1996). However, it could be useful for future work to account for affective processes as well.

In sum, it is essential that future work continue to investigate the ways in which maltreatment risk may disrupt everyday parent-child interactions, as these interactions could serve as optimal targets for prevention and intervention efforts. The specific nature of rupture

and repair processes may be an especially relevant target based on the frequency to which these instances occur on a daily basis (e.g., Tronick, 1989; Tronick & Beegly, 2011). Last, different individual and dyadic profiles should be assessed to better understand the complex ways in which family risk may contribute to the likelihood of dyadic ruptures and the ability for dyads to repair these ruptures.

CHAPTER III

STUDY 2: MATERNAL AND PATERNAL MENTAL HEALTH AND PARENT-CHILD INTERACTION PROCESSES: APPLYING AN ACTOR-PARTNER INTERDEPENDENCE MODEL

Children of parents with poor mental health concerns as depression and anxiety are at increased risk of experiencing negative concurrent and future outcomes, including poor emotion regulation, behavior problems, and their own mental health problems (Carter, Garrity-Rokous, Chazan-Cohen, Little & Briggs-Gowan, 2001; Goodman 2007; O'Connor, Heron, Goldin, Beveridge, & Glover, 2002). One likely mechanism of transmission is through daily parent-child interactions (Campbell, Cohn, & Meyers, 1995; Hoffman, Crnic, & Baker., 2006; Tronick, 1989). The ways in which parents interact and care for their children may be compromised by their psychopathology, with studies linking poorer mental health to harsher discipline (Cohen, Hien, & Batchelder, 2008; McLearn, Minkovitz, Strobino, Marks, & Hou, 2006), less positivity and more negativity (e.g., Cohn & Campbell, 1992; Cohn, Campbell, Matias, & Hopkins., 1990; Hoffman & Drotar, 1991), and less emotional flexibility during interactions with their children (Lunkenheimer et al., 2013).

Detriments in parental mental health are a serious public health concern, with recent work estimating that 17% of mothers (Horwitz, Briggs-Gowan, Storfer-Isser, & Carter, 2009) and 10% of fathers (Paulson & Bazemore, 2010) suffer from some form of depression. For many parents, a variety of mental health symptoms such as anxiety, sadness, loss of interest, and problematic sleep patterns may impair their ability to effectively meet the social, emotional, and physical needs of their children (Cicchetti & Toth, 1998; Field, 2011; Whaley, Pinto, & Sigman, 1999).

As such, young children, who lack the capacity to independently meet their developmental needs, may be especially vulnerable to the effects of compromised parental mental health.

For some families, parental psychopathology can compromise interactions within the family, even amongst healthy family members (Goodman, 2008; Jacob & Johnson, 1997). Such findings align with a systems-based perspective on families, which would suggest that interactions between one parent and child influence, and are influenced by, the child's interactions with the other parent (Goodman, 2008; Holmes & Huston, 2010). The aim of the current study was to investigate the influence of parental psychopathology on the interactions between that parent and the child (actor effects), as well as the interactions between the other parent and the child (partner effects).

Mother and Father Mental Health: A Family Affair

Much of the foundational work on the role of parental mental health (e.g., depression) in parent-child interactions has focused on the symptomology of one parent as related to interactions between that parent and her child (e.g., Foster, Garber, & Durlak, 2008; Goodman & Brumley, 1990; Kane & Garber, 2004; Pelaez, Field, Pickens, & Hart, 2008). This work has found strong negative actor effects, such that higher levels of symptomology are related to compromised interactive processes, such as anxious parents showing less warmth and promoting less autonomy in their children (Whaley et al., 1999) and depressed parents being less supportive and more intrusive with their children (e.g., Field, Healy, Goldstein, & Guthertz, 1990; Lovejoy, Graczyk, O'Hare, & Neuman, 2000).

However, in two-parent families, the relation between parental well-being and parent-child interactions may be influenced by the health of the *other* parent as well (Goodman, 2008). Evidence for such processes has been found in empirical tests of spillover effects, whereby the

stress of one parent (or one relationship in the family, such as a marriage) has adverse consequences for family functioning. For example, marital conflict has been found to negatively affect parenting behaviors and parent-child relationships (Gerard, Krishnakumar, & Buehler, 2006; Katz & Gottman, 1996), and parent perceptions of work-family conflict have been shown to have negative spillover effects in the family setting (Williams & Alliger, 1994).

Related to parental mental health, past work has shown that the depression of one parent has implications for interactions between other family members. For example, partner effects of depression have been found in relation to parent-child interaction during adolescence, such that one parent's depression has been linked to poorer interaction patterns, including less positivity (Jacob & Johnson, 1997) and less open communication (Ponnet et al., 2013), between the other parent and the child. In infancy, Goodman (2008) found that maternal depression was linked to fathers' parenting stress as well as less-optimal father-child interactions, where interaction quality was assessed as the dyad's ability to engage in a mutually synchronous interaction; e.g., the parent being able to soothe the infant and recognize and respond to cues, as well as the infant's ability to provide effective clues and respond to parent attempts to interact.

However, not all evidence has found partner effects for parental symptomology to be negative in nature. For example, in a study of parents and 7 year olds, Nelson, O'Brien, Blankson, Calkins, and Keane (2009) used an Actor-Partner-Interdependence Model (APIM) to examine actor and partner effects in the relation between family stress and parents' emotion socialization of their children. Results indicated a positive partner effect, such that that when one parent reported depressive symptoms, the other parent actually reported showing *more* supportive responses to their child's negative emotions, which was the outcome of interest. Similarly, Hossain, Field, Gonzales, Malphurs, & Del Valle (1994) examined families with a

depressed mother and nondepressed father. Results indicated that although the mother-infant interactions were compromised by depression, the dysfunctional patterns were not evident during father-infant interactions.

Together, this research suggests that partner well-being plays an important role in parent-child interactions, but that there is variability in the ways in which other parent's well-being influences these interactions. Conflicting findings within past research clearly indicate that more work must be done to adequately understand the mechanisms through which the psychopathology of one parent affects interactions between the other parent and child. In particular, paternal mental health deserves more attention in our field (Goodman, 2008, Kane & Garber, 2004; Stoneman, Brody, & Burke, 1989), and much can be gained by having a better understanding of the ways in which fathers' and mothers' mental health may serve to exacerbate or mitigate the effects of psychopathology in the other parent.

Two aspects of parent-child interactions that have emerged as being especially important to early childhood development as well as highly susceptible to parental psychopathology include dyadic repair (e.g., Biringen, Emde, & Pipp-Siegel, 1997; Reck et al., 2004; Tronick, 1989) and dyadic flexibility (e.g., Albright & Tamis-LeMonda, 2002; Lunkenheimer et al., 2013). Although maternal actor effects have been found in relation to both constructs (e.g., Cicchetti & Toth, 1998; Lovejoy et al., 2000;), little is known about the ways in which father mental health may contribute to father-child interactive processes, as well as how father mental health may contribute to these processes between mothers and children. The current study aimed to analyze actor and partner effects between parental psychopathology and dyadic repair and flexibility during parent-child interactions through the use of Actor-Partner Interdependence Models (APIM; Kenny, Kashy, & Cook, 2006).

Dyadic Repair

Dyadic repair represents the movement from a period of stress, discomfort, or conflict towards a mutually adaptive state during interpersonal interactions (Biringen et al., 1997; Reck & Tronick, 2004; Tronick, 1989; Weinberg et al., 2006). All social relationships experience at least some level of negativity, discomfort, or stress, and parent-child relationships are no exception. From the moment of birth, parents and children must learn together how to navigate such times of difficulty, with the burden of responsibility weighing most heavily on parents during the child's earliest stages of life (Tronick, 1989). The consistent ability of dyads to manage times of stress or difficulty is critical to the process of coregulation, whereby the child's experiences are regulated through interactions with the parent, as infants and young children lack the necessary capacities to regulate themselves independently (Feldman, Greenbaum, & Yirmiya, 1999; Lunkenheimer et al., 2011; Tronick & Reck, 2009). Over time, coregulatory processes lay the internal groundwork necessary for children to strengthen their own capacity to regulate different experiences. Rupture-and-repair processes (Tronick & Reck, 2009; Tronick, 1989) during parent-child interactions can be seen as one specific mechanism of coregulation.

Research on repair during early mother-child interactions has suggested that maternal depressive symptoms may make the dyad vulnerable to experiencing ineffective or inconsistent repair processes after stressful or difficult interactions (e.g., Jameson et al., 1997; Reck et al., 2004; Weinberg et al., 2006). Jameson et al. (1997) found that compared to healthy dyads, interactions between depressed mothers and their toddlers were characterized by fewer instances of dyadic coordination and fewer repairs after such instances. In a study of mothers and their infants, Weinberg et al. (2006) also found that dyadic repair processes were less successful in depressed mother-child dyads, especially for male children. Collectively, these studies have

provided evidence that dyadic processes (beyond just maternal behaviors) can be compromised by maternal depressive symptomology.

Further, in two reviews on the topic of interactive processes between depressed mothers and their infants, Tronick and Reck (2009) and Reck et al. (2004) highlighted that periods of mismatch are prolonged in such dyads, and that both the mother and child show differing profiles of interaction compared to healthy controls. For example, in a discussion of mutual regulatory processes, Tronick and Reck (2009) suggested that depressed mothers are less able to accurately read and track the infant's affective communications, which delays the reparation of the child's negative affective experience. Consequently, both members of the dyad experience more chronic negative affect due to the lack of reliable and timely repair processes, eventually leading to the child displaying a more consistently depressed affect. In this way, consistently poor reparatory processes during dyadic interactions could be one mechanism in the transmission of risk for depression from parents to their children (Tronick, 1989).

Parent-Child Dyadic Flexibility

Similar to repair processes, the dyadic flexibility of parent-child interactions has also been shown to relate to healthy child development (e.g., Granic et al., 2007; Lunkenheimer et al., 2011). Dyadic flexibility is a measure of the number of moment-to-moment transitions that dyads make in their behavior or affective expressions during real-time interactions, and/or the degree to which dyads make use of the repertoire of affect (valence and intensity) or goal-directed behaviors available to them (Lunkenheimer et al., 2011). Thus, a dyad exhibiting higher flexibility would show more consistent movements among varying states of behavior or affect during an interaction. Conversely, dyadic rigidity represents the degree to which the dyadic

interactive repertoire is constrained, such that dyads are more likely to remain in specific states of interaction than they are to alter their interaction.

There have been a limited number of studies that have used micro-analytic methodology to assess dyadic flexibility as the second-by-second transitions that parents and children make during their interactions (e.g., Hollenstein, Granic, Stoolmiller, & Snyder, 2004; Lunkenheimer et al., 2011; Lunkenheimer et al., 2013). For example, Lunkenheimer et al. (2013) found that higher levels of maternal depressive symptoms were found to relate to less flexible interactions between mothers and preschoolers during a difficult task. Although Tronick and colleagues didn't necessarily use the terminology of flexibility, their findings that the dyadic ability to consistently move out of periods of negativity or miscoordination is compromised by maternal depression (e.g., Tronick, 1989; Tronick & Reck, 2009) could also indicate an inverse relation between depression and flexibility.

These relations are important, as rigidity (the converse of flexibility) during parent-child interactions has been shown to relate to negative outcomes during early childhood such as higher levels of child externalizing behaviors (Hollenstein, et al., 2004). Prior work has indicated that even when interactions are rigid around positive experiences (e.g., when children are not exposed to consistent, nontraumatic negativity or conflict), children miss opportunities to develop strategies for coping with negativity and stress, which can lead to feelings of hopelessness and lack of self-esteem (e.g., Biringen et al., 1997; Lieberman, 1994; van Der Giessen et al., 2014). In sum, past work on the structural nature of parent-child interactions has suggested that parental mental health may contribute to the degree to which parent-child dyads transition to various states of behavior during interaction (e.g., their flexibility or rigidity), and that the structure of interactions may contribute to children's developing regulatory capacities.

The Current Study

Using a sample of two-parent families, the current study tested multiple dimensions of parent-child interaction processes as related to parental psychopathology. To address limitations of prior work, both parents were included in the current study, which allowed for a more comprehensive assessment of these processes beyond the mother-child relationship, which has been most often studied (e.g., Tronick, 1989; Tronick & Reck, 2009). Much of the foundational work on parental mental health and parent-child interactive processes has focused on depression in particular (e.g., Jameson et al., 1997; Tronick, 1989); however, the majority of this work has also only examined mothers. It has clearly been documented that women are more likely to experience depression than men (Parker & Brotchie, 2010) and that men and women may differ in their experience and reporting of mental health symptomology in general (Afifi, 2007). Thus, the current study accounted for a broader assessment of parental psychopathology as opposed to only examining depressive symptoms. Last, the current study focused specifically on dyadic repair and flexibility within goal-directed behaviors between parents and children (e.g., parental discipline and guidance, child compliance and noncompliance), whereas some past literature has focused on the affective elements of these processes between parents and children (e.g., Tronick, 1989, Weinberg et al., 2006). The behavioral exchanges between parents and children were particularly relevant in the current study as past work has indicated that parental psychopathology may relate to increased use of maladaptive parenting behaviors (e.g., Field et al., 1990; Kane & Garber, 2004; Lovejoy et al., 2000) as well child noncompliance in early childhood (Kuczynski & Kochanska, 1990).

The current study assumed mother-child and father-child data to be nonindependent and used data analytic techniques that could account for this nonindependence. Specifically, co-

parents (e.g., whether romantic partners or not) are likely nonindependent due to the strong likelihood that one parent influences (and is influenced by) the experience of the other. Traditional models of examining parent-child interactions in the family context may be inadequate for truly assessing interdependent data, as the assumption of independence in such data is commonly violated (Kenny et al., 2006). Statistical assessments that fail to take issues of nonindependence into account (a) may risk fully understanding the relational element of parenting and (b) may discover biased estimates of statistical significance (Kenny et al., 2006).

Thus, as the goal of the current study was to examine mother and father psychopathology, it was important to utilize analyses specific to nonindependent data. Actor Partner Interdependence Models (APIM; Cook & Kenny, 2005; Kenny et al., 2006) were used in the current study because these models address the methodological limitations of traditional data analyses by treating the dyad (e.g., mother-father, parent-child, doctor-patient) as the unit of analysis. APIMs allow for researchers to assess three specific types of effects (actor, partner, and interaction) simultaneously in the same model. *Actor effects* represent the effect of one person on his/her own outcome (e.g., mother's depression on her interactions with her child). *Partner effects* represent the effect the partner has on the respondent's outcome (e.g., father's depression on mother-child interactions). Last, *interaction effects* can be assessed to determine how actor or partner effects may differ by partner (e.g., do actor effects for mothers differ from actor effects for fathers?) (Cook & Kenny, 2005; Pollard, Riggs, & Hook, 2014). In the current study, separate APIMs were used for each outcome of interest: repair proportion, repair speed, and flexibility.

Primary hypotheses. *Repair (Models 1 & 2):* Based on prior work on maternal depressive symptoms and repair processes (e.g., Tronick, 1989; Weinberg et al., 2006), I

hypothesized that actor effects for both parents (e.g., maternal psychopathology on mother-child repair and paternal psychopathology on father-child repair) would be negative, such that higher levels of parental psychopathology would predict lower proportions of repair as well as slower time to repair in both mother-child and father-child interactions. The evidence for partner effects has been mixed, with some work suggesting that depression in one partner has negative effects on child interactions with the other partner (Goodman, 2008) and others finding that nondepressed partners' interactions with children are not compromised by the other parent's depression (Nelson et al., 2009). Regardless of the inconsistency in direction, this work has made it clear that partner depression can affect parent-child interactions. Thus, I hypothesized that within the current sample there are significant partner effects; however, I did not hypothesize a specific direction for these effects as related to repair.

Flexibility (Model 3): Based on prior research showing an inverse relation between depressive symptomology and flexibility in mothers (e.g., Lunkenheimer et al., 2013), I hypothesized that there would be negative actor effects of psychopathology on parent-child flexibility during interactions, such that higher levels of symptomology are related to lower flexibility between the parent and child. Given a dearth of prior evidence on the influence of mother's mental health on flexibility during father-child interactions, and vice versa, I hypothesized that there would be partner effects related to parent-child flexibility, but did not predict a specific direction of these effects.

APIM Covariates. Three covariates were accounted for in the current models: shared negative affect, child cognitive skills, and child emotion regulation. As previously discussed, examining structural dimensions of interpersonal interaction (e.g., flexibility) in isolation can be problematic because two families may show similar levels of flexibility but engage in

qualitatively different interaction content. Thus, when examining structural processes, it can be advantageous to also take into account a content-oriented measure of the interaction (Lunkenheimer & Leerkes, in press). As such, negative affect (e.g., the amount of time parent or child showed negativity during the interaction) was accounted for in the current analyses.

Due to the challenging nature of the observed task of interest, children's cognitive abilities were controlled for in analyses. It is plausible that dyads with more cognitively advanced children could have a qualitatively different experience during the task than dyads with children who may be struggling with problem-solving or other cognitive capacities necessary for successfully completing the task. Last, child emotion regulation was also controlled for in the current models. Child emotion regulation (ER) has been shown to relate to parental psychopathology (Feng et al., 2008) as well as parent-child interactions (Kochanska et al., 2001), indicating that the processes under investigation in the current project could differ as a function of child ER.

Method

Participants

Data from 25 two-parent families were used in the current study. On average, children (12 females) were 36.8 months old (*SD* = .60), mothers were 30 years old (SD = 4.80), and fathers were 32.5 years old (SD = 5.10). The racial background of parents included 78% Caucasian (*N* = 39), 8% multiracial (*N*=4), 4% Native American (*N*=2), and 4% Asian (*N*=2). Further, 14% (*N*=7) were Latino/Hispanic. On average, yearly family income was between $40,000 and $49,999, and 60% of families reported a yearly income of $39,999 or lower. Parent education varied: 12% completed high school/GED or less, 50% completed partial college or an associate's degree, 32% completed a 4-year degree, and 6% completed a graduate degree.

Families from the current sample were part of a larger study aimed to select families at risk for child maltreatment. Families were recruited through a variety of local agencies that serve families experiencing high levels of financial, familial, or occupational stress (e.g., Salvation Army, Child Protective Services, the Women, Infant, and Children nutritional supplement program). During an initial screening call, a project staff member screened each family for demographic and risk factors. In order to qualify for the current project, families had to report one of the following: low income (i.e., less than 200% of the poverty line based on number of family members supported), current or previous involvement with Child Protective Services, and/or recent use of social welfare services. Exclusion criteria included the child being outside the targeted age range and/or having a diagnosed neurogenetic or developmental disability. Family-level exclusion criteria included the parents and/or child being unable to speak and understand English, having a medical condition that significantly affected breathing or heart rate, and/or parents being under the age of 18 at the time the target child was born.

Procedure

After parents expressed interest in the study, they were given more information and screened for participation during a 10-15 minute initial phone call. At this time, families scheduled their first session and were given the option to hold this session in their homes or in the laboratory. During this session (T1), parents filled out a variety of surveys detailing information about their childhood, their parenting styles, behavior problems of the target child, and other information regarding their family's current well-being.

When children were 3 years old (T2), families came to the laboratory to engage in a series of dyadic and individual tasks. Each session involved one parent and one child, meaning that families participated in two separate observational sessions, one with mother and one with

father. Each session lasted between 1½ and 2 hours. During this visit, parent-child dyads completed three dyadic tasks including the Parent-Child Challenge Task (PCCT), which was the focus of the current study (see Measures). During this T2 session, the parent also filled out the same surveys that they completed at T1 while a trained experimenter completed a set of individual assessments with the child, including the *Wechsler Preschool and Primary Scale of Intelligence* third edition (WPPSI-III; Wechsler, 2002), an Executive Function (EF) battery (Willoughby, Blair, Wirth, & Greenberg, 2010), and an Effortful Control (EC) battery (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996).

Measures

Dyadic Interaction Coding System. Parent-child sessions were recorded and subsequently coded on a second-by-second basis using Noldus Observer XT 8.0 software using a dyadic interaction coding system (Lunkenheimer, 2009). Parent and child behaviors were coded by a trained set of coders on a second-by-second basis and were mutually exclusive of one another, such that at any given point in time, each person's behavior would be captured by one code. If the same behavior occurred multiple times in a row without interruption (e.g., three positive reinforcements), the original behavior was coded continuously during that interval. Two graduate and undergraduate coders were trained on the coding scheme and tested for reliability on 20% of the dataset in relation to a standard set by the principal investigator. Drift reliability was also assessed on an additional 15% of videos. Analyses of reliability were performed using a standard 3-second window using Noldus Observer XT 8.0.

GridWare 1.15 software (Lamey et al., 2004) was used to create State Space Grids (SSG), which tracked each dyad's movement between unique behavioral states throughout the interaction (see Table 1 for a full list of behaviors; see Figure 4 for a sample SSG). Using SSG

as a method of analysis allowed for the calculation of dyadic repair proportions, repair speed, and dyadic flexibility, all of which are described in greater detail below.

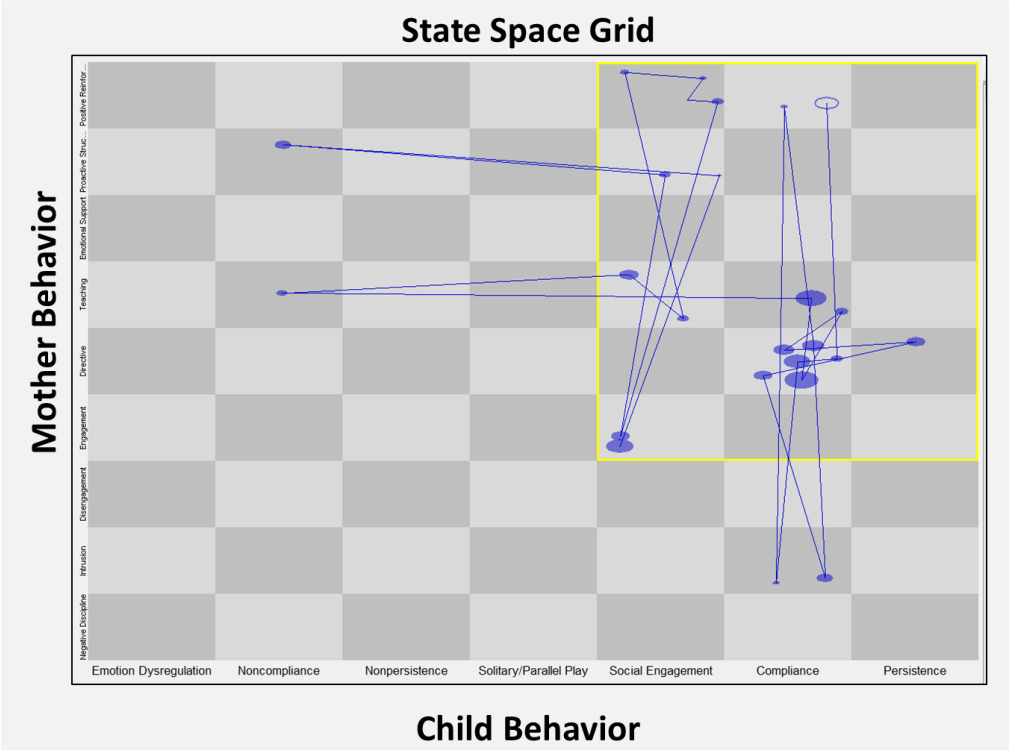


Figure 4: Sample State Space Grid with mutually adaptive region highlighted

Parent Child Challenge Task (PCCT). The PCCT (Lunkenheimer et al., under review) is a three-part puzzle task created to assess parent-child interaction patterns during a challenging task. The PCCT is meant to mimic many interactions that parents and children may have on a daily basis. Mothers and children participated in the PCCT for a total of 10 minutes, during which they were instructed to complete three separate puzzle designs. During the PCCT, mothers were told to help their child as they normally would, but only using their words; the child was to actually put the puzzle together. Dyads were told that if they finished all three puzzle designs, the child would receive a prize. Two separate but highly similar puzzles were used: *Day and Night* (Smart Games, 2011) and *Castle Logix* (Smart Games, 2007). Both puzzle

sets include a variety of wooden pieces and a guidebook that included 48 unique puzzle designs that included multiple levels of difficulty (starter, junior, expert, and master). Three designs were selected from both the *Day and Night* and the *Castle Logix* guidebooks. These designs increased in difficulty and were meant to be too difficult for children to complete on their own, meaning that the parent would need to actively support the children's attempts to complete the puzzles. Puzzle sets were counterbalanced between mothers and fathers, such that 12 mother-child and father-child dyads completed the *Day and Night* puzzle and 13 mother-child and father-child dyads completed the *Castle Logix* puzzle set.

The PCCT involved three conditions. The first condition, PCCT-Baseline (PCCT-B), lasted 4 minutes and involved the parent and child working to put the puzzles together. After 4 minutes, the experimenter interrupted to tell the family that they only had 2 minutes left to finish; this portion is known as the PCCT-Challenge (PCCT-C). The PCCT-C was designed to present a mild challenge into the interaction, as the dyad believed that they had to complete all puzzles in order to get a prize. In the PCIS, the PCCT-C lasted for 2 minutes and in the PYCP the PCCT-C lasted for t3 minutes; task time was controlled for in the current analyses.

At the end of the PCCT-C, the experimenter returned to give the child a prize, regardless of whether or not the puzzles had all been completed. If children completed all three puzzles, the experimenter reflected back "You worked so hard to finish these puzzles; here is a prize for working so hard." If children had not finished all three puzzles, the experimenter said, "You were working so hard. We realized that we didn't give you enough time to finish all those puzzles. Here is a prize for working so hard." Children either received a coloring book or play dough as a prize. Dyads were instructed to play together with the prize as they normally would while the experimenter set up the next task. This session, known as the PCCT-Repair (PCCT-R)

lasted for 3 minutes and was meant to assess the dyad's ability to return to a neutral or positive interaction after a mild challenge (e.g., PCCT-C). The current study made use of the PCCT-B and PCCT-C conditions.

Dyadic flexibility. Dyadic flexibility represented the variation in dyadic behavioral states between parent and child during the interaction period. The measure of dyadic flexibility was calculated using the number of transitions dyads made between different dyadic behavioral states. Transitions were computed through the use of nine-cell by seven-cell state space grids (SSG) that were based on the corresponding nine parent behavioral codes and seven child behavioral codes from the dyadic interaction coding system (see Table 1 for a full list of behaviors; see Figure 4 for a sample SSG). Transitions represented the number of times the dyad transitioned between dyadic states on the SSG; a higher number of transitions indicated that the dyad made use of more cells in the grid, and thus displayed higher levels of behavioral flexibility. Flexibility was calculated by dividing the raw number of transitions by the total task time.

Repair. Repair was assessed during the Parent Child Challenge Task (PCCT) that each parent completed separately with the child at age 3 (T2). Repair was assessed in two separate ways: proportion and speed. The proportion of repair was operationalized as the proportion of instances where the dyad moved to the shared adaptive behavior state directly after engagement in the maladaptive behavior region. Dyads were considered to be in a maladaptive state when *either or both* persons were engaged in a negative behavior (see Table 1 for list of behaviors). Importantly, "maladaptive" in the current context was not meant to reflect instances that were developmentally maladaptive, as for example, child noncompliance is a normative aspect of children's development at this age (Powers et al., 1994). Rather, in the current context, the term

"maladaptive" was reflective of any behavior that did not align with the goal of the interaction (e.g., to complete three challenging puzzles). Conversely, dyads were considered to be in an adaptive state when both persons were engaged in an adaptive, goal-oriented behavior. Figure 5 provides a visual illustration of repair. In this figure, the dyad visited a separate maladaptive behavior state three times and immediately returned to the adaptive region after two of these instances, giving them a repair proportion of .67. In other words, on average across their interaction, they repaired their maladaptive behavioral states two out of every three times.

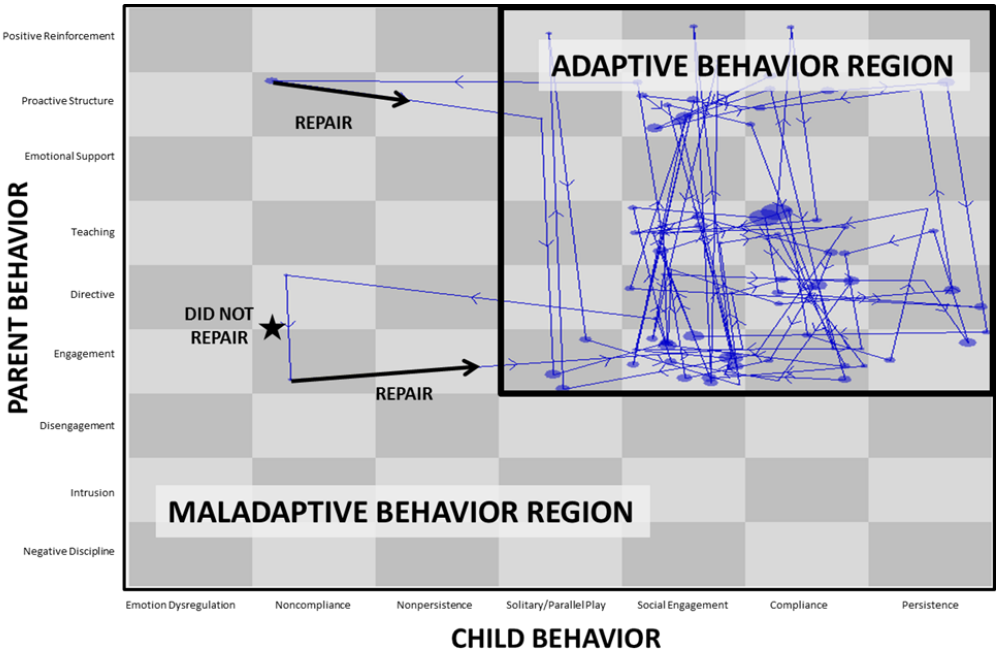


Figure 5: Mother-child dyad showing a repair proportion of .67

Second, the speed with which each dyad repaired their maladaptive behaviors was assessed. The speed of repair for each dyad was calculated by dividing the number of visits to the maladaptive region by the total duration spent in the maladaptive region during the interaction. Thus, if a dyad visited the maladaptive region three separate times, and spent a total of 60 seconds in the maladaptive region, then their average speed of repair would be 20 seconds.

Parental psychopathology. Parents completed the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983) to assess psychopathology symptoms. The BSI asks responders to rate on a scale from 0 (*Never*) to 4 (*Almost Always*) how frequently they have experienced a variety of symptoms in the past week. The BSI includes a total of 53 items that assess multiple domains of psychopathology including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. For the purposes of the current study, a composite measure of the BSI was used to capture parents' experience of problematic symptomology. This measure is known as Positive Symptom Distress Index (PSDI), which is calculated by dividing the sum of each respondent's symptomology by the total number of positive responses. Thus, the PSDI captured the intensity with which a parent was experiencing any symptoms of psychopathology (Derogatis & Melisaratos, 1983). Cronbach's alpha for the current sample was .95.

Child cognitive skills. Child cognitive skills at T2 were controlled for to account for any relation between cognitive skills and children's ability to complete the puzzles. *The Wechsler Preschool and Primary Scale of Intelligence* third edition (WPPSI-III; Wechsler, 2002) Block Design task was used to measure cognitive skills. The 20-item Block Design task tests children's perceptual and visual-spatial abilities and involves the child having to replicate increasingly difficult designs with blocks presented by an experimenter. The maximum raw score a child could receive on this task was 40; the task ended when a child failed to correctly complete three designs in a row. Due to minor variability in child age at T2, raw scores were transformed into scaled scores that account more accurately for the child age using the WPPSI scoring manual (Wechsler, 2002). Scaled scores can range from 1-19 (higher scores represented

higher task performance), with 10 representing the average score based on child age. The task has shown high internal consistency (α = .85; Wechsler, 2002).

Negative affect. Negative affect during parent-child interaction represents the total amount of time during the PCCT that the parent or child expressed negative affect during the PCCT-B and PCCT-C conditions. In the Dyadic Coding System (Lunkenheimer, 2009), parent and child negative affect was separated into two categories: low negative affect and medium-high negative affect. See Table 6 for examples of low and medium-high negative affect for both parents and children. For the purposes of the current study, the time spent in either of these two levels was combined to create a measure of overall duration of negative affect.

Table 6

Parent and Child Negative Affect Code Descriptions

Parent Negative Affect	**Description**	**Examples**
Low-Negative	Some kind of low-level or brief negative affect present, often related to vocal tone or smaller physical movements	Furrowed eyebrows, strained facial expression, heavy sigh, or hard edge in voice tone
Med/High Negative	There is a more substantial kind of negative affect present that may include a longer duration of negative affect or a more extreme instance	Crying, putting hand on face in exasperation, raising voice in anger
Child Negative Affect		
Low-Negative	Some kind of low-level or brief negative affect present, often related to vocal tone or smaller physical movements	Whining, rolling eyes, frowning
Med/High Negative	There is a more substantial kind of negative affect present that may include a longer duration of negative affect or a more extreme instance	Crying, raising voice in anger or sadness,

Child emotion regulation (ER). Child ER was assessed using the emotion regulation subscale of the Emotion Regulation Checklist (ERC; Shields & Cicchetti, 1997). The ERC asks

raters to assess how often the child has shown specific reactions to various situations over the last 6 months (e.g., "The child is a cheerful child" or "The child is easily frustrated."). Twenty-four items were scored on a four-point Likert scale ranging from 1 (*Rarely/Never*) to 4 (*Almost Always*). The regulation subscale represents children's abilities to display appropriate affective responses, their emotional awareness and empathy. Several subscale items were reversed, then scores from the total subscale were averaged, such that higher scores represented higher emotion regulation. Cronbach's alpha reliability was .78.

Analytic Plan

Preliminary analyses. Given that little prior research has examined second-by-second repair rates during parent-preschooler interactions, a series of preliminary analyses were run to examine distribution properties of key variables prior to analyzing the proposed models. Any variables found to be nonnormally distributed were transformed. Additionally, a series of *t*-tests and one-way ANOVAs were used to assess potential differences in repair and flexibility based on a set of family sociodemographic factors, to explore whether repair and flexibility differed by these factors. Further, based on the novel examination of father-preschooler interactive processes, an additional series of descriptive analyses were performed to assess any differences between mother-child and father-child interaction processes.

Primary analyses. The current study was designed to assess actor and partner effects of parents' psychopathological symptoms on two specific parent-child interactive processes: repair and flexibility. Primary research questions included: How do a parent's own psychopathological symptoms at T1 relate to their own parent-child interaction processes (dyadic repair and flexibility) at T2 (actor effect)? And, how do psychopathological symptoms of one

parent at T1 affect parent-child interactive processes (e.g., repair and flexibility) with the other parent at T2 (partner effect)?

The current research questions were analyzed using an Actor Partner Interdependence Model (APIM; Cook & Kenny 2005; Kenny, Kashy, & Cook, 2006). APIMs are useful in understanding the systemic nature of family interactions, and have been used to do so in a variety of publications regarding family, marital, and parent-child relationships (Cook & Kenny, 2005). Specifically, Kenny et al. (2006) discussed extensively the concept of nonindependence. As applied to the current study, the construct of nonindependence indicates that one cannot assume that an individual parent's interactions with his/her child are acting independently of the other parent; rather, research has clearly indicated that there are systemic influences on parenting from the other partner (e.g., Goodman, 2008). This makes an APIM an ideal model for assessing parenting in two-parent families. APIM can be used with indistinguishable dyads (e.g., same-sex partners, same-sex roommates) as well as distinguishable dyads (e.g., parent-child pairs, manager-employee pairs). In the current study, the dyads were distinguishable (e.g., mother-child dyads could be distinguished from father-child dyads by parent sex).

There are three primary types of analyses that can be used to conduct APIM analyses in distinguishable dyads: pooled regressions, multilevel modeling (MLM), and structural equation modeling (SEM). Kenny et al. (2006) recommended using an MLM or SEM approach over the pooled regression approach. The current study made use of the MLM Two-Intercept Model, as each parent's experiences (level 1) were nested within the couple (level 2). Recommendations from Kenny et al. (2006) were used related to data structuring and the use of MLM with dyadic data. As a final note, in MLM APIM analyses, degrees of freedom can be noninteger values (Lorber, O'Leary, & Smith Slep, 2011).

Based on the recommendations from Kenny et al. (2006), the data set was structured to be pairwise prior to analyses such that there were two rows of data for each dyad, with rows distinguished by parent (1 = mother, -1 = father). Thus, mothers' data were entered as one row of variables, as were fathers' data (see Figure 6 for sample data illustrating a pairwise structure). In the pairwise data set structure, there were two variables representing parent psychopathological symptoms within each row: Actor PSDI (e.g., on the mother's line, the mother's PSID score) and Partner PSDI (e.g., on the mother's line, the father's PSDI score).

ID	Role	ChildAge (mo)	DV_Repair Probability	Actor_PSDI	Partner_PSDI
1	1	37.1	.67	1.25	1.05
1	-1	37.1	.80	1.05	1.25
2	1	36.8	.55	2.12	1.75
2	-1	38.8	.25	1.75	2.12

Figure 6: Sample dataset illustrating pairwise structure

Results

Missing Data, Nonnormality, and Standardization

Missing data were rare, and no observational data were missing. Four parents did not complete the PSDI at baseline and one child did not complete the WPPSI Block Design task. One mother scored a "4" on PSDI which represents the highest score possible at the item level. Upon further examination, this score was considered to be an outlier, as the mother only answered a positive response for one item, in which she answered a "4." Her PSDI score was excluded from analyses both because of the score's difference from mean and the potential for altering meaningful relationships in an artificial manner. Missing data were imputed using the Markov chain Monte Carlo (MCMC) method in SPSS (PASW-22.0) and allowed for a maximum of 100 iterations. Five imputations were created and a pooled estimate approach was used with imputed data in the final analyses. No predictor or outcome variables were found to be nonnormal based on a skewness value greater than 2.

Preliminary Analyses

Preliminary analyses indicated that repair speed, repair proportion, and flexibility for mothers and fathers were not related to ethnicity, income level, or education, indicating that it was not necessary to control for these variables in final analyses. Child age was significantly related to father-child flexibility, and thus was included as a covariate in the final models, as were child cognitive skills, child emotion regulation, puzzle set, and negative affect. See Table 7 for descriptive statistics.

Table 7

Study Descriptive Data

	N	*M*	*SD*	Range
Child Age (months)	25	36.76	.56	36-38.48
Child WPPSI Block Design (Scaled)	25	9.4	3.74	1-16.00
Child Emotion Regulation	25	31.96	5.01	25-42
Mother PSDI	24	1.25	1.30	0-1.86
Mother-Child Neg. Affect Duration (seconds)	25	10.66	14.46	0-60.00
Mother-Child Repair Probability	25	.38	.27	0-1.00
Mother Child Repair Speed	25	10.41	9.38	0-40.58
Mother-Child Flexibility (transitions/minute)	25	18.78	2.17	14.45-22.82
Father PSDI	25	1.46	1.43	1-2.50
Father-Child Neg. Affect Duration	25	12.62	18.76	0-78.19
Father-Child Repair Probability	25	.39	.30	0-1.00
Father-Child Repair Speed	25	5.96	3.73	0-13.17
Father-Child Flexibility (transitions/minute)	25	18.95	2.92	11.37-23.21

T-tests indicated no difference between mother-child and father-child dyads in the number of ruptures, $t(48) = -.72$, $p=.44$, repair proportion $t(48) = .10$, $p=.92$, or flexibility $t(48) = .22$, $p=.82$ during interactions. A significant difference emerged in repair speed, with mother-child dyads taking 10.41 seconds and father-child dyads taking 5.96 seconds to repair maladaptive interactions, $t(48) = -2.53$, $p = .025$. Father and mother showed similar levels of

psychopathology as assessed by PSDI scores, $t(48) = 1.47$, $p=.14$. Parent psychopathology was not significantly correlated with speed of repair, repair proportions, or flexibility for either parent. For both mothers and fathers, repair proportion was negatively correlated with average time taken to repair a rupture (e.g., higher repair proportion was related to quicker repairs). See Table 8 for correlations between key study variables.

Table 8

Correlations between Mothers and Fathers for Key Variables

	PSDI	Repair Probability	Repair Speed	Flexibility
PSDI	**.381**$^{+}$	.148	.063	-.066
Repair Probability	.011	**-.188**	-.662**	.024
Repair Speed	-.219	-.530*	**.297**	-.081
Flexibility	.150	-.019	-.006	**.005**

Note: Correlations for mothers are above the diagonal and correlations for fathers appear below the diagonal. Bolded correlations are those between dyad members.

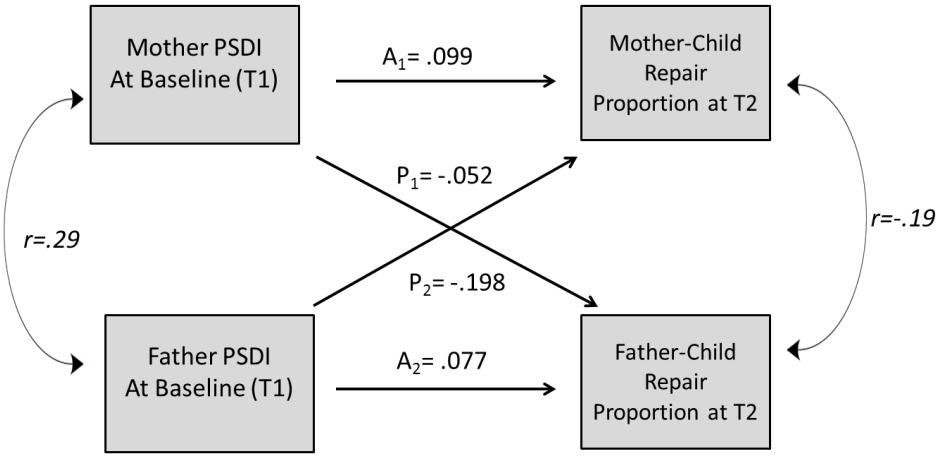
APIM Specification and Results

Prior to conducting APIM analyses, nonindependence was assessed in the current sample in order to validate the use of a distinguishable dyad data format. Theoretically, nonindependence is assumed in heterosexual couples who share a voluntary linkage (Kenny et al., 2006), as prior work has indicated that individuals within a couple may already been quite similar before meeting, such as having similar religious beliefs, political stances, socioeconomic status, and education level (Epstein & Guttman, 1984). Kenny et al. (2006) suggested that a sample have a minimum of 25 dyads before testing for nonindependence, and that nonindependence should be established through a Pearson's correlation using an alpha value of .20. For sample sizes with less than 25 dyads, nonindependence should be assumed, even if the correlation is not significant (Kenny et al., 2006). In the current study (N=25 dyads), mother and father psychopathology was positively related (r=.29, p=.23). Based on the acknowledgement

from Kenny et al. (2006) that 25 dyads should be the minimum for accurately testing nonindependence, nonindependence was assumed for the current sample.

A series of MLM two-intercept models for distinguishable dyads were used with SPSS (PASW-22.0) to test APIM hypotheses. As previously discussed, MLM models were used based on the nested nature of parents, such that each individual parent was nested within the couple. The following variables were included in the final models: parent gender, negative affect, child age, child WPPSI, actor (e.g., respondent) and partner (e.g., the respondent's partner) psychopathology, and each dependent variable. Task time was also included as a covariate in the repair models but not in the flexibility model, as the calculation of dyadic flexibility accounted for time (e.g., number of transitions divided by task time). For all models, the within-dyad variable was parent gender (male, female) and the dependent variable was the actor-child interaction outcome.

Model 1 (see Figure 7) tested actor and partner effects of parental psychopathology on parent-child repair proportions. The dyadic repair proportion represented the likelihood of repair and was calculated by dividing the total number of repairs by the total number of ruptures. For mothers, the PSDI did not show a significant actor effect on mother-child repair proportion or a significant partner effect on father-child repair proportions, indicating that mothers' PSDI did not significantly contribute to repair proportions with either parent, controlling for fathers' PSDI and the specified covariates (see Table 9). Similarly, no significant actor or partner effects emerged for fathers' PSDI on father-child (actor) or mother-child (partner) repair proportions.



A_1: Actor effect of mother's psychopathology at T1 on mother-child repair proportion at T2
A_2: Actor effect of father's psychopathology at T1 on father-child repair proportion at T2
P_1: Partner effect of mother's psychopathology at T1 on father-child repair proportion at T2
P_2: Partner effect of father's psychopathology at T1 on mother-child repair proportion at T2
r_1: Correlation between mother and father psychopathology at baseline
r_2: Correlation between mother-child and father-child repair probabilities during follow-up visit

Figure 7: APIM assessing parental psychopathology (T1) on parent-child repair proportion (T2)

Table 9

APIM Results for Repair and Flexibility

DV: Repair Probability		
APIM Parameters	***b***	**SE**
Child Age	0.009	0.083
Child WPPSI	-0.002	0.015
Puzzle	0.015	0.093
Child Regulation	0.102	0.206
Negative Affect	0.002	0.003
Fathers	-0.176	2.970
Mothers	-0.370	2.961
Father Actor	0.077	0.177
Mother Actor	0.099	0.146
Father Partner	-0.198	0.165
Mother Partner	-0.052	0.174
DV: Repair Speed		
APIM Parameters	***b***	***SE***
Child Age	0.248	1.845
Child WPPSI	0.031	0.330
Puzzle	0.875	1.557
Child Regulation	-2.878	3.702
Negative Affect	-0.018	0.045
Fathers	7.437	64.823
Mothers	8.434	65.304
Father Actor	-2.792	2.352
Mother Actor	2.220	6.384
Father Partner	1.561	1.971
Mother Partner	-1.105	6.025
DV: Flexibility		
APIM Parameters	***b***	***SE***
Child Age	0.970	0.627
Child WPPSI	0.040	0.116
Child Regulation	1.268	0.714
Negative Affect	0.223	1.578
Puzzle	-0.047	0.024
Fathers	-19.696	22.274
Mothers	-21.442	22.128
Father Actor	1.295	1.338
Mother Actor	-0.209	1.182
Father Partner	-1.043	1.199
Mother Partner	1.521	1.267

Model 2 (see Figure 8) tested actor and partner effects of parental psychopathology on parent-child repair speeds (e.g., the average time taken to repair each rupture). For mothers, the PSDI did not show a significant actor effect on mother-child repair speed or a significant partner effect on father-child repair speed, indicating that mothers' PSDI did not significantly affect repair speed with either parent controlling for fathers' PSDI and the specified covariates. Similarly, no significant actor or partner effects emerged for fathers' PSDI on father-child (actor) or mother-child (partner) repair speed.

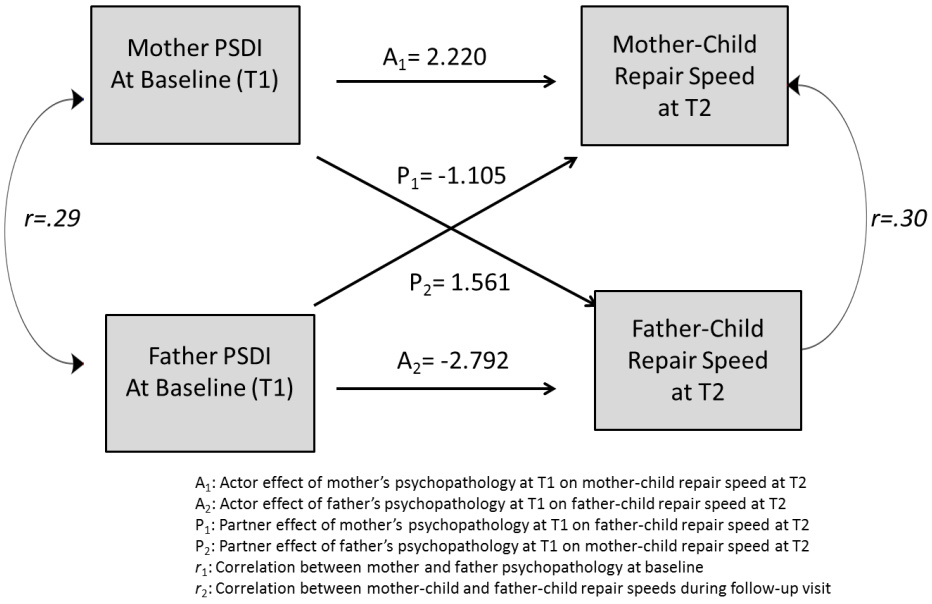


Figure 8: APIM assessing parental psychopathology (T1) on parent-child repair speed (T2)

Model 3 (see Figure 9) tested actor and partner effects of parental psychopathology on parent-child flexibility (e.g., the number of behavioral transitions during the interaction). For mothers, PSDI did not show a significant actor effect on mother-child flexibility or a significant partner effect on father-child flexibility, indicating that mothers' PSDI did not significantly affect flexibility with either parent controlling for fathers' PSDI and the specified covariates.

Similarly, no significant actor or partner effects emerged for fathers' PSDI on father-child (actor) or mother-child (partner) flexibility.

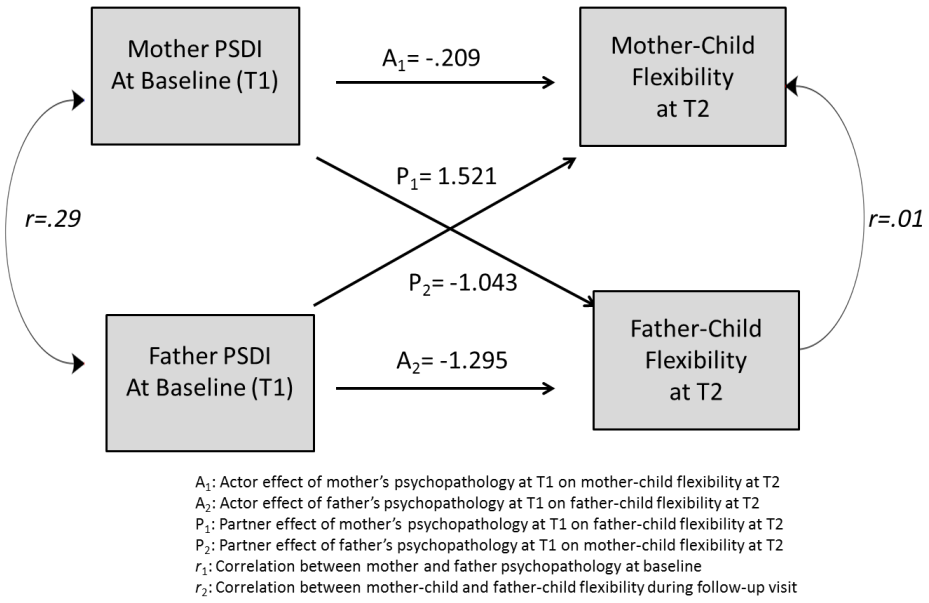


Figure 9: APIM assessing parental psychopathology (T1) on parent-child flexibility (T2)

Had actor or partner effects emerged in any of the three models, an MLM-Interaction model (Cook & Kenny, 2005; Kenny et al., 2006) would have been used to test any differences in strengths of actor or partner effects in the current models. However, as no significant effects were present, these models were not used.

Post-Hoc Analyses

Based on the unexpected finding of mother-child dyads taking significantly longer to repair their dyadic ruptures than father-child dyads, a post-hoc ANCOVA was performed to ensure that this difference was not accounted for by extraneous variables including child age, or puzzle type (e.g., *Day and Night* or *Castle Logix*). Results indicated that on average, father-child dyads were quicker to repair their interactive ruptures than mother-child dyads when controlling for child age and puzzle type, $F(1, 42) = 4.78$, $p=.034$.

Discussion

The current study targeted multiple goals: (a) to increase our knowledge of parent-child interaction processes, namely dyadic repair and flexibility, in mother-child and father-child dyads, and (b) to assess actor and partner effects of parental psychopathological symptoms on these processes in early childhood. These goals were warranted because the majority of previous work on parent-child interaction processes has involved mothers and children especially regarding repair (e.g., Tronick, 1989) and flexibility (e.g., Lunkenheimer et al., 2013). Further, children are actively internalizing self-regulatory capacities through interactional experiences throughout early childhood (Kochanska, Coy, & Murray, 2001), highlighting the importance of understanding these processes during the preschool age.

Mother-Child and Father-Child Interaction Processes

Based on little previous empirical work on the father-child interactive processes of interest to the current study, no hypotheses were made concerning differences between mother-child and father-child flexibility or repair processes. Mother-child and father-child dyads showed similar patterns of flexibility and repair proportion during their interactions; however, mother-child and father-child dyads diverged in repair speed. Specifically, mother-child dyads took nearly twice as long to make this transition than father-child dyads, despite visiting the maladaptive region (e.g., rupturing) at similar rates.

The similarities and differences between mother-child and father-child dyads contribute to a diverse set of findings regarding the question "Do mothers and children interact differently than fathers and children?" Extant literature suggests that this question is best answered in one word: "sometimes." As examining gender-based parenting differences was not the primary aim of the current study, readers are encouraged to review other articles that have targeted this topic

such as Winsler, Madigan, and Aquilino (2005), John, Halliburton, and Humphrey (2013), and Lindsey, Mize, and Pettit (1997), among others. However, I considered the current findings as they corresponded with prior work and suggested future directions to gain clarification.

In the current study, mother and father parent-child dyads showed similarities in their behavioral flexibility during interactions, which aligns with a prior investigation of parent-preschooler affective flexibility during a problem-solving interaction, which also found no parent sex differences (Lunkenheimer et al., 2011). However, the difference in repair speed between mother-child and father-child dyads was a curious finding that deserves further attention. For the current sample, father-child dyads were quicker to repair instances of maladaptive behavior. This could be interpreted in multiple ways. For example, this could indicate that in the current context, father-child dyads were more effective or efficient in resolving maladaptive behaviors compared to mother-child dyads. Some extant work would support this interpretation, including work on child compliance with mothers versus fathers. Powers et al. (1994) found that at age 2, children did not differ in their compliance to mother and father demands; however, at age 4, children were more likely to comply with fathers than mothers.

Furthermore, in parent-child interactions with mothers, fathers, and their toddlers, children showed higher levels of self-regulated compliance (e.g., "child's enthusiastic compliance to task, child displays positive affect and continues work without adult monitoring;" Feldman & Klein, 2003, p. 684) during play with fathers than with mothers. As child compliance could be one mechanism of repair (e.g., child moving from noncompliance to compliance), this extant work would suggest that father-child dyads may be more effective at repairing at this specific developmental period, as it has been defined here. However, as the current study did not fully investigate these processes, such that analyses did not differentiate

which interactive partner was more likely to rupture or repair, firm conclusions should not be drawn based on this finding. Other hypotheses may be equally as valid in explaining the current finding, such as gender differences in parents' willingness to "wait out" times of noncompliance with their children, and can neither be proved nor disproved with the current analyses.

Actor and Partner Effects of Parental Psychopathology

The second and primary goal of the current study was to examine the ways in which parental psychopathology contributed to flexibility and repair processes in early childhood. This goal served as an extension of past work in two primary ways: First, a clear gap in the literature has emerged related to an understanding of how parental psychopathology contributes to dyadic repair and flexibility processes during early childhood, even though the contributions are better understood at other developmental periods (Jameson et al., 1997; Tronick, 1989; Weinberg et al., 2007). Second, the dyadic processes of repair and flexibility have more commonly been investigated related to affective experiences during parent-child interactions (e.g., Granic et al., 2007; Tronick, 1989), while goal-directed behaviors (e.g., parent teaching, child compliance) have largely been examined at the individual level (e.g., parental psychopathology as related to parent behavior or child behavior) (e.g., Foster et al., 2008; Lovejoy et al., 2000).

The current study used actor-partner interdependence models (APIM) to assess actor and partner effects of parental psychopathology on parent-child interaction processes. APIMs were considered to be the most appropriate method of analysis as family-based data are considered nonindependent, and APIMs allow researchers to more adequately account for the potential relations between individual data within a system (e.g., an individual's experience within a family) than many other methods (Kenny et al., 2006). Specifically, APIMs allowed for the examination of actor effects (e.g., one parent's psychopathology as related to his/her interactions

with the child) and partner effects (e.g., one parent's psychopathology as related to his/her partner's interactions with the child). Repair proportion, repair speed, and flexibility were assessed in separate APIMs. Based on prior research indicating a strong relation between parental psychopathology and compromised parent-child interaction patterns (e.g., Lunkenheimer et al., 2011; Lunkenheimer et al., 2013; Tronick, 1989; Weinberg et al., 2006), negative actor effects were hypothesized in all models. Specifically, higher actor psychopathology was hypothesized to predict lower repair proportions, slower repair speeds, and less flexibility during interactions with children. These hypotheses were not substantiated across all three models, as no relation was detected between a parent's psychopathology and the interactive processes of interest for mothers or fathers.

The literature on partner effects has been mixed with some work indicating a detrimental effect of partner psychopathology on actor-child interactions (e.g., Goodman, 2008; Jameson et al., 2007), and other work indicating a more compensatory relationship (e.g., Nelson et al., 2009). As such, no directional hypotheses were made regarding partner effects. Results indicated that partner effects (e.g., the relation between partner psychopathology on parent-child interactive processes with the other parent) were not significant for mothers or fathers on any outcome of interest. There could be multiple explanations for the lack of significant actor and partner effects in the current study, which will be explored further.

Limitations

Sample constraints. Kenny et al. (2006) indicate that APIMs can be used successfully with 25 dyads; however, sample size was still a concern in the current study for two primary reasons. First, parental psychopathology was of primary interest in the current study. Specifically, past work has specifically examined these processes in the context of maternal

depressive symptomology (Lunkenheimer et al., 2011, 2013; Tronick, 1989) as opposed to other types of mental health symptomology. The current study made use of a broader assessment of psychopathology (e.g., the positive symptom distress index) in an attempt to account for potential differences in the type of symptomology reported by mothers and fathers. However, a limited range of symptomology was reported in the current sample. Mothers and fathers both reported a positive response to an average of only 13 out of 53 items on the Brief Symptom Inventory, which could have limited the ability to fully assess the role of psychopathology on the processes of interest. Further, it is also plausible that parental depression is uniquely related to these interactive processes in a way that does not map on to other forms of psychopathology. Thus, by employing a broader assessment of parental mental health, the current study may not have been able to adequately detect the connection between depressive symptomology and repair and flexibility processes for the current sample that has been demonstrated in comparable studies.

Second, smaller sample sizes can decrease one's ability to detect significant results, even if the hypothesized relations are present. Small sample size may be particularly influential in the current study, as some prior work has suggested that mothers and/or fathers may interact differently with daughters compared to sons (e.g., Chaplin et al., 2005; Lindsey, Mize, & Pettit, 1997). The current sample size restricted the ability to test across multiple groups (e.g., mother-daughter, mother-son, father-daughter, father-son) to determine if the expected relationships differed based on the interaction between parent and child gender. Similarly, as dyadic measures, repair and flexibility are assessing the dyad's activity during interactions and do not directly represent the independent contributions of each individual. Although there are many strengths to this approach, it is plausible that there may be different profiles within these dyadic

processes, such as dyads where only one person ruptures versus dyads where both (or neither) rupture. Thus, future work using larger sample sizes may find it useful to assess different processes at both the individual and dyadic levels to gain a richer understanding of these relationships.

Affective vs. behavioral processes. One way in which the current study aimed to address a key limitation in the literature was through the examination of dyadic behavioral interactions. I hypothesized that there would be overlap between the extensive literature regarding parental depression and affective dyadic processes (e.g., affective repair, affective flexibility) and the literature regarding parental depression and individual goal-directed behaviors (e.g., parent discipline, child compliance). However, if the current findings are providing a valid test of these relations (i.e., if these results are not an artifact of a restricted sample), it could be that parental psychopathology has a unique effect on dyadic affective processes that may not be evident in more goal-directed behavioral processes. This is a plausible hypothesis given that depression is a mood-based disorder, with multiple depression markers being affective in nature (e.g., depressed mood, loss of interest, reduced self-esteem) (American Psychiatric Association, 2000). Further, Tronick (1989) posited that the link between maternal depressive symptoms and impaired repair processes could stem from the depressed parent's inability to accurately and appropriately recognize child affective signals (e.g., distress, disinterest). Taking together the affective nature of depression as well as the past work, it could be that behavioral repair is not capturing an extension of affective repair, as was proposed here, which could explain the lack of relations between key variables in the current study. However, it is difficult to hypothesize these relations with any certainty considering the current study's small sample size and consequent inability to examine depressive symptoms only.

Future Directions

A variety of next steps should be taken to continue assessing repair and flexibility processes between mother-child and father-child dyads in early childhood. First, the current finding of father-child dyads repairing their maladaptive interactions more quickly than mother-child dyads deserves further attention. To the knowledge of the researcher, no other published work has documented descriptive or comparative analyses related to father-child repair processes in early childhood. Thus, future work could further investigate these processes by asking such questions as: During father-child interactions, are there differences in who initiates ruptures and repairs? What is the average time for a behavioral rupture to be repaired in father-child dyads across different developmental periods? Are there differences in the strategies in which mother-child and father-child dyads utilize to repair their interactions? Do father-child and/or mother-child behavioral repair consistencies relate to concurrent or future child outcomes? In sum, these findings should be used as a first step in a more comprehensive examination of these processes to more fully understand their implications.

As discussed in the limitations section, there are several steps that should be taken to more specifically examine potential actor and partner effects of parental depression on parent-child interactive processes before null findings are accepted. First, analyses should be conducted with larger sample sizes and potential individual or dyadic profiles should be examined. Similarly, depressive symptomology should be isolated to test whether depression is uniquely related to these processes as compared to broader psychopathology. Specific profiles of interest could be parent-child gender interactions, as well as different parent mental health profiles. For example, do actor and/or partner effects differ depending on if both parents are depressed compared to when only one (or neither) are depressed? Larger sample sizes could also allow for

a broader range of moderators and profiles to be tested in order to gain a clearer understanding of how these relations exist (or do not).

Concluding Remarks

Although the primary hypotheses within the current study were not supported, the strengths of the current study should not be overlooked. First, the current study accounted for nonindependence of family-based data using APIM analyses. This allowed the current project to go beyond assessing one parent's psychopathology solely on that parent's interactions, as has commonly been examined in the parent-child literature (e.g., Kane & Garber, 2004; Tronick & Weinberg, 1997), to assessing partner effects as well. Thus, by controlling for partner psychopathology, the current study took steps to better account for the nature of shared experiences within families. Second, the current sample included families that were deemed at-risk for child maltreatment based on a set of sociodemographic variables (see the Method section). Assessing the current interactive processes in this sample contributes to the literature in multiple ways, as research on families at risk for child maltreatment is already limited compared to other clinical and community samples and research on father-child dyads is limited compared to mother-child dyads (e.g., Kane & Garber, 2004, Stoneman et al., 1989).

Last, the combination of survey- and observation-based data in the current study has the potential to provide unique information compared to survey-based measures only. Assessing real-time family interactions on a second-by-second basis can allow researchers to gain information regarding a wide variety of interactive processes, including temporal relationships between dyadic experiences (e.g., repairing after a rupture) and to determine dyadic interactive profiles (e.g., flexible vs. rigid dyads). This type of information would be difficult to gain in the absence of structured analyses of observed interactions and has been shown to contribute to

meaningful child outcomes, including child behavior problems (e.g., Granic et al., 2007; Lunkenheimer et al., 2011). In sum, the current study highlights the importance of taking a systemic perspective in assessing the potential contributions of maternal and paternal psychopathology on real-time parent-child interactive processes during early childhood.

CHAPTER IV

CONCLUSIONS

The primary aim of the current studies was to extend knowledge of how family risk (e.g., parental psychopathology, child maltreatment risk) related to micro-level parent-child interactive processes during the preschool period. These studies aimed to fill a salient gap in the literature regarding these processes during the preschool age. This developmental period was deemed especially important as parent-child interactions continue to play a significant role in the development of children's regulatory capacities (e.g., Kochanska et al., 2001; Lunkenheimer et al., 2013). Furthermore, parent-child interactive patterns remain susceptible to family risk during this period (e.g., parental depression) (e.g., Crnic, Gaze, & Hoffman, 2005; Lunkenheimer et al., 2013) and these patterns can spill over into children's relationships and interactions with others in different settings (e.g., peer relationships in preschool) (Black & Logan, 1995; MacDonald & Parke, 1984; Schneider et al., 2001). Multiple aspects of parent-child interactions were assessed, including rupture and repair processes (e.g., Skowron et al., 2010; Tronick, 1989) and dyadic flexibility (e.g., Lunkenheimer et al., 2011).

Review of Study 1

In Study 1, family risk for child maltreatment (CM) was examined in relation to rupture and repair processes during mother-child interactions (N=136 dyads). This study used a cumulative risk model based on the strength of this approach as reported by Begle et al. (2010) and Mackenzie et al. (2012). There were no differences in the number of ruptures or the effectiveness of repair between the high- and low-risk groups. In both groups children were

more likely to rupture and mothers were quicker to repair. These patterns aligned with hypotheses for the low-risk group but were unexpected in the high-risk group.

Cox hazard regressions were used to assess the relation between CM risk (measured continuously) and the likelihood of the four individual outcomes: mother rupture, mother repair, child rupture, child repair. CM risk was associated with less time to mom rupture (e.g., quicker mom ruptures) which aligned with past work indicating maladaptive parenting processes in at-risk families (e.g., Skowron et al., 2010). CM risk was not significantly related to the time-to-event for any of the other three outcomes.

Review of Study 2

In Study 2, actor partner interdependence models (APIM; Kenny et al., 2006) were used to examine the relation between parental psychopathology and parent-child interactive processes, including repair and flexibility. The current sample included 50 parents and their children (e.g., 25 mother-child and 25 father-child dyads). The inclusion of fathers in the current study represented a much needed step in the field of early parent-child interactions, which has commonly focused on mother-child interactions.

Based on past work suggesting that maternal psychopathology, depression in particular, relates to less effective repair processes (e.g., Tronick, 1989; Weinberg et al., 2004) and less flexibility during interactions (e.g., Lunkenheimer et al., 2013), I hypothesized negative actor effects in the current sample for both mothers and fathers for all outcomes. Additionally, I hypothesized the presence of partner effects (e.g., the effect of dad's psychopathology on mom-child interactions), but did not hypothesize a specific direction of these effects, as past work has provided mixed findings related to the directionality of partner effects on parental stress and mental health (Goodman, 2008; Nelson et al., 2009). Contrary to study hypotheses, no

significant actor or partner effects emerged in these models for mother or fathers. Great consideration was given to the absence of significant findings, which was previously discussed.

Strengths and Implications of Findings

Both studies had several key strengths that should be acknowledged. First, the use of observational data coded on a second-by-second basis allowed for the examination of how family risk related to the micro-level interactions between parents and children. As many family-based interventions target parent-child interactions (e.g., *Stop Now and Plan;* as discussed in Granic et al., 2004) the current examination of these processes contributed to a growing body of literature regarding how these interactive patterns relate to child and family well-being (e.g., Granic et al., 2004; Hollenstein et al., 2004; Lunkenheimer et al., 2013). Furthermore, clinical techniques such as Parent-Child Interaction Therapy (PCIT; McNeil & Hembree-Kigin, 2010) are based in the micro-interactions between parents and children, and have proven successful in altering maladaptive patterns in high-risk populations such as maltreating families (Chaffin et al., 2004). Second, the inclusion of fathers in Study 2 was of particular importance as, to my knowledge, this was the first empirical investigation of moment-to-moment rupture and repair processes during father-child interactions. Furthermore, the use of APIMs in Study 2 allowed for a more comprehensive assessment of the systemic nature of parental psychopathology as related to parent-child interactions than examining mother-child or father-child interactions separately.

The current studies also introduced methodological considerations for the investigation of repair processes in future work. Based on the comprehensive nature to which rupture and repair processes were examined, these studies brought to light an issue in the measurement of these processes regarding individuals or dyads that *did not rupture* during their interactions. Although prior work has theorized that the lack of rupture during interactions may be meaningful (e.g.,

Biringen et al., 1997; Tronick, 1989), no direction has been given regarding how to best account for these dyads in analyses. In the current study, these dyads were included in frequency counts but were considered missing in other analyses (e.g., an individual that didn't rupture didn't have a score for "average time to rupture"). Survival analyses in Study 1 were particularly useful as such analyses better account for censored data (Singer & Willett, 2003). This issue of "nonevents" should be targeted more directly in future work investigating these interactive processes.

This work also highlighted the complex nature of assessing risk in nonclinical, community samples. Although community samples are commonly used in social science research (Polit & Beck, 2010), such samples can be quite distinct from clinical populations. Thus, the assessment and categorization of risk (e.g., high risk vs. low risk) should be thoughtfully carried out. For example, even though a fairly conservative approach was taken in the assessment of risk in Study 1 (e.g., 75th percentile), the lack of differences between the high- and low-risk groups could have been attributed to the relatively low level of risk in the sample. Similarly, in Study 2, the restricted range of reported mental health symptomology could have limited my ability to adequately understand the role of parental psychopathology on the specific parent-child interaction processes of interest.

Concluding Remarks

In conclusion, the current studies used methodologically sound and appropriate techniques in the assessment of family risk on parent-child interactions during early childhood. Future work should consider both the strengths and limitations of these studies in the investigation of various forms of risk (e.g., maltreatment, depression, child behavior problems) to aid in the continued advancement of the field. In particular, the everyday, moment-to-moment

interactions between parents and their young children should continue to be examined and findings should be used in the development of family-based programming.

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