

**INTERPARENTAL RELATIONSHIP ADJUSTMENT IN INFANCY  
AND CHILD SELF-REGULATION AT 7–8 YEARS**

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Self-regulation plays an important role in children's social, emotional and academic adjustment. Yet, relatively little is known about its early family antecedents beyond parenting and parent–child relationships. The aim of this study was to investigate the prospective associations between interparental relationship adjustment in infancy and children's behavioral and emotional self-regulation at 7–8 years of age. Direct and indirect links between interparental relationship adjustment at 2 months and subsequent child self-regulation were examined, with the affective quality of the mother–child and father–child relationships at 12 months investigated as potential mediators of the indirect association.

The participants were a sample of 353 children and their parents. Mothers and fathers reported their interparental relationship adjustment on the Dyadic Adjustment Scale (DAS) when their child was 2 months old. When the child was 12 months old, they reported the quality of their child-relationship on the Parent–Child Dysfunctional Interaction subscale of the Parenting Stress Index – Short Form (PSI–SF). Children's self-regulation was assessed at the age of 7–8 years using parent reports on three subscales of three questionnaires: the Attention subscale of the Five to Fifteen (FTF), the Inhibitory Control subscale of the Children's Behavior Questionnaire (CBQ), and the Emotion Self-Regulation subscale of the Emotion Questionnaire (EQ). The measures of attention and inhibitory control were combined into a single index of behavioral self-regulation. The direct and indirect associations between interparental relationship adjustment and child behavioral and emotional self-regulation were tested within parallel multiple mediator models with mother–child and father–child relationships as mediators. The main analyses were performed using the PROCESS macro for SPSS.

Interparental relationship adjustment in infancy had both direct and indirect positive associations with children's self-regulation at 7–8 years. The findings varied for behavioral and emotional self-regulation. Interparental relationship adjustment at 2 months had an independent association with children's *behavioral* self-regulation at 7–8 years, while there was also evidence for mediated effects through both mother–child and father–child relationships at 12 months. The effect of early interparental adjustment on *emotional* self-regulation, however, was indirect, mediated only by mother–child relationship quality in infancy.

The findings of this study suggest that better interparental relationship adjustment early in infancy is associated with children's better self-regulatory abilities at 7–8 years of age, and that at least some of this association may be independent of the quality of parent–child relationships in infancy. At the same time, however, early parent–child relationships, especially mother–child relationship, mediate some of this association. These findings indicate the importance of supporting parents' interparental relationship adjustment during the early phases of child rearing. The results further suggest that, in addition to the more traditional focus on parent–child interactions, early prevention and intervention of child self-regulatory and adjustment problems could benefit from also targeting interparental relationship functioning.

**Keywords:** behavioral self-regulation, emotional self-regulation, interparental adjustment, interparental relationship, parent–child relationship, self-regulation

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## 1. INTRODUCTION

Self-regulation, broadly defined as an ability to regulate one's behavior, emotion, attention and thought (Karoly, 1993), is agreed to have comprehensive impacts on well-being over the life course. In children, it has been linked with, for example, social competence and academic functioning, and difficulties with self-regulation have been associated with externalizing and internalizing problems (for reviews, see Bridgett, Burt, Edwards, & Deater-Deckard, 2015; Eisenberg, Spinrad, & Eggum, 2010). Childhood self-regulation has also been found to be an important predictor of health and wealth in adulthood (Moffitt et al., 2011). In addition, self-regulation has been suggested to mediate and moderate the effects of environmental factors on child adjustment (e.g., Eisenberg, Smith, & Spinrad, 2011; Lengua, Bush, Long, Kovacs, & Trancik, 2008). Given the significance of self-regulation in many developmental outcomes, it is important to understand the factors affecting its development.

Both neurobiological and environmental factors contribute to the development of self-regulation. Self-regulation is thought to have rather strong temperamental and neurobiological origins (Rothbart & Bates, 2006). Still, early experiences have been shown to play an important role in its development (Eisenberg et al., 2011; Lengua et al., 2008; Lengua, Honorado, & Bush, 2007), possibly through shaping the structure and functioning of the developing neurobiological systems associated with self-regulation (Blair, 2010; Leerkes & Parade, 2015). During the first years of life, when top-down self-regulation of attention, behavior and emotion, as well as the associated frontal brain areas develop rapidly (Bridgett et al., 2015), family context is the primary source of environmental influence for most children. Indeed, research has established a firm link between various family factors and children's self-regulation (Morris, Silk, Steinberg, Myers, & Robinson, 2007). However, most research on the family-origins of self-regulation has focused on the quality of parenting and dyadic parent-child relationships, while the role of interparental relationship quality for children's developing self-regulation has received far less research attention. Yet, family systems perspective highlights the importance of studying marital relationship in addition to and together with parent-child relationships in order to gain a more complete understanding of the processes affecting individual development (Cox & Paley, 2003; Minuchin, 1985).

Research focusing on interparental relationship has consistently found that it is associated with many aspects of children's adjustment, including self-regulation, either directly or via its effects on other family processes, such as parenting and parent-child relationships (Cummings & Davies, 2010; Morris et al., 2007). However, previous research is limited in three important ways. First,

most research on the influence of interparental relationship on children has been conducted with older children and adolescents. Research on how interparental relationship functioning during infancy may affect children's regulatory capabilities is scarce, even though infancy is known to be a time-period both important for the development of self-regulatory processes (e.g., Calkins & Leerkes, 2011; Leerkes & Parade, 2015; Rothbart, Ellis, & Posner, 2011) and burdensome for interparental relationship (Doss, Rhoades, Stanley, & Markman, 2009). Second, the existing research exploring the effects of interparental relationship during infancy on child self-regulation is mostly cross-sectional or short-term longitudinal in nature. Therefore, little is known about longer-term developmental consequences of interparental relationship functioning in infancy. Third, previous research has largely focused on overt interparental aggression and conflict, while less overt aspects of interparental relationship dynamics, such as overall relationship adjustment, have been infrequently considered, especially in infancy. Interparental relationship adjustment (or dyadic adjustment) refers to the overall quality of the interparental relationship consisting of partners' satisfaction with the relationship, agreement on important issues, the amount of shared interests and activities, and expressions of affect (Spanier, 1976). The aim of the current prospective longitudinal study was to address these gaps in literature by examining the effects of interparental relationship adjustment in infancy on children's behavioral and emotional self-regulation at the age of 7–8 years. Following from the family systems perspective, it was simultaneously analyzed whether interparental relationship adjustment has direct effects on later self-regulation, and whether the quality of mother–child and/or father–child relationship in infancy mediates the effect.

### **1.1. Self-regulation: definition and development**

Diverse definitions and measures of self-regulation have been used across studies in different subdisciplines of psychology. The most commonly used frameworks for studying self-regulation in childhood and adolescence have been effortful control and executive functions (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Zhou, Chen, & Main, 2012). Effortful control, traditionally used in developmental and temperament literature, refers to the self-regulatory component of temperament that serves to modulate reactivity in emotional, attentional, and motor domains (Rothbart & Bates, 2006). It consists of an ability to voluntarily inhibit or activate behavior, to focus and shift attention, to integrate information, plan and detect errors (Rothbart & Bates, 2006). Executive functions, on the other hand, have traditionally been studied in neuropsychology and cognitive neuroscience literatures (Bridgett et al., 2013; Zhou et al., 2012). The three core

components of executive functions are inhibitory control (including selective / focused attention and control over one's behavior), working memory and cognitive flexibility (see Diamond, 2013, for review). Historically, effortful control and executive functions have been studied as distinct constructs related to children's self-regulation, but recently some researchers have suggested that they are considerably similar or even overlapping at conceptual, behavioral, and neurobiological levels (Bridgett et al., 2013; Zhou et al., 2012). Central aspects and the most commonly used measures of both are attentional regulation (i.e., voluntary focusing and shifting of attention) and inhibitory control of behavior and impulses (i.e., the ability to suppress inappropriate behavior and inhibit predominant responses) (Eisenberg et al., 2011; Zhou et al., 2012).

The operational definition of self-regulation used in this study is based on a review article by Bridgett et al. (2015), and could be summarized as an individual's ability to manage their attention, behavior and emotion. Bridgett et al. (2015) present a comprehensive conceptualization of self-regulation that integrates different aspects of the construct. They state that, at a general level, self-regulation can be differentiated into two separable but interacting components: the more voluntary or effortful top-down self-regulation and the more automatic or reactive bottom-up self-regulation (see also Eisenberg, Hofer, Sulik, & Spinrad, 2013). This study focuses on the more voluntary top-down self-regulation, which, according to Bridgett et al. (2015), can be further divided into behavioral and emotional self-regulation. In their conceptualization, behavioral self-regulation incorporates both effortful control and executive functions discussed above and, thus, its central components are voluntary focusing and shifting of attention and inhibitory control of behavior and impulses. Emotional self-regulation, on the other hand, refers to the self-regulatory processes involved in the modulation of one's experience and behavioral expression of emotion (Eisenberg et al., 2013). The indicators of self-regulation examined in the current investigation are 1) attentional regulation, 2) inhibitory control of behavioral responses, and 3) emotion self-regulation.

Attentional regulation and inhibitory control, central aspects of behavioral self-regulation, are important processes also for the regulation of emotional arousal, experience and expression (i.e. emotional self-regulation) (Eisenberg et al., 2011). Shifting attention away from distressing or arousing stimuli and focusing it on neutral or positive ones help modulating arousal and emotional experience. Inhibitory control, on the other hand, is important in regulating emotion-related behavior, for example inhibiting aggressive impulses when angered (Eisenberg et al., 2011) and resisting temptations (Diamond, 2013).

The top-down self-regulatory processes (i.e., behavioral and emotional self-regulation) develop dramatically during the first years of life. In the early months of life, infants depend almost completely on adults for the regulation of their affect (Calkins & Leerkes, 2011; Eisenberg et al.,

2010). However, infants' ability to voluntarily regulate their arousal levels begins to emerge between 3 to 6 months of age (Calkins & Leerkes, 2011). This early self-regulation of emotional states is largely based on the developing attentional self-regulation: the infants become capable of disengaging their attention from arousing stimuli, shifting it and focusing on more neutral stimuli (Calkins & Leerkes, 2011; Rothbart et al., 2011). The ability to effortfully inhibit behavior upon command (inhibitory control) emerges and improves somewhat later, between 2 and 4 years of age (Diamond, 2013; Eisenberg et al., 2010). Self-regulatory skills continue improving markedly through toddler and preschool years, and 5-year-old children are already quite efficient in controlling their attention, inhibiting inappropriate behavior and regulating emotions (Eisenberg et al., 2010). The development of self-regulation continues more gradually through childhood, and adolescence is another period of rapid development (Bridgett et al., 2015).

Improvement in top-down self-regulation of attention, behavior and emotion is associated with development in frontal areas of the brain, especially prefrontal cortex (see Bridgett et al., 2015). These brain areas mature most rapidly during the early years of life (from birth to 5–8 years of age) (Bridgett et al., 2015), and early environmental experiences have been shown to affect the development of their structural and functional characteristics (Blair, 2010). Early in life, during infancy, family interactions are the most salient source of environmental experience. Thus, to better understand the processes promoting or compromising the development of self-regulation and subsequent child adjustment, it is important to investigate the longitudinal effects of different family factors in infancy. However, the influence of some family-related factors on developing self-regulation (e.g., parenting and mother–child relationship) have received much more research attention than others, such as interparental relationship.

## **1.2. Interparental relationship and child self-regulation**

The quality of interparental relationship, in addition to the more studied parent–child relationships, is an important family context for the development of infant self-regulation (Cummings & Davies, 2010; Leerkes & Parade, 2015). Interparental relationship can be viewed as forming the basis for the family system functioning, and it is an important contributor to the emotional climate of the family (Morris et al., 2007). Research shows that, on average, the quality of interparental relationship deteriorates after becoming parents: marital satisfaction decreases and conflict increases (Doss et al., 2009). It has been suggested that very young children are more likely to be exposed to interparental conflict than older children (Fantuzzo, Boruch, Beriama, & Atkins, 1997).



They may also be more vulnerable to its negative effects because their capacity to self-regulate arousal is relatively immature and they depend heavily on parents for the regulation of their emotional states, and because infancy is a critical developmental phase of – with potential long-term effects on – self-regulatory processes and the associated neurological and physiological systems (Calkins & Leerkes, 2011; Leerkes & Parade, 2015). Interparental conflict and other dynamics are also known to affect other family processes, such as parenting and parent–child relationships (Erel & Burman, 1995), which in turn have been shown to affect children’s developing self-regulation (Bernier, Carlson, & Whipple, 2010; Morris et al., 2007). Despite all this, most research on the relations between interparental relationship and child adjustment has focused on older children. Furthermore, the majority of the studies investigating the effects of interparental relationship dynamics on child self-regulation have focused on marital conflict or aggression, but it is also important to gain understanding on how other, less overt aspects of interparental dynamics, such as relationship adjustment, influence the development of self-regulation. Compared to interparental conflict, the concept of interparental relationship adjustment provides a broader and more multifaceted picture of the overall quality of the interparental relationship, involving also positive aspects of interparental relationship functioning. The focus of this study, therefore, is on interparental relationship adjustment, whose effects on child self-regulation have been infrequently studied, especially during infancy. Its longitudinal associations with later self-regulation are even less researched.

Studies with school-aged children and adolescents have consistently found a link between interparental conflict and child externalizing and internalizing symptoms, as well as poorer social and academic functioning (Cummings & Davies, 2010). It has been suggested that this association is mediated by children’s self-regulation, which is negatively affected by interparental conflict and plays an important role in such adjustment outcomes (e.g. Cummings & Davies, 2010; Eisenberg et al., 2010). The small body of research focusing on infants suggests that interparental relationship quality and conflict also influence infants and their developing emotional and physiological regulatory abilities. For example, previous studies have found that interparental conflict is associated with lower levels of behaviorally observed infant emotion regulation (Crockenberg, Leerkes, & Lekka, 2007; Porter, Wouden-Miller, Silva, & Porter, 2003) and physiological regulation (Porter et al., 2003) as early as 6 months of age. Adjustment and other less overt, positive aspects of interparental relationship functioning (e.g. positive interparental emotions), although rarely studied, have also been found to have implications for emotional and physiological regulation in infancy. Graham, Ablow, and Measelle (2010) found that better interparental relationship adjustment was associated with better physiological regulation in exciting and potentially

distressing novel situation in 5-month-old boys, and Porter et al. (2003) found that positive interparental emotions and activities were associated with higher levels of behaviorally observed infant emotion regulation at 6 months of age. However, none of the aforementioned studies investigated the longitudinal associations beyond the age of 6 months.

Longitudinal associations between interparental conflict and aspects of child self-regulation and adjustment have been found in samples of preschool and school-aged children (e.g., Cummings, George, McCoy, & Davies, 2012; Cummings, Schermerhorn, Davies, Goeke-Morey, & Cummings, 2006). However, surprisingly little is known about the longitudinal relations between interparental relationship functioning in infancy and subsequent child development, including the development of self-regulation. The results of a few short-term longitudinal studies indicate that interparental conflict at 8–9 months of age is negatively related to 2-year-old children’s cognitive abilities (Pendry & Adam, 2013) and emotion regulation (Frankel, Umemura, Jacobvitz, & Hazen, 2015). One study found that interparental aggression at 7 months predicted toddler attention skills at 15 months which, in turn, were associated with increased risk for attention deficit/hyperactivity symptoms and conduct problems indicating poor self-regulation at 3 years of age (Towe-Goodman, Stifter, Coccia, & Cox, 2011). To my knowledge, only a couple of earlier studies have explored longer-term longitudinal predictions of interparental functioning in infancy, but interparental relationship was not their main focus and the results are mixed. Favez et al. (2012) found that interparental adjustment measured during pregnancy and at 18 months was not linked with any of the child outcomes, including internalizing and externalizing symptoms, at 5 years but they did not directly measure child self-regulation. On the other hand, Lindblom et al. (2015), using a subsample of the same original sample as this study, found that children whose families were characterized by harmonious family relationships during infancy and better interparental relationship adjustment at 2 months showed more efficient emotion regulation, as indexed by emotional attention biases, at 10 years of age compared to children from families with less optimal interparental and family-wide functioning in infancy. However, since interparental relationship was not investigated independently of a wider family system type, it is not possible to differentiate its effect from other family factors.

### *1.2.1. Direct and indirect links between interparental relationship and child self-regulation*

Research, mostly based on children beyond infancy, has established both direct and indirect mechanisms through which interparental relationship functioning impacts child self-regulation.

Direct effects refer to the emotional and physiological reactions that are triggered in children as a result of exposure to interparental relationship dynamics, while indirect effects operate through the effects interparental relationship quality has on, for example, parenting and parent–child relationships that in turn affect the development of self-regulation (Cummings & Davies, 2010; Erel & Burman, 1995). Few studies, however, have examined the longitudinal pathways between interparental functioning in infancy and later child self-regulation.

Evidence for *direct effect* mechanisms comes from studies noting that simply being exposed to interparental dynamics, especially conflict, affects infants’ regulatory development. For example, Graham, Fisher, and Pfeifer (2013) found that 6–12 -month-old infants whose mothers reported higher interparental conflict had greater brain activation in areas involved with emotion and stress regulation in response to angry vocal tones, and this effect was observed when the infants were sleeping. The authors concluded that environmental stressors, such as interparental conflict, may be related to infants’ neural functioning in areas critical for emotion and stress regulation, and that infants exposed to high levels of conflict may process stressor-relevant stimuli, such as angry tones of voice, even during sleep. Other investigators found that 6–14-month-old infants who had a higher history of being exposed to interparental conflict reacted to a live destructive interparental conflict situation with more dysregulated affect than infants without previous exposure to interparental conflict (Du Rocher Schudlich, White, Fleischhauer, & Fitzgerald, 2011). Both of these results indicate that previous experiences of high levels of interparental conflict may risk the early development of regulatory processes and prime infants to experience future conflict more intensely.

It has been suggested that exposure to interparental conflict may be particularly stressful during infancy, when children’s own regulatory capacity is only emerging and they depend heavily on parents for regulating their emotional and physiological arousal (Calkins & Leerkes, 2011). When engaged in conflict, parents may be unavailable to aid their infant in regulating intensive emotional states (Cummings & Davies, 2010). Repeated exposure to stressful situations and unregulated arousal is associated with alterations in infants’ regulatory psychophysiology, such as HPA-axis functioning (Blair, 2010; Leerkes & Parade, 2015). Atypical patterns of HPA activity and subsequent chronically elevated levels of stress-hormone cortisol in infancy may have lasting effects on the structural and functional development of the frontal brain regions involved in self-regulation (Blair, 2010; Leerkes & Parade, 2015). Conversely, it has been suggested that favorable early experiences may have a positive impact on brain development (Blair, 2010). These lasting effects that early experiences may have on the developing stress-regulation system and brain areas

critical in self-regulation is one plausible mechanism for the potential longitudinal association between interparental relationship adjustment in infancy and child self-regulation at 7–8 years.

In addition to direct effects, interparental relationship has been found to affect children *indirectly*, via other family processes. There is considerable evidence that interparental relationship quality affects the quality of parent–child relationships and interactions (Erel & Burman, 1995; Krishnakumar & Buehler, 2000). The positive association between the quality of interparental and parent–child relationships has been found both in infancy and later childhood and is often explained by spillover model, which suggests that both positive and negative emotions and behaviors of the interparental relationship “spill over” to parent–child relationships and interactions, and thus set the tone of the emotional climate of parent–child interactions (Erel & Burman, 1995). The global affective quality of the early parent–child (especially mother–child) relationship and interactions, in turn, has been consistently linked with the development of self-regulatory capabilities (e.g. Bernier, Beauchamp, Carlson, & Lalonde, 2015; Bridgett et al., 2015; Morris et al., 2007). Kraybill and Bell (2013), for example, found that mothers’ positive affect during interactions with her 10-month-old infant predicted children’s self-regulatory executive functioning abilities at 4 and 6 years of age. In addition to simple spillover of emotions and behaviors from interparental to parent–child interactions, it is also likely that parents in more supportive and satisfying interparental relationships may be more available to respond consistently and sensitively to their infant’s needs, whereas parents in negative or conflictual relationships may be less emotionally available and responsive for their children due to being preoccupied with concerns arising from interparental relations (Erel & Burman, 1995). These parenting behaviors are also linked with the development of self-regulation (e.g., Kochanska, Murray, & Harlan, 2000). Thus, another plausible effect mechanism in the longitudinal association between early interparental relationship adjustment and later child self-regulation is indirect, mediated by the quality of the early parent–child relationships.

There are only a few studies, to my knowledge, that examine the direct versus indirect relations between interparental relationship functioning in infancy and child self-regulation, and not all of them have investigated both mother–child and father–child relationships as mediators. Inclusion of fathers is important because there is some evidence that interparental relationship quality may affect father–child relationships more than mother–child relationships (Stroud, Durbin, Wilson, & Mendelsohn, 2011). In contrast to studies with older children that have consistently found support for both direct and indirect (parenting-mediated) associations between interparental functioning and aspects of child self-regulation and adjustment (Cummings & Davies, 2010; Fosco & Grych, 2013; Stroud, Meyers, Wilson, & Durbin, 2015), many studies focusing on infants have not found support for the mediated effects through parenting or parent–child interactions. Instead, for example,

Crockenberg et al. (2007) found that prenatal marital aggression together with infant exposure to conflict directly predicted infant emotion regulation at 6 months, while negative maternal behavior in mother–infant interactions did not mediate this association. Similarly, Graham et al. (2010) found that the associations between prenatal interparental dynamics (including adjustment) and infant physiological emotion regulation at 5 months were independent of maternal sensitivity. Furthermore, both of the aforementioned longitudinal studies of interparental conflict in infancy and child outcomes (Frankel et al., 2015; Pendry & Adam, 2013) found direct links between conflict at 8–9 months and child development at 2 years (emotion regulation and cognitive development, respectively), and neither found a mediated effect through parenting or attachment variables. These studies provide evidence for the direct links between interparental dynamics and child self-regulation in infancy, but they have not investigated longer-term longitudinal associations that may function through different pathways. It has also been suggested that the effect mechanisms (direct vs. indirect) may be different for interparental conflict and interparental adjustment, such that the effects of adjustment, which is a less overt aspect of interparental functioning, may more often be mediated through the quality of parent–child interactions, while overt conflict may more often be directly related to child development (Leerkes & Parade, 2015).

### **1.3. The current study: research questions and hypotheses**

The purpose of this study was to examine the prospective direct and indirect links between interparental relationship adjustment in early infancy (at 2 months) and child self-regulation at the age of 7–8 years. The affective quality of the mother–child and father–child relationships at 12 months were investigated as mediators of the indirect association. Figure 1 presents the design of the study.

It is particularly important to study these family dynamics and their interplay during infancy, because the experiences of interactions in different family systems (e.g., interparental and parent–child) during this period influence the development of the immature frontal brain systems underlying self-regulation (Leerkes & Parade, 2015) and, thus, may set the course for the development of self-regulation in later years. As self-regulation appears to be a critical factor in children’s psychological, social and academic adjustment (e.g., Bridgett et al., 2015; Eisenberg et al., 2010, 2013), understanding how different family factors enhance or interfere with its development is important both for understanding the development of children’s adjustment problems, and identifying targets for early prevention and intervention (Eisenberg et al., 2011). Yet,

prospective longitudinal research on the early family antecedents of self-regulation is scarce, especially that focusing on interparental relationship functioning and simultaneously analyzing the mediating effects of both maternal and paternal child-relationship. This study extends previous work also by focusing on the long-term effects of early interparental adjustment instead of conflict, and by examining its influence on multiple aspects of self-regulation: behavioral (as indexed by attentional regulation and inhibitory control) and emotional.

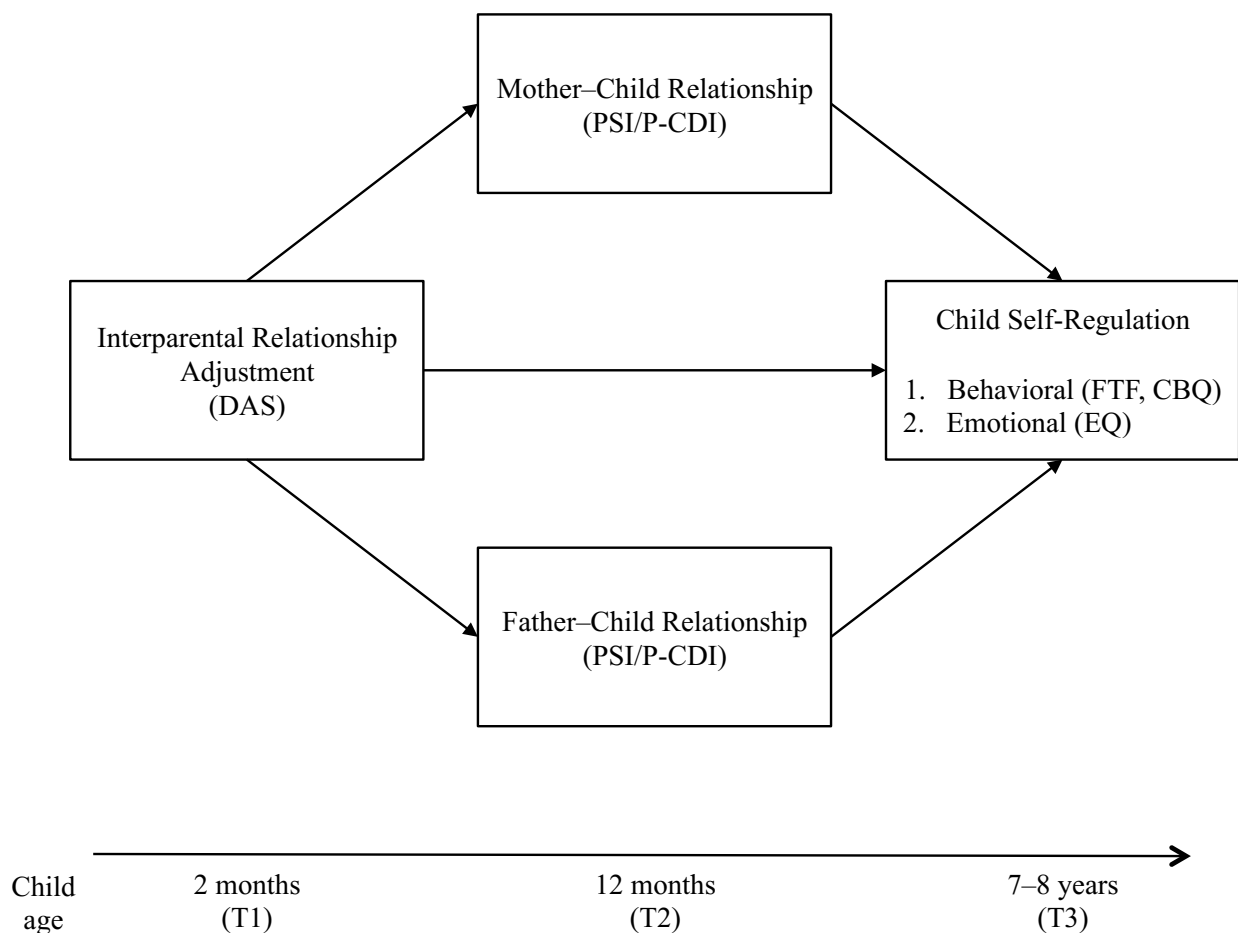


Figure 1. The design and measures of the current study. DAS = Dyadic Adjustment Scale (Spanier, 1976); PSI/P-CDI = Parenting Stress Index / Parent-Child Dysfunctional Interaction (Abidin, 1995); FTF = Five to Fifteen (Attention) (Kadesjö et al., 2004); CBQ = Children’s Behavior Questionnaire (Inhibitory Control) (Putnam & Rothbart, 2006); EQ = Emotion Questionnaire (Emotion Self-Regulation) (Rydell et al., 2003)

The research questions of the current study were twofold. First, the broader or more general research question was whether interparental relationship adjustment at infants’ age of 2 months is

related to children's self-regulation at 7–8 years of age. Despite the lack of comparative longitudinal studies it was hypothesized that interparental relationship adjustment at 2 months would be associated with children's self-regulation at 7–8 years such that better interparental adjustment would predict better child self-regulation. This hypothesis was based on existing studies linking interparental conflict (Crockenberg et al., 2007; Graham et al., 2013; Porter et al., 2003) and interparental adjustment (Graham et al., 2010; Porter et al., 2003) to infant self-regulatory processes during the first year of life, as well as on one short-term longitudinal study noting associations between interparental conflict in infancy and child emotional self-regulation at 2 years (Frankel et al., 2015). Further grounds for the expectation of longer-term longitudinal association between interparental relationship adjustment in infancy and child self-regulation in middle childhood came from two literatures: 1) literature highlighting the importance of interparental functioning to the functioning of other family-systems, such as parent–child relationships (Cummings & Davies, 2010; Erel & Burman, 1995; Krishnakumar & Buehler, 2000) which, in turn, are known to have longitudinal associations with children's self-regulatory abilities (Bernier et al., 2015; Kochanska et al., 2000; Kraybill & Bell, 2013; Morris et al., 2007), and 2) literature indicating that the relational experiences in infancy substantially influence the development of psychophysiological stress-regulation systems and frontal brain regions (Blair, 2010; Leerkes & Parade, 2015), and thereby potentially have long-term effects on neurophysiological functioning underlying behavioral and emotional self-regulation (Bridgett et al., 2015).

Second, it was more specifically investigated whether interparental relationship adjustment at 2 months is directly and independently associated with child self-regulation at 7–8 years, or whether the association is indirect and mediated through the quality of parent–child relationships at infants' age of 12 months. Previous studies with infants have found that interparental conflict is independently linked with aspects of child self-regulation and development, and that this association is not mediated by parenting or attachment variables (Crockenberg et al., 2007; Frankel et al., 2015; Graham et al., 2010; Pendry & Adam, 2013). However, studies with older children have consistently found support for both direct and indirect pathways between interparental conflict and self-regulation (Cummings & Davies, 2010; Fosco & Grych, 2013), and Leerkes and Parade (2015), considering infants, suggested that indirect effects and spillover are likely to be a more prevalent effect mechanism in case of less overt interparental dynamics, such as interparental relationship adjustment, while direct effects may be more common in case of interparental conflict. In this study, both direct and indirect associations were anticipated. Thus, it was expected that interparental relationship adjustment in early infancy would be independently and directly associated with children's later self-regulation and, in addition, that the quality of parent–child

relationships in infancy would partially mediate the association between interparental relationship adjustment and child self-regulation.

## 2. METHOD

### 2.1. Participants and procedure

Participants were part of a larger longitudinal study investigating the role of psychological, family and medical factors in child development (Lindblom, 2017; Repokari, 2008). The original sample was 798 Finnish married or cohabiting couples with singleton pregnancies, recruited during the second trimester of pregnancy (18–20 weeks of gestation). About half of the couples had conceived naturally ( $n = 382$ , 48%) and 52% had undergone a successful assisted reproductive treatment (ART) with their own gametes ( $n = 416$ ). Naturally conceived (NC) couples were recruited while attending a routine ultrasonographic examination in the Helsinki University Central Hospital and ART couples were recruited from five Finnish infertility clinics. Only couples with no self-reported infertility history and women over the age of 25 years were included in the NC group. Recruitment took place during 1999–2000, and both groups were sampled by systematically asking all eligible couples to participate in the study.

The mean age of parents in the original sample at the beginning of the study was 33.12 years ( $SD = 3.73$ ) for mothers and 34.49 ( $SD = 4.96$ ) for fathers. About a third of mothers ( $n = 246$ , 33%) and fathers ( $n = 243$ , 35%) reported having tertiary education (a bachelor's or master's degree), over half of mothers ( $n = 438$ , 59%) and fathers ( $n = 400$ , 57%) had secondary or vocational education, and 7% of mothers ( $n = 51$ ) and 8% of fathers ( $n = 53$ ) reported having only basic education (elementary and junior high school). The mean duration of partnership at the time of the first measurement was 8.56 years ( $SD = 4.54$ ), and 70% of the couples were married ( $n = 525$ ). Half of the women were expecting their first child ( $n = 404$ , 53%), a third were having their second child ( $n = 242$ , 32%), and 15% already had two or more children ( $n = 118$ ). ART and NC couples did not differ in maternal or paternal age, yet mothers (but not fathers) in NC group were more educated than in ART group,  $\chi^2(3, N = 735) = 13.00, p = .005$ , in that they more often had tertiary education (NC = 38% vs. ART = 30%). ART couples had longer partnerships than NC couples ( $9.54 \pm 4.46$  years vs.  $7.56 \pm 4.41$  years),  $t(746) = 6.10, p < .001$ , and ART mothers (68%) were more often primiparous than NC mothers (37%),  $\chi^2(1, N = 764) = 77.38, p < .001$ .



Women and men completed questionnaires independently during the second trimester of pregnancy (18–20 weeks of gestation), and when the child was 2 months and 12 months old. The families were invited to participate again when the child was 7–8 years old. Demographic data presented in the current study were obtained at the measurement during pregnancy, while the data concerning the current research questions were collected when the child was 2 months (T1; interparental relationship adjustment), 12 months (T2; parent–child relationships) and 7–8 years old (T3; child self-regulation). The ethical committees of the participating clinics approved the study.

During pregnancy, 798 couples participated in the study. The participation rate was 790 (99%) for mothers and 744 (93%) for fathers. When the child was 2 months old (T1 of this study), 653 (82%) families participated. The response rates for mothers and fathers were 651 (82%) and 609 (76%), respectively. At the 12-month phase (T2), 543 (68%) families took part. Respondents were 541 (68%) mothers and 501 (63%) fathers. When the child was 7–8 years old (T3), 491 (62%) families participated, and the respondents were 483 (61%) mothers and 292 (37%) fathers. Altogether 381 families participated in all three assessments, so the total participation rate (T1 + T2 + T3) for families was 48%. Mothers' total participation rate was 376 (47%) and fathers' was 243 (30%).

Of those 381 families that had some data on all three relevant assessments, 355 families had complete data on the study variables examined in the current investigation. Half of the children in these families were girls ( $n = 181$ , 51%) and 174 were boys. Two children (1 girl, 1 boy) were reported by their parents as having been diagnosed with a developmental or neurological condition with effects on self-regulatory abilities (autism, mental retardation) and were therefore excluded from further analysis. The remaining 353 families (44% of the original sample) formed the analytic sample of the current study. Parents in the analytic sample were slightly older than parents in families that had dropped out, missed at least one data collection phase, or had incomplete data (mothers' age at the beginning of the study:  $33.56 \pm 3.83$  vs.  $32.80 \pm 3.58$ ,  $t(753) = 2.82$ ,  $p = .005$ ; fathers' age at the beginning of the study:  $34.88 \pm 5.19$  vs.  $34.19 \pm 4.73$ ,  $t(734) = 1.90$ ,  $p = .058$ ). Their combined family SES score was also higher,  $t(761) = 2.38$ ,  $p = .018$ . There were no significant differences in other background variables (maternal or paternal education, length of partnership, number of children, fertility history [ART vs. NC]). The families in the analytic sample were similar with other families also in both mother- and father-reported interparental relationship adjustment at T1 and parent–child relationships at T2.

## 2.2. Measures

To assess *interparental relationship adjustment* during infancy, both parents were asked to complete the Dyadic Adjustment Scale (DAS; Spanier, 1976) at two occasions: when the child was two months (T1) and twelve months old (T2). The T1 measurement was used in the current study so that interparental adjustment, as the predictor variable, would temporally precede the mediator variables of the study. The DAS is a widely used self-report measure of interparental relationship functioning that consists of 32 items pertaining to relationship satisfaction (e.g., “How often do you and your partner quarrel?”), agreement on various topics important for relationship functioning (e.g., handling family finances, making major decisions), and frequency of engaging in activities together (e.g., “How often do you and your mate calmly discuss something?”). Most items are rated on a 0–5 Likert scale, the scale for two items is 0–4 and for one 0–6, and two items are dichotomous yes/no - questions. The total sum score reflecting overall relationship adjustment ranges from 0 to 151, with higher scores indicating better adjustment. The total score, rather than separate subscale scores, was selected to be used because its reliability is better established in literature (Graham, Liu, & Jeziorski, 2006), and also because the current research focused on the effects of broader interparental relationship adjustment. In this study, the internal consistency reliability (Cronbach’s  $\alpha$ ) of the total sum score was .91 for both women and men. Mothers’ and fathers’ ratings of interparental adjustment were significantly correlated ( $r = .59, p < .001$ ), so a single index of interparental relationship adjustment was created by combining their reports by first standardizing and then averaging their scores. Creating a composite variable of maternal and paternal reports on interparental relationship is a common practice in the field, and it is done in order to reduce the number of variables in analyses and the risk for type I error.

Mothers and fathers reported their parenting experience at T1 and T2 using the Parenting Stress Index – Short Form (PSI–SF; Abidin, 1995). PSI–SF is a 36-item questionnaire that provides a total sum score and three subscale sum scores calculated from 12 items each. The subscales are Parental Distress (reflecting, e.g., parent’s sense of parenting competence and perceived social support), Parent–Child Dysfunctional Interaction (reflecting parent’s satisfaction with the child-relationship and perception of whether the child meets their expectations), and Difficult Child (representing child characteristics that make them easy or difficult to manage). The Parent–Child Dysfunctional Interaction subscale (P-CDI) was used in this study as an indicator of the *parent–child relationship quality*, and only the 12-month evaluation (T2) was used. The other two subscales and the total sum score were not used in order to reduce overlap with the measure of interparental relationship adjustment on the one hand, and outcome measures of child self-regulation on the other. In the PSI–

SF, parents rate their agreement with individual items on a 1–5 Likert scale, so the 12-item subscale sum score reflecting parent–child relationship quality varies between 12 and 60 ( $\alpha$  .76 for mothers and .83 for fathers). In the original questionnaire, higher scores indicate greater levels of stress, but for the purposes of this study, the scale was reversed such that higher scores were consistent with a more positive experience of the parent–child relationship.

Child self-regulation was measured using the relevant subscales of three different questionnaires. These were part of a larger set of questionnaires on child development that mothers and fathers were asked to complete independently when the child was 7–8 years old (T3). Scale scores were calculated for the participants with valid data on at least two thirds of the items comprising the scale. To simplify the analyses and to reduce rater bias, maternal and paternal reports were combined by calculating the mean of their standardized scale scores. For the families with only one parental report available ( $n = 118$ ), the scales consist of only this report.

In the current study, an index of *behavioral self-regulation* was created by combining the measures of attentional regulation and inhibitory control by first standardizing and then averaging the two indicators. This was based on both theoretical (Bridgett et al., 2015) and empirical considerations. There was a rather strong correlation between the measures of attentional regulation and inhibitory control ( $r = .62, p < .001$ ), while their associations with emotion self-regulation, yet significant, were weaker ( $r = .45$  for inhibitory control and  $r = .47$  for attention, both  $ps < .001$ ). Furthermore, the pattern of associations between predictor variables and these two measures was highly similar, while a different pattern emerged for emotion self-regulation.

Attentional regulation was measured using the Attention subdomain of the Five to Fifteen questionnaire (FTF; Kadesjö et al., 2004). FTF is a parent-report measure originally consisting of 181 items, 8 domains and 20 subdomains designed for screening and identification of childhood neuropsychiatric conditions such as ADHD. Eight subdomains were used altogether in the broader study of which this study is a part. The Attention subdomain used in the current study consists of nine items (e.g., “Child often has difficulty sustaining attention in tasks or activities”). Parents rate their child’s behavior on a 3-point Likert scale ranging from 0 (does not apply at all) to 2 (definitely applies), with higher scores indicating more difficulty. In this study, the scale was reversed for the analyses such that higher scores reflect less difficulty and therefore better attentional regulation. The mean of the item scores was calculated to create a subdomain score ranging from 0 to 2 ( $\alpha = .86$  for mothers and .85 for fathers). Maternal and paternal reports correlated significantly,  $r = .66, p < .001$ .

Inhibitory control of behavioral responses was assessed by the 6-item Inhibitory Control scale of the Children’s Behavior Questionnaire (CBQ) short form (Putnam & Rothbart, 2006). The

Inhibitory Control scale measures the child's capacity to suppress a dominant or inappropriate response under instructions and to plan actions (e.g., "Can easily stop an activity when s/he is told "no"). Parents rate their child's behavior on a 7-point Likert scale ranging from 1 (extremely untrue of my child) to 7 (extremely true of my child). Scale score was calculated by averaging the item scores. Reliabilities ( $\alpha$ ) were .76 for mothers and .75 for fathers. Higher scale scores indicate better inhibitory control. Maternal and paternal reports were significantly correlated,  $r = .57, p < .001$ .

*Emotional self-regulation* was assessed by the Emotion Self-Regulation subscale of the long version of The Emotion Questionnaire (EQ; Rydell, Berlin, & Bohlin, 2003). EQ is a 40-item parent-report questionnaire covering the emotions of sadness, anger, fear, and positive emotions–exuberance. It provides separate scores for emotionality and emotion regulation, and further yields separate scores for the child's emotion self-regulation and the child's ability to regulate emotions with the help of adults. Following Rydell's et al. (2003) suggestion, only the 12 items reflecting child's own regulation were used in this study as the children were 7–8 years old and in their middle childhood. In the EQ, the self-regulation of each four emotions is measured with a three-item subscale (e.g., "When my child becomes angry, he/she has difficulties calming down on his/her own."). Parents rate their child's behavior on a 5-point Likert scale ranging from 1 (does not apply to my child at all) to 5 (applies very well to my child). The scale is reversed in scoring so that higher scores are consistent with higher levels of regulatory capacity. A mean score was calculated for each subscale. These subscale scores reflecting the self-regulation of different emotions were significantly correlated ( $r_s = .42-.56$  for mothers' reports and  $.45-.59$  for fathers' reports, all  $p_s < .001$ ), so a composite variable reflecting the child's general capacity for emotional self-regulation was created by averaging the subscale scores ( $\alpha = .81$  for mothers and  $.82$  for fathers). Maternal and paternal reports were significantly correlated,  $r = .44, p < .001$ .

The background variables investigated in the current study were child gender, family socioeconomical status (SES), maternal age, parity, and fertility history (ART/NC). Family SES was calculated by averaging the standardized maternal and paternal SES-scores. Parity was dichotomized based on whether the couple's female partner was a first-time mother (primiparous) or had already one or more children (multiparous).

### 2.3. Statistical analyses

First, the associations between background variables and study variables were examined using independent samples t-tests (child gender, parity, fertility history [ART/NC]) and Pearson product-moment correlation coefficient (maternal age, family SES).

Associations among study variables were initially examined with correlation coefficients. Simple associations between interparental relationship adjustment at T1, parent–child relationships at T2 (separately for mothers and fathers), and child behavioral and emotional self-regulation at T3 were then investigated using multiple regression analyses, controlling for covariates (child gender, SES and parity). This was followed by the mediation analyses, wherein the direct and indirect effects of interparental relationship adjustment on later child self-regulation were estimated, with both mother–child and father–child relationships examined as potential mediators within the same parallel multiple mediator model. Mediation analyses were performed using the PROCESS macro for SPSS (version 2.16) (Hayes, 2013), which enables the investigation of more than one mediators within the same model. The significance of indirect effects was determined using 95 % bias-corrected bootstrap confidence interval based on 5000 samples. The regression coefficient for the indirect effect was considered significant if the associated confidence interval did not cross zero (Hayes & Rockwood, in press). Bootstrap confidence interval was selected over other alternatives as the test of mediation because it does not rely on assumptions of normality of the sampling distribution (Hayes & Rockwood, in press). All analyses were run separately with behavioral and emotional self-regulation as an outcome variable. The same covariates were used in all analyses to make them comparable.

### 3. RESULTS

Table 1 presents the sample means, standard deviations and ranges of interparental relationship adjustment, parent–child relationship, and child self-regulation variables.

Table 1. Variable means, standard deviations, and ranges.

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	Range	
				Actual	Potential
Family factors during infancy					
Interparental relationship adjustment (DAS) <sup>a</sup>	353	115.07	11.23	70.50–143.00	(0–151)
Mother–child relationship (PSI/P-CDI) <sup>b</sup>	353	16.36	3.85	12.00–32.00	(12–60)
Father–child relationship (PSI/P-CDI) <sup>b</sup>	353	16.71	4.34	12.00–34.00	(12–60)
Child self-regulation at 7–8 years <sup>a</sup>					
Behavioral self-regulation					
Attentional regulation (FTF) <sup>b</sup>	351	0.50	0.38	0.00–2.00	(0–2)
Inhibitory control (CBQ)	351	5.48	0.81	2.42–7.00	(1–7)
Emotional self-regulation (EQ)	353	3.88	0.53	1.83–5.00	(1–5)

*Note.* The scores are presented on each instrument’s original scale. Higher values on interparental relationship adjustment, inhibitory control and emotional self-regulation reflect a more positive evaluation; higher values on parent–child relationship and attentional regulation reflect a more negative evaluation. <sup>a</sup> The values are for combined maternal and paternal report. <sup>b</sup> Scales where higher scores originally mean more problems were reversed for analyses so that all scales were in the same direction, with higher scores referring to a more positive evaluation.

Based on preliminary analyses, child gender, family SES, and parity (dichotomized as primiparous vs. multiparous) were included as covariates in the main analyses. Child gender was significantly associated with both behavioral,  $t(349) = 5.84, p < .001$ , and emotional self-regulation,  $t(351) = 2.87, p = .004$ , such that girls were better regulated than boys. Higher family SES was significantly associated with better behavioral self-regulation ( $r = .15, p = .005$ ), but unrelated to emotional self-regulation ( $r = .02, p = .654$ ). Parity, on the other hand, was significantly associated with emotional self-regulation, with multiparous (as compared to primiparous) parents evaluating their child as better regulated,  $t(350) = 2.70, p = .007$ , but it was unrelated to behavioral self-regulation,  $t(348) = 1.46, p = .145$ . Additionally, primiparous couples reported better interparental relationship adjustment at two months of parenting than did couples who already had children,  $t(350) = 3.80, p$

< .001. There were no significant associations between maternal age or fertility history (ART vs. naturally conceived) and the study variables.

### 3.1. Associations between interparental relationship adjustment, parent–child relationships and child self-regulation

As presented in Table 2, a number of significant correlations were observed between the study variables. Interparental relationship adjustment at 2 months was positively associated with both parents’ parent–child relationship at 12 months. The relation between the quality of mother–child and father–child relationship, although significant, was modest. In fact, both were more strongly associated with earlier interparental relationship adjustment than with each other. All relations between early family factors and child self-regulation at 7–8 years of age were positive, and all except the association between interparental adjustment and child emotional self-regulation were statistically significant.

Table 2. Correlations between study variables ( $n = 353$ )

Variables	1	2	3	4
1. Interparental relationship adjustment (T1)				
2. Mother–child relationship (T2)	.26***			
3. Father–child relationship (T2)	.33***	.21***		
4. Child behavioral self-regulation (T3) <sup>a</sup>	.17**	.20***	.16**	
5. Child emotional self-regulation (T3)	.10 <sup>+</sup>	.27***	.11*	.53***

<sup>a</sup> $n = 351$ ; T1 = 2 months; T2 = 12 months; T3 = 7–8 years; \*\*\*  $p < .001$ , \*\*  $p < .01$ , \*  $p < .05$ , +  $p < .10$

Controlling for child gender, family SES, and parity, the simple effects of interparental relationship adjustment on child self-regulation and parent–child relationships (potential mediators) were examined next. Interparental relationship adjustment at infant’s age of 2 months had a significant and positive total effect (i.e. the effect without the mediators in the model) on child behavioral self-regulation,  $\beta = .18$ ,  $t(340) = 3.54$ ,  $p < .001$ , and emotional self-regulation at 7–8 years,  $\beta = .12$ ,  $t(342) = 2.13$ ,  $p = .034$ . Better interparental relationship adjustment at 2 months also predicted more

positive mother–child relationship,  $\beta = .27$ ,  $t(342) = 5.07$ ,  $p < .001$ , and father–child relationship at infant’s age of 12 months,  $\beta = .33$ ,  $t(342) = 6.26$ ,  $p < .001$ .

Simple effects of parent–child relationships at 12 months on the two measures of child self-regulation at 7–8 years were also examined. Both mother–child relationship,  $\beta = .16$ ,  $t(340) = 3.18$ ,  $p = .002$ , and father–child relationship,  $\beta = .16$ ,  $t(340) = 3.23$ ,  $p = .001$ , when examined separately, predicted behavioral self-regulation, and similarly, both mothers’,  $\beta = .24$ ,  $t(342) = 4.68$ ,  $p < .001$ , and fathers’,  $\beta = .12$ ,  $t(342) = 2.33$ ,  $p = .020$ , child-relationship predicted emotional self-regulation.

### **3.2. Tests of direct and indirect effects on child behavioral self-regulation**

When the associations between interparental relationship adjustment at T1, mother–child and father–child relationships at T2, and child behavioral self-regulation at T3 were investigated within the same model, better interparental relationship adjustment at 2 months remained directly related to better child behavioral self-regulation at 7–8 years,  $t(334) = 2.15$ ,  $p = .033$  (see Figure 2). However, the effect was attenuated with parent–child relationships in the model. Both mother–child relationship,  $t(334) = 2.11$ ,  $p = .036$ , and father–child relationship at 12 months,  $t(334) = 1.97$ ,  $p = .049$ , also remained significantly related to behavioral self-regulation at 7–8 years when interparental relationship adjustment was in the model. The indirect effect of interparental relationship adjustment on child behavioral self-regulation was also significant, with the specific indirect effects through mothers’ and fathers’ child-relationship being of approximately the same size. This indicates that both partially account for or mediate the effect of interparental relationship adjustment at 2 months on child behavioral self-regulation at 7–8 years of age.



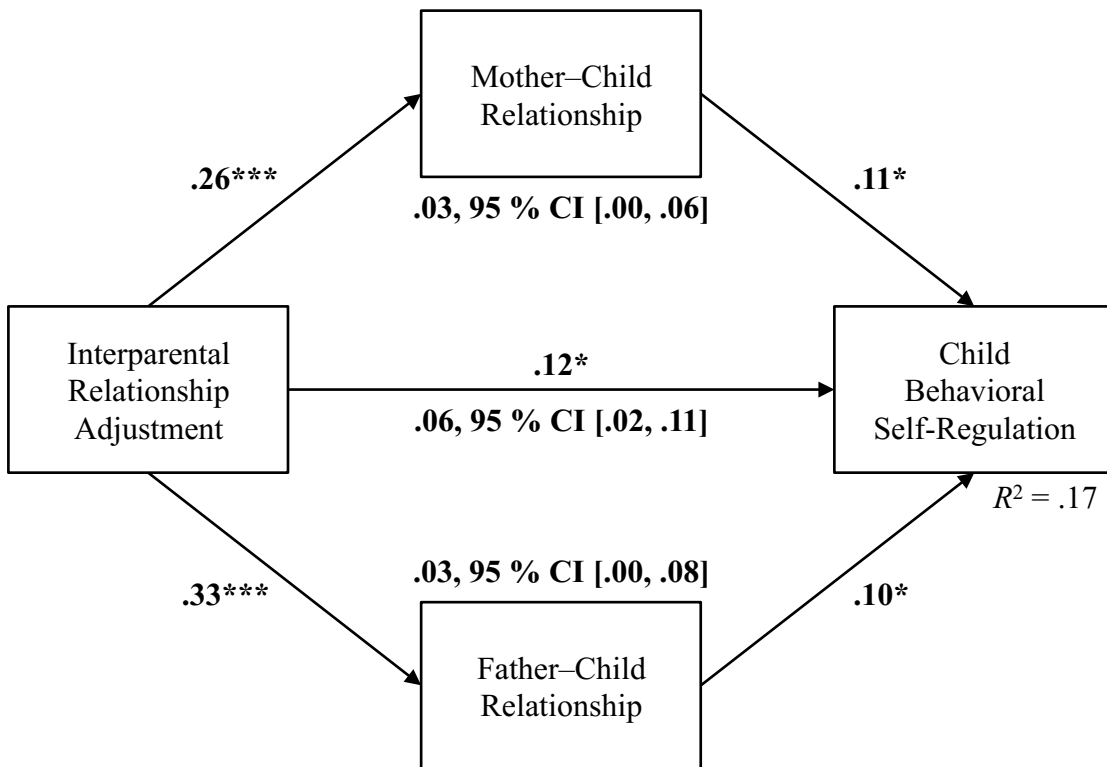


Figure 2. Direct and indirect effects of interparental relationship adjustment on child behavioral self-regulation. Direct effect, with both parent–child relationship variables in the model, is above the line, while the total indirect effect is below the line. Specific indirect effects through maternal and paternal child-relationship are also presented. The confidence intervals for the indirect effects are bias-corrected bootstrap CIs based on 5000 samples. All variables were standardized before entering the analysis.  $^{***} p < .001$ ,  $^* p < .05$ .

### 3.3. Tests of direct and indirect effects on child emotional self-regulation

With T2 mother–child and father–child relationship variables in the model, T1 interparental relationship adjustment was no longer a significant predictor of T3 child emotional self-regulation,  $t(336) = 0.58$ ,  $p = .564$  (see Figure 3). In fact, only mother–child relationship at 12 months remained a significant predictor of child emotional self-regulation at 7–8 years,  $t(336) = 4.06$ ,  $p < .001$ , while father–child relationship,  $t(336) = 1.26$ ,  $p = .208$ , was no longer a significant predictor when interparental relationship and both parent–child relationship variables were investigated in the same model. The test of the total indirect effect of interparental relationship adjustment on child emotional self-regulation, as well as the test of the specific indirect effect through mother–child relationship were significant, but the specific indirect effect through father–child relationship was non-significant. This indicates that the effect of early interparental adjustment on later emotional

self-regulation was indirect, mediated by mother–child (but not father–child) relationship quality in infancy.

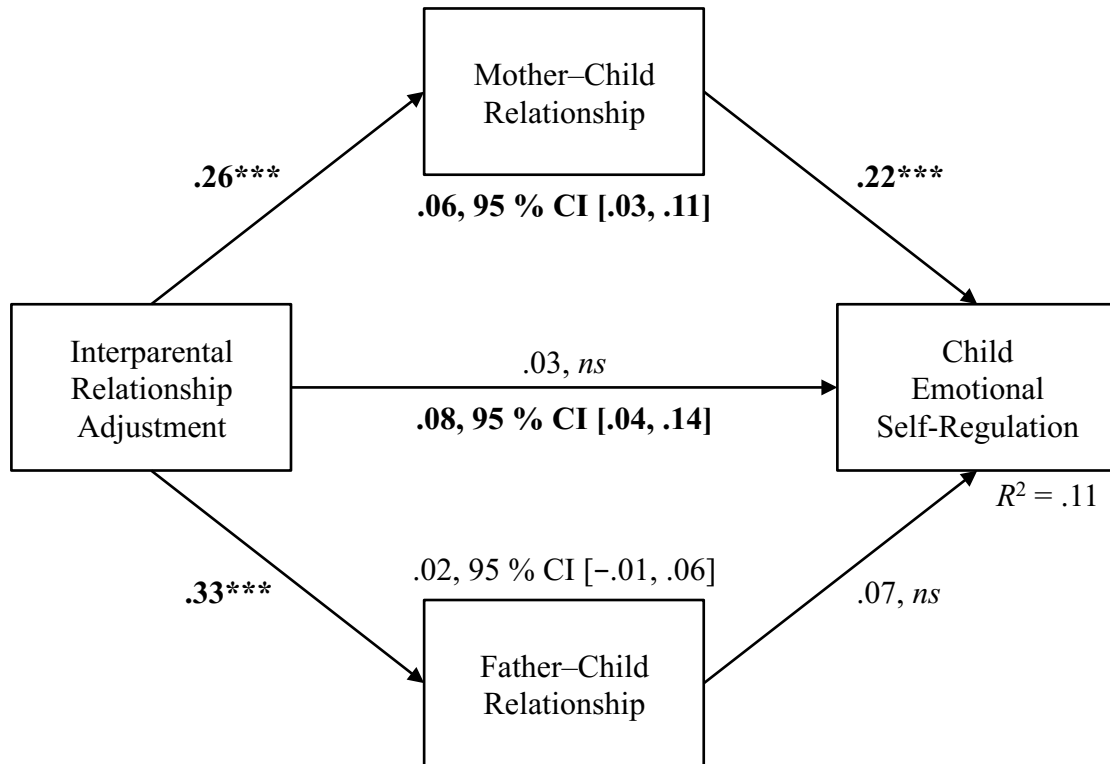


Figure 3. Direct and indirect effects of interparental relationship adjustment on child emotional self-regulation. Direct effect, with both parent–child relationship variables in the model, is above the line, while the total indirect effect is below the line. Specific indirect effects through maternal and paternal child-relationship are also presented. The confidence intervals for the indirect effects are bias-corrected bootstrap CIs based on 5000 samples. All variables were standardized before entering the analysis.  $^{***} p < .001$ ,  $ns$  = nonsignificant.

#### 4. DISCUSSION

This prospective longitudinal study examined the effects of interparental relationship adjustment in infancy on child behavioral and emotional self-regulation at 7–8 years. The direct and indirect associations were tested simultaneously within a multiple mediator model, with mother–child and father–child relationships examined as potential mediators.

As hypothesized, interparental relationship adjustment at 2 months had both direct and indirect

positive associations with children's self-regulation at 7–8 years. The findings, however, were somewhat different for behavioral and emotional self-regulation. For behavioral self-regulation (attentional regulation and inhibitory control), the results were as expected; interparental relationship adjustment at 2 months had an independent association with children's behavioral self-regulation at 7–8 years, while there was also evidence for mediated effects through both mother–child and father–child relationships at 12 months. However, a different pattern of associations emerged for emotional self-regulation; the effect of early interparental relationship adjustment on later emotional self-regulation was indirect, mediated only by mother–child relationship quality in infancy. Taken together, these findings suggest that better interparental relationship adjustment early in infancy is associated with children's better self-regulatory abilities at 7–8 years of age, and that at least some of this association may be independent of the quality of parent–child relationships in infancy. At the same time, though, early parent–child relationships, especially mother–child relationship, mediate some of this association.

The finding that better interparental relationship adjustment in early infancy was related to children's better self-regulation at 7–8 years is in line with previous studies noting associations between interparental adjustment (Graham et al., 2010; Porter et al., 2003) and conflict (Crockenberg et al., 2007; Frankel et al., 2015; Graham et al., 2013; Porter et al., 2003) and infants' developing self-regulation during infancy. The results of the current prospective study extend earlier knowledge by noting longitudinal associations between interparental adjustment in early infancy and child self-regulation many years later, in middle childhood.

Although not the main focus of the current investigation, the positive association between interparental relationship adjustment and the quality of both parents' parent–child relationship evidenced in this study lends support to the spillover model suggesting that emotions of the marital relationship may “spill over” into parent–child relationships and interactions (Erel & Burman, 1995). In the current study, the better the interparental relationship adjustment was at 2 months of parenting, the better the mothers' and fathers' self-reported parent–child relationship quality was when their child was 12 months old. Consistent with earlier research (e.g., Krishnakumar & Buehler, 2000; Stroud et al., 2011), this association was slightly stronger for fathers than for mothers, implying that fathers' child-relationship may be more affected by interparental relationship quality than mothers'.

Both mother–child and father–child relationships at infant's age of 12 months were (equally) significant mediators of the indirect link between interparental relationship adjustment in early infancy and child *behavioral* self-regulation at 7–8 years. At the same time, the direct association between interparental adjustment and children's later *behavioral* self-regulation was also significant.

In contrast, only an indirect link was found between interparental relationship adjustment and children's later *emotional* self-regulation, and only the mother-child relationship was a significant mediator of this relation. These findings differ from earlier – mostly cross-sectional or short-term longitudinal – research with infants that have generally found interparental relationship functioning to be directly linked with child self-regulation and failed to find evidence of mediated effects through parenting or attachment variables (e.g., Crockenberg et al., 2007; Frankel et al., 2015; Graham et al., 2010). The finding of both direct and indirect associations between interparental adjustment and child self-regulation is, however, consistent with earlier research conducted with older children noting both direct and indirect (parenting-mediated) associations (Cummings & Davies, 2010; Stroud et al., 2015). They are also in line with Leerkes' and Parade's (2015) proposition that indirect effects may be more prevalent in the case of less overt aspects of interparental dynamics, such as adjustment, than with conflict which has been the focus of most previous research in infancy. The findings raise the possibility that even though the concurrent link between interparental dynamics and child self-regulation has often been found to be direct during infancy, the longer-term longitudinal associations may function through different pathways and depend in part on parent-child relationship quality. Since this was one of the first studies to examine such long-term associations and the results were mixed, these associations need to be further studied in future longitudinal research. Furthermore, differing findings for behavioral and emotional self-regulation suggest that distinct mechanisms may underlie the development of different aspects of self-regulation and point to the importance of considering specific sub-components of self-regulation (e.g., behavioral and emotional; see Bridgett et al., 2015) also in future studies.

Finally, it is noteworthy that also the father-child relationship emerged as a significant mediator of the indirect association between early interparental adjustment and later child behavioral (yet not emotional) self-regulation, and the size of the indirect effect through fathers' child-relationship quality was similar to that of mothers'. This suggests that father-child relationship may play a significant independent role in the development of some aspects of children's self-regulation. These findings add to the growing literature on father's role in the development of self-regulation and highlight the importance of involving fathers in future studies as well.

#### **4.1. Strengths and limitations**

The current study was one of the first studies to investigate the direct and indirect contributions of interparental relationship functioning on child self-regulation using a longitudinal design that begins in infancy and extends beyond the first few years of life. It was a prospective, longitudinal study with a rather large sample size and both mothers and fathers as respondents. Despite these strengths, the study also has limitations. First, interparental relationship adjustment, parent–child relationships and child self-regulation were assessed using parental self-report questionnaires. The use of observational methods and/or standardized tests in addition to the self-report measures could have provided a more reliable assessment of these constructs. However, in this study, mothers’ and fathers’ reports on interparental relationship adjustment and child self-regulation were combined resulting in multi-informant constructs, adding to their reliability and reducing potential biases. Furthermore, one can argue that interparental adjustment – being a more covert aspect of relationship functioning than conflict and a rather subjective experience – may be better captured by self-report than observational measures, and that parents’ report on how their children function in everyday situations may provide a more ecologically valid measure of child self-regulation than standardized tests and observations made under laboratory conditions. Yet, including behavioral measures and more informants (e.g., teachers) would have improved the assessment of child self-regulation, and using observational methods would have provided important information on parent–child relationships.

Second, in addition to the family factors assessed in the current investigation, there are several other factors that were not assessed here that likely influence the development of child self-regulation. In particular, parental self-regulation was not assessed, even though it has been shown to affect many aspects of family environment, including interparental functioning and parenting behaviors, that in turn affect child self-regulation (e.g., Bridgett et al., 2015). Also, children’s brain development and stress physiology, important contributors to self-regulation and potentially affected by parent self-regulation through both genetic and environmental pathways, were not assessed. Third, several other possible confounders were not included. Specifically, children’s early self-regulatory capabilities were not controlled before 7–8 years of age, and interparental adjustment and parent–child relationship quality were not controlled after infancy or at 7–8 years. Thus, the results do not rule out the possibility that potential continuity in interparental adjustment and/or parent–child relationships influence the found associations. Finally, the parents in the study sample were relatively highly educated, and it is unclear whether the results generalize to more disadvantaged populations.

## 4.2. Future directions and conclusion

This study adds to the slowly growing literature on the effects of interparental relationship dynamics during infancy, and is one of the first to evaluate their long-term effects on child self-regulation in middle childhood. This study also broadens the focus of research by investigating the effects of interparental adjustment, instead of conflict, and by simultaneously evaluating the direct and indirect effects, including the quality of both the mother–child and father–child relationships as mediators. Further longitudinal research is, however, needed in order to gain a better understanding of the factors and processes affecting the development of self-regulation. Future studies are advised to employ longitudinal designs extending beyond infancy and preschool years, multiple methods of data collection (e.g., questionnaires and observations), and more complex designs wherein more factors associated with the development of self-regulation would be assessed at multiple time-points.

Self-regulation plays an important role in children’s social, emotional and academic adjustment (Bridgett et al., 2015; Eisenberg et al., 2010). Knowledge of the early family antecedents of children’s self-regulation is important as it can provide targets for prevention and early intervention aimed at enhancing children’s self-regulation and, subsequently, various adjustment outcomes. The finding that interparental relationship adjustment at 2 months post-birth was significantly associated with mothers’ and fathers’ parent–child relationship quality at 12 months and related both directly and indirectly to child self-regulation at 7–8 years highlights the importance of supporting parents’ interparental relationship functioning very early on in infancy in order to promote optimal child development. The results of this study further imply that, in addition to overt verbal and physical conflict with known detrimental effects on child development, attention in clinical and healthcare practice should also be paid to more subtle forms of interparental dynamics, such as relationship adjustment. Based on the findings of the current investigation, clinicians and healthcare professionals working with families with infants are recommended to routinely assess interparental relationship adjustment and inform the parents on its importance and potential long-term implications for their child’s self-regulation. More generally, at a societal level, it is important to increase awareness of infancy as a critical developmental period when major developmental changes with potential long-term effects on future development take place rapidly over a short period of time. At the same time, it is also important to recognize that it is often a burdensome period for parents, their interparental relationship and parent–child relationships, and that all these aspects of the family functioning influence infants’ development. Therefore, in order to promote favorable child development and prevent later self-regulatory and adjustment problems as well as the resultant costs for the society, it would be important to develop low-threshold services aimed at

supporting parents' well-being and maintaining interparental relationship quality, and make those services readily available for parents during the often challenging early years of child rearing.

To summarize, the results of this study suggest that even rather normative variation in early family environment, namely the differences in interparental relationship adjustment in infancy, may contribute to individual differences in self-regulation in middle childhood both independently and through its effects on parent–child relationships. Therefore, it is important to consider interparental relationship functioning, in addition to often-targeted parent–child relationships, when choosing targets for prevention and early intervention of children's self-regulatory and adjustment problems.

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