Maternal reflective functioning: Influence on parenting practices and the early development of externalizing behavior

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General Introduction

Chapter 1

In the last few decades, violence and aggression have become major global public health issues (Krug, Mercy, Dahlberg, & Zwi, 2002). Violence and aggression are associated with social, psychological, neurobiological, genetic, and environmental risk factors which offer potential novel opportunities for intervention and prevention (Liu et al., 2013). Aggression during early childhood not only poses challenges to families, health professionals, and educators, it is also predictive of persisting aggressive behavior and violence (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Campbell, Spieker, Burchinal, Poe, & NICHD Early Child Care Research Network, 2006; NICHD Early Child Care Research Network, 2004). Therefore, timely prevention efforts are of great importance. To be able to tackle the problem of aggression and violence, it is essential to study the factors that may account for the initial manifestation and continuation of such behavior, particularly those factors that are potentially malleable. Parental reflective functioning might be an interesting candidate in this respect, as it has been associated with children's externalizing and internalizing behavior (Benbassat & Priel, 2012; Ha et al., 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013) and is considered trainable (Katznelson, 2014).

The significance of parenting practices for children's socio-behavioral development and psychosocial adjustment is undisputed. In the last two decades research in the field of child development has increasingly focused attention on the parents' capacity to treat their child as a psychological agent (i.e., an individual that can reason about its own and other people's intentions, goals, and beliefs) (Baron-Cohen, Tager-Flusberg, & Cohen, 1993). This relatively new focus has partly been motivated by the fact that attachment researchers have struggled to identify the possible mechanisms for the intergenerational transmission of attachment security (Bowlby, 1973, 1988). The classical attachment model proposed that parental responsiveness (i.e., prompt and contingent reaction to infant's signals) was the mechanism that linked maternal and child attachment security. Thus, the mother's state of mind affects her sensitivity to the child's cues (Main, Kaplan, & Cassidy, 1985), which impacts the child's attachment security (Ainsworth, Blehar, Waters, & Wall, 1978). Sensitivity is defined as the ability to respond in a timely, appropriate, and contingent manner to the child's signals (Ainsworth, Bell, & Stayton, 1974). However, a large meta-analysis showed that maternal sensitivity could only explain a relatively minor part of the association between maternal attachment representations and child attachment (Van IJzendoorn, 1995). In their search for possible additional mechanisms that might help explain the intergenerational transmission of attachment security, several researchers proposed that maternal mentalizing (i.e., the ability to reflect upon and make sense of

oneself and others in terms of mental states) might be a good candidate, as it seems to be related to both maternal and infant attachment security (Bernier & Dozier, 2003; Fonagy & Target, 2005; Main, 1991; Meins, 1997). The idea behind this was that 'secure' parents are more reflective; this makes their children more confident that their internal states will be appropriately processed, accepted, and responded to. As a result, the child is able to form a secure attachment relationship to the parents (Sharp & Fonagy, 2008).

Besides that maternal mentalizing has been related to child attachment security (Bernier & Dozier, 2003; Fonagy, Steele, & Steele, 1991; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005) and maternal attachment security (Bick, Dozier, & Moore, 2012; Slade, Belsky, Aber, & Phelps, 1999; Slade, Grienenberger, et al., 2005), there are also indications that maternal mentalization may play a much broader role in children's socio-behavioral development (Sharp & Fonagy, 2008). For example, higher maternal mentalization has been positively associated with children's regulatory capacities, social skills, and ability to play and symbolize (Fonagy, 2008; Fonagy, Gergely, Jurist, & Target, 2002). An increasing number of studies on the links between parental mentalizing and child socio-behavioral development are currently appearing. However, more studies on the underlying mechanisms by which parental mentalizing affects children's socio-behavioral development are much needed. Because parental mentalizing is considered trainable (Slade, 2007; Slade, Sadler, De Dios-Kenn, et al., 2005), it is becoming an interesting target for programs aiming to improve children's socio-behavioral development and/or the prevention of adverse child behaviors such as aggression and disruptive behaviors.

Reflective functioning and related constructs

Before a more elaborate overview of parental mentalizing or reflective functioning (RF) and its role in the development of children's (externalizing) behavioral problems will be given, several important concepts in this respect will be discussed.

The concept of mentalization has been defined as the capacity to reflect upon and make sense of oneself and others, both implicitly and explicitly, in terms of mental processes and subjective states (Fonagy & Bateman, 2008; Fonagy et el., 1991). A comprehension of mental states is necessary to make sense of, predict, and anticipate another person's actions (Fonagy & Target, 1998). Mentalizing has also often been studied in relation to parenting, which led to the introduction of the concepts of 'parental mentalizing' and 'parental reflective functioning' (Slade, 2005; Slade, Grienenberger, et al., 2005). Reflective functioning in the context of parenting is defined as the parents' ability to

"*keep the child in mind*", meaning being able to make sense of their child's mental states and using this understanding to guide their own responses to the child (Slade, Sadler, & Mayes, 2005). More specifically, parental RF is seen as the parents' ability to think reflectively about themselves as parents, the child, and their relationship with the child (Slade, 2005). Within the context of attachment or parenting, RF is often used as an operationalization of the parental mentalizing ability (Arnott & Meins, 2007; Fonagy, Gergely, Jurist, & Target, 2002; Grienenberger, Kelly, & Slade 2005; Slade, Belsky, Aber, & Phelps, 1999). High RF is also considered a main outcome of adequate mentalization abilities. Therefore, the concepts of RF and mentalizing are frequently used interchangeably in the literature and in this thesis.

In order to investigate the aforementioned possible mechanisms involved in the intergenerational transmission of attachment security, the concept of maternal mind-mindedness was introduced (MMM; Meins, 1997). MMM describes the mother's inclination to treat her child as an individual with a mind of its own. MMM is closely related to maternal RF, as both concepts consider the mother's ability to treat her child as a psychological agent, with the potential to reason about either their own or other people's explicit goals, intentions, and beliefs (Baron-Cohen et al., 1993; Behne, 2005; Meltzoff, 2007; Sharp & Fonagy, 2008; Symons, 2004). During infancy, MMM is measured at a certain point in time using observations of interactions between parent–infant dyads. Parental RF, on the other hand, is measured within the context of the ongoing, current, and evolving parent-child relationship using an interview (Slade, 2005; Slade, Bernbach, Grienenberger, Levy, & Locker, 2002; Slade, Patterson, & Miller, 2007). Nonetheless, RF and MMM are both operationalizations of parental mentalizing and therefore considered similar concepts.

Another construct that is related to mentalizing, is Theory of Mind (ToM). The term ToM first appeared in 1978 in a paper on chimpanzees and refers to the ability to attribute mental states to the self and to others (Premack & Woodruff, 1978). Examples of mental states are emotions, feelings, intentions, desires, beliefs, and thoughts. In the last few decades, broader definitions of ToM have appeared and these include not only the ability to attribute mental states to self and others, but also the ability to reflect on the contents of one's own mind and the minds of others. This placed the capacity to interpret behavior of others within a mentalistic framework (Sharp & Fonagy, 2008). Mentalistic in this sense implies our capacity to attribute mental states to ourselves as well as to others, and to utilize this capacity in order to anticipate and shape our own and others' behavior. As ToM has often been linked to specific tasks and/or age groups (O'Connor & Hirsch, 1999), such as the 'false-belief' task used to study ToM in young children (Frye & Moore, 2014; Lagattuta

et al., 2015), some researchers prefer to use the more general term mentalizing instead of ToM. ToM can be considered a measurement of children's mentalizing ability.

Summarizing the different constructs, RF and MMM can be regarded as complementary constructs associated with parental mentalizing, whereas ToM generally refers to the developing mentalizing ability in the child.

Prenatal and postnatal reflective functioning

Maternal mentalizing starts to develop during pregnancy, as a woman's representations of herself as a mother and of her baby become increasingly specific (Slade, Cohen, Sadler, & Miller, 2009). Prenatal reflective functioning refers to a parent's capacity to think of the fetus, from at least the last trimester onward, as a separate individual, with developing personal features, temperament, and needs. A reflective parent is interested and curious about the baby's developing capacities and experiences from early on, and willing to observe and think of the reactions of the baby in relation to the parent's own actions and mental states. The reflective parent-to-be is able to already imagine and think of situations with the baby after birth, for example how the child will resemble the parent(s) and what temperamental characteristics he or she might have. Also, reflective parents-to-be will think of the impact they already may have on their baby, consider the importance of their own health and behavior for the unborn child, and think of the changes that having a child will bring to their lives. So, during pregnancy the parents prepare for the birth of the baby by making room for the child both in mind and in practice (Pajulo et al., 2015).

Postnatal mentalizing or RF can be regarded as a parent's ability to understand his or her own mental states, to keep the child's mental states in mind, and to understand how these mental states impact their behavior (Ordway, Webb, Sadler, & Slade, 2015). A reflective parent is aware of one's own and the child's mental states, understands how these mental states impact behavior, and seems better equipped to regulate complex emotional experiences. The reflective parent will also understand that mental states can be ambiguous, that they can be hidden or disguised, and that they can change in valence or intensity over time (Slade, 2002, 2005). The low reflective parent, on the other hand, appears oblivious of one's own or the child's mental state. Often they will fail to step back from immediate emotional experiences to consider the underlying mental processes (Fonagy et al., 1996), or even deny (negative) emotional experiences related to parenting (Slade, 2005).

So, reflective parents have the ability to regulate and reflect on their own thoughts and emotional experiences, and are also able to also link these to their child's internal

experiences and behavior (Slade, Grienenberger, et al., 2005). This capacity helps the parents to recognize and read their child's cues, thereby facilitating the parents in understanding the meaning and intention of their child's signals and making them see the child as a separate individual. This provides parents with a framework of how to respond when confronted with child-rearing issues (Ordway, Sadler, Dixon, & Slade, 2014).

Parental postnatal RF has been associated with parenting behavior (Grienenberger et al., 2005; Huth-Bocks, Muzik, Beeghly, Earls, & Stacks, 2014; Stacks et al., 2014). For example, mothers who are aware of their child's mental states and whose representations of the child typically involve positive elements, show more sensitivity or responsiveness during mother-child interactions (Demers, Bernier, Tarabulsy, & Provost, 2010; Grienenberger et al., 2005; Slade et al., 1999). Lower RF has been associated with more negative maternal parenting behaviors, such as negativity, controlling parenting, and intrusiveness (Slade, Grienenberger, et al., 2005; Stacks et al., 2014). So, parental RF is regarded as a vital element for adequate, responsive parenting (Fonagy et al., 2002). However, most studies on parental RF and parenting behavior have been conducted during the postnatal period and assessed parenting behavior during one task (Grienenberger et al., 2005; Pajulo et al., 2008) or used composite scores derived by averaging across the interactive tasks (Rosenblum, McDonough, Sameroff, & Muzik, 2008; Stacks et al., 2014). Parental RF may be more strongly related to adequate interactive parenting behavior during more challenging or stressful situations, as reflective parents are assumed be better able to regulate more challenging (emotional) experiences (Slade 2002, 2005). More research is necessary to examine to what extent prenatal and postnatal RF are related to parenting behavior and whether the influence of parental RF on parenting behavior varies between contexts.

Parental reflective functioning and child socio-behavioral development

Parental RF is thought to be especially important during infancy, when the infant's communication is limited to a non-verbal level, and therefore parents interpret the infant's internal world through observation of their behavioral and affective cues. During infancy the child relies on the parent as an important source of information about the self, others, and the world. When the child is distressed, the reflective parent's empathic responses teach the infant that emotions are manageable and acceptable, which in turn serves as a vital function in organizing and regulating the infant's emotional state (Fonagy et al., 2002). In time, these mutual regulatory processes nurture the infant's capacity to self-regulate, and ultimately to embody its internal experiences and to mentalize him or herself.

Postnatal parental mentalizing has been linked to children's socio-behavioral development (Benbassat & Priel, 2012; Laranjo, Bernier, Meins, & Carlson, 2010; Sharp & Fonagy, 2008). For example, parental mentalizing has been positively related to children's ability to regulate behavior (Heron-Delaney et al., 2016; Suchman, DeCoste, Castiglioni, Legow, & Mayes, 2008; Suchman, DeCoste, & Mayes, 2009), to the quality of ToM (Laranjo et al., 2010; Meins & Fernyhough, 1999; Meins et al., 2003), and to RF-abilities in school-aged children (Ensink, Bégin, Normandin, & Fonagy, 2016) and adolescents (Benbassat & Priel, 2012). Alternatively, a lack of parental mentalizing or inadequate parental mentalizing seems to be related to less optimal child psychosocial outcomes (Sharp & Fonagy, 2008). For instance, lower levels of parental RF have been associated with more behavioral problems in children (Benbassat & Priel, 2012; Ensink et al., 2016; Ha, Sharp, & Goodyer, 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013), like conduct problems (Psychogiou, Daley, Thompson, & Sonuga-Barke, 2008; Sharp, Fonagy, & Goodyer, 2006), attention problems, and social withdrawal (Fonagy et al., 2002).

So, whereas adequate postnatal parental RF is thought to contribute to quality of behavior and emotion regulation in the child and to facilitate the child's developing RF-capacity, poor parental mentalizing is supposed to increase the risk for the development of behavioral problems. One can imagine that reflective parents operationalize their understanding of their child's mental states through parenting behaviors. Inadequate parenting behaviors (such as hostility, unresponsiveness, and ineffective parenting) have also been related to children's behavioral problems (Edwards & Hans, 2015; Feng, Shaw, & Silk, 2008; Healy, Murray, Cooper, Hughes, & Halligan, 2013; Hughes & Ensor, 2006; Keren & Tyano, 2012), so the effects of parental RF on children's behavioral problems may be mediated by parenting behavior. The foundations of the mother-infant relationship are formed prenatally and considering the fact that prenatal parental mentalizing is relatively strongly associated with postnatal mentalization (Arnott & Meins, 2007, 2008; Steele & Steele, 2008), more research on prenatal RF and its relation with later parenting behavior and children's socio-behavioral development is important.

From a clinical perspective it is also important to gain more insight in the effects of parental RF on children's socio-behavioral problems. Children growing up in families struggling with multiple complex problems, such as maternal mental illness, substance (ab)use, poverty, and single parenthood, are at risk for developing behavioral problems (Cabaj, McDonald, & Tough, 2014; Côté et al., 2006; Hay et al., 2011; Huijbregts, Séguin, Zoccolillo, Boivin, & Tremblay, 2008). These 'high-risk' families often need substantial

support to promote good enough care for their child. Parental RF is often compromised in these high-risk, multi-problem families (Pajulo et al., 2012; Schechter et al., 2005; Suchman, DeCoste, Castiglioni, et al., 2010). In light of the association between parental mentalizing and children's socio-behavioral development, parental RF may be an interesting component for intervention programs aiming to prevent or reduce behavioral problems in children. Programs focusing on improving parental RF in high-risk parents (Sadler et al., 2013; Slade, 2007; Slade et al., 2010) do indeed appear to enhance the level of RF (Katznelson, 2014). Prevention and intervention efforts initiated early in life are presumed to be most effective (Beauchaine, Neuhaus, Brenner, & Gatzke-Kopp, 2008). Therefore, research on the effects (of training) prenatal and postnatal RF on children's behavioral problems is important.

Physical aggression

In very young children, aggression is often studied by assessing (precursors of) physical aggression. Surprisingly, many studies on the development of aggression do not provide a specific definition of the concept and there is an ongoing debate on what should be interpreted as true aggressive behavior. Where some researchers argue that by definition all acts of physical force directed against other people are expressions of aggression (Alink et al., 2006; Côté et al., 2006), others oppose that forceful acts can only be deemed aggressive if there is clear intent to harm another person (Dodge, Coie, & Lyman, 2006; Estrem, 2005). Measuring intentions is very hard at any age, but it is particularly problematic when referring to behaviors in infants and toddlers. This is due to their limited verbal and cognitive abilities, especially as the capacity to understand the consequences of one's behavior and to oversee other people's feelings does not develop fully until the end of the preschool years (Zahn-Waxler, Radke-Yarrow, Wagner, & Chapman, 1992). Furthermore, many aggressive behaviors driven by anger, fear or intense frustration are not intentional but rather impulsive (Tremblay, 2000, 2003). Taken together, it might not be needed for the definition of aggression to include the criterion of intent (Tremblay, 2000), especially when investigating (precursors of) physical aggression in early infancy. Therefore, in this thesis aggression will be defined as a set of physical behaviors that may cause 'physical harm' to others and/or objects (the actual 'physical harm' will most likely be limited considering the age of the participating children).

With the developing motor ability to direct force against other people, early manifestations of physical aggression are part of the behavioral repertoire of infants (Caplan, Vespo, Pedersen, & Hay, 1991; Hay et al., 2011; Hay et al., 2010). In the first year

of life, physical aggression emerges as a response to goal blockage, conflict, and restraint. While the variety of aggressive behaviors during infancy is still limited, with increasing age, infants' mobility, activity and cognitive abilities grow and provide more occasions, ways, and diverse reasons for demonstrating aggression. During particular developmental periods, the use of some physical aggression seems universal (Côté et al., 2006; Tremblay et al., 1999; Tremblay et al., 2004); however, only a minority of 6-to-8-month-olds show physical force (Hay et al., 2010; Nærde, Ogden, Janson, & Zachrisson, 2014). For example, 15% of mothers report clear signs of anger and few report biting or hitting by their 6-month-olds (Hay et al., 2010). Generally, a pattern is observed in which the use of physical aggression increases with development and reaches a peak during the 2nd year of life (Alink et al., 2006; Nærde et al., 2014), with a decline in physical aggression from age 3 years onwards (Alink et al., 2006; Tremblay et al., 2004).

Most longitudinal studies on aggression had as primary intention the identification of factors determining atypical development indicated by high-risk pathways (Broidy et al., 2003; Tremblay et al., 2004), or focused on the study of physical aggression from toddlerhood or the (pre)school period onwards, with only a few starting in infancy (for a review, see Keren & Tyano, 2012). Current evidence on both the typical and atypical development of physical aggression starting from early infancy thus lags behind. To gain more insight in the mechanisms responsible for the development and persistence of (physical) aggression, more research is needed, especially as the few studies that have focused on early infancy seem to indicate that individual differences in precursors of physical aggression can already be observed from as early as 6 months. These differences remain stable from early infancy to the third year of life (Hay et al., 2010; Hay et al., 2014), suggesting some individuals are on the trajectory to high levels of aggression as early as 6 months of age (Hay et al., 2014).

During toddlerhood a group of aggressive 'early-starter' children can be identified, who seem to fail or struggle in developing more mature regulation abilities to replace physical aggression and who continue showing the most persistent and serious forms of aggression, including antisocial behavior, later in life (Aguilar, Sroufe, Egeland, & Carlson, 2000; Moffitt, Caspi, Harrington, & Milne, 2002). When high levels of aggression are present and/or persist after toddlerhood, negative behavioral outcomes are increasingly likely (Baillargeon et al., 2007; Côté et al., 2006; Tremblay et al., 2004). With interventions aiming to reduce aggression being more effective when offered at a younger age (Hermanns, Ory, & Schrijvers, 2005), this underlines the importance of understanding how

aggression unfolds at the earliest possible stages in order to prevent the risk of the array of socio-behavioral problems later in development and to prevent negative economic consequences, like long-lasting and expensive treatment programs.

Since parental RF seems to be associated with the development of socio-behavioral problems in children (Ha et al., 2011; Walker, Wheatcroft, & Camic, 2011), parental RF might be important in managing childhood aggression. Postnatal parental mentalizing has been inversely associated with externalizing behavioral problems in older children (Benbassat & Priel, 2012; Ensink et al., 2016; Ha et al., 2011; Meins et al., 2013). Also, more frequent maternal references to mental states have been related to lower levels of aggression in 2-year-olds (Garner & Dunsmore, 2011). However, no studies to date have examined the role of maternal RF in the development of early physical aggression. More research is essential to unravel to potential role of maternal RF in the development of (precursors of) physical aggression in early infancy.

Objectives and outline of the thesis

Violence in society is an increasing concern of policy makers and public health. It is therefore relevant to study the mechanisms that are related to the development of aggression and violence in individuals, especially factors that are malleable. The risk for developing aggressive behavior has been associated with multiple (complex interactions between) neurobiological, neurocognitive, and social-environmental factors. The present thesis will specifically focus on maternal reflective functioning and its association with (externalizing) behavior in early childhood; RF seems to be trainable and it has been linked to infant emotion regulation and socio-behavioral development. So far, studies directly linking parental RF and childhood aggression are scarce. Hence, more research on the association between prenatal and postnatal RF on the one hand and children's aggressive behavior on the other is important. Therefore, the aim of the current thesis is to investigate the effect of maternal RF on the development of (precursors of) behavioral problems, especially aggressive behavior, from infancy onwards. A further aim is to examine whether potential effects of maternal RF on child aggression can be explained by parenting behavior, particularly maternal sensitivity and intrusiveness.

The studies described in this dissertation are part of the longitudinal Mother-Infant Neurodevelopment Study (*MINDS*) – Leiden. *MINDS* – Leiden is a large ongoing study into neurobiological and neurocognitive predictors of early behavioral problems and the effects of an early intensive RF-based home visiting program for first-time high-risk

mothers and their children. Therefore, **Chapter 2** offers an overview of the background, design, and sample characteristics of *MINDS* – Leiden.

Factors that have been used to define risk status with respect to child socio-behavioral outcomes, such as substance (ab)use and psychiatric problems of parents (World Health Organization, 2005), have also been associated with reduced maternal mentalizing (Pajulo, Helenius, & Mayes, 2006; Pajulo et al., 2012; Rosenblum et al., 2008; Sadler et al., 2007; Toth, Rogosch, & Cicchetti, 2008). To date, studies predominantly investigated maternal RF in the postnatal period using either low-risk samples or clinical and/or high-risk samples without a control group (Grienenberger et al., 2005; Miller, 2008; Schechter et al., 2005; Suchman, DeCoste, Leigh, & Borelli, 2010). In order to be able to potentially enhance maternal RF in a very early stage, it is important to understand which factors determine the quality of maternal RF in general and more specifically of prenatal RF. In **Chapter 3,** we will examine whether prenatal RF differs between a group of first-time mothers-to-be from a high-risk (HR) background and a low-risk control group. Furthermore, we will determine which psychosocial and environmental risk factors in the HR-group are linked to quality of prenatal RF.

Risk factors negatively impact children's socio-behavioral development, either directly and/or indirectly, through parenting capacities and parent-child interactions (Cyr, Euser, Bakermans-Kranenburg, & Van IJzendoorn, 2010; Seng & Prinz, 2008). Quality of parental RF may be an important mechanism through which risk factors impact parenting behavior, as low parental RF has been linked to the presence of risk factors (Pajulo et al., 2006; Pajulo et al., 2012; Rosenblum et al., 2008; Sadler et al., 2007; Toth et al., 2008), and because reflective parents may operationalize the understanding of their child's mental states through their interactive behavior with the child. However, no studies to date have investigated the potential mediating role of prenatal RF in associations between risk factors and maternal interactive behavior. In **Chapter 4**, we will investigate whether prenatal RF is related to postnatal maternal interactive behavior in first-time mothers and their six-month-old infants, and to what extent quality of prenatal RF might explain the negative influence of the presence of multiple risk factors on maternal interactive behavior. Due to its essential role in providing adequate and cohesive responses to infant distress, it could be that RF is more strongly related to adequate (or positive) maternal interactive behavior during more challenging tasks. Hence, we will also examine the relation between prenatal RF and maternal interactive behavior during both non-challenging and challenging tasks.

Considering the fact that early physical aggression increases the likelihood for a less optimal development, and that it has a negative impact on the child's family, it is vital to increase our understanding of the early manifestations and factors influencing the onset and developmental course of aggression. Particularly more knowledge about malleable factors is essential for the treatment and prevention of those unwanted behaviors. With its established value as an important concept for thinking about quality of parenting behavior and parent-child interactions (Farrow & Blissett, 2014; Grienenberger et al., 2005; Koren Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002) and its links to the development of socio-behavioral problems in children (Ha et al., 2011; Walker et al., 2011), parental RF may be an interesting target in this respect. Most research to date has been conducted on the effects of postnatal RF on children's socio-behavioral development. No studies to date have examined the role of prenatal RF in the development of early physical aggression. The aim of **Chapter 5** is therefore to investigate whether maternal prenatal RF predicts the development of physical aggression in infancy and whether maternal sensitivity and/or intrusiveness mediate or moderate this association.

Parental RF has mostly been studied postnatally as an unitary construct, in which it has been linked to children's socio-behavioral development. However, there are indications that it might be more appropriate to regard parental RF as a multidimensional construct. A more detailed understanding of the components of both prenatal and postnatal parental RF and their potentially differential implications for early behavioral development may enhance the efficacy of prevention and intervention programs aiming at reducing children's behavioral problems by focusing on improvement of specific aspects of parental RF. In **Chapter 6,** we will investigate maternal prenatal and postnatal RF as multi-dimensional constructs, and whether the dimensions of RF are differentially associated with children's temperament and externalizing behavior 20 months post-partum.

Finally, in **Chapter 7** the results of the previous mentioned studies will be integrated and discussed. Scientific and clinical implications and recommendations for future research will be provided.

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Chapter 2

The Mother-Infant Neurodevelopment Study (*MINDS*) – Leiden: Background, design and study population.

Smaling, H. J. A., Suurland, J., Huijbregts, S. C. J., Van der Heijden, K. B., Van Goozen, S. H. M., & Swaab, H. The Mother-Infant Neurodevelopment Study (MINDS) – Leiden: Background, design and study population. *Under review*.

Abstract

This paper describes the background, design, and sample characteristics of the Mother-Infant Neurodevelopment Study – Leiden, a longitudinal study investigating 1) mechanisms through which neurobiological, neurocognitive and social-environmental factors increase risk for emotional and behavioral problems in early childhood, 2) effects of an intensive home-visiting program for first-time mothers at high-risk on child neurobiological, neurocognitive and emotional and behavioral development, and 3) which factors (neurobiological, neurocognitive and social-environmental) predict variation in effects of the home-visiting program on child emotional and behavioral outcomes. A total of 275 families (128 low-risk and 147 high-risk) were included in the study. High-risk women were randomly assigned to the intervention (n = 65) or high-risk control group (n = 82). Six assessment waves were conducted within a four-year period. Demographic and mental health characteristics of the low-risk and high-risk group, collected during the first assessment at 27 gestational weeks, are presented. This study will help identifying specific biomarkers, precursors of neurocognitive functions and temperamental factors in infancy, facilitating the detection of children at risk for later emotional and behavior problems. Furthermore, this study may yield insights into effective, targeted, and tailor-made components of prevention programs, ultimately reducing the psychological and economic costs of mental health problems to society.

Introduction

Children growing up in families struggling with multiple complex issues, including maternal psychiatric problems, substance (ab)use, single parenthood, and poverty, are at high risk for developing emotional and behavioral problems (Cabaj, McDonald, & Tough, 2014; Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Hay, Mundy, et al., 2011; Huijbregts, Seguin, Zoccolillo, Boivin, & Tremblay, 2008). As these problems raise major public health concerns and increase costs to society, it is important to gain insight into developmental mechanisms and effectiveness of prevention approaches. Recent theoretical models have emphasized the complex interactions between neurobiological vulnerabilities and environmental risk factors (Beauchaine, Neuhaus, Brenner, & Gatzke-Kopp, 2008; Belsky & Pluess, 2009; Boyce & Ellis, 2005), and the mediating role of neurocognitive and neurobiological factors in the link between early adversity and emotional and behavioral outcomes (Van Goozen, Fairchild, Snoek, & Harold, 2007).

However, there are several important gaps in the current literature. First, most studies so far have involved toddlers, school-aged children and adolescents, and little is known about earlier manifestations of neurobiological and neurocognitive vulnerabilities, and how these might increase risk for emotional and behavioral problems later in life. This is particularly important given that the neurobiological systems underlying later emotional and behavioral regulation rapidly develop during the prenatal period and first years of life, resulting in increased sensitivity to environmental influences (Beauchaine et al., 2008; Laurent, Harold, Leve, Shelton, & Van Goozen, 2016). Prevention efforts initiated early in life are therefore presumed to be more effective (Beauchaine et al., 2008). Second, most longitudinal studies investigating the neurobiological and neurocognitive mechanisms underlying emotional and behavioral problems in early childhood involved community samples. Because evidence is accumulating that shows that different neurodevelopmental processes underlie emotional and behavioral development in normative versus high-risk or clinical samples (Beauchaine, 2001; Beauchaine et al., 2008), it is of critical importance to extend the current body of literature with studies focusing on high-risk samples in order to fully understand the mechanisms that are related to the development of emotional and behavioral problems.

The overarching aim of the Mother-Infant Neurodevelopment Study (*MINDS*) – Leiden study is to examine which neurobiological, neurocognitive and social-environmental factors

increase risk or confer protection for developing emotional and behavioral problems in the first years of life in a heterogeneous sample of low- and high-risk families. Based on integrative models of the neurobiological bases of early-onset antisocial behavior (Van Goozen et al., 2007), and theories of differential susceptibility (Belsky & Pluess, 2009) and biological sensitivity to context (Boyce & Ellis, 2005), we considered neurobiological and neurocognitive factors as potential mediating and moderating mechanisms that lead to emotional and behavioral problems. We adopted a rigorous and systematic approach, assessing a wide range of social-environmental (i.e., maternal psychiatric problems, substance (ab)use, poverty, social support, parenting, maternal reflective functioning), neurocognitive (i.e., precursors of executive functioning, Theory of Mind, language, empathy) and neurobiological factors (i.e., autonomic nervous system and hypothalamic pituitary adrenal axis) that may either directly, indirectly, or in interaction increase risk for emotional and behavioral problems in young children.

Families at risk need substantial support to promote good enough care for their child. However, it is often difficult to engage these families in intervention programs. Home-visiting programs for first-time mothers at high-risk have the advantage of serving families at their home, thereby increasing the likelihood that they will (continue to) participate. Home-visiting programs have been found to be effective in improving maternal prenatal health behaviors (e.g., reductions in tobacco use), maternal life course (e.g., fewer rapid second pregnancies, returning to school/ seeking education), sensitive parenting behavior and parenting attitudes, and child physical abuse (e.g., number of emergency room visits, injuries or ingestions treated, and accidents requiring medical attention) (Mejdoubi et al., 2014; Mejdoubi et al., 2015; Olds, Sadler, & Kitzman, 2007; Ordway et al., 2014; Sweet & Appelbaum, 2004). Further, positive effects of home-visiting programs have been reported for a wide range of child outcomes (Avellar & Supplee, 2013; Filene, Kaminski, Valle, & Cachat, 2013; Mejdoubi et al., 2015; Olds et al., 2007; Ordway et al., 2014; Peacock, Konrad, Watson, Nickel, & Muhajarine, 2013; Sweet & Appelbaum, 2004). For example, home-visiting programs have been found to positively affect cognitive development (e.g., academic and arithmetic achievement, intellectual functioning, executive functioning, receptive language), socio-emotional development (e.g., attachment security, social development, emotional vulnerability), and to reduce behavioral problems (e.g., externalizing and internalizing behavior problems). Also, favorable results have been reported for birth outcomes (e.g., birth weight, gestational age) and physical health, although these effects have been less consistent among different home-visiting programs

(Avellar & Supplee, 2013; Filene et al., 2013; Robling et al., 2016). Moreover, at 15 year follow-up, adolescents who had received home visitation early in life had fewer arrests and convictions, and committed fewer violations of probation (Olds et al., 1998).

Despite these promising results, the overall effect sizes of studies evaluating home-visiting programs are relatively small (Filene et al., 2013), and many studies report non-significant findings (Avellar & Supplee, 2013). Currently, an important question is which factors predict this variability in the effects of home-visiting programs on child outcomes? While it is generally acknowledged that effectiveness of prevention programs may vary as a function of neurobiological and neurocognitive vulnerabilities (Beauchaine et al., 2008), there are no studies that have examined child neurobiological and neurocognitive factors as moderators of the effects of home-visiting programs. Moreover, surprisingly little is known about the effects of home-visiting programs on child neurobiological and neurocognitive development. Therefore, a second overarching aim of *MINDS* – Leiden was to evaluate the effects of an intensive home-visiting program for first-time mothers at high-risk on child neurobiological, neurocognitive and emotional and behavioral development, and to evaluate the predictive value of these child neurobiological and neurocognitive factors on the effectiveness of such a program.

Study aims

MINDS – Leiden is part of a large research program funded by the Dutch government called 'Brain & Cognition – Social innovation in health, education, and safety' (http://www.nwo.nl/en/research-and-results/programmes/nihc/hcmi/index.html). The purpose of this Brain & Cognition program is to promote neurobiological and neurocognitive research to develop and improve intervention efforts aimed at reducing aggression and violence in society.

In the present study three important questions are addressed. First, which neurobiological and neurocognitive factors predict (directly, indirectly or in interaction with social-environmental factors) emotional and behavioral problems – specifically aggressive behavior – in the first three-and-a-half years of life? Second, what are the effects of an intensive home-visiting program for first-time mothers at high-risk on neurobiological, neurocognitive and emotional and behavioral development in children in the first years of life? Third, which factors (neurobiological, neurocognitive and social-environmental) predict variation in effects of the home-visiting program on child

emotional and behavioral outcomes? This paper describes the design of the study, the measures used, the intervention program and the sample characteristics.

Methods

Study design

The *MINDS* – Leiden study was designed as a longitudinal randomized control trial (see Figure 1 for an overview of the design of the study). Based on elaborate screening for the presence of risk factors during the first prenatal home visit (27 weeks gestation), pregnant women were assigned to either the high-risk (HR) or low-risk (LR) group (see *screening for risk factors* for a description of allocation criteria). Women in the HR group were randomly assigned to the high-risk intervention (HR-I) group (see *The intervention* for more details) or the high-risk control (HR-C) group. All participating families were followed over a period of approximately four years, consisting of six assessment waves, (the first assessment took place in the third trimester of pregnancy and the last assessment took place when the children were 3.5-4 years of age). A total of 65 families were included in the HR-I group. Families in the HR-I group took part in a home-visiting program starting within 2 weeks after the prenatal assessment until 2.5 years post-partum.

Recruitment

Recruitment of pregnant women took place between February 2011 and April 2015, via hospitals, midwifery clinics, prenatal classes, pregnancy fairs, and social workers. Dutch-speaking primiparous women between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. Exclusion criteria were heavy drug addiction or severe psychiatric or psychotic disorder, an intelligence quotient (IQ) below 70, major acute or significant chronic illness in the mother or a disorder or syndrome in the child, which would affect normal development. We oversampled families from a high-risk background in order to obtain sufficient variance in risk factors that might influence children's early socio-emotional and cognitive development. This was done by collaborating with midwifery/obstetric clinics in areas with a low average social-economic status and/or by recruitment through social workers. All participating women provided written informed

consent. The study was approved by the Medical Research Ethics Committee at the Leiden University Medical Centre (NL39303.058.12), and by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University (ECPW-2011/025).

Screening for risk factors

Classification to the HR-group was based on the following risk factors (Smaling et al., 2015; World Health Organization, 2005, 2016): 1) positive screening on current psychiatric disorder(s) or substance use (alcohol, tobacco and/or drugs) during pregnancy; or 2) presence of two or more of the following risk factors: single status (biological father not involved), unemployment, financial problems, no secondary education, limited social support network (<4 individuals listed in network), and young maternal age (<20 years). In case only one risk factor was present - other than an indication for current psychiatric disorder(s) or substance use - women were discussed in a clinical expert meeting to determine whether placement in the HR-group was appropriate ($n = 6$).

Positive screening on current psychiatric disorder(s) was established by the Mini-International Neuropsychiatric Interview – plus (M.I.N.I. - plus; Sheehan et al., 1997; Van Vliet, Leroy, & Van Megen, 2000) by screening for the following disorders: depressive disorder (current), dysthymic disorder (past 2 years), suicidality, mania (current), panic disorder (current and lifetime), agoraphobia (current), social phobia (current), other type of phobia (current), obsessive-compulsive disorder (current), generalized anxiety disorder (GAD; current), posttraumatic stress disorder (current), alcohol dependence and abuse (current and lifetime), drug dependence and abuse (non-alcohol, current and lifetime), attention-deficit/hyperactivity disorder (lifetime), and antisocial personality disorder (lifetime). Current is defined as 'in the past month' for all diagnoses except GAD, which has a 6-month time frame, and alcohol abuse/dependence and drug abuse/dependence for which a 12-month time frame is used.

The size of the social support network was established by using the Norbeck Social Support Questionnaire (NSSQ; Norbeck, Lindsey, & Carrieri, 1981, 1983). The presence of other risk factors (i.e., substance use during pregnancy, no secondary education, unemployment, financial problems, single status, and maternal age) were assessed by means of the Dutch translation of the 'Becoming a mother' questionnaire (Hay et al., 2011; Smaling et al., 2015).

Procedures

The study comprised of six assessment waves (see Figure 1). During the third trimester of pregnancy (T1), at 6 months (T2) and at 20 months (T4) post-partum 2-to-2.5 hour home visits were carried out by two female researchers. One leading researcher conducted all the tasks with the infant and guided the mother-infant interaction tasks, while a second researcher digitally recorded the whole session and administered the questionnaires to the mother. At 12 months (T3), 30 months (T5) and 40 months (T6), the mother-infant dyads visited the Babylab at the Faculty of Social and Behavioral Sciences, Leiden University. The lab test sessions were carried out by one researcher, while a second researcher was seated behind a one-way screen, recorded the session and provided observational records.

Table 1 gives an overview of the main research areas of the study. In addition, Table 2 gives a detailed overview of instruments and its content used in the study. T1 included an interview regarding the emotional impact of the pregnancy to assess prenatal reflective functioning (RF), a structured interview to asses current psychiatric disorders, and various questionnaires to assess demographic information, mental and physical health, life style, social support, self-efficacy in the nurturing role, executive functioning, emotion regulation, life events, and antenatal attachment. T2 to T5 started with a free play session to measure maternal interactive behavior. For T2, T3, and T5, this was followed by attachment of the cardiac monitoring equipment to the child to measure their autonomic nervous system (ANS) reactivity and regulation during mildly stressful events (see Table 2 for the paradigms that were used to measure stress reactivity and regulation). In addition, during the lab visits saliva samples were taken several times (before and after stress) from mother and child to measure hypothalamic pituitary adrenal (HPA)-axis functioning. Moreover, each wave consisted of various age-appropriate tasks to measure precursors of executive functioning, temperament and emotion, empathy, Theory of Mind, and language skills, and ended with the mother completing various questionnaires to assess demographic information and multiple mother (i.e., mental and physical health, obstetric characteristics, life style, social support, self-efficacy in the nurturing role, executive functioning, emotion regulation, life events, parenting cognitions and parenting stress) and child domains (language, temperament, aggression, behavioral problems, executive functioning) (see Table 1 and 2 for more details). Mother-child interaction during normal, playful interaction, teaching tasks and following mildly stressful events was observed at T2 to T5. T4 also included an interview regarding maternal representations of the relationship with their child and the emotional impact of parenting to measure postnatal RF. At T6, children

were assessed for approximately 1 hour in individual testing rooms, and then brought together with their mother and one or two other families for a simulated birthday party and a 20 minute free play session with peers, designed to provide an acceptable yet emotionally arousing setting in which to observe children's social behavior (and specifically aggressive behavior) with their peers.

The intervention

Families in the HR-I group (n = 65) participated in an intensive home-visiting program based on 'Minding the Baby' (MTB) (Sadler et al., 2013; Slade et al., 2005; Slade, Sadler, & Mayes, 2005). MTB is an interdisciplinary home-visiting program developed at Yale University Child Study Center and Yale University School of Nursing (Slade et al., 2010). MTB focuses on young vulnerable first-time parents, primarily mothers, who are at high risk due to multiple complex issues, including psychiatric problems, poverty, young maternal age, single motherhood, or limited social support. MTB combines two well-researched early-intervention models; home visiting and infant-parent-psychotherapy, in order to meet the holistic, complex, multilayered care needs of vulnerable families (Sadler et al., 2013). The program specifically aims to enhance maternal reflective functioning (RF) and the development of secure attachment relationships, as well as to address maternal (mental) health issues. RF refers to the mother's capacity to 'keep the baby in mind', to make sense of his/her internal states, emotions, thoughts, and intentions, as well as her own (Slade, 2002). Particularly in high-risk mothers, RF is often compromised, leading to disrupted interactions, insecure attachment relationships, and long term emotional difficulties. In the present study (see Table 3), RF skills were significantly lower among women in the HR-group compared to women in LR-group. In MTB, parents are encouraged to be curious, to try and figure out what the child needs or is thinking or feeling even in early infancy. RF is seen as a key to maternal sensitivity and plays an important role in the development of the child's capacity for Theory of Mind and adaptive socio-emotional development in young children (Ordway et al., 2014; Laranjo, Bernier, Meins, & Carlson, 2010; Sadler et al., 2013; Sadler, Slade, & Mayes, 2006; Slade, Sadler, & Mayes, 2005). Programs that are specifically aimed at improving parental RF in 'at-risk' parents indeed appear to improve RF-skills and parenting behavior (Katznelson, 2014; Suchman et al., 2010). For a more detailed description of the conceptual framework underlying the MTB-model, see Sadler and colleagues (2013).

The MTB-program offers a treatment manual with a set of well-developed protocols and guidelines (Slade et al., 2010). At the same time, the program can be adapted to the individual needs of the family and the circumstances of each home visit. For implementation of the MBT-program in The Netherlands, one of the PI's (HS) and social workers of the *MINDS*-Leiden team were thoroughly trained in the basic constructs and techniques of the reflective parenting model used in MTB. This MTB 'Introductory training institute' provides the basis for implementation of the MTB-program in other settings. A difference between the original MTB and the intervention used in this study is that we chose to work only with clinical social workers ("coaches"), instead of alternating the home visits between a nurse practitioner and clinical social worker. This decision has been based on the fact that in The Netherlands, mother and child pay regular visits to a pediatric nurse in the first four years of life. In the MTB-program, the visits by the nurse practitioner are mostly centered around health-related issues, which in The Netherlands are monitored by pediatric nurses at child health and welfare centers.

Home visits generally lasted about one hour, although at times of crisis home visits could be extended or increased in frequency. The home visits were conducted by a trained coach, starting during the last trimester of pregnancy until the child was 2.5 years old, and were scheduled weekly during the first year and continued two-weekly after that. Apart from the planned home visits, the coaches were available for their families when needed (by phone or 'Whatsapp'). The main objective of the coaches was to promote parental RF, support the mother-infant attachment relationship, and stimulate adequate parenting skills. Further, the coaches aimed to reinforce prenatal health care and health education, supported both mother's and child's health and development, helped mothers to extend or build a stronger social support network, educated mothers about the safety of their child, referred to a range of treatments as appropriate when psychiatric complaints were detected, and helped mothers negotiate issues involving legal, financial and housing problems. However, the coaches conferred regularly about their families during monthly supervision meetings, and maintained close contact with each other and their supervisor in case of crisis, or other family problems.

Table 1. The main research areas of the *MINDS* - Leiden Study.

Maternal variables	Wave 1: pregnancy	Wave 2: 6 months	Wave 3: 12 months	Wave 4: 20 months	Wave 5: 30 months	Wave 6: 3.5 years
Demographics	X	X	X	X	X	X
Reflective functioning	X			X		X
Mental and physical health	X	X	X	X	X	X
Life style	X	X			X	X
Social support	X				X	X
Self-efficacy in the nurturing role	X	X		X		
Executive functioning	X				X	
Emotion regulation	X				X	
Life events	X					X
Antenatal attachment	X					
Obstetric characteristics		X				
Parenting		X	X	X	X	X
Parenting stress					X	
IQ estimate		X				
Stress reactivity and regulation			X		X	

Child variables	Wave 1: pregnancy	Wave 2: 6 months	Wave 3: 12 months	Wave 4: 20 months	Wave 5: 30 months	Wave 6: 3.5 years
Physical health		X	X	X	X	X
Cognitive development		X				
Stress reactivity and regulation		X	X		X	X
Language development			X	X	X	X
(Precursors of) executive functioning			X	X	X	X
(Precursors of) Theory of Mind			X	X	X	X
(Precursors of) empathy				X	X	X
Aggression		X	X	X	X	X
Behavioral problems (other)				X	X	X
Temperament		X	X	X		
Peer social interaction						X

Note. IQ = intelligence quotient.

Table 2. Research domains, instruments, and contents.

Domain (mother)	Instrument / data source	Content
Demographics, lifestyle, physical health & obstetric characteristics	'Becoming a mother'-questionnaire and 'Being a mother'-questionnaire (Hay, Mundy, et al., 2011; Smaling et al., 2015)	Key information regarding demographics, obstetric characteristics, life style, and physical health
Life events	List of Threatening Experiences – questionnaire (LTE-Q; Brugha & Cragg, 1990)	Stressful life events over the past year to self and close others, and whether they currently have impact
Social support	Norbeck Social Support Questionnaire (NSSQ; Norbeck, Lindsey, & Carrieri, 1981, 1983)	Functional variables (affect, aid, affirmation) and total network variables of social support (number of persons in the network, duration of relationships, frequency of contact), and loss of support within past year
	Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988)	Subjective assessment of social support adequacy
Self-efficacy in the nurturing role	Self-efficacy in the nurturing role scale (SENR; Pedersen, Bryan, Huffman, & Del Carmen, 1989)	Mothers' perceptions of their competence on basic skills required in caring for an infant
Mental health	Mini-International Neuropsychiatric Interview (M.I.N.I.) – plus (Sheehan et al., 1997)	Screening for psychiatric disorders
	Beck depression inventory (BDI) – II (Beck, Steer, & Brown, 1996)	Intensity of depression

	State-Trait Anxiety Inventory (STAI; Spielberger, 2010; Spielberger, Gorsuch, & Lushene, 1970)	Indication of transient anxiety and tendency to experience general anxiety
	Aggression Questionnaire (AQ; Buss & Perry, 1992)	Verbal aggression, physical aggression, anger, and hostility
	Borderline personality checklist (Arntz et al., 2003; Giesen-Bloo, Arntz, & Schouten, 2005)	Severity of borderline-related symptoms during past month
Emotion regulation	Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004)	Clinically relevant difficulties in emotion regulation.
Antenatal attachment	Maternal antenatal attachment scale (MAAS; Condon, 1993; Van Bussel, Spitz, & Demyttenaere, 2010)	Quality of mother's affective experiences towards the fetus and intensity of preoccupation with the fetus
Reflective functioning	Pregnancy Interview (PI) – Revised (Slade, 2007; Slade, Patterson, & Miller, 2007) and Parent Development Interview (PDI) – Revised (Slade et al., 2003; Slade et al., 2005)	Parental reflective functioning
Parenting	Adapted version of the Mother Infant Coding System (Miller, McDonough, Rosenblum, & Sameroff, 2002) to code maternal behavior during Free play, Teaching tasks, and Still-Face Paradigm (SFP; Tronick et al., 1978)	Maternal interactive behavior (e.g., sensitivity, intrusiveness) with her child during various contexts.
	Parental Cognitions and Conduct Toward the Infant Scale (PACOTIS; Boivin et al., 2005)	Parental perceptions and behavioral tendencies towards infant

Parenting stress	Nijmeegse Ouderlijke Stress Index (NOSI; Abidin, 1990; De Brock, Vermulst, Gerris, & Abidin, 1992)	Parenting stress
IQ	Wechsler Adult Intelligence Scale (WAIS-III-NL; Wechsler, 2005) – subtests Vocabulary, Matrix Reasoning, and Digit Span	Global indicators of intellectual functioning (IQ estimate) - mother
Executive functioning	Behavior Rating Inventory of Executive Function–adult version (BRIEF - A; Roth, Isquith, & Gioia, 2005)	Difficulties in executive functioning in daily life
Stress reactivity and regulation – baseline, stress and recovery	Maternal response to mildly stressful situation (i.e., short mother-child separation and child exposure to fear paradigm (see child variables))	*Hypothalamic pituitary adrenal (HPA)-axis*: Cortisol and Alpha-amylase (saliva) *Subjective experience of stress (mother):* Visual Analogue Scale (VAS; Lesage, Berjot, & Deschamps, 2012)

Domain (child)	**Instrument / data source**	**Content**
Cognitive development	Infant Mental Development Index of the Bayley Scales of Infant Development (BSID), 2nd version (Bayley, 1993)	Global measure of infant cognitive development
Stress reactivity and regulation – baseline, stress and recovery	Stressors: - *Social*: Still-Face Paradigm (Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2009; Tronick et al., 1978)	*Autonomic nervous system (child)*: Heart rate, pre-ejection period, skin conductance, respiratory sinus arrhythmia with the Vrije

	- *Frustration*: Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith & Rothbart, 1999a, 1999b), Car seat, Gentle arm restraint - *Fear*: Adapted version of unpredictable-mechanical-toy from the Lab-TAB (Baker, Shelton, Baibazarova, Hay, & van Goozen, 2013; Goldsmith & Rothbart, 1999a)	Universiteit Ambulatory Monitoring System (VU-AMS; De Geus, Willemsen, Klaver, & Van Doornen, 1995; Willemsen, De Geus, Klaver, Van Doornen, & Carrofl, 1996) *Hypothalamic pituitary adrenal (HPA)-axis*: Cortisol and Alpha-amylase (saliva) *Behavioral stress reactivity and regulation (child)*: observation (coding based on Lab-TAB)
Aggression	Cardiff Infant Contentiousness Scale (CICS; Hay et al., 2010)	Early manifestations of aggression
	Physical Aggression Scale for Early Childhood (PASEC; Alink et al., 2006)	Physical aggression
	Peer Interaction Coding System (PICS; Caplan, Vespo, Pedersen, & Hay, 1991; Hay, Nash, et al., 2011)	Peer aggression
Behavioral problems	Child Behavior Check List (CBCL) 1 ½ -5 year (Achenbach & Rescorla, 2000; Achenbach & Ruffle, 2000)	Internalizing and externalizing behavioral problems
Temperament	Short versions of the Infant Behavior Questionnaire (IBQ; Rothbart, 1981) and Early Childhood Behavior Questionnaire (ECBQ; Putnam & Rothbart, 2006)	Dimensions of temperament (i.e., negative emotionality, effortful control)
(Precursors of) executive functioning	BRIEF – preschool version (Gioia, Espy, & Isquith, 2003)	Difficulties in executive functioning in daily life

	Music box (Goldsmith & Rothbart, 1999a)	Sustained attention
	Don't Paradigm (adapted from Kochanska, Tjebkes, & Fortnan, 1998)	Infants' spontaneous restraint to maternal prohibition
	Self-restraint (Friedman, Miyake, Robinson, & Hewitt, 2011), and Inhibitory control tasks (Carlson & Moses, 2001)	Inhibitory control
	Snack task and Gift task (Kochanska, Coy, & Murray, 2001; Spinrad et al., 2007)	Delay of gratification
	Hide the pots (Bernier, Carlson, & Whipple, 2010), and Spin the pots (Hughes & Ensor, 2005)	Working memory
	Dimensional Change Card Sort (Zelazo, 2006)	Mental flexibility
(Precursors of) Theory of Mind	Pleasure-disgust task (Slaughter & McConnell, 2003)	Social referencing
	Discrepant desires tasks (Atance, Bélanger, & Meltzoff, 2010; Laranjo, Bernier, Meins, & Carlson, 2010; Repacholi & Gopnik, 1997)	Understanding of discrepant desires
	Early Social Communication Scales (ESCS) – subtask joint attention (Mundy et al., 2003)	Joint attention
	Visual Perspectives (Bigelow & Dugas, 2009; Carlson, Mandell, & Williams, 2004; Laranjo et al., 2010)	Visual perspective taking
	Subtest functional and symbolic imitation - Autism Diagnostic Observation Schedule (ADOS; Luyster et al., 2009)	Imitation

	False belief tasks (Bigelow & Dugas, 2009)	False belief
(Precursors of) empathy	Pain task (Young, Fox, & Zahn-Waxler, 1999; Zahn-Waxler, Robinson, & Emde, 1992)	Empathy
	Mishaps (Kochanska, Gross, Lin, & Nichols, 2002)	Guilt
	Emotion recognition task (Pollak, Cicchetti, Hornung, & Reed, 2000)	Emotion recognition
	Emotion eliciting film clips of ecologically valid situations (e.g., fear, sadness)	Social attention with the Tobii T120 eye-tracker
Language development	MacArthur communicative development inventory (Fenson et al., 2000)	Communicative skills in infants and toddlers
	Reynell Developmental Language Scales(Reynell, 1985), Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997)	Receptive language skills
	Schlichting Expressive Language Test (Schlichting, Van Eldik, Lutje Spelberg, Van der Meulen, & Van der Meulen, 1995)	Expressive vocabulary skills

Group characteristics

Table 3 provides an overview of demographic and obstetric characteristics of the LR-and HR-groups. Compared to women in the LR-group, women in the HR-group were significantly younger, lower educated, had a lower income, were more often non-Caucasian and single, and had a smaller social support network (*ps* < .01). Further, pregnancies in the HR-group were more often unplanned, and women in the HR-group more often experienced miscarriages or had undergone abortion (*ps* < .05).

Among women in the LR-group (*n* = 128), 9% (*n* = 11) had one risk factor present, which was mostly limited social support (*n* = 5), followed by single parenthood (*n* = 2), young maternal age (*n* = 2), unemployment (*n* = 1) or no secondary education (*n* = 1). In the HR-group, 64% of the women (*n* = 94) had an indication for current psychiatric disorder(s), with 26% (*n* = 38) having two or more diagnoses on the M.I.N.I.-plus. See Table 4 for an overview of the diagnoses on the M.I.N.I.-plus in the HR-group. Substance use during pregnancy was the second most frequent observed risk factor in the HR-group. Of the women who used substances during pregnancy, 33% (*n* = 48) continued to smoke, 5% (*n* = 8) drank alcohol, 1% (*n* = 1) continued to use (other) drugs, 2% (*n* = 3) were smoking and drinking alcohol, 3% (*n* = 5) were smoking and using drugs, and 1% (*n* = 1) used all these substances (smoking, alcohol and drugs). Drugs used during pregnancy were cannabis (*n* = 4), cocaine (*n* = 1), methadone (*n* = 1), and cocaine and cannabis (*n* = 1).

Table 3. Demographic characteristics of the low-risk and high-risk groups.

	LR (n = 128)		HR (n = 147)		Group comparisons[a]
Variables	*M*	*SD*	*M*	*SD*	
Maternal age (years)	23.42	1.74	21.56	2.32	$F(1,273)=55.59^{***}$, $\eta^2=.17$
Maternal education (% high[b])	41%		7%		$\chi^2(1)=44.10^{***}$
Monthly family income (Euros)	2,944.02	964.50	1,609.00	1,145.00	$F(1,273)=107.47^{***}$, $\eta^2=.28$
Ethnicity (% Caucasian)	91%		76%		$\chi^2(1)=10.06^{**}$
Married or living with partner (%)	98%		61%		$\chi^2(1)=54.59^{***}$
First-time pregnant (%)	87%		76%		$\chi^2(1)=5.53^{*}$
Unplanned pregnancy (%)	23%		72%		$\chi^2(1)=65.15^{***}$
Expecting twins (%)	4%		5%		*ns*
Gestational weeks at assessment	30.03	3.77	29.91	3.68	*ns*
Size social support network	9.19	3.84	6.94	3.54	$F(1,273)=25.40^{***}$, $\eta^2=.09$
Prenatal reflective functioning	4.27	1.03	3.53	0.86	$F(1,273)=42.58^{***}$, $\eta^2=.14$
Number of risk factors	0.09	0.29	2.24	1.35	$F(1,273)=311.72^{***}$, $\eta^2=.53$
Current psychiatric disorder(s) (%)	0%		64%		$\chi^2(1)=124.36^{***}$
Substance use pregnancy (%)	0%		44%		$\chi^2(1)=70.78^{***}$
Alcohol	0%		7%		$\chi^2(1)=7.36^{**}$

Tobacco	0%	39%	$\chi^2(1)=62.61^{***}$
(Other) drugs	0%	5%	$\chi^2(1)=6.25^{*}$
Single parenthood (%)	2%	21%	$\chi^2(1)=24.70^{***}$
Unemployed (%)	1%	24%	$\chi^2(1)=31.89^{***}$
No secondary education (%)	1%	9%	$\chi^2(1)=9.21^{**}$
Financial problems (%)	0%	25%	$\chi^2(1)=37.23^{***}$
Limited social support (<4 persons)	4%	12%	$\chi^2(1)=6.21^{*}$
Young maternal age (<20 years)	2%	20%	$\chi^2(1)=23.63^{***}$

Note: $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$ [a]ANOVA or Chi-square test, [b]Maternal education (% high) represents percentage with a bachelor's or master's degree, LR = low-risk group, HR = high-risk group.

Table 4. Overview of the current psychiatric problems in the HR-group.

Current psychiatric problems*	N
Depressive disorder	17
Dysthymic disorder	8
Suicidality	11
Mania	1
Panic disorder	15
Agoraphobia	17
Social phobia	7
Other type of phobia	8
Obsessive-compulsive disorder	5
Generalized anxiety disorder	4
Posttraumatic stress disorder	4
Alcohol dependence / abuse	9
Drug dependence / abuse (non-alcohol)	18
Attention-deficit/hyperactivity disorder	7
Antisocial personality disorder	14

Note: N high-risk group = 147; * = positive screening based on the M.I.N.I.-plus (Sheehan et al., 1997; Van Vliet & De Beurs, 2007).

Discussion

This paper presented an overview of the background, methods and study population of the *MINDS* - Leiden study, a longitudinal study investigating social-environmental, neurobiological, and neurocognitive mechanisms predicting emotional and behavioral problems in young children and variation in effects of an intensive RF-based home-visiting program for first-time mothers with a high-risk background. The scope for changing behavior is greatest in the early years because neurobiological systems involved in emotional and behavioral regulation are presumed to be most sensitive for environmental influences early in development (Beauchaine et al., 2008). The outcomes of this study may result in the identification of specific biomarkers, precursors of neurocognitive functions and temperamental factors in infancy, which directly, indirectly or interactively with social-environmental risk factors, may help to detect children who are at risk for later emotional and behavior problems.

Home-visiting programs hold considerable promise for improving child outcomes (Avellar & Supplee, 2013; Filene et al., 2013; Olds et al., 2007; Peacock et al., 2013; Sweet & Appelbaum, 2004). From a socio-economic and ethical perspective, intervention programs should only be offered to those families who are expected to benefit and an alternative should be offered to those who are not expected to benefit. The outcomes of our study may result in a better understanding of the individual (neurocognitive and neurobiological) factors that explain variation in effects of home-visiting programs. Ultimately, this may contribute to more efficient matching of families to intervention programs while at the same time provide relevant information to further enhance the effectiveness of the home-visiting program.

A considerable strength of the study includes the random controlled trial and the use of multi-method approach, including a combination of (semi-)structured interviews, questionnaires, behavioral observations, and physiological measures. An important aspect of the current study, compared to previous studies evaluating the effects of home-visiting programs (Olds et al., 2007; Ordway et al., 2014; Robling et al., 2016), is the use of both a high-risk and a low-risk control group when examining the effects of home-visitation, which allows us to more thoroughly determine the extent to which neurobiological and neurocognitive development in children in the HR-I group normalizes (as observed deviations in HR-children compared to LR-children throughout development may, in part, depend on their 'starting levels').

A limitation of this study is that we lack information about the number of subjects that refused to participate before the research team tried to contact them for scheduling the first assessment. This is due to our sampling strategy in which we relied on external parties for the recruitment of potential participants. It cannot be ruled out that non-participants may differ from participants in several respects, especially as participation in a longitudinal study with 6 assessments requires a strong commitment of the mothers and might be perceived as a burden. This may have resulted in the loss of more severe cases. For example, in our high-risk sample, only a small group of participants had three or more risk factors present (17%). We do have information about the women who were recruited by their healthcare provider and gave permission to contact them for partaking in the study, but declined participation when they were contacted (16%). The most common reasons for not participating were: too busy/too time-consuming, partner does not want to participate, personal problems, medical problems, or miscarriage.

A special point of interest is the potential loss of participants to follow-up over time. Although some loss to follow-up is inevitable, we used various strategies for maximizing retention in order to retain as many participants as possible. For example, mothers received gift certificates (respectively 15, 20, 25, 30, 35, and 25 EUR) and a present for their child after each assessment. After completion of the fifth assessment, they received a personalized DVD with video material from all five assessments. Also, over the course of the study regular contact was maintained by telephone calls after birth, birth- and birthday cards, and a newsletter (every 3 months). Travel expenses were covered for lab visits (wave three, five, and six). Moreover, we offered to pick mother and child up from their homes and drive them to our baby lab when they had difficulties coming to the lab, and mothers in the HR-intervention group were often accompanied to the lab by their coach. With data collection for the first assessment completed, attrition rates between the first and second assessment were 5%. Therefore, we are optimistic that our strategies are working and our attrition rates in the long run will be limited.

At this moment, funding has been obtained for the first five waves of follow up, and we plan to seek funding for additional follow-up cycles. Now that the study is well underway, efforts are being made to disseminate the results of our study to obstetric care providers, health care workers, pediatricians and policymakers on a regular basis. Further, once we have gained insight into factors that predict the effectiveness of the home-visiting program, we will look for ways to implement the program in clinical practice. For this, we have

already sought cooperation with health care organizations in the area of Leiden, The Hague, and Amsterdam.

Taken the potential restraints into account, we believe that this study program may provide detailed insight in the factors associated with (very) early child development and treatment success for interventions aiming to reduce and/or prevent emotional and behavioral problems. We hope that by effectively addressing behavioral problems from infancy onwards, improvements in (mental) health status (of children and their mothers), and public health policy and decision making may be achieved.

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Chapter 3

Prenatal reflective functioning in primiparous women with a high-risk profile.

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Abstract

The concept of maternal reflective functioning (RF) has been gaining increasing interest as a possible intermediate mechanism in associations between a wide range of psychosocial risk factors and poor child outcomes. The purpose of the present study was to determine which psychosocial risk factors are linked to prenatal RF in a high-risk (HR) group of primiparous women. Differences in prenatal RF between the HR group and a low-risk (LR) control group also were examined. The sample consisted of 162 women (M = 22.22 years, SD = 2.39; 83 classified as HR). RF was coded from the Pregnancy Interview (Slade, 2007a). Risk status was assessed by means of the Mini-International Neuropsychiatric Interview-plus (M.I.N.I.-plus; Sheehan et al., 1997) and several questionnaires. HR women demonstrated significantly lower RF quality than did the LR group. Regression analyses indicated that maternal education, size of social support network, and substance use during pregnancy were the strongest predictors of prenatal RF for the HR group. The results suggest that maternal RF potentially could be an important target for those prevention and intervention programs that aim to reduce adverse psychosocial development in offspring of HR mothers.

Introduction

The transition into motherhood can be a challenging and stressful period (Heinicke, 1995). During pregnancy, women develop a new and different mindset (Stern, 1995). Pregnancy results in the activation of internalized representations of the self and the other. A woman's representations of herself as a mother and of the baby become increasingly specific during pregnancy (Slade, Cohen, Sadler, & Miller, 2009). Around the third trimester, these are fairly consolidated and become relatively stable over time (Theran, Levendosky, Bogat, & Huth-Bocks, 2005). Psychological adjustment to motherhood is partly determined by the ability to visualize oneself in the maternal role and by one's reflective functioning (RF) capacity (Slade et al., 2009). RF in the context of parenting has been defined as the mother's ability to think about herself as a parent, her child, and the relationship with her child in terms of mental states and to use this understanding to guide her responses to the child (Slade, Sadler, & Mayes, 2005). The understanding of mental states in oneself and the other is necessary to make sense of, predict, and anticipate another person's actions (Fonagy & Target, 1998). The mother's ability to adapt to the challenges and changes of pregnancy has been shown to affect children's outcomes (Darvill, Skirton, & Farrand, 2010; Paulson, Dauber, & Leiferman, 2006; Rini, Dunkel-Schetter, Wadhwa, & Sandman, 1999).

Maternal RF has been related to parenting behaviors (Grienenberger, Kelly, & Slade, 2005; Koren Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002; Pajulo et al., 2008; Sokolowski, Hans, Bernstein, & Cox, 2007), attachment security (Slade, Belsky, Aber, & Phelps, 1999; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005), and child development (Benbassat & Priel, 2012; Slade, 2007b; Suchman, DeCoste, & Mayes, 2009). For example, maternal RF plays a key role in helping children to develop flexible and adaptive mechanisms of self-regulation, and to establish productive and sustaining relationships (Sharp & Fonagy, 2008; Slade, Grienenberger et al., 2005). Previous research predominantly has investigated maternal RF in the postnatal period. A woman's emotional experience of pregnancy and the nature of her developing relationship with her baby are expected to influence her postnatal representations and interactive behavior with her child. Therefore, to optimize children's socio-behavioral development that may be affected by poor parenting practices and parent–child interactions, it is important to understand which factors determine the quality of prenatal RF.

The conditions under which a pregnancy takes place vary greatly due to the amount and type of internal and external resources available. These factors could affect prenatal maternal RF. Maternal characteristics that have been negatively related to RF include psychiatric illness (Fonagy & Luyten, 2009; Levinson & Fonagy, 2004; Perry, Newman, Hunter, & Dunlop, 2015; Toth, Rogosch, & Cicchetti, 2008), substance use during pregnancy (Pajulo et al., 2012), single parenthood (Huth-Bocks, Levendosky, Bogat, & Von Eye, 2004), unavailability of support from family and friends (Larney, Cousens, & Nunn, 1997; Sadler et al., 2007; Smith, 1999), scarcity of material resources (e.g., regarding housing or financially), and low educational attainment (Pajulo, Helenius, & Mayes, 2006; Rosenblum, McDonough, Sameroff, & Muzik, 2008; Sadler et al., 2007; Theran et al., 2005; Vrieze, 2011). These factors also have been used to define risk status with respect to child socio-behavioral outcomes (World Health Organization, 2005). However, these risk factors have been investigated separately, but not simultaneously, in relation to RF, especially not in relation to prenatal RF.

The purpose of the present study was to determine which risk factors are most strongly related to prenatal RF in a sample of primiparous women with a high-risk profile (HR group). Given that many studies on maternal RF in the peripartum period have been conducted in either low-risk samples or clinical and/or high-risk samples without a control group (Grienenberger et al., 2005; Miller, 2008; Schechter et al., 2005; Suchman, DeCoste, Leigh, & Borelli, 2010), it was first examined whether prenatal RF in first-time mothers-to-be differed between the HR group and a low-risk control group (LR group). Women in the HR group were expected to have lower RF, as prior studies have shown that HR women generally tend to have more negative prenatal representations about their child, themselves, and their partner (Pajulo, Savonlahti, Sourander, Piha, & Helenius, 2001). Next, the relation between number of risk factors and prenatal RF was examined in the HR sample. The presence of more risk factors was expected to negatively impact prenatal RF because these stressors could preoccupy the mothers-to-be and interfere with their mental space to think reflectively. To provide insight in the relative contribution of each risk factor in the prediction of prenatal RF in the HR group, a number of factors that have been related to RF quality separately in earlier studies were examined concurrently. It was expected that all factors associated with risk status in this study would have independent contributions to the quality of prenatal RF. Since this is the first time that these risk factors were investigated together, no specific hypotheses were made about the relative weight of each risk factor.

Methods

Participants

The present study is part of the Mother–Infant Neurodevelopment Study in Leiden, The Netherlands (*MINDS* - Leiden). *MINDS* - Leiden is a large, longitudinal study on neuro-biological and neurocognitive predictors of early behavior problems. The study was approved by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University, and by the Medical Research Ethics Committee at Leiden University Medical Centre. All participating women provided written informed consent. Women were recruited during pregnancy via midwifery clinics, hospitals, prenatal classes, and pregnancy fairs. Dutch-speaking, primiparous women between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. We chose to oversample women from a HR background to attain sufficient variance in children's early socio-emotional and cognitive development. After completing the prenatal visit in the third trimester of pregnancy, women were allocated to the LR or the HR group. Classification in the HR group was based on the following criteria (Mejdoubi et al., 2011; World Health Organization, 2005): (a) positive screening on current psychiatric disorder(s) or substance use (alcohol, tobacco, and/or drugs) during pregnancy or (b) presence of two or more of the following risk factors: no secondary education, unemployment, poverty or financial problems, limited social support network, single status, and young maternal age (<20 years). In case only one risk factor was present - other than an indication for current psychiatric disorder(s) or substance use - women were discussed in a clinical expert meeting to determine whether placement in the HR group was appropriate.

The total sample consisted of 79 LR women (*M* age = 23.47, *SD* = 1.79) and 83 HR women (*M* age = 21.05, *SD* = 2.28). Maternal demographic variables are summarized in Table 1.

Procedure and Measures

All participants completed a 2- to 2½-hr home visit conducted by two trained female researchers, ideally around 27 gestational weeks. The home visit included an interview regarding the emotional experience of the pregnancy, a semi-structured psychiatric interview, and a variety of questionnaires concerning demographic information, lifestyle, social support, and health of the mother-to-be.

Prenatal reflective functioning. A Dutch translation (Smaling & Suurland, 2011) of the Pregnancy Interview-Revised (PI-R; Slade, 2007a) was administered to assess the level of prenatal RF. The PI-R is a 22-item, semi-structured interview. The questions tap into the emotional experience of the pregnancy, mother's prenatal representations of her relationship with her unborn child, and of herself as a parent. The PI-R was digitally recorded and transcribed verbatim. Coding for RF was performed using the Reflective Functioning Scoring Manual designed for use on the PI (Slade & Patterson, 2005; Slade, Patterson, & Miller, 2007). The mother's responses to the individual questions were scored, and from these, an overall score on an 11-point scale from -1 (negative RF) to +9 (full or exceptional RF) was assigned. Scores under 5 indicate either negative, absent, or low RF whereas scores of 5 and above indicate clear evidence of mentalizing (Slade et al., 2007). Transcripts were coded by trained research assistants under supervision of the first author. Fifteen percent of the interviews were coded by a second rater. Interrater agreement with intraclass correlations for individual passage scores were .87 and .90 for the overall RF score.

Psychiatric disorders. The Mini-International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1997) is a short, structured diagnostic interview to screen for psychiatric disorders according to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; American Psychiatric Association, 1994) and the International Statistical Classification of Diseases and Related Health Problems (ICD-10; World Health Organization, 1992). The current study used the Dutch version of the M.I.N.I.-plus (Van Vliet, Leroy, & Van Megen, 2000) to screen for the presence of the following disorders: depressive disorder (current), dysthymic disorder (past 2 years), suicidality, mania (current), panic disorder (current and lifetime), agoraphobia (current), social phobia (current), other type of phobia (current), obsessive-compulsive disorder (current), generalized anxiety disorder (GAD; current), posttraumatic stress disorder (PTSD; current), alcohol dependence and abuse (current and lifetime), drug dependence and abuse (non-alcohol, current and lifetime), attention deficit hyperactivity disorder (ADHD; lifetime), and antisocial personality disorder (ASPD; lifetime). Current is defined as "in the past month" for all diagnoses except GAD, which has a 6-month time frame, and alcohol abuse/dependence and drug abuse/dependence, for which a 12-month time frame is used. The interviewer rates each disorder with a score of 0 (absent) or 1 (present). The M.I.N.I.-plus has been shown to have good psychometric qualities (Van Vliet & De Beurs, 2007).

Social network. To gain more insight in the size of mother's social support system, the Norbeck Social Support Questionnaire (NSSQ; Norbeck et al., 1981, 1983) was administered. Participants are asked to list each significant person in their lives who provides personal support to them and indicate the kind of relationship that they have with them (e.g., spouse or partner, family members, friends, work or school associates, neighbors, healthcare providers, counselor or therapist, minister/priest/rabbi, other). The total number of persons listed was used in current analyses. A categorical variable also was created and coded as 1 (<4 individuals listed) or 0 (≥ 4 individuals listed). The NSSQ has been judged to be a valid and reliable instrument to assess total network support and has been used often with pregnant women (Meadows-Oliver, Sadler, Swartz, & Ryan-Krause, 2007; Norbeck & Anderson, 1989).

Demographics, health, and lifestyle. Demographics and information about maternal health and lifestyle (including substance use) was gathered using a Dutch translation of the "Becoming a mother" questionnaire from the Cardiff Child Development Study (Hay et al., 2011). Educational level of the participants was registered using five response categories: (a) no education, (b) primary, (c) lower secondary, (d) higher secondary, and (e) tertiary education. Current substance use (tobacco, alcohol, other drugs) was assessed using three response categories: (a) never used any substance during pregnancy, (b) substance use only until pregnancy was acknowledged (first trimester only), or (c) continued substance use during pregnancy. Dichotomous variables were created for current substance use, unemployment, single parenthood, and financial problems and were coded as 1 (present) or 0 (absent). Maternal age was coded dichotomous as 0 (≥ 20 years) or 1 (<20 years). Maternal educational level also was coded as 1 (no secondary education) or 0 (secondary education or higher).

Risk status. The MINI plus, the NSSQ, and the "Becoming a mother" questionnaire were used to assess the presence of the eight predefined risk factors. The dichotomous variables that were created for the eight HR- or LR-classification factors were added together to create a total score of risk factors (possible range = 0 – 8).

Table 1. Descriptives of the total sample, and the high-risk and low-risk group.

	LR (n = 79)	HR (n = 83)	Total (N = 162)	F(df) **χ^2 (df)**
Age (years)	23.47 (1.79)	21.05 (2.28)	22.22 (2.39)	57.10 (1, 160)**
Ethnicity (% Caucasian)	91.1%	78.3%	84.6%	
Monthly family income after tax earnings (Euros)	2,893.53 (1,038.93)	1,316.94 (943.46)	2,085.77 (1,265.37)	102.41 (1, 160)**
Prenatal reflective functioning	4.28 (0.87)	3.36 (0.84)	3.81 (1.01)	41.56 (1, 160)**
Size social support network	9.42 (4.20)	6.77 (3.18)	8.06 (3.93)	20.62 (1, 160) **
Unemployed (%)	1.3%	22.9%	12.3%	**17.49 (1)****
Completed at least a secondary education (%)	98.7%	89.2%	93.8%	**6.41 (1)***
Financial problems (%)	0%	21.7%	11.1%	**19.27 (1)****
Indication for current psychiatric disorder(s) (%)	0%	56.6%	29.0%	**63.02 (1)****
Single parenthood (%)	2.5%	24.1%	13.6%	**16.04 (1)****
First-time pregnant (%)	84.8%	72.3%	78.4%	**3.75 (1)**
Unplanned pregnancy (%)	25.3%	72.3%	49.4%	**35.73 (1)****
Substance use during pregnancy (%)	0%	47.0%	24.1%	**48.89 (1)****
Tobacco	0%	44.6%	22.8%	**45.64 (1)****
Alcohol	0%	7.2%	3.7%	**5.93 (1)***
(Other) drugs	0%	4.8%	2.5%	**3.90 (1)***

Note. ** p < .01; * p < .05. Standard deviations are in parentheses. Boldface indicates chi-square statistic. LR = low-risk group, HR = high-risk group, df = degrees of freedom. In the sample the main (other) drug used during pregnancy was cannabis, no other illegal substances were used during pregnancy.

Data Analyses

Before testing the main study hypotheses, all variables were examined for outliers and violations of assumptions applying to the statistical tests used. First, we examined whether the HR and the LR groups differed on prenatal RF using analysis of variance. Since a maximum of only one risk factor (other than substance use and indication for psychiatric disorder) could be present in the LR group, subsequent analyses were performed for the HR group only. First, the relation between the number of risk factors and prenatal RF was examined for the HR sample. Subsequently, associations were examined between all risk factors and prenatal RF. Finally, to examine the relative strength of each risk factor associated with prenatal RF in the HR group, a regression analysis was conducted with the risk factors that were shown to be associated with prenatal RF in the correlational analyses. All analyses were conducted using SPSS for Windows, Version 21.0.

Results

Descriptive Statistics

Descriptive statistics and differences between the HR and the LR groups for all variables are shown in Table 1. RF scores for the whole sample ranged from 2 (inexplicit references to mental states) to 7 (marked RF). For the HR group, the RF scores ranged from 2 (12.1%) to 5 (normal RF, 10.8%), with 50.6% scoring 3 (low RF). In the LR sample, scores ranged from 3 (22.8%) to 7 (1.3%), with 39.2% scoring 4 (rudimentary RF).

More than half of the HR women had an indication for current psychiatric disorder(s) (56.6%, n = 43), with 15.7% (n = 13) having even two or more diagnoses on the M.I.N.I. - plus. Ten women scored positive on current depressive disorder, 4 on dysthymic disorder, 2 on suicidality, 5 on panic disorder, 6 on agoraphobia, 2 on social phobia, 1 on other type of phobia, 2 on PTSD, 6 on alcohol dependence and abuse, 4 on drug dependence and abuse (non-alcohol), 6 on ADHD, and 9 on ASPD.

In the HR group, 37.3% (n = 31) women continued smoking tobacco, 3.6% (n = 3) continued drinking alcohol, 1.2% (n = 1) continued using cannabis, 3.6% (n = 3) were smoking tobacco and drinking alcohol, and 3.6% (n = 3) continued smoking both tobacco and cannabis during pregnancy. Due to small numbers per subgroup, classification was

based on continued substance use regardless of the substance of choice. Table 2 displays the number of risk factors present in the HR group.

Table 2. Number of risk factors present in the high-risk group.

Number of risk factors	*N*	Cumulative percentage
1	24	28.9
2	32	67.5
3	15	85.5
4	7	94.0
5	3	97.6
6	1	98.8
7	1	100.0

Risk Status and reflective functioning

Analysis of variance showed a significant difference in prenatal RF between the HR group (M = 3.36, SD = 0.84) and the LR group (M = 4.28, SD = 0.97), $F(1, 160) = 41.56$, $p < .001$, $\eta_p^2 = .21$, with the HR women scoring significantly lower. Correlation analysis showed that for the HR group, the total number of risk factors was negatively associated with prenatal RF, $r = -.34$, $p < .001$, indicating that the presence of multiple risk factors was related to lower RF. The sum score of risk factors explained 12% of the variance in prenatal RF.

Reflective functioning in the HR sample

For the HR group, associations were calculated between the variables determining HR or LR classification and prenatal RF. Pearson correlation was used to measure the association between continuous variables, while point-biserial correlations and the phi coefficient were used for the dichotomous variables. As Table 3 shows, a moderate, negative correlation was found between RF and substance use during pregnancy, indicating that substance use during pregnancy was related to lower RF. Positive correlations were found between prenatal RF and age, educational level, and size of social support network, indicating that a

larger support network, higher maternal age, and higher education level were related to higher RF.

Next, all risk factors significantly correlating with prenatal RF were entered in a linear regression predicting RF for the HR-group (Table 4). The regression model was significant, $F(4, 78) = 7.88$, $p<.001$, $\eta_p^2 = .25$, and maternal education ($\beta = .23$), size of social support network ($\beta = .32$), and substance use during pregnancy ($\beta = -.25$) were all unique predictors of prenatal RF. Maternal age was not a significant predictor of prenatal RF over and above the effects of educational attainment, social support, and substance use.

Table 3. Associations between risk factors and prenatal reflective functioning in the high-risk sample.

		1	2	3	4	5	6	7	8
1.	Reflective functioning	1							
2.	Age	.25* [a]	1						
3.	Educational level	.38** [a]	.42** [a]	1					
4.	Current psychiatric disorder(s)	.05 [b]	.01 [b]	-.33** [b]	1				
5.	Substance use during pregnancy	-.27** [b]	-.06 [b]	-.19* [b]	.27** [c]	1			
6.	Single parenthood	-.14 [b]	-.13 [b]	-.16 [b]	.09 [c]	.02 [c]	1		
7.	Financial problems	-.02 [b]	-.21* [b]	-.17 [b]	.03 [c]	.20 [c]	.05 [c]	1	
8.	Unemployment	-.17 [b]	-.22* [b]	-.36** [b]	.23* [c]	.06 [c]	.57** [c]	.13 [c]	1
9.	Size social support network	.37** [a]	.27** [a]	.26** [a]	.11 [b]	.10 [b]	-.27** [b]	-.10 [b]	-.31** [b]

Note. N = 83, ** $p < .01$; * $p < .05$, [a] = Pearson correlation, [b] = point-biserial correlation [c] = Cramer's φ.

Table 4. Regression analysis testing predictors of prenatal reflective functioning in the high-risk sample.

Variable	*B*	*SE B*	*β*	*t*	*p*	*Adjusted* R^2
Age	0.02	0.04	.05	0.46	.648	.25
Education level	0.24	0.11	.23	2.13	.036*	
Substance use	-0.41	0.16	-.25	-2.52	.014*	
Size social support network	0.09	0.03	.32	3.18	.002**	

Note. N = 83, **$p < .01$; *$p < .05$; β is the standardized regression coefficient.

Discussion

The present study examined whether prenatal RF differed between primiparous "at-risk" women (HR group) and a low-risk (LR) control group, and determined which specific risk factors were associated with prenatal RF in HR women. As hypothesized, HR women demonstrated significantly lower levels of prenatal RF, as compared to the LR group. The total number of risk factors had a moderate, negative relation with RF quality. This indicates that the presence of more risk factors places a higher demand on the mother-to-be, resulting in less mental resources to think about the future child and the upcoming motherhood. These findings are in line with the majority of existing studies indicating that the presence of risk factors negatively affects mothers' RF ability, with HR women have lower RF and more negative mental representations (Huth-Bocks et al., 2004; Leigh, 2011; Seng & Prinz, 2008; Theran et al., 2005). An exception to the rule is a study by Perry et al. (2015), who found similar prenatal RF levels for both HR and LR women. However, their sample size was limited and consisted mainly of multiparous women. In addition, employment status and income were not assessed, which may have impacted between group comparisons.

For the HR group, a number of risk factors that separately have been related to RF quality were examined simultaneously to provide insight into their relative contributions to the quality of prenatal RF. Maternal age, educational attainment, social support, and substance use during pregnancy had moderate associations with prenatal RF in the HR group. Contrary to our expectations, indication for current psychiatric disorder(s), financial problems, single parenthood, and unemployment had no significant associations with prenatal RF in this group.

The non-significant association between positive screening for current psychiatric disorder(s) and prenatal RF in the HR group may be the most surprising (see Katznelson, 2014). The present study used a dichotomous measure as an indication for current psychiatric disorder(s), which may have resulted in loss of information regarding subclinical symptoms and, hence, the non-significance of effects. It is possible that the HR women without a current diagnosis according to the M.I.N.I.-plus still had psychiatric problems. Support for this suggestion comes from the fact that a large proportion of HR women had experienced psychiatric problems in the past (and received treatment for their disorder), but were currently stable or doing "well enough" to not qualify for a current

diagnosis. Furthermore, when the regression analysis was performed on all participants (both LR and HR women), an indication for psychiatric disorder(s) was a close to significant predictor of RF, suggesting that an increase in variance (with "the absence of psychiatric problems" in LR women) increases the role of psychiatric disorder(s) as a predictor. Despite the fact that this is not the only study that failed to find associations between psychiatric problems and RF in a HR population (Rudden, Milrod, Target, Ackerman, & Graf, 2006; Schechter et al., 2005; Vrieze, 2011), it would not be wise to discard psychiatric problems as a possible predictor of RF quality based on the present results. We suspect that more in-depth clinical assessments using a more continuous scale to assess psychiatric disturbances and not self-reports are most likely to yield meaningful data. More research is necessary to further unravel the possible role of current and past psychiatric problems in relation to maternal RF.

Taking this into account, the question remained within the HR group whether there were specific risk factors adding to the prediction of RF quality. Results showed that size of social support network was the strongest predictor of prenatal RF. The availability of social support appears to benefit the adjustment to upcoming motherhood (Sadler et al., 2007; Smith, 1999), resulting in stable perceptions of the future infant in the last trimester of pregnancy (Larney et al., 1997). Feeling supported facilitates women to gain confidence in the new perceptions of themselves and eases the transition into motherhood (Darvill et al., 2010). One may speculate that social support also reduces the impact of emotional stressors and simulates psychological well-being, thereby resulting in more mental space to think reflectively.

Substance use during pregnancy was the second-strongest predictor of prenatal RF. Studies examining RF in substance-abusing mothers have consistently found that substance abuse has detrimental effects on RF (Pajulo et al., 2012; Pajulo et al., 2008; Suchman et al., 2010). The most commonly used substances in those studies were opiates and amphetamines, and to a lesser extent, cannabis and alcohol. Although all abusing women in the study by Pajulo et al. (2012) also were excessive smokers, most studies did not report data specifically regarding nicotine use. The preferred substance in our sample was tobacco, with few women using a second or other substance (alcohol or cannabis). This is the first study showing that smoking during pregnancy can be linked to lower prenatal RF. Since there are no other studies to our knowledge that have related (prenatal) RF to maternal smoking, we can only speculate about the underlying mechanisms. During pregnancy and perinatal phases, neurobiological changes take place in the mother's brain (especially in the

reward system) that lead to a state of "maternal preoccupation" (Swain, Lorberbaum, Kose, & Strathearn, 2007). One could speculate that - at least in substance-abusing mothers - the substance use might weaken the mother's capacity to invest in a close relationship with her future baby by interfering with natural sources of reward and satisfaction (Allen, Fonagy, & Bateman, 2008). The substance use likely leads to a preoccupied or absent mind, making it more difficult to make adequate inferences about intentions and emotions of oneself and one's future child (Suchman, DeCoste, McMahon, Rounsaville, & Mayes, 2011). Another possibility is that women with lower RF are more inclined to smoke or continue smoking during pregnancy. Perhaps a limited capacity to think reflectively impairs a woman's ability and willingness to fully understand the detrimental effects of substance use for her unborn child and herself. Thus, low RF might make it easier to smoke despite the pregnancy. Furthermore, both RF and smoking have been linked to other risk factors. For example, younger, single, poorer, and less educated women are more likely to smoke during pregnancy (Cnattingius, Lindmark, & Meirik, 1992; Kaneko et al., 2008; Lu, Tong, & Oldenburg, 2001; Ockene et al., 2002). In addition, both RF and maternal smoking have been associated with poor outcomes in mothers (Jacobsen et al., 2005; Yanbaeva, Dentener, Creutzberg, Wesseling, & Wouters, 2007) and their children (Benbassat & Priel, 2012; Durmus¸ et al., 2011; Huijbregts, Van Berkel, Swaab-Barneveld, & Van Goozen, 2011; Huijbregts, Warren, De Sonneville, & Swaab-Barneveld, 2008). Therefore, RF–smoking associations might still represent the influence of different, yet-to-be-revealed factors, although the majority of those seem to have been taken into account in the present study. Still, more research is necessary to unravel the exact nature of the association between (prenatal) RF and maternal smoking.

The third and final predictor of prenatal RF was maternal education. Maternal education has been associated with mothers' engagement in (appropriate) mind-minded commenting, a construct closely related to maternal RF (Meins et al., 2003; Rosenblum et al., 2008). Scoring RF is dependent on language (Slade & Patterson, 2005; Slade et al., 2007). Mothers-to-be who have had limited education and who struggle with environmental adversity may use language more instrumentally and less as a means of describing more complex emotional and cognitive experiences, resulting in lower RF. Previous research relating educational attainment and RF has shown some mixed results (Button, Pianta, & Marvin, 2001; Pajulo et al., 2012; Suchman et al., 2010). A possible explanation for these mixed results is that most studies have relied on samples that were fairly restricted regarding socio-demographics and risk status and used years of education to assess

education level. The current study used a categorical measure of educational level, which has been related to maternal RF (Rosenblum et al., 2008).

Finally, when looking at a model to predict prenatal RF from the sum-score of risk factors, the predictive power was inferior to the proportion-explained variance by a model consisting of a specific combination of risk factors. Although the significant prediction of the sum score provides some degree of support for the cumulative risk hypothesis (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987), these results also suggest that the influence of risk factors is not equal and more complex. Future studies should investigate combinations of risk factors (e.g., moderating effects) in addition to single and additive effects. Based on the data of the present study, we argue that there should be a further expansion of attention to the complex of environmental contexts of pregnancy.

Certain limitations regarding this study should be noted. First, assessment of current psychiatric disorder(s) was done using a psychiatric interview based on common dichotomous psychiatric- classification systems. Due to small numbers per subgroup and comorbidity, no distinctions between the various psychiatric disorders or severity of the disorder(s) were made in our analyses. Second, the restricted age range of the sample limits the generalizability of results. Our sample consisted of fairly young women. Note that the psychosocial and biological context of pregnancy changes with increasing maternal age. Older maternal age has been associated with psychological benefits (more resilience, fewer symptoms of depression and anxiety) and socio-demographic factors likely to contribute to optimal adjustment (home ownership, professional occupation) (McMahon et al., 2011). In line with such findings, it may be the case that the relations of different factors associated with prenatal RF change with age as well. Third, a cross-sectional design was used, which limits the possibility to make causal inferences. Finally, the present study used a global RF score based on the interviewee's responses across all interview questions. This could have obscured differences that exist in relation to the more specific aspects of prenatal RF. RF is thought to have a self-reflective and an interpersonal component that together provide an individual with a capacity to distinguish inner from outer reality and intrapersonal mental processes from interpersonal ones (Fonagy, Gergely, Jurist, & Target, 2002). Future research should examine if prenatal RF can be regarded as a two-dimensional construct with a child-related RF component and self-related RF component.

Despite the limitations, the results of the present study provide evidence for the presence of specific risk factors associated with the quality of prenatal maternal RF in a high-risk population. HR women appear to have more inaccurate and biased preexisting

beliefs that impact the way that they perceive and respond to information related to their upcoming motherhood and future baby. Prenatal representations and RF have predictive value for the attachment pattern of the child (Sharp & Fonagy, 2008; Slade, Cohen, Sadler, & Miller, 2006; Slade, Grienenberger, et al., 2005) and potentially for the mother's postnatal behavior (Arnott & Meins, 2007). Therefore, RF could be one of the possible mechanisms that might mediate associations between risk factors and children's developmental outcomes. Future research should explore the construct of RF in more depth and in a continuous fashion. Valuable knowledge may arise from studies investigating (longitudinal) associations between prenatal RF, postnatal RF, maternal interactive behavior with her infant, and child development.

Clinical Implications

Children from an "at-risk" population generally have higher chances of less favorable developmental outcomes. These risk factors impact child development either directly or indirectly through parenting capacities and parent–child interactions (Cyr, Euser, Bakermans-Kranenburg, & Van IJzendoorn, 2010; Seng & Prinz, 2008). Parental RF could potentially be an important target for prevention and intervention programs, as it has been associated with certain established risk factors, parenting behaviors, and child outcomes (Benbassat & Priel, 2012; Rosenblum et al., 2008; Sharp & Fonagy, 2008). Since the first foundations of the mother–infant relationship are formed prenatally, it is important to enhance the positive experience of growth in the transition to motherhood. Promoting prenatal RF could be an effective way to improve the mother's representations of her unborn child and their developing relationship. Interventions specifically focusing on improving RF of "at-risk parents" do indeed appear to increase the level of RF (Katznelson, 2014). However, intervention studies with a longitudinal design are required to further establish prenatal RF as an important intervention target while also providing evidence for causality. Interventions should start prenatally, since motivation and openness for change is often stronger during the perinatal period (Slade, 2002). Besides focusing on directly enhancing RF, programs also should focus on trying to indirectly improve RF by reducing psychosocial risk factors to further improve their efficacy.

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Chapter 4

Prenatal reflective functioning and accumulated risk as predictors of maternal interactive behavior during free play, the Still-Face Paradigm, and two teaching tasks.

Smaling, H. J. A., Huijbregts, S. C. J., Suurland, J., Van der Heijden, K. B., Mesman, J., Van Goozen, S. H. M., & Swaab, H. (2016). Prenatal reflective functioning and accumulated risk as predictors of maternal interactive behavior during free play, the Still-Face Paradigm, and two teaching tasks. *Infancy*, n/a-n/a. doi: 10.1111/infa.12137. Epub ahead of print.

Abstract

This study examined whether prenatal reflective functioning (RF) was related to mothers' interactive style across contexts with their six-month-old infants (*M* age = 6.02 months, *SD* = 0.41, 54% boys), and to what extent quality of prenatal RF could account for the influence of accumulated risk on maternal interactive behavior. Accumulated risk was defined as the sum-score of a selection of risk factors that have been associated with suboptimal infant development. Mother-infant dyads (N = 133) were observed during free play, two teaching tasks, and the Still-Face Paradigm (SFP). Better prenatal RF was associated with more positive maternal behavior in all settings and less negative behavior during teaching and SFP-reengagement. Accumulated risk and prenatal RF predicted shared variance in maternal interactive behavior (with unique predictive effects observed only for RF on sensitivity during teaching and SFP-play, and for accumulated risk on sensitivity and positive engagement during SFP-play, and internalizing-helplessness during SFP-reengagement). Accumulated risk had an indirect effect on maternal sensitivity during teaching and SFP-play through prenatal RF. These findings suggest not only that RF may be targeted prenatally in order to improve mother-infant interactions, but also that enhancing RF-skills may ameliorate some of the negative consequences from more stable perinatal risk factors that influence parent-child interactions.

Introduction

Children's developmental outcomes have been associated with a large variety of biological and environmental risk factors (Appleyard, Egeland, Van Dulmen, & Sroufe, 2005; Cabaj, McDonald, & Tough, 2014; Walker et al., 2011). It has become evident that the presence of multiple risk factors or combinations of specific risk factors disproportionally increase the chances of poor socio-behavioral development among offspring (Appleyard et al., 2005; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). These risk factors influence child socio-behavioral development directly or indirectly through parenting capacities and parent-child interactions (Cyr, Euser, Bakermans-Kranenburg, & Van IJzendoorn, 2010; Seng & Prinz, 2008). Parental mentalizing (i.e., the ability to understand and interpret one's own and others' behavior in the light of mental states such as feelings, thoughts, fantasies, beliefs and desires (Fonagy, Gergely, Jurist, & Target, 2002)) has also been linked to child socio-behavioral development (Benbassat & Priel, 2012; Laranjo, Bernier, Meins, & Carlson, 2010; Sharp & Fonagy, 2008) and may be one of the driving forces of the quality of parenting behaviors and parent-child interactions (Farrow & Blissett, 2014; Grienenberger, Kelly, & Slade, 2005; Koren Karie, Oppenheim, Dolev, Sher, & Etzion-Carasso, 2002). The present study examined whether mothers' prenatal reflective functioning ability (RF), an operationalization of parental mentalizing, was linked to postnatal interactive style with their infants across different contexts, and whether prenatal RF accounted for any influence of accumulated risk (i.e., the sum-score of a selection of risk factors that have been associated with suboptimal infant socio-behavioral development) on maternal interactive behavior.

In the context of parenting, prenatal maternal RF is defined as the ability of the mother-to-be to think reflectively about herself as a mother, her (future) infant, and the developing relationship with her infant in terms of mental states and to use this understanding to direct her responses towards her infant (Slade, Sadler, & Mayes, 2005). Highly reflective mothers are aware of their own and infant's mental states, understand how these mental states impact behavior, and appear better equipped to regulate complex emotional experiences. Low reflective mothers, on the other hand, seem unaware of their own or their infant's mental states and deny (negative) emotional experiences related to parenting (Slade, 2005). Particularly in times of heightened emotions, a reflective mother is likely to respond to her infant's cues with acceptance and in an appropriate manner (Slade, Grienenberger,

Bernbach, Levy, & Locker, 2005). Therefore, maternal RF is viewed as a crucial component in helping mothers to provide cohesive responses to infant distress (Grienenberger et al., 2005), and to be sensitive in their caretaking (Fonagy et al., 2002).

Maternal RF has been related to different parenting behaviors during non-challenging and challenging tasks (Grienenberger et al., 2005; Huth-Bocks et al., 2014; Pajulo et al., 2008; Stacks et al., 2014). In general, mothers with better parental RF-skills show more sensitivity when interacting with their child (Grienenberger et al., 2005; Rosenblum, McDonough, Sameroff, & Muzik, 2008; Stacks et al., 2014). Sensitivity refers to the parental ability to respond to their child's signals in a contingent, timely and appropriate manner (Ainsworth, Bell, & Stayton, 1974). Conversely, lower maternal RF has been associated with higher levels of negative parenting behavior (Grienenberger et al., 2005; Stacks et al., 2014). Also, better maternal RF has been linked with enhanced mother–child relationships and communication (Borelli, West, DeCoste, & Suchman, 2012; Grienenberger et al., 2005). However, most studies linking maternal RF to parenting behavior either assessed the interactive behaviors during one task (Grienenberger et al., 2005; Pajulo et al., 2008) or used composite scores derived by averaging across the interactive tasks (Rosenblum et al., 2008; Stacks et al., 2014).

One of the few studies that reported separate correlations between maternal RF and parenting behavior across tasks showed that better postnatal RF was related to more positive parenting behavior during free play and teaching, and less negative parenting behavior but only during free play (Huth-Bocks, Muzik, Beeghly, Earls, & Stacks, 2014). Indicators of maternal mind-mindedness, another operationalization of parental mentalizing, have also been found to vary across contexts (Meins, 1997; Meins, Fernyhough, Fradley, & Tuckey, 2001). For example, more emotional and mental state discourse was used during play with toys compared to play without toys (Laranjo et al., 2010), and labeling mental states more often occurred during book reading compared to joint play (Drummond, Paul, Waugh, Hammond, & Brownell, 2014). Other studies examining whether maternal behavioral responses varied depending on context, play focus, and affective valence have reported mixed results (Calkins, Smith, Gill, & Johnson, 1998; Feldman, Greenbaum, Mayes, & Erlich, 1997; Joosen, Mesman, Bakermans-Kranenburg, & Van IJzendoorn, 2012; Mayes, 2000; Miller, McDonough, Rosenblum, & Sameroff, 2002). It is clear, however, that different contexts require flexible interactive behavior of the mother. Possibly, the influence of maternal RF also differs across contexts, with a larger role for maternal RF during more challenging tasks, due to its essential role in providing adequate

and cohesive responses to infant distress. Therefore, the current study examined maternal interactive behavior in relation to prenatal maternal RF during non-challenging (i.e., free play with toys and face-to-face play) and challenging (two teaching tasks and reengagement after stressor) tasks.

The context of pregnancy varies greatly in terms of type and amount of internal and external resources available, which, in turn, impact maternal RF. Several demographic and psychosocial risk factors are known to have detrimental effects on the parental RF-ability. Lower RF has been related to psychiatric problems (Perry, Newman, Hunter, & Dunlop, 2013; Toth, Rogosch, & Cicchetti, 2008), substance use during pregnancy (Pajulo et al., 2012; Smaling et al., 2015), single parenthood (Huth-Bocks, Levendosky, Theran, & Bogat, 2004), limited social support (Sadler et al., 2007; Smaling et al., 2015), and scarcity of material resources (Pajulo, Helenius, & Mayes, 2006; Sadler et al., 2007). Many of these risk factors have been directly associated with poor parenting and child socio-behavioral development as well (Hoff, Laursen, & Tardif, 2002; Leerkes et al., 2014; Mayes & Truman, 2002; Stacks et al., 2014), and poor parenting has been suggested to mediate associations between the risk factors listed above and child outcomes (Bank, Marion, Patterson, & Fetrow, 1993; Harold et al., 2011; Martinez-Torteya et al., 2014; Oyserman, Bybee, Mowbray, & Hart-Johnson, 2005). It is not yet clear through which processes these risk factors affect parenting in such a negative way. Quality of parental RF may be an important mechanism in this respect.

Many studies to date focused on specific risk factors for poor parenting and child outcomes, thereby often statistically controlling for other, potentially "confounding" risk factors in their data analyses. Other studies, however, have shown that combinations of risk factors (either cumulatively or in interaction) have the strongest effects on quality of parenting and child behavioral development (Appleyard et al., 2005; Atzaba-Poria, Pike, & Deater-Deckard, 2004; Evans & Kim, 2007; Evans, Kim, Ting, Tesher, & Shannis, 2007; Sameroff et al., 1987). However, no studies to date have examined the potential mediating role of prenatal RF in associations between accumulated risk and maternal interactive behavior in different contexts.

We investigated the effects of accumulated risk and prenatal maternal RF on maternal postnatal interactive behavior in a sample of first-time mothers with their 6-month-olds. Mother-infant dyads were observed interacting during a free play task with toys, two teaching tasks, and the play and reunion episodes of the Still-Face Paradigm (SFP). Our first aim was to examine whether prenatal RF was related to maternal interactive behavior across

contexts. We expected higher levels of prenatal RF to be associated with more sensitivity and positive engagement, and less intrusiveness and internalizing-helplessness behavior (defined as the degree to which mothers show resigned, helpless, or anxious behavior) during all tasks. This was based on the assumption that mothers with greater prenatal RF might also behave more adequately and sensitive towards their infant postnatally as maternal RF has been associated with more balanced and positive mental representations of the infant, and with more developmentally appropriate expectations (Schechter et al., 2005; Schechter et al., 2006). With maternal RF suggested to be especially important in providing adequate responses to infant distress (Grienenberger et al., 2005; Slade et al., 2005), it was hypothesized that the associations between prenatal RF and maternal behavior would be stronger for more challenging contexts (teaching tasks and reunion episode of the SFP). We also hypothesized that the presence of more risk factors would be related to more intrusiveness and internalizing-helplessness, and less sensitivity and positive engagement across contexts. The final goal was to examine whether prenatal RF explains the potential effects of accumulated risk on maternal interactive behavior across contexts. We expected an indirect effect of accumulated risk on maternal interactive behavior through prenatal RF across contexts.

Methods

Participants

The present study is part of the Mother-Infant Neurodevelopment Study in Leiden, The Netherlands (*MINDS* - Leiden). *MINDS* - Leiden is a large ongoing longitudinal study into neurobiological and neurocognitive predictors of early behavioral problems. The study was approved by the Medical Research Ethics Committee at the Leiden University Medical Centre, and by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University. Women were recruited during pregnancy via hospitals, midwifery clinics, prenatal classes, and pregnancy fairs. Dutch-speaking primiparous women between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. We oversampled women characterized by presence of risk factors for suboptimal offspring behavioral development (Smaling et al., 2015).

The total sample at the first assessment (T1), around 27 gestational weeks, consisted of 142 women. Nine women did not participate in the second assessment (T2), 6 months post-partum. Attrition was due to inability to contact (n = 5), personal problems (n = 2), emigration (n = 1), and premature delivery (11 weeks early, n = 1). Sample attrition was unrelated (ps > .05) to demographic variables such as maternal age, ethnicity, and household income.

The final sample consisted of 133 first-time mothers and their healthy six-month-old infants who had completed both T1 and T2 of the study. Demographic variables and obstetric characteristics are summarized in Table 1. Of the 133 participants, 76 were not characterized by any of the eight predefined risk factors (see *Procedures and instruments*), 29 had one, 18 had two, 7 had three, 2 had four, and 1 had five risk factors present.

Procedures and instruments

The assessments consisted of a 2- to 2.5-h home visit, conducted by two female researchers. T1 included an interview regarding the emotional experience of the pregnancy, a semi-structured psychiatric interview, and a variety of questionnaires concerning demographic information, lifestyle and health. During T2, after some time to get familiar with the researchers, mother-infant dyads subsequently performed a free play task, two teaching tasks, watched a 2-minute Baby Einstein video (2002, The Baby Einstein, LLC), and underwent the Still-Face Paradigm. Finally, the Infant Mental Development Index of the

Bayley Scales of Infant Development, 2nd version (BSID-II; Bayley, 1993) was administered. After the infant tasks, three subtests of the Wechsler Adult Intelligence Scale, third version (WAIS-III; Wechsler, 2005) were administered to the mother and she was asked to complete several questionnaires.

Table 1. Demographic and obstetric sample characteristics.

	M	*SD*
Maternal age (years)	22.86	2.17
Family monthly income after tax earnings (Euros)	2,469.14	1,222.62
% mothers with a Bachelor's or Master's degree	31%	
% Caucasian	89%	
% single mothers	6%	
WAIS Vocabulary*	37.47	11.03
WAIS Matrix Reasoning*	19.99	3.50
WAIS Digit Span - backwards*	6.81	2.05
Infant gestational age at birth (weeks)	39.19	2.02
Infant birth weight (gram)	3328	544
Infant APGAR-score at 5 minutes	9.59	0.88
Infant sex (% male)	54%	
Infant age (months)	6.02	0.41
Mental Development Index (BSID-II)	101.44	17.86

Note. N = 133, *M* = mean, *SD* = standard deviation, WAIS = Wechsler Adult Intelligence Scale, BSID = Bayley Scales of Infant Development, 2nd edition, * = raw scores.

Maternal reflective functioning. At T1, the Pregnancy Interview – Revised (PI-R; Slade, 2007; Smaling & Suurland, 2011) was used to assess prenatal reflective functioning. The PI-R is a 22-item interview to assess the emotional experience of the pregnancy, mother's prenatal representations of her relationship with her unborn child, and of herself as a parent. The PI-R was digitally recorded and transcribed verbatim. Coding for RF was performed using the Reflective Functioning Scoring Manual (Slade & Patterson, 2005; Slade, Patterson, & Miller, 2007). The mother's responses to the individual questions were scored and from these an overall score ranging from -1 (negative RF) to +9 (full or exceptional RF) was assigned. Scores under 5 indicate either negative, absent, or low RF, whereas scores of 5 and above indicate clear evidence of mentalizing (Slade et al., 2007). An example of a response that would score a '-1' would be: "*Sometimes the baby kicks me in the ribs just to annoy me*." An example of a score '5' would be: "*My boyfriend was just really excited when I told him I was pregnant. This made me feel very happy*." An example of a '9' is: "*It's going to be hard when I have to go back to work. I try to not think about it too much, because that really puts me down and I know that feeling depressed is not good for the baby, because she feels what I feel. When I actually have to go to work I will probably feel guilty all the time. I decided to have this baby, so I feel like I must be there for her 24/7. Leaving her at daycare makes me feel like a bad mother. I will probably think about her all day and call a few times to know if she's alright. I can also imaging that after a while it might be nice to go back to work. I love the mental stimulation, so I know in the long run me staying at home won't make me happy either. I will just have to make the most of our time together. But I don't want to put too much pressure on the time we do have together, making her feel pushed. I don't want her to be affected by my issues. It's just going to be very hard for me*." Transcripts were coded by trained research assistants under supervision of the first author. Mean inter-rater agreement for individual passage scores was .87 and .90 for the overall RF-score.

Risk Factors. At T1, the absence or presence of eight risk factors (World Health Organization, 2005; Smaling et al., 2015), was determined. Positive screening on current psychiatric disorder(s) was established by the Mini-International Neuropsychiatric Interview – plus (M.I.N.I-plus; Van Vliet, Leroy, & Van Megen, 2000) (n = 28), limited social support network (<4 individuals listed in network) was assessed by using the Norbeck Social Support Questionnaire (NSSQ; Norbeck et al., 1981; Norbeck, Lindsey, & Carrieri, 1983) (n = 5), substance use during pregnancy (n = 26 continued substance use during pregnancy; 22 used tobacco, 1 drank alcohol, 2 drank alcohol and continued smoking, and 1

used marijuana), no secondary education (n = 3), unemployment (n = 6), financial problems (n = 10), single status (n = 8), and young maternal age (<20 years, n = 11) were all established by means of the Dutch translation of the 'Becoming a mother' questionnaire (Hay et al., 2011). Each risk factor was scored as present (1) or absent (0). Scores on the risk factors were added together to create a sum-score of risk factors to represent the accumulated risk score (possible range 0 – 8).

Mother-infant interaction tasks. Mother-infant dyads engaged in a series of recorded interactive tasks at T2 adapted from Miller and colleagues (2002). In the present study, we used data from an unstructured free play task with toys, two structured teaching tasks, a face-to-face free play task (without toys, Still-Face Paradigm (SFP) play-episode), and a challenging "reengagement after stressor" task (SFP reunion-episode). During the 3-minute unstructured free play task, mothers were given a set of age-appropriate toys and instructed to play with their infant as they would normally do. During the teaching tasks, mothers were given two challenging tasks to "teach their infant". Task 1 involved stacking a set of cups of various sizes and task 2 consisted of putting rings around a pole. All infants were unable to perform either of these tasks independently. Each teaching task lasted 2.5 minutes. Next, the infant watched a 2-minute relaxing movie, while lying on a blanket. Subsequently, mother-infant dyads participated in the Still-Face Paradigm (Tronick, Als, Adamson, Wise, & Brazelton, 1978). The SFP was used to assess maternal behavior during face-to-face play (play-episode) and reengagement after stressor (reunion-episode). The SFP consists of three consecutive two-minute episodes. During the task, infants were seated in an infant seat placed on a table. Mothers sat on a chair approximately 1 meter from the infant at eye level. Mothers were instructed to play with their infant as they normally would (without toys). Immediately following this play-episode, the Still-Face (SF) episode started. During the SF-episode, mothers were instructed to remain immobile, hold a neutral expression on their face, and not respond to or touch their infant. The procedure ended with the reunion-episode in which mothers could resume play and respond to their infant in any way they felt was appropriate, but without taking the infant out of the seat.

When infants became highly distressed, mothers were allowed to abort the SF-episode and move on to the reunion-episode (n = 2) (Tronick et al., 1978). The entire procedure was videotaped with one camera focused on the infant. A wooden frame with a mirror was placed behind the infant seat, through which the mother's facial expression and behavior could be recorded. Data of one mother-infant dyad was missing because the infant was too distressed to participate in the SFP.

Coding of maternal behavior. Maternal interactive behavior was coded with an adapted version of the 4-point global rating scales (0 = absent to 3 = high levels or predominantly present) of the Mother Infant Coding System (Miller et al., 2002). Maternal behavior was rated on four dimensions: positive engagement (PE; extent to which the mother succeeded in positively engaging her infant in interaction), sensitivity (SE; degree to which mother contingently, timely and appropriately responds to her infant), intrusiveness (IN; extent to which mother handles the infant roughly and interferes with the infant's needs and behaviors), and internalizing-helplessness behavior (IH; degree to which mother gives up trying to engage or soothe infant). The difference between sensitivity and positive engagement is that sensitivity is more about how well the mother is able to read and respond to her infant's cues (infant-centered; e.g., follow cues, acknowledge infant state, gently soothe, use appropriate pacing, soft tone), whereas positive engagement is more centered around how well the mother is able to engage her infant in toy play and/or playful dyadic interaction (Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2009; Miller et al., 2002).

Interactions were coded independently with different coders rating different tasks. All coders were trained extensively until intraclass correlations (ICC) were .70 or higher across dimensions on a subset of 20 recordings. A subset of recordings (15% of the sample) was double-coded to assess ongoing inter-rater reliability. ICCs ranged from .73 to .99.

Cognitive functioning. Global indicators of maternal and infant cognitive functioning were obtained as they could influence quality of prenatal RF and parenting abilities, and were likely to be associated with accumulated risk. The Infant Mental Development Index (MDI) of the Bayley Scales of Infant Development, 2nd version (BSID-II; Bayley, 1993) was used as a global measure of infant cognitive development at T2. The researchers who administered or scored the BSID-II were trained in developmental assessment and interpretation. Raw scores were converted to a scaled score (M = 100, SD = 15).

Three subtests of the WAIS-III-NL (Wechsler, 2005) - Vocabulary, Matrix Reasoning, and Digit Span – backwards - were used as indicators of maternal intellectual functioning. For each subtest, the raw scores were used in statistical analyses.

Data analyses

All variables were examined for outliers and violations of specific assumptions applying to the statistical tests used. Internalizing-helplessness showed a non-normal distribution in all tasks and was therefore dichotomized into 'no' or 'some' internalizing-helplessness behavior. Due to strong correlations between maternal behaviors for the two teaching tasks, average scores were calculated and used in further analyses.

Correlation analyses were performed to examine associations between prenatal RF, accumulated risk, and postnatal maternal interactive behavior. Fisher *r*-to-*z* transformations were conducted to test for significant differences in the correlation coefficients of prenatal RF and maternal behavior across contexts. Because of the multiple models tested, we applied the Benjamini and Hochberg False Discovery Rate (FDR) to correct for capitalization on chance (Benjamini & Hochberg, 1995, 2000; Benjamini & Yekutieli, 2001). To investigate the unique predictive value of prenatal RF and accumulated risk with respect to maternal behavior, multiple regression analyses were conducted.

Bootstrap procedures described by Preacher and Hayes (2008) were used to investigate whether accumulated risk had an indirect effect on maternal interactive behavior via prenatal RF. Separate analyses were conducted for the various maternal behaviors across the different tasks. Bias corrected and accelerated (BCa) confidence intervals (C.I.) were reported. BCa confidence intervals were set at 0.95 with 5000 resamples. All analyses were conducted using the Statistical Package for Social Sciences (SPSS for Windows, version 21.0, SPSS Inc., Chicago, IL).

Results

Preliminary analyses

Demographic and obstetric characteristics of the sample are presented in Table 1. The means and standard deviations for prenatal RF, accumulated risk, and maternal interactive behavior are listed in Table 2.

Accumulated risk was negatively related to infant birth weight (r = -.21, p < .01), indicating that the presence of more risk factors was linked to lower birth weight. Prenatal RF and maternal postnatal behavior were not associated with the BSID-II Mental Development Index, obstetric characteristics, and infant demographics listed in Table 1 (ps > .10). Hence, no obstetric characteristics and infant demographics were added as covariates in subsequent analyses.

Since maternal age, educational level, and financial status are part of the accumulated risk score, these variables were not included as potential covariates in subsequent analyses. The WAIS subtests Matrix Reasoning and Digit Span - backwards were not related to prenatal RF, accumulated risk or maternal interactive behavior. The subtest Vocabulary, however, correlated with prenatal RF (r = .37, p < .001), accumulated risk (r = -.30, p < .001), and more than half of maternal interactive behaviors and was therefore included (as predictor/covariate) in subsequent regression and mediation analyses.

Prenatal RF, accumulated risk, and maternal interactive behavior across contexts

Bivariate Pearson correlations between prenatal RF and accumulated risk, and postnatal interactive behavior across tasks are shown in Table 3. Accumulated risk was negatively associated with prenatal RF (r = -.39, p < .001), sensitivity during all four tasks, and positive engagement during free play, SFP-play, and SFP-reengagement, while positive associations were identified with intrusiveness during free play and teaching, and internalizing-helplessness behavior during free play, teaching, and SFP-reengagement.

Prenatal RF was also significantly related to maternal interactive behavior (see Table 3). Higher prenatal RF was associated with more sensitivity across tasks. Higher prenatal RF also related to more positive engagement during free play, teaching and SFP-play. Prenatal RF was negatively related to intrusiveness during teaching, and internalizing-helplessness during teaching and SFP-reengagement.

Table 2. Prenatal maternal reflective functioning and maternal interactive behavior across tasks.

Variable	*M* (*SD*)	Range
Prenatal Reflective Functioning	3.99 (1.05)	2 – 7
Positive Engagement		0 – 3
Free play	2.23 (0.71)	1 – 3
Teaching task	2.23 (0.50)	1 – 3
SFP – play	1.68 (0.65)	0 – 3
SFP – reengagement	1.36 (0.75)	0 – 3
Sensitivity		0 – 3
Free play	2.55 (0.62)	1 – 3
Teaching task	2.13 (0.62)	1 – 3
SFP – play	1.89 (0.54)	1 – 3
SFP – reengagement	1.78 (0.57)	1 – 3
Intrusiveness		0 – 3
Free play	0.33 (0.59)	0 – 3
Teaching task	1.16 (0.66)	0 – 3
SFP – play	2.25 (0.69)	0 – 3
SFP – reengagement	2.32 (0.70)	0 – 3
Internalizing-helplessness		0 – 3
Free play	0.04 (0.19)	0 – 2
Teaching task	0.05 (0.22)	0 – 1
SFP – play	0.05 (0.23)	0 – 1
SFP – reengagement	0.17 (0.38)	0 – 2

Note. N = 133, *M* = mean, *SD* = standard deviation, SFP = Still-Face Paradigm.

Table 3. Associations between prenatal reflective functioning, accumulated risk, and maternal interactive behavior across tasks.

	Prenatal RF	Risk factors		Prenatal RF	Risk factors
Free play			**SFP – play**		
PE	.20**	-.21**	PE	.17*	-.21**
SE	.21**	-.21**	SE	.31**	-.38**
IN	-.14	.16*	IN	-.09	.02
IH	-.11	.16*	IH	.04	.02
Teaching			**SFP – reengagement**		
PE	.19*	-.12	PE	.04	-.15‡
SE	.36**	-.26**	SE	.22**	-.26**
IN	-.20**	.16‡	IN	-.06	.08
IH	-.19*	.25**	IH	-.20**	.26**

Note. ** $p < .01$; * $p < .05$; ‡ = no longer significant after correction for False Discovery Rate, RF = reflective functioning, PE = positive engagement, SE = sensitivity, IN = intrusiveness, IH = internalizing-helplessness behavior, SFP = Still-Face Paradigm, Risk Factors = sum-score of risk factors.

Fisher *r*-to-*z* transformations were conducted to test whether the correlation coefficients between prenatal RF and maternal interactive behavior differed across contexts. The associations between internalizing-helplessness behavior and prenatal RF differed significantly between SFP-play and teaching ($z = 1.87$, $p < .05$), and SFP-play and SFP-reengagement ($z = 1.94$, $p < .05$), indicating that prenatal RF was more strongly related to internalizing-helplessness behavior during the more challenging (teaching and SFP-reengagement) tasks compared to the non-challenging face-to-face play (SFP-play).

Predicting maternal interactive behavior in different contexts

Multiple regression analyses were performed to determine the main effects of each of the following independent variables: prenatal RF, accumulated risk, and maternal vocabulary in predicting maternal interactive behaviors across the four contexts studied. Several significant models were identified after correcting for FDR, in which on one occasion prenatal RF was the only significant predictor (sensitivity during teaching [model: $F(3,128) = 4.48$, $p < .01$]), on two occasions accumulated risk was the only significant predictor (positive engagement during SFP-play [model: $F(3,128) = 3.05$, $p < .05$]; internalizing-

helplessness during SFP-reengagement [model: $\chi^2(3) = 9.49$, $p < .05$]), and on one further occasion both prenatal RF and accumulated risk remained significant unique predictors (sensitivity during SFP-play [model: $F(3,128) = 9.27$, $p < .001$]). Maternal vocabulary also predicted several parenting behaviors over and above the effects of prenatal RF and accumulated risk (sensitivity during free play [model: $F(3,128) = 4.48$, $p < .01$] and SFP-reengagement [model: $F(3,128) = 5.68$, $p < .01$]; and intrusiveness during free play [model: $F(3,128) = 3.75$, $p < .05$]) (see Table 4).

Does prenatal RF mediate associations between accumulated risk and maternal interactive behavior?

Based on significant cross-correlations of accumulated risk, prenatal RF, and maternal interactive behavior, as shown in Table 3, mediation analyses were performed for sensitivity during all four contexts, positive engagement during free play and SFP-play, and internalizing-helplessness during teaching and SFP-reengagement in order to determine if prenatal RF mediated the effects of accumulated risk on maternal interactive behavior, whilst controlling for maternal vocabulary. Results of the mediation analyses revealed a significant indirect effect of accumulated risk on sensitivity during teaching through prenatal RF (point estimate -.05, 95% C.I. = -.0944 – -.0123, Figure 1) and for sensitivity during SFP-play (point estimate -.03, 95% C.I. = -.0651 – -.0026, Figure 2).

Table 4. Regression analyses predicting maternal interactive behavior from prenatal reflective functioning, sum-score of risk factors, and maternal vocabulary.

Predictors	*ß*	*t*	*p*	η^2		*ß*	*t*	*p*	η^2
Sensitivity – Free play					**Sensitivity – Teaching**				
Prenatal RF	.10	1.02	.312	.04*	Prenatal RF	.28	3.03	.003**	.14**
Risk Factors	-.12	-1.26	.211		Risk Factors	-.13	-1.41	.162	
Vocabulary	.19	2.09	.039*		Vocabulary	.10	1.13	.259	
Sensitivity – SFP play					**Sensitivity – SFP reengagement**				
Prenatal RF	.18	2.01	.046*	.16**	Prenatal RF	.08	0.85	.404	.10**
Risk Factors	-.30	-3.35	.001**		Risk Factors	-.18	-1.95	.053	
Vocabulary	.05	0.57	.569		Vocabulary	.20	2.22	.029*	
Positive engagement – Free play					**Positive engagement – Teaching**				
Prenatal RF	.12	1.23	.222	.04‡	Prenatal RF	.14	1.44	.153	.03
Risk Factors	-.14	-1.51	.133		Risk Factors	-.04	-0.37	.709	
Vocabulary	.06	0.67	.507		Vocabulary	.10	1.07	.288	

Predictors	*ß*	*t*	*p*	η^2		*ß*	*t*	*p*	η^2
Positive engagement – SFP play					**Positive engagement – SFP reengagement**				
Prenatal RF	.15	1.50	.135	.05*	Prenatal RF	-.05	-0.46	.647	<.01
Risk Factors	-.19	-2.01	.046*		Risk Factors	-.14	-1.47	.144	
Vocabulary	-.13	-1.39	.168		Vocabulary	.08	0.87	.387	
Intrusiveness – Free play					**Intrusiveness – Teaching**				
Prenatal RF	-.02	-0.17	.863	.06*	Prenatal RF	-.16	-1.59	.114	.02
Risk Factors	.09	0.92	.360		Risk Factors	.09	0.98	.330	
Vocabulary	-.24	-2.58	.013*		Vocabulary	-.01	-0.12	.902	
Predictors	*B*	SE_b	*p*	*Exp(B)*		*B*	SE_b	*p*	*Exp(B)*
Internalizing-helplessness – Free play					**Internalizing-helplessness – Teaching** ǂ				
Prenatal RF	-.28	.59	.638	0.76	Prenatal RF	-.79	.61	.193	0.45
Risk Factors	.36	.38	.344	1.43	Risk Factors	.48	.34	.152	1.62
Vocabulary	-.04	.05	.386	0.96	Vocabulary	.01	.04	.889	1.01

Predictors	*B*	SE_b	*p*	*Exp(B)*		*B*	SE_b	*p*	*Exp(B)*
					Internalizing-helplessness – SFP reengagement				
					Prenatal RF	-.40	.31	.192	0.67
					Risk Factors	.46	.23	.046*	1.59
					Vocabulary	.01	.02	.701	1.01

Note. ** $p < .01$; * $p < .05$; [†] = no longer significant after correction for False Discovery Rate. RF = reflective functioning, SFP = Still-Face Paradigm, Risk Factors = sum-score of risk factors, Vocabulary = subtest Vocabulary of the Wechsler Adult Intelligence Scale.

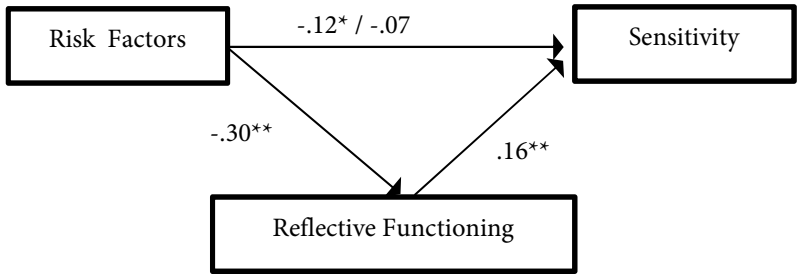

Figure 1. Direct and indirect effect of accumulated risk on sensitivity during teaching, whilst controlling for maternal vocabulary.

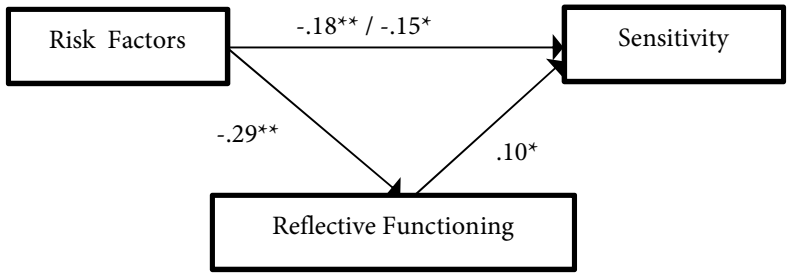

Figure 2. Direct and indirect effect of accumulated risk on sensitivity during face-to-face play, whilst controlling for maternal vocabulary.

Discussion

This study examined the effects of maternal prenatal reflective functioning and accumulated risk on maternal interactive behavior in first-time mothers and their six-month-old infants during free play, the Still-Face Paradigm, and two teaching tasks. Better prenatal RF was associated with more sensitivity and positive engagement across contexts, and with less intrusiveness and internalizing-helplessness behavior, but only during the more challenging tasks (teaching task and SFP-reengagement). The presence of more risk factors was associated with less sensitivity and positive engagement across contexts, more intrusiveness during free play, and more internalizing-helplessness behavior across contexts. Accumulated risk had an indirect effect on sensitivity during teaching and SFP-play through prenatal RF. Unique predictive value for both prenatal RF and accumulated risk was limited, as both constructs were related and predicted shared variance in maternal behavior across contexts, with additional effects for maternal vocabulary.

As expected, better prenatal maternal RF was associated with more sensitivity and positive engagement across contexts (more positive engagement and sensitivity during free play, teaching, and SFP-play, and sensitivity during SFP-reengagement). Reflective mothers seem more able to accurately understand their infant's internal states, and as a result, they are more likely to organize their behaviors to support the infant in a manner that is in line with its current emotions, needs, and interests. This is consistent with prior studies linking postnatal maternal RF to more sensitive and/or positive interactive behavior using either non-challenging tasks (Pajulo et al., 2008), challenging tasks (Grienenberger et al., 2005) or average scores across tasks (Rosenblum et al., 2008; Stacks et al., 2014). The current study adds to the literature by showing that prenatal maternal RF is related to postnatal maternal interactive behavior, that overall the strength of these associations does not differ across contexts, and that maternal RF is especially important for sensitive interactive behavior.

Better prenatal RF was associated with less intrusiveness and internalizing-helplessness behavior, but only during the more challenging tasks: teaching and SFP-reengagement. These results are in line with those of Grienenberger and colleagues (2005), who found that better postnatal maternal RF related to less negative parenting behavior in a challenging context, and with studies using average scores of maternal behavior across challenging and non-challenging tasks (Rosenblum et al., 2008; Stacks et al., 2014).

Teaching and SFP-reengagement are considered more challenging and stressful for mothers, since infants are generally (more) distressed and upset during these tasks (Mesman et al., 2009; Miller et al., 2002). Our results suggest that particularly in times of heightened emotions, a reflective mother seems better in reading the signals of her infant and is more likely to know how to respond to her infant's cues in an appropriate and non-intrusive manner. By reflecting on her infant's experience the mother is enabled to put her own affective experiences in a broader perspective, to better understand her own and her infant's reactions, and to learn from the experiences to become a 'better' parent (Slade, Grienenberger, Bernbach, Levy, & Locker, 2005). More indirect evidence for the significance of maternal RF in times of heightened emotions stems from studies linking better RF-levels with maternal persistence and self-awareness of their distress tolerance (Rutherford, Booth, Luyten, Bridgett, & Mayes, 2015; Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013) and from neuro-imaging studies showing that interpersonal or attachment-related stress and heightened arousal negatively impact upon brain regions involved in mentalization (Fonagy & Luyten, 2009; Nolte et al., 2010).

As expected, the presence of more risk factors was associated with less positive interactive behavior (sensitivity and positive engagement) and higher levels of internalizing-helplessness behavior (and to a lesser extent intrusiveness) across three of the four contexts. These findings are largely consistent with prior research indicating that the presence of risk factors increases the chances of less optimal parent-child interactions (Martinez-Torteya et al., 2014; Prelow, Weaver, Bowman, & Swenson, 2010; Stacks et al., 2014).

Furthermore, indirect effects of accumulated risk on maternal interactive behavior through prenatal RF were also identified, but only for sensitivity during teaching and SFP-play. These mediation effects suggest that an accumulation of risk factors places a higher demand on the mothers, resulting in mothers' heightened focus on their own needs and thus less mental resources to think reflectively about their infant, and thereby negatively impacting their ability to respond to their infant in a responsive, sensitive manner.

Several limitations of our study should be noted. A possible limitation of coding RF based on verbal narrative is that it might not always best capture the true parental RF-capacity of women who have difficulty with expressive language or who are struggling with environmental adversity (Sadler et al., 2013). Indeed, we found that maternal vocabulary was related to prenatal RF and accumulated risk. However, unique effects for prenatal RF (and accumulated risk) in predicting maternal behavior were also identified, over and above

the effects of maternal vocabulary. This underlines the fact that prenatal RF is more than just a mere reflection of maternal verbal ability. Currently attempts are being made to move beyond parent's verbal capacities to get a grasp of parental mentalizing. Examples of concepts under investigation are parental mirroring behavior (Bigelow, Power, Bulmer, & Gerrior, 2015) and parental embodied mentalizing (ability to perceive, understand, and deduce infant's mental states from the infant's kinesthetic expressions and adjust one's own kinesthetic patterns accordingly) (Shai & Belsky, 2011). Future studies will hopefully be able to disentangle the contributions of verbal and nonverbal indicators of parental mentalizing to parental interactive behavior and child behavioral development.

Second, it may be considered a limitation that, in order to obtain a score for accumulated risk, a sum-score of risk factors was used. Whereas separate risk factors are often related or present simultaneously, and it might in fact be that this simultaneous presence has particularly strong effects on parenting and child outcomes (Appleyard et al., 2005; Sameroff et al., 1987; Stacks et al., 2014), it is also possible that different risk factors differentially influence parenting behavior. Future studies looking into accumulated risk might consider the use of weighted scores for accumulated risk. Third, little over half of our sample did not have any predefined risk factors, thereby limiting the impact of the accumulated risk variable, especially given that only a small group of participants had more than two risk factors. Finally, a global prenatal RF score was used based on the mother's responses across the whole interview. This could have masked distinctions that exist in relation to more specific aspects of prenatal RF. Future research should examine whether prenatal RF can be regarded as two-dimensional construct with a more self-reflective and interpersonal component. This has already been shown for postnatal measures of parental RF (Suchman, DeCoste, Leigh, & Borelli, 2010). This two-factor model should be replicated and examined further with regard to prenatal RF as well as parenting and child behavioral development.

Despite the limitations, the results of our study highlight the importance of prenatal RF, suggesting that women with low prenatal RF, are at heightened risk to display less optimal parenting behavior. Also, 'at risk' mothers seem to have more difficulty to think reflectively about themselves as a parent, their infant, and infant-related intent that (negatively) impact how they think about and respond to their infant (Milner, 2003; Pajulo, Savonlahti, Sourander, Piha, & Helenius, 2001). One of the important mechanisms through which risk factors seem to negatively impact upon parenting behavior, and possibly child developmental outcomes as well, is parental RF. Maternal RF is known to increase from the

prenatal to postnatal period (Poznansky, 2010; Sadler et al., 2013), possibly due to a 'natural' increase in maternal RF, with the baby actually being present and the mother becoming more experienced and familiar with her infant. Thus, it seems feasible that quality of parental RF at the time of testing or observation would be an even stronger predictor of parenting behavior (or mediator/moderator of associations between accumulated risk and parenting behavior).

Nonetheless, our results indicate that prenatal RF plays a particularly important role in sensitive, adequate interactions between mothers and their infants. Parental RF could be targeted prenatally to improve parent-infant interactions later, and positive RF-development may amend some of the negative consequences from other prenatal risk factors. The lack of (many) unique effects of both prenatal RF and accumulated risk on maternal interactive style may (albeit speculatively) be interpreted as an indication that negative effects of perinatal risk factors may be ameliorated by targeting RF. Programs that specifically focus on improving parental RF in 'at-risk' parents appear to improve the level of RF and parenting behavior (Katznelson, 2014; Suchman, DeCoste, Castiglioni, et al., 2010).

Future research should include measures of parental distress tolerance and/or emotion regulation capacities when examining the links between risk factors, parental RF, and maternal parenting behavior to further unravel its mechanisms. A better understanding of the factors and mechanisms that influence the dyadic processes during infancy and early childhood development, will enable us to develop more effective prevention and interventions programs.

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Chapter 5

Prenatal reflective functioning and development of aggression in infancy: The role of maternal intrusiveness and sensitivity.

Smaling, H. J. A., Huijbregts, S. C. J., Van der Heijden, K. B., Hay, D. F., Van Goozen, S. H. M., & Swaab, H. (2016). Prenatal reflective functioning and development of aggression in infancy: The role of maternal intrusiveness and sensitivity. *Journal of Abnormal Child Psychology*, n/a-n/a. doi: 10.1007/s10802-016-0177-1. Epub ahead of print.

Abstract

Maternal reflective functioning (RF) has been associated with quality of parent-child interactions and child development. This study investigated whether prenatal RF predicted the development of infant physical aggression and whether maternal sensitivity and/or intrusiveness mediated or moderated this association. The sample consisted of 96 first-time mothers (M = 22.57 years, SD = 2.13) and their infants (54% male). Prenatal RF was measured with an interview, maternal behavior was observed during free play at 6 months post-partum, and infant physical aggression was assessed at 6, 12, and 20 months using maternal reports. Multivariate analyses of variance showed that relatively poor prenatal RF was related to relatively high infant physical aggression. These associations were moderated by maternal intrusiveness, with significant differences in physical aggression between RF-groups reportedly only in the absence of intrusiveness. Generally, mothers reported an increase in physical aggression between 6 and 12 months, except when they had both low RF-skills and were relatively less sensitive. It is concluded that prenatal RF is associated with (development of) infant physical aggression, and may be targeted in intervention programs aimed at reducing early physical aggression. Less adequate parenting, however, may counteract the beneficial effects of good RF, or obscure insight into children's behavioral development.

Introduction

Early manifestations of physical aggression can be observed from the second half of the first year of life, when infants are first developing the motor ability to direct force against other people (Hay et al., 2011; Hay et al., 2010). At 6 months of age, 15% of mothers reported clear signs of anger, and a significant number of mothers reported biting or hitting in their infants. While few 6-month-olds react with anger and physical force when a peer takes an object away from them, most 1-year-olds do (Hay et al., 2010). Generally, an increase in aggression can be found in the 2nd year of life (Alink et al., 2006; Nærde, Ogden, Janson, & Zachrisson, 2014; Tremblay et al., 2004). During the first half of the second year, the average use of physical aggression roughly doubles (Hay, 2005). In the second part of the year, some report a continued increase (Tremblay et al., 2004), while a temporary decrease has also been reported (Hay, 2005).

During toddlerhood a group of 'early-starter' children can been identified, who appear to fail or trail behind in developing more sophisticated regulation strategies (e.g., language and other cognitive abilities) to replace physical aggression and who go on showing the most persistent and severe forms of antisocial behavior later in life (Aguilar, Sroufe, Egeland, & Carlson, 2000; Moffitt, Caspi, Harrington, & Milne, 2002). However, individual differences in contentiousness (i.e., an increased inclination for expressions of anger and use of physical force during early social interactions) can be observed in 6-month-olds and predict infants' later use of force towards peers as well as broader conduct problems (Hay et al., 2010; Hay et al., 2014). These findings suggest that some individuals might already set forth on the trajectory to high levels of aggression as early as 6 months of age (Hay et al., 2014).

When high levels of physical aggression are present and/or persist after toddlerhood, negative outcomes including high conflict involvement, poor social skills, academic failure, and internalizing problems are increasingly likely (Campbell, Spieker, Burchinal, Poe, & NICHD Early Child Care Research Network, 2006). Most longitudinal studies on aggression have focused on the (pre)school age with only few starting in infancy (for a review see, Keren & Tyano, 2012). However, given these adverse outcomes, understanding how physical aggression unfolds at its earliest stages is necessary to identify opportunities for prevention and intervention (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Tremblay et al., 2004).

Inadequate parental reflective functioning (RF) and negative parenting behavior (i.e., unresponsiveness, intrusiveness, lack of positive involvement, and hostile or coercive parenting) both have been linked to children's behavioral problems, whereas adequate parental RF and positive parenting behavior (i.e., sensitivity, involvement, and warmth) have been shown to be a protective factor in this respect (Benbassat & Priel, 2012; Edwards & Hans, 2015; Ha, Sharp, & Goodyer, 2011). Therefore, this study investigated whether maternal prenatal RF can predict the development of infant physical aggression and whether maternal sensitivity (i.e., capacity to respond to children's signals in a contingent, timely and appropriate manner) and intrusiveness (i.e., degree to which parents interfere with their child's needs and behaviors and handle the child forcefully) mediated or moderated this association.

Parental RF or parental mentalizing refers to the parent's capacity to understand his or her own mental states (defined as beliefs, desires, feelings, intentions, and thoughts), the ability to keep the child's mental states in mind, and the awareness that an individual's behavior is a reflection of mental states (Ordway, Webb, Sadler, & Slade, 2015; Slade, 2005). During pregnancy maternal RF starts to develop, as the mother-to-be prepares for the birth of the baby by making room for the infant both in mind and in practice (Slade, Cohen, Sadler, & Miller, 2009). More specifically, prenatal RF refers to the mother's ability to think of the fetus, from at least the last trimester onwards, as a separate individual with developing personal features, needs, and temperament (Pajulo et al., 2015). Developmental continuity has been shown regarding pre- and postnatal RF (Arnott & Meins, 2008; Steele & Steele, 2008).

Parental RF may be especially important during infancy, when the infant's communication is limited to a non-verbal level, and therefore parents interpret the infant's internal world through observation of their child's behavioral and affective cues. The reflective parent's empathic responses will promote the infant's sense that emotions are acceptable and manageable, which, in turn, will enable the infant to develop a capacity to self-regulate, and lead to better psychosocial adjustment later in life (Ordway et al., 2015). When parents act on incorrect assumptions about their child's mental states, this might result in the child feeling confused and being misunderstood by his/her parents. Consequently, the child may become withdrawn, aversive, hostile or coercive (Fearon et al., 2006). Lower postnatal parental RF and maternal mind-mindedness have been associated with more externalizing and internalizing behavior in children (Benbassat & Priel, 2012; Ha et al., 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013), as well as with more

attention problems, social withdrawal, and dysfunctional mother-child interaction (Fonagy, Gergely, Jurist, & Target, 2002). Furthermore, more maternal references to mental states have been related to lower scores on reported aggression in 2-year-olds (Garner & Dunsmore, 2011), and negative parental perceptions of their child predict ongoing externalizing behavior problems in adolescence (Olson, Bates, Sandy, & Lanthier, 2000). These findings provide evidence supporting the significant role of maternal postnatal RF in the development of behavioral problems in childhood and adolescence. However, no studies to date have examined the role of prenatal RF in the development of early physical aggression.

Both prenatal and postnatal maternal RF have been related to parenting behaviors (Grienenberger, Kelly, & Slade, 2005; Pajulo et al., 2008). Better prenatal RF has been linked to more maternal sensitivity and successful positive engagement, and less intrusiveness and internalizing-helplessness behavior 6 months post-partum (Smaling et al., 2016). Higher levels of postnatal RF have been associated with more sensitivity during mother-child interactions (Grienenberger et al., 2005; Pajulo et al., 2008). Furthermore, lower postnatal RF has been associated with more negative maternal parenting behaviors, such as negativity, controlling parenting, and intrusiveness (Stacks et al., 2014). Therefore, maternal RF may be regarded as a critical component for adequate and sensitive caretaking (Fonagy et al., 2002).

Inadequate and unresponsive parenting behaviors (e.g., ignoring child or spanking child with hand when misbehaving) have been related to children's behavioral problems (Edwards & Hans, 2015; Healy, Murray, Cooper, Hughes, & Halligan, 2013; Hughes & Ensor, 2006; Keren & Tyano, 2012). In contrast, children who have more productive encounters (i.e., more opportunities to engage in activities that are meaningful, challenging, and afford possibilities for learning) are reported to have fewer behavior problems (Benbassat & Priel, 2012; Bradley & Corwyn, 2005). Similar observations have also been made in very young children (between 1.5 and 3.5 years old), where sensitive parenting was negatively associated with high and increasing levels of physical aggression (Huijbregts, Séguin, Zoccolillo, Boivin, & Tremblay, 2008), while maternal hostile and ineffective parenting was positively associated with high and rising physical aggression trajectories (Côté et al., 2006; Tremblay et al., 2004).

Reflective parents use their understanding of the child's mental states to direct their responses towards the child (Slade, Sadler, & Mayes, 2005). These responses are likely to be operationalized through parenting behaviors. Thus, parental behavior could be a mediating

mechanism through which prenatal RF exerts its influence on children's behavioral development. The effects of reflective functioning may also be more prominent when its qualities or characteristics are adequately translated into maternal behavior and interactions with her child (i.e., into sensitivity and a lack of intrusiveness). In other words, it is also possible that moderating effects are present: when a mother has good RF-abilities, but cannot translate these into her behavior (for example, she acts too intrusively), the positive effects of RF may be (partly) decreased.

To our best knowledge, there are no studies that have investigated the potential moderator and/or mediator effects of parenting on the link between prenatal RF and physical aggression. However, there are studies that have examined such effects for the link between postnatal RF and attachment security, which is inversely related to behavioral problems (Grienenberger et al., 2005; Savage, 2014). The influence of postnatal RF on infant attachment security was mediated by the maternal ability to regulate infant distress without frightening or otherwise disrupting the child (Grienenberger et al., 2005). Similarly, sensitivity mediated the relation between maternal mind-mindedness (an operationalization of parental mentalizing) and infant attachment (Laranjo, Bernier, & Meins, 2008), and between postnatal RF and infant attachment (Stacks et al., 2014). Furthermore, postnatal maternal insight - a concept closely related to RF - predicted secure infant attachment, but particularly when mothers also showed sensitivity (Hawkins, Madigan, Moran, & Pederson, 2015).

In summary, the first aim of our study was to examine associations between prenatal maternal RF, sensitivity, and intrusiveness, and the development of infant physical aggression at 6, 12, and 20 months. Based on studies so far, we expected better prenatal RF and higher sensitivity to be related to lower infant aggression levels at 6, 12, and 20 months, while higher intrusiveness was expected to be related to higher and increasing levels of infant aggression. Second, we investigated whether maternal sensitivity and intrusiveness mediated and/or moderated the possible link between prenatal RF and infant physical aggression. Based on the previously reported associations between (mostly postnatal) RF, parenting, and physical aggression in young children, it was expected that the effect of prenatal RF on infant physical aggression would in part be explained by maternal sensitivity and intrusiveness. Furthermore, moderating effects were expected with stronger effects of prenatal RF on infant physical aggression when mothers were highly sensitive and low intrusive.

Methods

Participants

The present study is part of Mother-Infant Neurodevelopment Study in Leiden, The Netherlands (*MINDS* – Leiden; Smaling et al., 2015). *MINDS* – Leiden is an ongoing longitudinal study into neurobiological and neurocognitive predictors of early behavioral problems. The study was approved by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University (ECPW-2011/025), and by the Medical Research Ethics Committee at Leiden University Medical Centre Committee (NL39303.058.12), and complied with the Helsinki Declaration and APA ethical standards. Women were recruited during pregnancy via hospitals, midwifery clinics, prenatal classes, pregnancy fairs, and social workers. We oversampled families from a high-risk background in order to obtain sufficient variance in risk factors that might influence children's early socio-emotional and cognitive development. This was done by collaborating with midwifery/obstetric clinics in areas with a low average social-economic status and/or by recruiting through social workers. Dutch-speaking first-time mothers-to-be between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. We specifically focused on mothers between 17 to 25 years old because they are underrepresented in the current literature. All participating women provided written informed consent.

The total sample at the first assessment (T1), around 27 gestational weeks, consisted of 110 women. 14 families left the study (13%). Attrition was due to inability to contact (n = 7), personal problems (n = 4), emigration (n = 1), and premature delivery (more than 8 weeks early, n = 2). Sample attrition was unrelated to maternal age and ethnicity. However, mothers who dropped out had obtained lower educational levels: $t(108) = 2.99$, $p < .005$.

Thus, the final sample for the current study consisted of 96 mother-child dyads who completed all four waves of the study. Women were predominantly Caucasian (84.8%), 6.2% Surinamese or Antillean, 4.8% mixed (Caucasian and other origin), and 4.2% of other origin. Most women (51.0%) had completed higher secondary school or lower vocational education, 27.1% had completed higher vocational education or an university degree, 19.8% had completed lower secondary school, and 2.1% completed primary school. Additional maternal demographic variables and infant characteristics are summarized in Table 1.

Table 1. Demographic and obstetric sample characteristics.

	M	*SD*
Maternal age (years)	22.57	2.13
Family monthly income after tax earnings (Euros)	2,353.15	1,190.02
% mothers with a Bachelor's or Master's degree	27.1%	
% Caucasian	84.8%	
% single mothers	8.3%	
Infant gestational age at birth (weeks)	39.01	2.00
Infant birth weight (gram)	3344	551
Infant APGAR-score at 5 minutes	9.43	1.03
Infant sex (% male)	54.2%	
Mental Development Index (BSID-II)	99.62	18.01
Infant age (months) at T2	5.96	0.41
Infant age (months) at T3	12.15	0.73
Infant age (months) at T4	20.00	0.88
WAIS Vocabulary*	37.32	11.18
WAIS Matrix Reasoning*	19.57	3.62
WAIS Digit Span - backwards*	7.00	2.12

Note. N = 96, M = mean, SD = standard deviation, T1 = first wave, T2 = second wave, T3 = third wave, T4 = fourth wave, BSID-II = Bayley Scales of Infant Development, 2nd version, WAIS = Wechsler Adult Intelligence Scale, * = raw scores.

Procedures and instruments

The assessments at 27 gestational weeks (T1), 6 months (T2), and 20 months post-partum (T4) consisted of a 2- to 2.5-hours home visit and were conducted by two female researchers. The third wave (T3) at 12 months consisted of a 1.5- to 2-hours lab visit, conducted by one female researcher in the room, while the second researcher was seated behind a one-way screen and made sure all tasks were filmed. T1 included an interview regarding the emotional experience of the pregnancy, a psychiatric interview, and various

questionnaires (for more details, see Smaling et al., 2015). After some time to get familiar with the researcher(s), the post-partum waves generally started with several mother-infant tasks with a focus on children's cognitive and social development. At T2, three subtests of the Wechsler Adult Intelligence Scale, third version (WAIS-III; Wechsler, 2005) were administered to the mother. Each wave ended with the mother completing various questionnaires.

Reflective Functioning. At T1, the Dutch translation (Smaling & Suurland, 2011) of the Pregnancy Interview – Revised (PI-R; Slade, 2007a) was administered to assess the level of prenatal reflective functioning. The 22 items of this semi-structured interview tap into the emotional experience of the pregnancy, mother's prenatal representations of her relationship with her unborn child, and of herself as a parent. The PI-R was digitally recorded and transcribed verbatim. Responses to the individual questions were scored and then, based on the scores per question, the interview as a whole was given a typicality score. This typicality score was used in the analyses. RF was scored on a scale from −1 (negative RF) to +9 (full or exceptional RF), where scores of 5 and above signify distinct evidence of mentalizing (Slade, Patterson, & Miller, 2007). Markers of high RF are indicated by four different types of reflective capacity: (1) demonstrating an awareness of the nature of mental states, (2) explicitly attempting to tease out mental states underlying behavior, (3) acknowledging developmental aspects of mental states, and (4) mental states in relation to the interviewer (Slade et al., 2007). Transcripts were coded by trained research assistants under supervision of the first author. Prior to scoring, all coders were trained extensively by the first author until intra-class correlations (ICCs) were .80 or higher for the individual question scores and overall score using a gold standard set of transcripts. Fifteen percent of the interviews were coded by a second rater. Inter-rater agreement was .87 for individual question scores and .90 for the typicality score.

Maternal behavior. At T2, maternal parenting behavior was assessed during a 3-minute unstructured free play task (FP) in which mothers were given a set of age-appropriate toys and instructed to play with their child as they would normally do. Sensitivity (SEN; degree to which mother appropriately and timely responds to her infant) and intrusiveness (INT; extent to which the mother handles the infant roughly and interferes with the child's needs and behaviors) were coded using an adapted version of the 4-point global rating scales (0 = absent – 3 = high levels or predominantly present) of the Mother Infant Coding System (Miller et al., 2002). All coders were trained extensively until the ICCs were .70 or higher across the dimensions on a subset of 20 recordings. Fifteen percent of the sample was

double-coded to assess ongoing inter-rater reliability. ICCs ranged from .79 (INT) to .84 (SEN). Different coders were used for the coding of maternal behavior and prenatal RF.

Infant aggression. The Cardiff Infant Contentiousness Scale (CICS; Hay et al., 2010) was used at 6 and 12 months to screen for early manifestations of aggression. For this study, the CICS was translated into Dutch and back translated into English, both by the first author and another experienced English-speaking researcher of the *MINDS* – Leiden team. Mothers were asked to report on infants' use of physical force in social interactions and the expression of anger, using a 3-point scale ranging from "not yet" (0) to "often" (2). The CICS has acceptable levels of internal consistency and inter-rater agreement (Hay et al., 2010). Internal consistency was first checked using the initial six items to measure infant physical aggression. To increase internal consistency, the item "pulls hair" was removed resulting in coefficient α = .52 at 6 months and α = .53 at 12 months, indicating modest measurement precision, an expected finding since the questionnaire consisted of a limited number of items. In contrast to the study by Hay and colleagues (2010), the removal of item "won't let go of toys" did not increase the α coefficient, so five items were used.

At 12 and 20 months, the 11-item Physical Aggression Scale for Early Childhood (PASEC; Alink et al., 2006) was used to assess physical aggression. Examples of items are: "bites", "physically attacks", and "starts fights". Mothers were asked whether their child has shown certain behaviors during the past 2 months on a 3-point scale ranging from "not true" (0) to "very true or often true" (2). At T3, missing values for 4 participants were replaced by the total (standardized) mean score. For the present study, the internal consistency was .78 at 12 months and .73 at 20 months. This is in line with internal consistency reported by Alink et al. (2006).

Infant cognitive development. The Infant Mental Development Index (MDI) of the Bayley Scales of Infant Development, 2nd version (BSID-II; Bayley, 1993) was used as a global measure of infant cognitive development at T2. The researchers who administered or scored the BSID-II were trained in developmental assessment and interpretation. Raw scores were converted to a scaled score (M = 100, SD = 15). Internal consistency of the MDI is .88 (Nellis & Gridley, 1994), with test–retest reliability reported to be r = .87 and a long term stability of r = .67 (Bayley, 1993).

Maternal cognitive functioning. Three subtests of the WAIS-III-NL (Wechsler, 2005) - Vocabulary, Matrix Reasoning, and Digit Span – backwards - were used as indicators of maternal intellectual functioning at T2. The WAIS-III has repeatedly been reported to

provide reliable and valid estimations of intelligence (Wechsler, 2005). For each subtest, raw scores were used in statistical analyses.

Data analyses

All variables were examined for outliers and violations of specific assumptions applying to the statistical tests used. For each variable, observations with values that exceeded three standard deviations from the mean were recoded to the next highest value within three standard deviations from the mean. Extreme values were recoded for two observations of PASEC at T3 and at T4. First, Pearson correlation analyses were performed to examine associations between infant aggression, prenatal RF, sensitivity, and intrusiveness.

Next, possible mediation effects by maternal sensitivity and intrusiveness of the effects of prenatal RF on infant physical aggression were tested using bootstrap procedures described by Preacher and Hayes (2008).

Subsequently, two groups were created for prenatal RF based on the median, which formed the main between-subjects variable in subsequent analyses of variance. Multivariate analyses of variance (MANOVA) were used to examine possible differences between both RF-groups in infant aggression at 6, 12, and 20 months. Two repeated measures analyses of variance (RM-ANOVA) were performed to examine whether reported absolute physical aggression scores changed from 6 to 12 months (using the CICS), and from 12 to 20 months (using the PASEC).

Two RM-ANOVAs with standardized scores at 6, 12, and 20 months (one using CICS at 6 and 12 months, and PASEC at 20 months; and one using CICS at 6 months, and PASEC at 12 and 20 months) were also conducted to examine differences between the RF-groups in the development of infant aggression across three assessment waves. Of note: one can only see whether the two RF-groups developed differently here in standardized units compared to the mean (= 0), so whether the RF-groups developed aggression scores further or closer to the mean of the entire group of children across assessments.

Finally, in order to test potential moderation effects, sensitivity and intrusiveness were dichotomized and added, separately, as independent variables to the MANOVA and RM-ANOVAs predicting infant aggression. All analyses were conducted using the Statistical Package for Social Sciences (SPSS) version 22.0 (IBM Corp., Armonk, NY).

Results

Preliminary analyses

Demographic and obstetric characteristics of the sample are presented in Table 1. Correlations between prenatal RF, sensitivity, intrusiveness, and infant physical aggression are listed in Table 2. Of the three indicators of maternal cognitive ability, only Vocabulary scores were related to prenatal RF (r = .30, p < .005), sensitivity (r = .20, p < .05), and intrusiveness (r = -.28, p < .005). However, Vocabulary was not associated with reported infant aggression (neither were maternal scores on Digit Span and Matrix Reasoning). Therefore, these indicators of maternal cognitive ability were not included as potential covariates.

Maternal age and family income were not associated with infant aggression or maternal sensitivity and intrusiveness. No significant associations were observed between obstetric characteristics and infant BSID-II-scores on the one hand and maternal RF, sensitivity, intrusiveness, and infant aggression on the other. No group differences were found between boys and girls with respect to infant aggression at 6, 12, and 20 months. Furthermore, no differences were found for level of prenatal RF, sensitivity, and intrusiveness between mothers of boys and girls. Therefore, maternal age, family income, obstetric characteristics, infant sex and infant BSID-II-scores were not included as covariates in subsequent analyses.

Prenatal RF was positively associated with sensitivity, indicating that better prenatal RF was associated with more sensitive parenting. For intrusiveness a negative trend was observed (r = -.15, p = .068). Prenatal RF was negatively associated with infant aggression at 6, 12, and 20 months (see Table 2), indicating that better prenatal RF was related to lower levels of infant physical aggression. Sensitivity was negatively associated with intrusiveness. Sensitivity and intrusiveness were not related to infant physical aggression. Mediation analyses to examine possible indirect effects of prenatal RF on infant aggression through sensitivity and/or intrusiveness could therefore not be carried out.

Furthermore, infant aggression at 6 months was positively associated with infant physical aggression at 12 months (as measured by the CICS, see Table 2). Both measures (CICS and PASEC) of infant aggression at 12 months were moderately correlated. Also, infant aggression at 12 months was positively associated with infant physical aggression at 20 months (as measured with the PASEC).

Table 2. Correlations between prenatal reflective functioning, infant aggression and maternal behavior.

		1	2	3	4	5	6	7
1.	Prenatal RF	1						
2.	T2 aggression (CICS)	-.17*	1					
3.	T3 aggression (CICS)	-.05	.21*	1				
4.	T3 aggression (PASEC)	-.19*	.15	.38**	1			
5.	T4 aggression (PASEC)	-.19*	.09	.31**	.42**	1		
6.	T2 sensitivity	.23*	.03	.07	.08	-.04	1	
7.	T2 intrusiveness	-.15	-.04	-.07	.05	.07	-.44**	1
	Mean	3.91	3.00^{+}	3.96^{+}	2.64^{+}	2.83^{+}	2.54	0.43
	SD	0.90	1.38^{+}	1.69^{+}	1.81^{+}	2.30^{+}	0.64	0.71

Note. ** $p < .01$; * $p < .05$, N = 96, $^{+}$ = unstandardized values, SD = standard deviation, RF = reflective functioning, T2 = second wave 6 months post-partum, T3 = third wave 12 months post-partum, T4 = fourth wave 20 months post-partum, CICS = Cardiff Infant Contentiousness Scale, PASEC = Physical Aggression Scale for Early Childhood.

Reflective functioning and infant aggression

In order to further examine the effects of prenatal RF on development of infant aggression, two groups were created for prenatal RF based on the median, with mothers with a prenatal RF-score < 4 being assigned to the 'low-RF' group ($n = 35$) and those with a RF-score ≥ 4 to the 'high-RF' group ($n = 61$).

A MANOVA was used to compare possible differences between both RF-groups in infant aggression at 6, 12, and 20 months. There was a significant multivariate difference between the high and low-RF groups in physical aggression scores: $F(4,91) = 2.96$, $p < .05$; Wilk's $\Lambda = 0.89$, partial $\eta^2 = .12$. Significant univariate differences were observed at 6 months: $F(1,94) = 4.78$, $p < .05$, partial $\eta^2 = .05$, and 20 months: $F(1,94) = 6.46$, $p < .05$, partial $\eta^2 = .06$, indicating that the high-RF group had lower absolute infant aggression scores at 6 and 20 months ($M = 2.77$, $SD = 1.31$ at 6 months, and $M = 2.39$, $SD = 2.12$ at 20 months) compared to the low-RF group ($M = 3.40$, $SD = 1.44$ at 6 months, and $M = 3.60$, $SD = 2.44$ at 20 months). A trend in the same direction was observed for 12 months ($p = .083$; low-RF $M = 3.06$, $SD = 2.20$; high-RF $M = 2.39$, $SD = 1.61$, PASEC-scores).

Next, two RM-ANOVAs were performed to examine whether reported absolute physical aggression scores changed from 6 to 12 months (using the CICS, see Figure 1a), and from 12 to 20 months (using the PASEC, see Figure 1b). The first RM-ANOVA, with CICS-aggression scores at 6 and 12 months as dependent variables, revealed a significant effect for Time: $F(1,94) = 18.77$, $p < .001$, partial $\eta^2 = .17$, indicating an increase in reported infant physical aggression between 6 and 12 months. There was no significant Group by Time effect, indicating that reported physical aggression increased for both the low and high RF-groups. The second RM-ANOVA, with PASEC-aggression scores at 12 and 20 months as dependent variables, showed no significant effects of Time or Group by Time. The significant difference between the high and low-RF group: $F(1,94) = 6.83$, $p < .01$, partial $\eta^2 = .07$, indicated higher aggression levels across time for the low RF-group (and therefore largely confirmed results of the MANOVA).

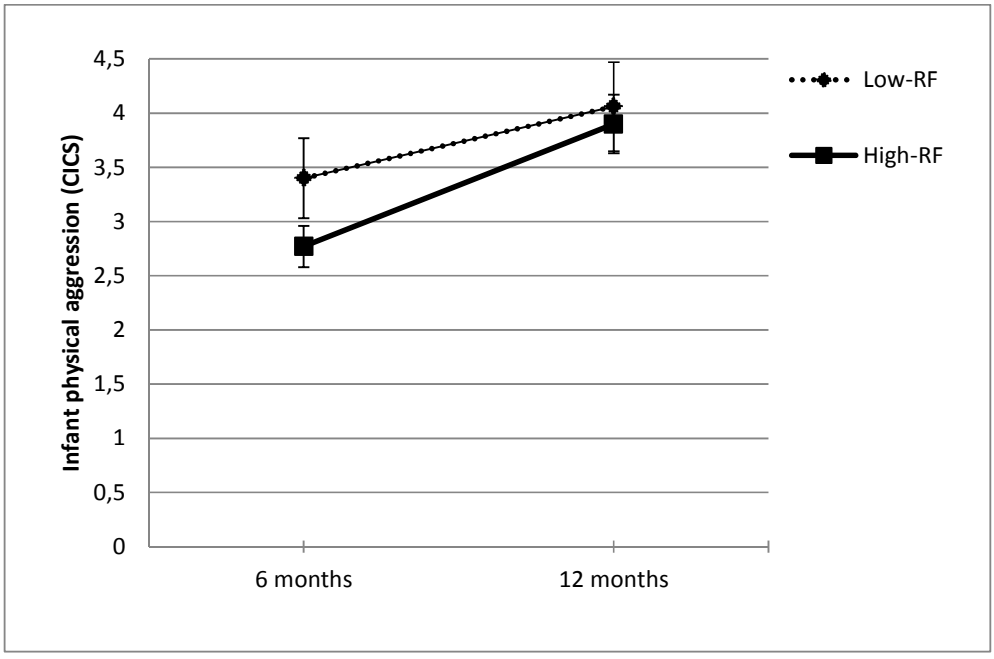

Figure 1a. Infant physical aggression from 6 to 12 months for the group with low reflective functioning (RF) skills versus the group with high RF-skills as measured by the Cardiff Infant Contentiousness Scale (CICS).

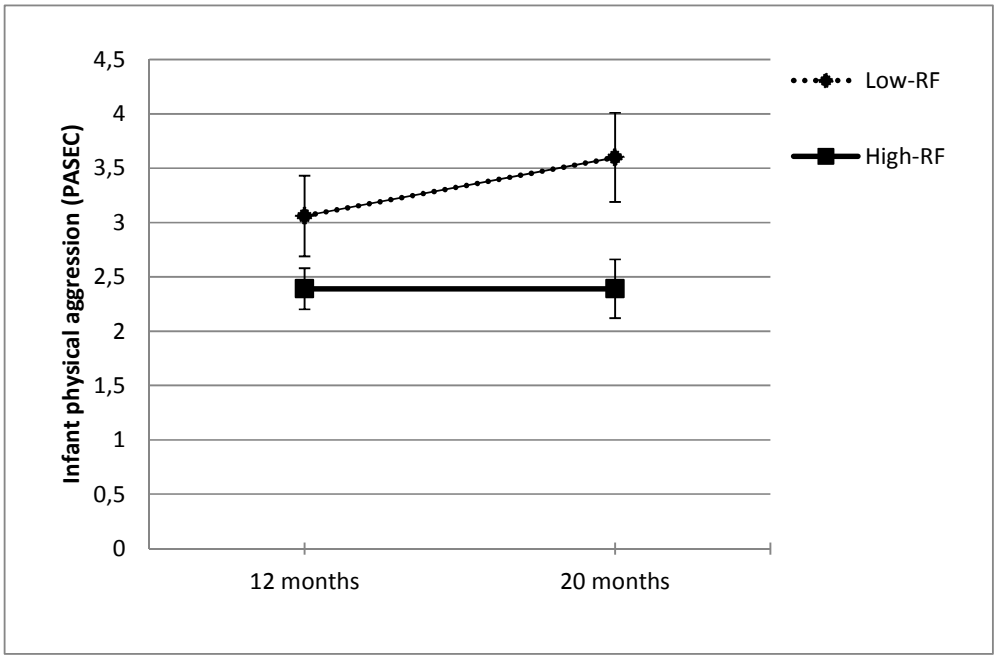

Figure 1b. Infant physical aggression from 12 to 20 months for the group with low reflective functioning (RF) skills versus the group with high RF-skills as measured by the Physical Aggression Scale for Early Childhood (PASEC).

Next, two separate RM-ANOVAs (one with the CICS-score and one with the PASEC-score at 12 months) were conducted using standardized scores to examine differences between the RF-groups in the development of infant physical aggression between 6 to 20 months. For both analyses, results showed no significant Time by Group effects, indicating that there were no differences in developmental pattern for the two RF-groups. The overall group difference in physical aggression between the high and low RF-groups was confirmed with both the CICS: $F(1,94) = 6.39$, $p < .05$, partial $\eta^2 = .06$,and PASEC: $F(1,94) = 10.32$, $p < .005$, partial $\eta^2 = .10$] (see Figure 1c).

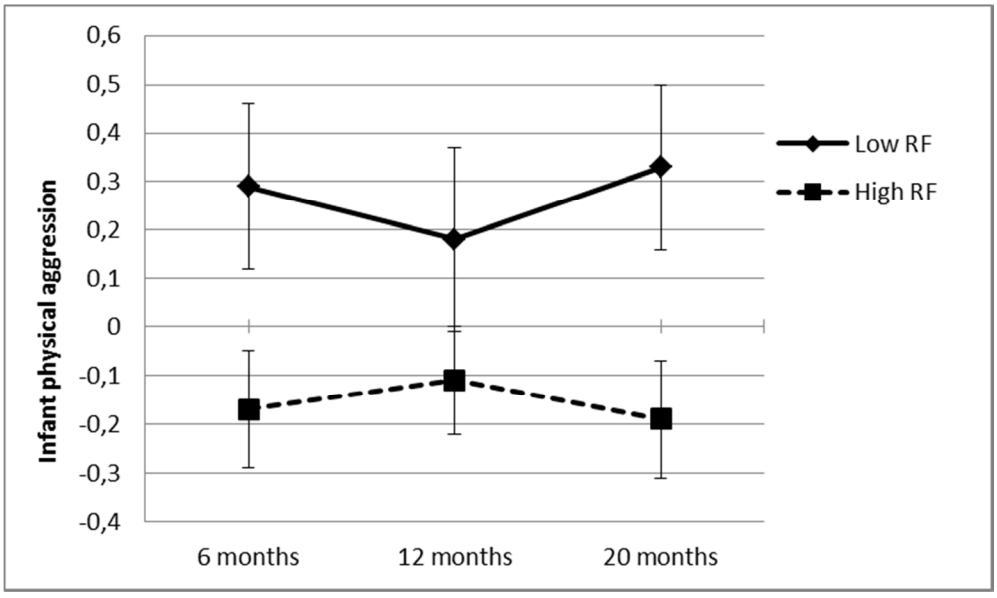

Figure 1c. Standardized infant physical aggression scores across time for the group with low reflective functioning (RF) skills versus the group with high RF-skills using the Cardiff Infant Contentiousness Scale at 6 months and the Physical Aggression Scale for Early Childhood at 12 and 20 months.

Reflective functioning, maternal behavior, and infant aggression

During free play, 66 women did not show signs of intrusiveness, 22 were minimally intrusive, 6 were mixed or moderately intrusive, and 2 were predominantly intrusive. Fifty-nine women were predominantly sensitive, 31 were mixed or moderately sensitive, and 6 were low sensitive. As the variance and distribution of scores for sensitivity and intrusiveness were limited, dichotomous variables were created for both maternal behaviors. Sensitivity was recoded as low-SEN (SEN-scores ≤ 2, n = 37) or high-SEN (SEN = 3, n = 59), whilst intrusiveness was recoded into no-INT (INT = 0, n = 66) or some-INT (INT-scores ≥ 1, n = 30).

Two separate MANOVAs were conducted with the dichotomous measures of RF and sensitivity or intrusiveness as independent variables and infant aggression scores as dependent variables. The MANOVA with sensitivity confirmed the effects of RF-group. No effects were observed for SEN or SEN by RF-group. For the MANOVA with intrusiveness, the multivariate tests showed a trend effect for RF-group: $F(4,89) = 2.03$, $p = .097$; Wilk's $\Lambda = 0.92$, partial $\eta^2 = .08$. Also, a RF-group by INT effect was found: $F(4,89) = 2.92$, $p < .05$;

Wilk's Λ = 0.88, partial η^2 =.12. Between-subjects effects showed a significant RF-group by INT effect for infant aggression at 12 months: $F(1,92) = 7.82$, $p < .005$, partial $\eta^2 = .08$ for the CICS (see Figure 2a), and $F(1,92) = 7.94$, $p < .005$, partial $\eta^2 = .08$ for the PASEC (see Figure 2b). A similar trend was observed for 20 months ($p = .088$). Additional t-tests to compare infant aggression at 12 months between both RF-groups per INT-group were conducted. For the some-INT group there were no differences between high and low-RF in reported aggression, but in the no-INT group, the low-RF group reported significantly more infant aggression compared to the high-RF group, CICS: $t(64) = 1.99$, $p < .05$; and PASEC: $t(29.80) = 2.60$, $p < .05$).

The RM-ANOVA to examine whether reported physical aggression changed from 6 to 12 months (using the CICS) with SEN and RF as independent variables confirmed the main effect of Time, indicating an increase in physical aggression between 6 and 12 months: $F(1,92) = 20.26$, $p < .001$, partial $\eta^2 = .18$. Also, a SEN x RF-group x Time interaction was found: $F(1,92) = 4.03$, $p < .05$, partial $\eta^2 = .04$. In the high-SEN group, both RF-groups reported an increase in infant physical aggression from 6 to 12 months, for the low-RF: $t(18) = 2.44$, $p < .05$, and for the high-RF: $t(39) = 3.51$, $p < .005$. For the low-SEN group, reported physical aggression levels increased in the high-RF group: $t(20) = 3.20$, $p <. 01$, while aggression levels remained stable in the low-RF group ($ps > .6$). The RM-ANOVA investigating changes in reported physical aggression from 12 to 20 months (using the PASEC) did not show Time- or SEN-related effects over and above the significant group difference between low and high RF: $F(1,92) = 5.40$, $p < .05$, partial $\eta^2 = .06$.

Next, two similar RM-ANOVA were executed, but with intrusiveness as an independent variable in addition to RF-group. The increase in physical aggression from 6 to 12 months was confirmed: $F(1,92) = 16.98$, $p < .001$, partial $\eta^2 = .16$. The INT x RF-group x Time effect approached significance ($p = .067$). The significant interaction between RF-group and INT was confirmed: $F(1,92) = 5.86$, $p < .05$, partial $\eta^2 = .06$. The low-RF group reported significantly more infant aggression compared to the high-RF group, but only when mothers showed no intrusiveness, at 6 months: $t(64) = 2.33$, $p < .05$; and at 12 months: $t(64) = 1.99$, $p < .05$.

The RM-ANOVA with the PASEC aggression-scores revealed a similar interaction between RF-group and INT: $F(1,92) = 7.05$, $p < .01$, partial $\eta^2 = .07$. Again, the low-RF group reported significantly more infant aggression compared to the high-RF group, but only when mothers showed no intrusiveness, at 12 months: $t(29.80) = 2.60$, $p < .05$, and at

20 months: $t(64) = 3.01$, $p < .005$. The lack of significant Time x RF-group x INT interactions indicated that the underlying pattern of RF-effects being particularly evident in case if no or little intrusiveness was present across time.

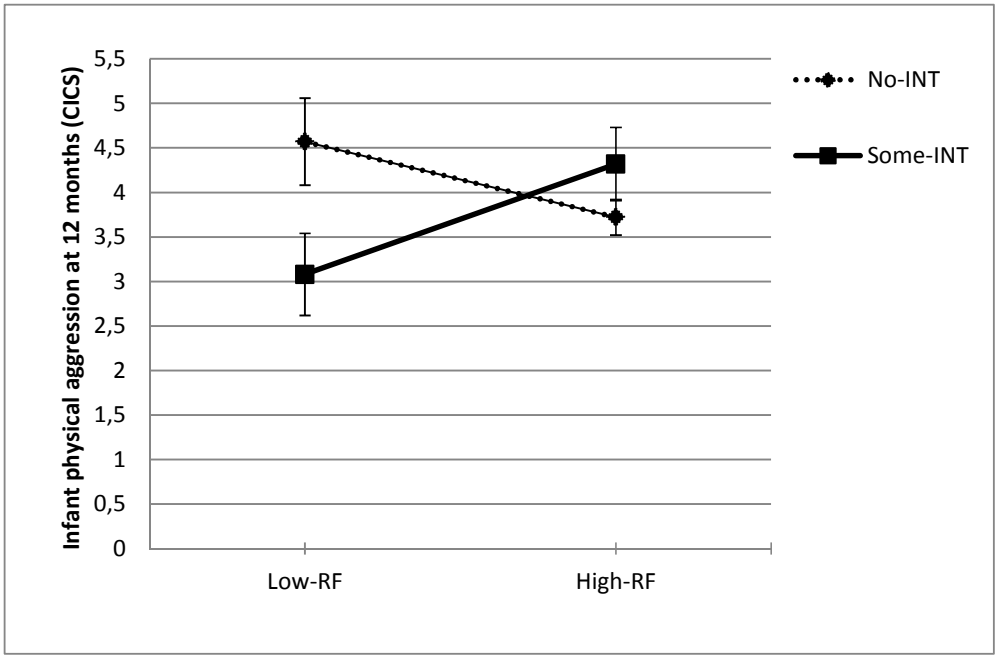

Figure 2a. Moderating effect of intrusiveness (INT) on the association between prenatal reflective functioning (RF) and infant physical aggression at 12 months as measured by the Cardiff Infant Contentiousness Scale (CICS).

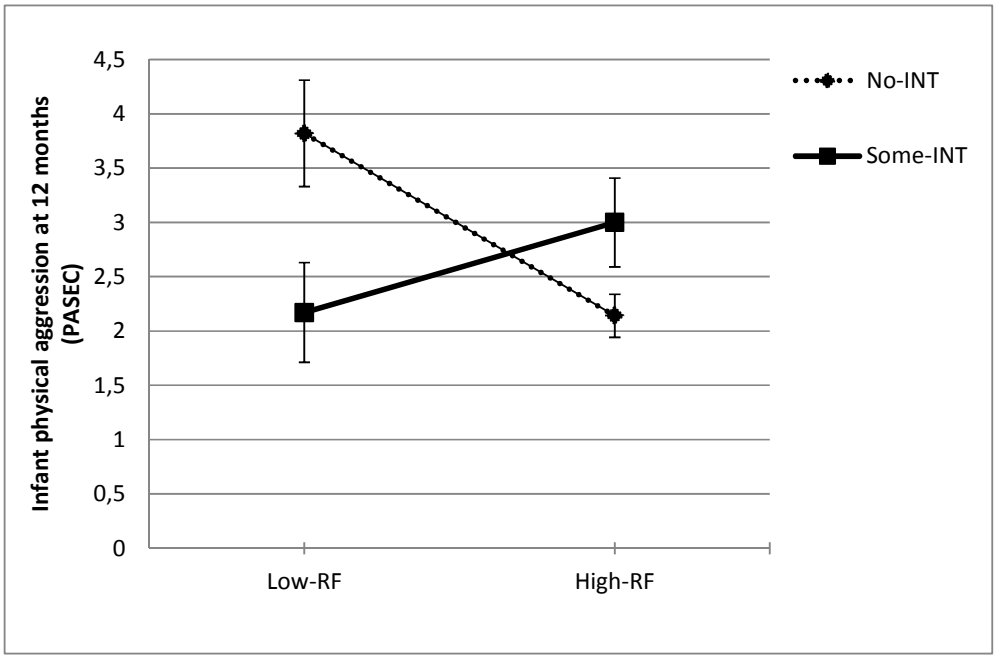

Figure 2b. Moderating effect of intrusiveness (INT) on the association between prenatal reflective functioning (RF) and infant physical aggression at 12 months as measured by the Physical Aggression Scale for Early Childhood (PASEC).

Discussion

The purpose of this study was to examine the effect of prenatal maternal RF on the development of infant physical aggression, and the possible moderating and/or mediating effects of maternal sensitivity and intrusiveness on this potential association. Prenatal RF was negatively associated with maternal reports of infant physical aggression at 6, 12, and 20 months. Maternal sensitivity and intrusiveness did not mediate the link between prenatal RF and infant physical aggression. Moderating effects for intrusiveness and sensitivity were observed. Better prenatal RF was particularly associated with less infant physical aggression among mothers who showed no or low signs of intrusiveness. However, for mothers who showed some intrusiveness in the interaction with their infant, prenatal RF-level seemed to have little effect on infant physical aggression. Generally, infant physical aggression increased from 6 to 12 months, but mothers with both low prenatal RF and mixed or low sensitivity did not report an increase.

As expected, better maternal prenatal RF was related to lower infant physical aggression levels. Our findings provide evidence supporting the notion that maternal RF plays an important role in children's social development. It has been suggested that maternal RF stimulates in the child a better understanding of his/her own mind and the minds of others, thereby supporting the developing RF-ability in the child (Sharp & Fonagy, 2008). When this 'meeting of minds' does not take place in early development, the child seems to be at an increased risk of developing behavioral problems and psychopathology, which may be partly due to impaired mentalizing and less optimal social-cognitive development (Laranjo, Bernier, Meins, & Carlson, 2010; Sharp & Fonagy, 2008; Slade, 2007b). Precursors of mentalizing start to develop late in the first year of life (Onishi & Baillargeon, 2005) and should be a future focus of studies investigating RF-behavior associations.

The effect of prenatal RF on reported infant physical aggression was not mediated by maternal parenting behavior. Surprisingly, no significant associations were found between maternal sensitivity and intrusiveness at 6 months and infant aggression at 6, 12, and 20 months. The fact the we (and others, e.g., Leerkes, Blankson, & O'Brien, 2009) did not find these links might be related to the time point - 6 months post-partum - used to observe sensitivity and intrusiveness: mixed results exist concerning the degree to which sensitivity and intrusiveness can be regarded as stable factors during infancy and later development (Joosen, Mesman, Bakermans-Kranenburg, & Van IJzendoorn, 2012; Kemppinen,

Kumpulainen, Raita-Hasu, Moilanen, & Ebeling, 2006; Lohaus, Keller, Ball, Voelker, & Elben, 2004). Alternatively, the lack of associations between parenting and infant aggression might be due to the limited distribution in scores for intrusiveness and sensitivity. Mothers in our sample were, on average, relatively highly sensitive and non-intrusive during the free play task. Possibly more variation in sensitivity and intrusiveness would be observed during tasks other than the relatively short and distress-free task administered here.

A moderating effect of intrusiveness on the link between prenatal RF and the development of infant physical aggression was found. Prenatal RF was negatively associated with infant physical aggression among mothers who showed no or limited signs of intrusiveness. For this group, rudimentary or better prenatal RF was linked to lower levels of infant physical aggression. For mothers who showed some intrusiveness, prenatal RF-level did not predict reported levels of infant physical aggression. These results indicate that beneficial effects of RF are more evident among women who show no intrusiveness. For the more roughly handling and/or interfering mothers other parenting skills or mother and infant factors might play a more important role in the development of infant physical aggression.

Generally, infant physical aggression increased from 6 to 12 months. However, when mothers had both low prenatal RF-skills and showed low or mixed sensitivity during the interaction with their infant, this increase in physical aggression was not reported. As an increase in physical aggression in these 6 months is to be developmentally expected (Hay et al., 2010), the fact that these women did not report such an intensification may indicate that these women are less able to accurately 'read' their infant or that they are less focused on their infant, thereby failing to notice certain behaviors. This would also implicate that, especially for this group of women, behavioral observations or more objective instruments are required rather than maternal reports of infant behavior.

Besides sensitivity and intrusiveness, there may be other aspects of parenting through which prenatal RF exerts its influence on children's aggressive behavior, or that moderate the observed associations. Different, but often related, mechanisms may be involved as well. One example of such a mechanism that has often been studied in the context of reflective functioning is attachment security. Another potentially important mechanism is early social cognition. Early social cognition or precursors to social cognition in the infants/toddlers may be influenced by the social cognitive abilities (e.g., the RF-level) of parents, and this in turn may influence social behavior. All mechanisms and all 'outcome measures' (here: physical aggression), may, at least in part, be a reflection of shared genetics. Also, the

source and extent of contribution of such genetic propensities in the prediction of physical aggression might change over time in early childhood (Lacourse et al., 2014). The (perinatal) environment created by the mother may also influence physical aggression development through its impact on gene expression and brain development (Ouellet-Morin et al., 2009). Consequently, the relation between maternal prenatal RF and child aggression may also (in part) be accounted for by genetics that are shared by mother and child, although shared genetics might play a more important role in associations between for example mother aggression and child aggression, or maternal RF and child mentalizing abilities. Finally, there is the possibility that interactions between maternal factors and the child genotype exist. A number of genetically-informative studies showed that prenatal risk factors predicted aggressive outcomes in offspring, even when controlling for genetic factors (Rice et al., 2010). For the investigation of (prenatal) RF such designs have not yet been used. This seems an important topic for future research. However, given that there are significant associations between prenatal RF and infant physical aggression, and given the fact that the perinatal environment is (partially) amenable to intervention the results of this study may be considered important also in the absence of a genetically informative design.

Contrary to our expectations, we only found an increase in infant aggression from 6 to 12 months, but not from 12 to 20 months. This might be due to the restricted age range, as we only looked at early manifestations of physical aggression up till 20 months post-partum. Generally, the first signs of infant aggression can be identified in the first year of life (Nærde et al., 2014; Hay et al., 2011; Hay et al., 2010), whilst the majority of children are exhibiting physical aggression toward siblings, peers, and adults by 17 months (Hay, Castle, & Davies, 2000; Keenan & Wakschlag, 2000), with a decline in physical aggression from age 3 years onwards (Alink et al., 2006; Tremblay et al., 2004). Thus, further follow-up measures of physical aggression beyond 20 months may be required to observe the expected increase (and subsequent decrease). Regardless of the potential explanations for the lack of an increase in reported physical aggression between 12 and 20 months, our results indicate that at least part of the increase already takes place in the second half-year of life. They also show that even during early infancy individual differences in physical aggression can be predicted based on prenatal maternal RF.

This study has a number of limitations. First, a different measure was used to rate infant aggression at 6 and 12 months (CICS) as compared to 12 and 20 months (PASEC). One limitation of the CICS scale, used at 6 and 12 months, is the fact that only a moderate level of internal consistency was achieved, although this was similar to those obtained in other

studies with α-coefficients for aggression items ranging from .51 to .72 (Côté et al., 2006; Hay et al., 2010; Nærde et al., 2014; NICHD Early Child Care Research Network, 2004; Tremblay et al., 2004). Furthermore, the contentiousness items were incorporated into a developmental milestones checklist and presented to the parents as behaviors that all infants might be expected to show. This potentially reduces the effects of social desirability. Following from this, a second potential limitation is that we used maternal report to assess infant physical aggression. Parental perceptions of child functioning may be biased by relationship with the child, knowledge of child behavior, social desirability, emotional status, personality, and inconsistent interpretation of items (Kagan, Snidman, Arcus, & Reznick, 1994). However, parental perceptions of their child's aggressive behavior have been differentiated in meaningful and consistent ways (Bates, 1990). Also, parents' ratings of infants' anger and aggression at 6 months correlate with observed aggression in 12-month-olds (Hay et al, 2011). Nonetheless, use of multiple informants (e.g., partners or co-parents) or direct observation of infant physical aggression would strengthen the findings presented here. Third, mothers who discontinued participation in the study had a slightly lower level of education. This might have resulted in the loss of some more extreme cases. Finally, given that prenatal RF is coded based on verbal narrative, one could imagine that the current RF measurement might not always best capture the true mentalizing capacity of a mother who has difficulty with expressive language.

In order to prevent (continuation of) physical aggression, both risk and protective factors should be targeted, at least as much as the disruptive behaviors themselves (Hughes & Ensor, 2006). Maternal RF seems an interesting candidate for incorporation in prevention and intervention programs (Katznelson, 2014; Ordway et al., 2014). The primary aim of any RF-based program must be the development of a reflective stance in parents (Slade, 2007b). This is based on the presumption that helping mothers develop a reflective stance would enable them to become more sensitive, regulating, and autonomy-promoting parents, resulting in a positive effect on a range of developmental outcomes in the infant (Ordway et al., 2014; Sadler et al., 2013; Slade, 2007b). Three areas are of particular interest for interventions aiming to enhance RF during pregnancy: 1) mentalizing about the self as a mother; 2) mentalizing the baby as having a separate mind; and 3) mentalizing about the emerging relationship with the fetus (Markin, 2013). There are various strategies to encourage maternal RF (Markin, 2013; Sadler et al., 2013; Sadler, Slade, & Mayes, 2006). For example, clinical care and counseling may include the clinician modeling a reflective stance, reviewing recorded mother-infant interactions, and putting

emotions that underlie behaviors into words for mother or infant (Slade, 2007b). The ability to reflect on the child's mental states in relation to their behavior may provide parents an outline that can help them learn that, when confronted with child-rearing issues (e.g., tantrums, aggression), trying to understand their child's mental states can help determine how to respond (Ordway, Sadler, Dixon, & Slade, 2014). The present study underlines this notion by providing evidence for the existence of associations between (prenatal) RF and infant physical aggression over time. Results also showed that RF should not be studied in isolation, as factors such as level of intrusive parenting, but probably other factors as well, have a moderating influence on RF-behavior associations.

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Chapter 6

Maternal reflective functioning as a multidimensional construct: Differential associations with children's temperament and externalizing behavior

Smaling, H. J. A., Huijbregts S. C. J., Van der Heijden, K. B., Van Goozen, S. H. M. & Swaab, H. (2016). Maternal reflective functioning as a multidimensional construct: Differential associations with children's temperament and externalizing behavior. *Infant Behavior and Development, 44*, 263-274. doi: 10.1016/j.infbeh.2016.06.007.

Abstract

Maternal reflective functioning (RF) has been associated with children's behavioral development. This study examined maternal prenatal and postnatal RF, as measured by the Pregnancy Interview and Parent Development Interview, as multidimensional constructs. It was also examined whether the RF-dimensions were associated with children's temperament and externalizing behavior, as assessed by several questionnaires. The sample consisted of 123 first-time mothers (*M* age = 22.85 years, *SD* = 2.21) and their children (*M* age = 19.97 months, *SD* = 0.85, 56% male). Two related but distinct dimensions were found for prenatal RF, termed self-focused and child-focused mentalization. Three dimensions were observed for postnatal RF, termed self-focused, child-focused, and relation-focused mentalization. Results showed that prenatal RF negatively related to reported child physical aggression. Postnatal self-focused RF was positively linked to externalizing behavior and negative emotionality in offspring, while relation-focused RF scores were again negatively associated with child physical aggression. Findings show that it is important to also look at the specific RF-dimensions when examining the effects of maternal RF on children's behavioral development, as differential associations with behavioral outcomes exist. Discussion further focuses on the importance of these findings in prevention and clinical practice, and suggestions are being made to further improve the measurement of maternal RF-dimensions.

Introduction

Reflective functioning (RF), an operationalization of mentalization, has been defined as the ability to understand and interpret one's own and others' behavior in the light of mental states such as feelings, thoughts, fantasies, beliefs and desires (Fonagy, Gergely, Jurist, & Target, 2002). Ascribing (personal) meaning to underlying emotions and helping to clarify the cause and effect relations between those underlying mental states and behavior, are essential for adequate interpersonal functioning.

Mentalizing or RF in the context of parenting has been defined as a parent's ability to understand their own mental states, to keep their child's mental states in mind, and to understand how these mental states impact behavior (Ordway, Webb, Sadler, & Slade, 2015). More specifically, maternal RF is seen as the mother's ability to think reflectively about herself as a parent, her child, and her relationship with the child (Slade, 2005). Maternal mentalizing starts to develop during pregnancy, as a woman's representations of herself as a mother and of the baby become increasingly specific (Slade, Cohen, Sadler, & Miller, 2009). Prenatal maternal RF refers to the mother's ability to think of the fetus, from at least the last trimester onwards, as a separate individual, with developing personal characteristics, needs, and temperament (Pajulo et al., 2015).

During pregnancy, a highly reflective mother prepares concretely and psychologically for the birth of the baby by making room for the infant both in mind and in practice (Pajulo et al., 2015). Postnatal maternal RF provides the mother an outline of how to respond when confronted with child-rearing issues (Ordway, Sadler, Dixon, & Slade, 2014). Specifically in times of elevated emotions, a reflective mother is likely to respond to her child's signals with acceptance and in an appropriate manner. The reflective mother's empathic responses serve a crucial function in organizing and regulating the child's emotional states (Fonagy et al., 2002) and enable the child to develop the capacity to self-regulate. Furthermore, the mother is most likely to respond sensitively when she can understand the meaning and intention of children's cues and see her children as separate from herself (Fonagy et al., 2002; Smaling et al., 2016). When the mother acts on incorrect assumptions about her child's mental states or does not recognize her own and her child's individual and separate emotional states, there is a risk for miscommunication (Ordway et al., 2015), which, in turn, could lead to poor emotion regulation, elevated stress responses, and behavioral problems (Bowlby, 1988; Ha, Sharp, & Goodyer, 2011; Sharp & Fonagy, 2008; Smaling et al., 2016).

Poor maternal RF or mentalizing has already been associated with behavioral problems in children (Benbassat & Priel, 2012; Ha et al., 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013), including attention problems, social withdrawal, anxiety, and dysfunctional mother-child interactions (Esbjørn et al., 2013; Fonagy et al., 2002; Smaling et al., 2016). The majority of studies linking maternal RF to child socio-behavioral development have focused on postnatal RF. Few studies have examined the role of prenatal maternal RF in the development of children's behavioral development, although some evidence exists showing that this is predictive of children's externalizing behavioral problems (specifically: physical aggression) as well (Smaling et al., 2016).

Prenatal and postnatal reflective functioning

Maternal RF has mostly been assessed postnatally, but it may be argued that for RF to develop optimally, this development should have started prenatally. Support for this notion comes from studies examining stability and change in maternal representations, part of maternal RF, which indicate moderate stability between prenatal and postnatal maternal representations (Benoit, Parker, & Zeanah, 1997; Theran, Levendosky, Bogat, & Huth-Bocks, 2005). Besides the moderate stability of the maternal representations, there are also studies suggesting more changeability of maternal representations (Aber, Belsky, Slade, & Crnic, 1999; Vizziello, Antonioli, Cocci, & Invernizzi, 1993). During the perinatal period mothers will slowly adapt to their new role. Likewise, during this period mothers might increasingly reflect upon their own childhood experiences. The birth of a healthy baby may also alleviate maternal anxieties activated during pregnancy, nurturing a more coherent and enriched representation of the woman as a mother and of her newborn baby. Furthermore, changes in maternal representations and mentalizing may be expected as these will be influenced by interactions with the actual baby. The importance of examining stability and change during the perinatal period is further underlined by the fact that prenatal maternal mentalizing predicts postnatal maternal mentalization, but not perfectly (Arnott & Meins, 2007, 2008; Steele & Steele, 2008). In case pre- and postnatal RF indeed differ, it may be hypothesized that they will differentially predict child socio-behavioral outcomes as well.

A dimensional approach to maternal reflective functioning

When looking more closely at the definitions used to describe the mentalizing ability or maternal RF, the following characteristics of RF can be identified: (a) awareness, recognition, and acknowledgement of mental states in oneself and others, (b) an

understanding of how mental states influence interpersonal interaction and behavior, (c) an understanding of mental state-dynamics in relationships, and (d) mental representations about relationships containing cognitive and emotional components (Fonagy & Bateman, 2008; Fonagy et al., 2002; Slade, 2005). Mentalizing with respect to infants and toddlers also often involves adopting a developmental perspective about the child's growing capabilities and trying to make sense of the child's internal world through observation of behavioral and affective cues (Slade, 2005, 2007). Whereas most studies to date have focused on maternal RF as a unitary construct, RF may have to be regarded as a multidimensional construct. Components may include (some of) the previously mentioned RF-characteristics. Whereas a distinction between these components appears to reflect a hierarchical structure of RF (with c being a more advanced form of RF than b, which in turn is more advanced than a), another plausible form of multidimensionality is one that distinguishes an intrapersonal dimension and interpersonal dimension (Benbassat & Priel, 2015). Awareness, recognition, and acknowledgement of mental states of oneself and of others may be related but distinguishable qualities, which, in turn, could differentially influence the understanding of mental-state dynamics of behavior and within relations.

Some empirical evidence for a two-dimensional structure of postnatal RF already exists. Suchman and colleagues (2010) identified a two-dimensional structure for postnatal RF in a sample of 47 substance-abusing mothers. A similar two-factor structure was identified by Borelli, St John, Cho, and Suchman (2016) in a high-risk community sample. The observed dimensions are in line with those theoretically suggested by Benbassat and Priel (2015). One dimension represented the maternal capacity to mentalize about her own emotions and behaviors (self-focused RF), while the second dimension represented the mother's capacity to mentalize about her child's mental states and behaviors, and about her interactions with the child (child-focused RF). Further indirect evidence for multidimensionality of concepts such as RF and mentalizing stems from studies showing separate though proximal neural networks for self-understanding and the understanding of others (Lieberman, 2007). These two forms of understanding may be related to different forms of interpersonal problems and psychosocial disorders (Luyten & Fonagy, 2012). For example, an impaired ability to self-mentalize appears to be an important characteristic of different forms of psychopathology (Fonagy et al., 2002), and may be present even when more general RF is intact (Bateman & Fonagy, 2006; Rudden, Milrod, Target, Ackerman, & Graf, 2006; Sharp et al., 2011).

Research aims

No studies to date have investigated whether the two postnatally identified RF-dimensions can also be observed for prenatal reflective functioning and no studies to date have examined whether these RF-components (prenatally and postnatally) are differentially related to children's temperament and externalizing behavior. A more detailed understanding of separate components of RF, and their implications for early behavioral development has the potential to enhance the efficacy of prevention and intervention programs aimed at reducing children's behavioral problems (Smaling et al., 2016; Smaling et al., 2015).

To summarize, the first goal of this study was to examine maternal reflective functioning (RF) prenatally and postnatally as multidimensional constructs. We expected to find two distinct, but related dimensions for both prenatal and postnatal maternal mentalizing. More specifically, we expected to find a self-focused and a child-focused component of RF prenatally and postnatally.

The second goal was to investigate associations between the different dimensions of prenatal and postnatal RF with children's temperament (i.e., negative emotionality and effortful control) and externalizing behavior (i.e., physical aggression and externalizing problems) at the age of 20 months. We expected that increased levels of RF, especially postnatal child-focused levels, would be associated with more optimal child behavior (less physical aggression, externalizing problems, and negative emotionality, and more effortful control).

Method

Participants

The present study is part of the Mother-Infant Neurodevelopment Study in Leiden, The Netherlands (*MINDS* – Leiden; Smaling et al., 2015). *MINDS* – Leiden is an ongoing longitudinal study into neurobiological and neurocognitive predictors of early behavior problems. Women were recruited during pregnancy via midwifery clinics, hospitals, prenatal classes and pregnancy fairs. Dutch speaking primiparous women between 17 and 25 years old with uncomplicated pregnancies were eligible to participate. We oversampled women characterized by the presence of risk factors associated with suboptimal offspring behavioral development. The study was approved by the ethics committee of the Department of Education and Child Studies at the Faculty of Social and Behavioral Sciences, Leiden University (ECPW-2011/025), and by the Medical Research Ethics Committee at Leiden University Medical Centre Committee (NL39303.058.12) and complied with the Helsinki Declaration and APA ethical standards. All participating women provided written informed consent.

The total sample at the first assessment, around 27 gestational weeks, consisted of 142 women. 19 families left the study (13%). Attrition was due to inability to contact (n = 8), personal problems (n = 7), emigration (n = 1), or premature delivery (>8 weeks early, n = 3). Sample attrition was unrelated to maternal age or ethnicity. However, mothers who left the study had lower educational levels: $t(140) = 3.27$, $p < .005$, and lower family income: $t(140) = 2.84$, $p < .005$.

Our final sample consisted of 123 mothers and their 20-month-old children who had completed both the first (prenatal home visit) and fourth wave (home visit 20 months post-partum) of the study. Women were predominantly Caucasian (89%), 5% Surinamese or Antillean, 2% mixed (Caucasian and other origin), and 4% other origin. At the time of the first assessment, 6% of the women were currently receiving treatment from a psychologist or psychiatrist (trauma (n = 2), anger management (n = 1), light therapy (n = 1), 'motivational issues' (n = 1), past depression (n = 1), Attention Deficit Hyperactivity Disorder (n = 1)). Most mothers had a partner (93%), and of these 7% were in a romantic relationship with someone other than the biological father of the baby. Only 5% of the women were unemployed and 7% reported to have financial problems. Most women (47%) had completed higher secondary school or lower vocational education, 32% had completed

higher vocational education or an university degree, 20% had completed lower secondary school, and 1% completed primary school. Women generally listed 9 people as part of their social support network (*SD* = 4.06, range 3 – 22). More demographic variables and child characteristics are summarized in Table 1.

Table 1. Demographic and obstetric sample characteristics.

	M	*SD*
Age at T1 (years)	22.85	2.21
Ethnicity (% Caucasian)	89%	
Monthly family income (in Euros)	2,456.99	1,215.84
Bachelor's or Master's degree (%)	32%	
Single (%)	7%	
Number of people listed in social support network	9.02	4.06
Unplanned pregnancy (%)	38%	
Caesarian (%)	12%	
Infant gestational age at birth (weeks)	39.20	1.97
Infant birth weight (gram)	3348	534
Infant APGAR-score at 5 minutes	9.45	0.98
Child gender (% male)	56%	
Child age at T4 (months)	19.97	0.85
Child receptive vocabulary*	9.04	2.02
Child expressive vocabulary*	2.91	2.46

Note. N = 123, M = mean, SD = standard deviation, *= raw scores, T1 = first wave around 27 gestational weeks, T4 = fourth wave 20 months post-partum.

Procedures and instruments

Waves 1 and wave 4 of the *MINDS* – Leiden study consisted of a 2- to 2,5-hour home visit, conducted by two trained female researchers. Wave 1 included an interview regarding the emotional experience of the pregnancy, a semi-structured psychiatric interview, and a variety of questions concerning demographic information, lifestyle and health of the mother. The fourth wave started with a free play task, followed by several mother-infant

tasks with a focus on children's cognitive and social development and two language tasks. After the infant tasks, the first researcher looked after the child, while the second researcher interviewed the mother about her emotional experiences as a parent. Each wave ended with the mother filling out several questionnaires. All mother-infant tasks were videotaped.

Demographics, information about maternal health and life style, and obstetric characteristics were gathered using Dutch translations of the 'Becoming a mother' and 'Being a mother' questionnaires from the Cardiff Child Development Study (Hay et al., 2011).

A Dutch translation (Smaling & Suurland, 2011) of the Pregnancy Interview – Revised (PI-R; Slade, 2007a) was administered to assess the level of prenatal RF. The PI-R is a 22-item semi-structured interview with questions that tap into the emotional experience of the pregnancy, mother's prenatal representations of her unborn child and of herself as a parent. The Parent Development Interview Revised - short version (PDI-R2; Slade et al., 2003) was used for determining postnatal RF. The PDI-R2 is a 24-item semi-structured interview that assesses the parents' representations of their relationships with their child, their own internal experience of parenting, and the child's reactions to normal separations, and routine upsets. Both interviews were digitally recorded and transcribed verbatim. Both pre- and postnatal RF were scored on a 11-point scale with higher scores reflecting better RF-skills (Slade, Bernbach, Grienenberger, Levy, & Locker, 2005; Slade, Patterson, & Miller, 2007). Scores of 5 indicate the presence of a basic mentalizing capacity; a rudimentary understanding of how mental states work together and influence behavior (Slade et al., 2007). Indices of high RF have the following characteristics : (a) showing an awareness of the nature of mental states, (b) explicitly making an effort to tease out mental states underlying behavior, (c) acknowledging the developmental aspects of mental states, and (d) recognizing mental states in relation to the interviewer (Fonagy, Target, Steele, & Steele, 1998; Slade, Bernbach, Grienenberger, Levy, & Locker, 2002; Slade et al., 2007). Low RF is characterized by: (a) denial of mental states, (b) bizarre or inappropriate attributions of RF, (c) distorted or self-serving RF, (d) naive or simplistic awareness of mental states, and (e) overly analytical or hyperactive usage of RF (Slade et al., 2002; Slade et al., 2007). Transcripts were coded by trained research assistants under supervision of the first author with different raters for the PI and PDI. The mean inter-rater agreement of individual passage scores were .87 for the PI and .91 for the PDI, and for the overall RF-score .90 for the PI and .94 for the PDI.

The 11-items Physical Aggression Scale for Early Childhood (PASEC; Alink et al., 2006) was used to assess children's use of physical aggression. Mothers were asked whether their child had shown certain behaviors during the past 2 months on a 3-point scale ranging from 0 (not true) to 2 (very true or often true). A total score for physical aggression was calculated. The internal consistency in our study was .73. This is in line with internal consistency reported by Alink et al. (2006).

The Child Behavior Check List 1 ½ -5 year (CBCL; Achenbach & Rescorla, 2000; Achenbach & Ruffle, 2000; Koot et al., 1997) was used to quantify externalizing behavioral problems. Items are scored from 0 (not true) to 2 (very true or often true) on the basis of the preceding 2 months, with higher scores indicating higher levels of problem behavior. The questionnaire generates a total problem-score, two broadband factors (i.e., externalizing and internalizing behavioral problems) and seven narrow band factors (i.e., emotionally reactive, anxious depressed, somatic complaints, withdrawn, sleep problems, attention problems, and aggressive behavior). Only the externalizing problems factor was used in the present study. Internal consistency in this sample was .85 for externalizing problems.

To assess children's negative emotionality (i.e., tendency to react to stressors emotionally) and effortful control (i.e., self-regulatory mechanisms of attention, activity, and inhibitory control), the mother completed the Dutch version of the Short Form of Rothbart's temperament questionnaire: the Early Childhood Behavior Questionnaire (ECBQ; Putnam & Rothbart, 2006). The items are phrased in the form of questions about the child's behavior in a given context (e.g., 'While having trouble completing a task [e.g., building, drawing, dressing], how often did your child get easily irritated?') and can be rated on a 7-point Likert scale ranging from 1 (never) to 7 (always). The Short Form of the ECBQ assesses the three broad dimensions of temperament: Negative affectivity or emotionality (discomfort, sadness, fear, anger-frustration, and soothability), Surgency (high-intensity pleasure, activity level, impulsivity and approach positive anticipation), and Effortful control (low-intensity pleasure, inhibitory control, perceptual sensitivity, and attentional control). Higher scores indicate higher levels of negative emotionality and surgency, and better effortful control. For the present study only the subscales Negative emotionality and Effortful control were used. Adequate internal consistency has been demonstrated for all scales (Putnam, Gartstein, & Rothbart, 2006). Internal consistency in this sample was .77 for Effortful control and .83 for Negative emotionality.

Language development was also assessed as it has been related to both maternal mentalizing and externalizing behavioral problems in young children in the past (Girard et al., 2014; Laranjo & Bernier, 2013; Petersen et al., 2013). The Reynell Developmental Language Scales (RDLS) were used to evaluate receptive language skills (Reynell, 1985). On the RDLS, children were asked to identify an array of objects and pictures (e.g., "Where is the ball?"). The RDLS yields receptive vocabulary age that can be converted into receptive language quotients. This instrument is appropriate for age range 1-7 years. The subtest word development of the Schlichting Expressive Language Test (SELT) was used to assess expressive vocabulary skills by asking the child to name objects or pictures. This subtest has good internal consistency (Schlichting, Van Eldik, Lutje Spelberg, Van der Meulen, & Van der Meulen, 1995). Raw scores were used in statistical analyses.

Data-analyses

All variables were examined for outliers and violations of specific assumptions applying to the statistical tests used. To test for the presence of multiple RF-dimensions on the PI and PDI, we entered all item scores per interview in a principle components factor analysis (PCA) and used a Scree-Test (Cattell, 1965) to determine the point where eigenvalues leveled off. Next, using an orthogonal Varimax rotation, we examined factor loadings for each variable. Based on our sample size, only factor loadings with an absolute value greater than .40 were interpreted (Stevens, 1992). Pearson *r* bivariate correlations (two-tailed) were conducted to test associations between maternal reflective functioning and children's externalizing problems, physical aggression, and temperament, and to identify potential confounding factors. All analyses were conducted using the Statistical Package for Social Sciences (SPSS for Windows, version 21.0, SPSS Inc., Chicago, IL).

Results

Descriptives

Demographic and obstetric characteristics of the sample are presented in Table 1. Prenatal RF levels ranged from 2 (inexplicit references to mental states) to 7 (marked RF), with an average of 4.04 (rudimentary RF, *SD* = 1.02). Postnatal RF levels ranged from 2 to 8 (on the way to exceptional RF), with an average of 4.32 (*SD* = 0.99). On average, RF increased 0.27 point (*SD* = 1.12) over time (range -3 to 3); $t(122) = 2.73$, $p < .005$.

Reflective functioning dimensions

The preliminary tests indicated that the data of the PI were suitable for factor analysis, KMO = .85, Bartlett's test of Sphericity = 440.06, $p < .001$. Results of the Scree-Test for the PI (prenatal RF) showed that a two-factor solution best fit the data. Results of the orthogonal Varimax rotation showed substantive loadings (i.e., ≥ .41) of "self-focused" RF-items on Factor 1 (eigenvalue = 5.10), and "child-focused" items on Factor 2 (eigenvalue = 1.51; see Table 2). Internal consistency for the seven self-focused items was .78 and for the six child-focused items this was .71. Pearson *r* correlation coefficient for the two factors was .55 ($p < .001$), indicating that the dimensions were related but distinct.

For the PDI (postnatal RF), examination of the scree plot indicated that a three-factor solution was the best fit for the data. The preliminary tests indicated that the data were suitable for factor analysis, KMO = .73, Bartlett's test of Sphericity = 301.94, $p < .001$. Results of the orthogonal Varimax rotation showed substantive loadings (i.e., ≥ .42) of "self-focused" RF-items on Factor 1 (eigenvalue = 4.05), "mother-child relationship"-focused RF-items on Factor 2 (eigenvalue = 1.42), and "child-focused" RF-items on Factor 3 (eigenvalue = 1.23; see Table 3). Internal consistency was .68 for the five self-focused items, .59 for the three mother-child relation items, and .50 for the thee child-focused items. Pearson *r* correlation coefficients for the three factors were between .42 and .47 ($p < .001$), indicating that the constructs were related but distinct. For further correlations between prenatal, postnatal, and pre- and postnatal dimensional and total scores, please see Table 4.

Table 2. Results of factor analysis[a] for reflective functioning coded from the Pregnancy Interview (N = 123).

	Factor Loading[b]	
Item	F_1	F_2
% variance	30.02	8.92
Mentalization: self		
What changes have you made in your daily activities since your pregnancy? How do you feel about doing these things differently?	**.70**	.04
Describe the father of the baby's reaction when he found out you were pregnant (including mother's feeling about reaction)*.	**.67**	.11
Describe your family's reaction when they found out about your pregnancy (including mother's feeling about reaction)*.	**.64**	.30
What are some of the good feelings you've had during your pregnancy?	**.41**	.34
Have you had any hard/difficult feelings during your pregnancy?	**.67**	.27
Have you had any worries about the baby?	**.64**	.07
Considering the first six months of your baby's life, when do you imagine you'll be the happiest?	**.48**	.22
Mentalization: child		
When would you say you first believed there was a baby growing inside of you?	-.01	**.55**
Would you say you have a relationship with the baby now?	.14	**.51**
What will your baby need from you after it's born?	.14	**.61**
What kind of person do you imagine your baby's going to be?	.08	**.51**
What do you imagine to be the hardest time of the first six months of your baby's life?	.39	**.51**
Who's going to help you take care of the baby after it's born?	.20	**.76**

Note: Only the items that loaded high on either one of the factors are shown, [a]Two-factor solution, Varimax rotation. [b]Factor loadings ≥ .40 were considered to be high, * = mothers are always asked about their own feelings about this as well, unless they already spontaneously answered this (sub)question, by the following probes: How did you feel about the reaction? Why do you think he/they reacted that way?

Table 3. Results of factor analysis[a] for reflective functioning coded from the Parent Development Interview (N = 123).

	Factor Loading[b]		
Item	F_1	F_2	F_3
% variance	26.97	9.44	8.19
Mentalization: self			
Have you ever felt angry as a parent?	**.60**	.30	.37
Have you ever felt needy as a parent?	**.80**	-.04	.07
Tell me about a time in the last week or two when you felt guilty as a parent.	**.42**	.35	.38
How has having your child changed you?	**.53**	.41	-.27
How do you want to be like and unlike your mother/father as a parent?	**.65**	.04	.09
Mentalization: relation			
Tell me about a recent time when you and your child really clicked. [How did you feel? How do you think child felt?]*	.04	**.85**	.08
Tell me about a recent time when you and your child weren't clicking. [How did you feel? How do you think child felt?]*	.37	**.44**	.31
How do you think your relationship with your child is affecting his/her development or personality?	.05	**.68**	-.01
Mentalization: child			
Has your child ever felt rejected?	.02	.14	**.51**
When your child is upset, what does he/she do?	.39	.14	**.58**
Describe a recent time when you and your child were separated. [What kind of effect did it have on the child?]#	.05	-.01	**.82**

Note: Only the items that loaded high on either one of the factors are shown, [a]Three-factor solution, Varimax rotation. [b]Factor loadings ≥ .40 were considered to be high, * = example of probe only to use if the question has not been answered, # = standard probe that must be asked.

Maternal reflective functioning and child behavior

Table 4 shows correlations between RF-scores and child temperament and behavior scores. Prenatal total RF was negatively associated with child physical aggression, indicating that mothers with higher prenatal RF-skills reported less child physical aggression 20 month post-partum. Higher self-focused postnatal RF was positively associated with externalizing problems and negative emotionality in the child. Higher postnatal relation-focused RF was linked to less reported child physical aggression.

To identify potential confounding factors, Pearson *r* bivariate correlations and t-tests were conducted to examine associations between maternal (e.g., age, education and income) and child factors (e.g., child age, gender, and language development) on the one hand, and reflective functioning, child temperament, externalizing problems, and physical aggression on the other. Although on a number of occasions significant associations were observed, these never concerned both the exact RF- and child outcome variables that were related in the first place, thus excluding the necessity to perform partial correlations. For example maternal age was positively related to prenatal total RF ($r = .30$, $p < .005$) and lower levels of children's negative emotionality ($r = -.28$, $p < .005$), but prenatal total RF was not significantly related to negative emotionality (only to physical aggression, which, in turn, was not significantly related to maternal age). Similarly, higher educated mothers had higher prenatal total RF ($r = .47$, $p < .001$) and higher relation-focused postnatal RF ($r = .28$, $p < .005$). They also reported less negative emotionality ($r = -.21$, $p < .05$) (and more effortful control ($r = .19$, $p < .05$)) in their children. However, the RF-dimensions associated with maternal education were not significantly related to negative emotionality (only to physical aggression, which, in turn, was not significantly related to maternal education). When partial correlations were performed anyway, despite not meeting the conditions for such statistical analyses, associations observed between RF-dimensions and child outcomes remained significant.

Table 4. Associations between maternal reflective functioning and children's externalizing behavior and temperament.

		1	2	3	4	5	6	7	8	9	10
1.	Prenatal RF	-									
2.	Postnatal RF	.38***	-								
3.	Prenatal self-focused RF	.02	.02	-							
4.	Prenatal child-focused RF	-.01	-.11	.55***	-						
5.	Postnatal self-focused RF	.15^{+}	.28**	.05	.11	-					
6.	Postnatal child-focused RF	.16^{+}	.14	.21*	.27**	.46***	-				
7.	Postnatal relation-focused RF	.13	.20*	.19*	.14	.47***	.42***	-			
8.	Physical aggression	-.21*	-.03	.04	.01	-.04	.11	-.18*	-		
9.	Externalizing problems	-.10	.17^{+}	.06	-.03	.19*	.08	-.02	.61***	-	
10.	Negative emotionality	-.11	.05	.12	-.04	.19*	.12	.02	.41***	.45***	-
11.	Effortful control	.02	-.10	.03	-.04	.04	-.01	.17^{+}	-.14	-.31***	-.24**

Note. Pearson correlation coefficients (two-tailed), N = 123, ***$p < .001$, **$p < .01$; *$p < .05$, $^{+}p < .1$, RF = reflective functioning.

Discussion

The goal of the present study was to investigate maternal prenatal and postnatal reflective functioning as multidimensional constructs, and to examine whether the observed dimensions of RF were differentially associated with 20-month-old children's temperament and externalizing behavior. Two related but distinct dimensions were found for prenatal RF, termed self-focused and child-focused mentalization. Three dimensions were observed for postnatal RF: self-focused, child-focused, and (mother-child) relation-focused mentalization. For prenatal RF, higher total prenatal RF-skills were related to lower reported levels of child physical aggression 20 months post-partum. Furthermore, higher levels of postnatal self-focused RF were related to more externalizing problems and more negative emotionality in the children. Better relation-focused RF was linked with less child physical aggression.

Maternal (total) RF over time

In general, maternal RF improved over time. This might to some degree be a function of normal development, as similar results have been identified by others using relatively young mothers and a comparable timespan between pre- and postnatal assessment of RF (Sadler et al., 2013). Apparently maternal RF develops as the mother grows more into the maternal role, becomes more experienced with her infant, and mother and child get to know each other better (Fonagy, Steele, Steele, Moran, & Higgitt, 1991). Supporting this claim, Poznansky (2010) found that as the infant became gradually more known to the mother, RF-levels increased between 10 and 28 months post-partum. It would be interesting to investigate in more detail whether parental RF-levels vary as a function of the child's developmental stage. For instance, parental RF may become easier with time, as children become more aware of their own mental states and will be better equipped to communicate more clearly about them to their parents, especially with developing language abilities. The fact that prenatal and postnatal (total) RF were only moderately related suggests that maternal RF-levels are definitely susceptible to change.

Components of maternal RF

Regarding the dimensionality of maternal RF, our results were, in part, as expected, with for example, a similar distinction for prenatal RF (child-focused versus self-focused RF) as was observed before for postnatal RF. For postnatal maternal RF, besides the child-focused and

self-focused dimension, an extra relation-focused RF-dimension (i.e., mentalization about how dynamics in mental processes influence interpersonal interaction and behavior) was identified. Although both termed "child-focused RF", the association between prenatal and postnatal child-focused RF was moderate, which seems indicative of the changeable nature of RF. There is evidence showing that women start viewing their unborn children as different individuals from themselves and that they form clear and distinct representations of both themselves as mothers and their infants by the third trimester of pregnancy (Ammaniti et al., 1992; Darvill, Skirton, & Farrand, 2010), but prenatal child-focused RF may for the larger part still differ from postnatal child-focused RF.

Based on the components that generally feature in theoretical descriptions of parental RF (see also Introduction), a three-dimensional structure for postnatal RF seems feasible. In the definitions of mentalizing, especially maternal RF, a great emphasis is placed on the dynamics in mental states and their influence on interpersonal interactions and behavior, and on the fact that parental RF consists of mental representations about relationships. These aspects might be specifically important in infancy and early childhood when the child is dependent on its parents for survival. Furthermore, the fact that the PI asks the mother to describe a relationship which does not yet have a basis in concrete reality, and the PDI refers to a current, ongoing relationship with the child, might be a possible explanation for the discrepancy in observed factor structure for both instruments.

The relation-component observed in postnatal RF may be specific to the mother–child relation or might also be observed in different types of relationships (e.g., with partners/parents/others). Similarly, it would be interesting to examine whether child-focused RF is specific for the mother-child relationship or that the ability to mentalize for the child can be indicative of a more general tendency towards greater reflectiveness for others, i.e., a more general other-focused RF-component. It has been suggested that, at least in part, RF and related constructs such as mind-mindedness (MM) are relation-specific (Luyten & Fonagy, 2014). For example, Meins, Fernyhough, Arnott, and Wilson (2006) found no relation between mothers' MM with their own infants and their tendency to attribute mindful intention to the behaviors of unknown infants. Mothers were only mind–minded when interpreting the behaviors of an infant with whom they had formed a relationship. The lack of significant concordance in MM between partners in study of Arnott and Meins (2007) provides further support for the argument that parental mentalizing is a relationship–specific construct.

In contrast to pre- and postnatal child-focused RF, the self-focused factors were not related. It is possible that self-focused RF in particular is influenced by the transition from pregnancy to becoming a mother, which would make this construct more sensitive to change. The perinatal period has been associated with major mental changes including a redefinition of the self, redefining relationships, redefining professional goals, and envisioning the baby (Laney, Hall, Anderson, & Willingham, 2015; Sadler, Novick, & Meadows-Oliver, in press; Sethi, 1995). It is also possible that postnatally self-focused RF remains more stable again. However, more longitudinal studies into parental RF are required to examine this in more detail.

As is clear from the above, the labeling of different dimensions of prenatal and postnatal RF remains, to some extent, speculative. In order to further improve (clarity about) the measurement potential of the PI- and PDI-interviews, some methodological issues may be considered. Originally the PI and PDI were developed in such a way as to ask for child- and self-mentalization to an even extent. In the current versions of the PI-R and PDI-R2S this does not yet appear to be the case. For example, the 'changes'-question of the PI-R (What changes have you made in how active you are…. for example in what you eat, and how much you exercise? Have there been any changes in how you are sleeping? How do you feel about doing these things differently) does not necessarily involve child-mentalization (at least not to the same degree as it asks for self-mentalization). The PDI-R2S has questions that more explicitly involve child-focused RF (such as: 'Does your child ever feel rejected?'), while others seem much more likely to elicit self-focused RF (for example: 'What gives you the most joy/pain or difficulty in being a parent?'), and there are also questions that explicitly ask for both self- and child-mentalization (such as: 'Tell me about a time in the last week or two when you felt really angry/guilty as a parent. Probe, if necessary: What kinds of situations make you feel this way? How do you handle your angry/guilty feelings? What kind of effect do these feelings have on your child?'). However, of those questions only the 'separation' question ('Think of a time you and your child weren't together, when you were separated. Can you describe it to me? Probe: What kind of effect did it have on the child? What kind of effect did it have on you?') is coded separately for mother and child. In order to be truly able to achieve equal measurement of self- and child-focused RF, some minor adjustments to the interviews may be required.

Maternal RF and children's externalizing behavior and temperament

We also examined whether the maternal RF-dimensions were differentially associated with 20-month-olds' temperament and externalizing behavior. For prenatal RF, the total score was related to child physical aggression, while the separate prenatal RF-components were not associated with child effortful control, negative emotionality, or externalizing problems. This might simply indicate that associations between total prenatal RF-score and behavior outcomes are stronger or more robust because of more restricted ranges in the separate prenatal RF-dimensions (ranges were 3.00 for child-focused prenatal RF and 3.43 for self-focused prenatal RF, versus 5.00 for total prenatal RF).

For postnatal maternal mentalizing, higher levels of self-focused RF were related to more reported negative emotionality and externalizing problems in the child. This is not the first study that found that (aspects of) parental RF can also be negatively linked to children's behavior For example, better parental RF has been associated with more internalizing problems and less positive self-perception among adolescents (Benbassat & Priel, 2012). As expected, higher levels of relation-focused maternal RF were linked with less reported child physical aggression. This seems to indicate that for postnatal mentalizing different maternal RF-components are differentially linked to child temperament and externalizing behavior.

The PDI items loading on relation-focused RF-factor ask the mother to reflect on situations that are less emotionally-salient compared to those loading on the self-focused RF-dimension. RF in these instances can be considered more implicit and subconscious (Allen, Fonagy, & Bateman, 2008). The PDI questions loading on the self-focused RF-factor ask the mother to reflect about painful or difficult emotions. This might make self-focused RF more difficult, as it can be characterized as a process requiring explicit and conscious analysis (Allen et al., 2008).

Although a certain level of self-reflectiveness is generally considered to be a good quality, there might also be less desirable consequences (Farber, 1989). The self-absorption paradox, for example, states that self-consciousness may improve the accuracy of self-knowledge at the cost of psychological distress (Trapnell & Campbell, 1999). Higher levels of postnatal self-focused RF may indicate that these mothers are working harder than mothers with lower self-focused RF to control their internal mental processes. Higher self-mentalization has also been linked with depression in substance abusing mothers, suggesting a possible self-absorbent component of self-mentalization (Borelli et al., 2012; Suchman et al., 2010). To speculate a bit more, it could be that because of this the more self-focused mothers might be less patient and therefore more inclined to report their child as

being 'difficult' (i.e., more negative emotionality and externalizing problems). The fact that higher levels of mind-mindedness (an operationalization of maternal mentalizing) have been negatively linked with mothers' perceptions of their child being difficult and that negative maternal preconceptions predict child difficult temperament (Kiang, Moreno, & Robinson, 2004) seem to partially support this claim (Demers, Bernier, Tarabulsy, & Provost, 2010).

Otherwise, children of more self-absorbed mothers might also exhibit more externalizing behavior to try and regain their mother's attention or as a result of less adequate self-regulatory skills (Ha et al., 2011; Sharp & Fonagy, 2008). Subsequently, because their children show more negative emotionality and externalizing problems perhaps this could trigger these mothers to engage in more postnatal self-mentalization.

Results for relation-focused RF were more in line with what would intuitively be expected: more relation-focused reflecting mothers reported lower levels of physical aggression in their 20-month-olds. Given that the interaction between children and their parents is ongoing and dynamic, it would make sense that reflection of the mother on her impact on the child and an awareness of the bidirectional influences, especially as the child matures, play an important role in child behavioral development. One might speculate that more adequate maternal relation-focused RF will enhance mother–child interaction, thereby enabling the child to develop self-regulatory abilities associated with fewer behavioral problems (Sharp & Fonagy, 2008).

Another worthwhile topic for future investigations into multidimensionality of RF and potentially differential associations with child outcomes would be to compare RF in controlled contexts (e.g., structured interview) and RF in uncontrolled situations (e.g., interaction with the child) (see also Luyten and Fonagy (2014)). Possibly, maternal RF during more challenging contexts is especially important for child socio-behavioral development.

Strengths and limitations

Strengths of the current study are the low attrition rate, its longitudinal nature, and the heterogeneous non-clinical sample. The use of gold-standard, time-intensive instruments for assessing maternal RF adds to the reliability of our findings. Furthermore, the measurement of maternal RF to date has largely been limited to one single dimensional scale. This is one of the first studies to not only investigate both prenatal and postnatal

maternal RF as multidimensional constructs, but also the first to relate the RF-dimensions to children's temperament and externalizing behavior.

This study has several limitations as well. First, mothers who discontinued study participation were more poorly educated and had lower family incomes. This may have resulted in the loss of some more extreme cases. Second, our sample consisted of fairly young, predominantly Caucasian women with a relatively high rate of unplanned pregnancy which might limit generalizability of results. Also, Borelli et al. (2016) found that child-focused RF differed across ethnic/racial groups for primary caregivers of school-aged children. Third, we used maternal report to assess children's externalizing behavior and temperament. The use of multiple informants (e.g., partners or co-parents) or direct observation of child externalizing behavior or temperament would strengthen the findings further.

Finally, the PI-R and PDI-R2 differ in the degree to which they call for explicit mentalization: while the PI-R only consists of demand questions, the PDI-R2 consists of both permit and demand questions. Demand questions 'demand' that the parent demonstrates the RF-ability, whereas permit questions 'permit' the parent to display the RF-capacity, but do not explicitly ask the use of mental state language (Fonagy et al., 1998). Furthermore, the PI-R explicitly asks about positive and negative emotions and more 'neutral' situations, while the PDI-R2 questions focus on difficult emotions and more emotional-laden situations (for example separations). Further refinement of the PI and PDI in which demand and permit questions and positive and negative emotions are balanced, and where self-focused and child-focused (as well as relation-focused) RF receive equal explicit attention, seems desirable.

Implications and conclusion

The results of the study emphasize the importance of acknowledging maternal RF as a complex, multidimensional construct. More research investigating the multiple dimensions of maternal mentalizing (e.g., self-focused versus child-focused versus relation-focused, implicit versus explicit, automatic versus intentional), especially in relation to parent-child interactions and children's behavioral development is warranted.

Our study also provides further support for the notion that maternal RF is important for early child temperament and externalizing behavior (Sharp & Fonagy, 2008; Slade, 2005; Smaling et al., 2016). Especially considering the fact that a difficult temperament (higher negative emotionality and reduced regulatory abilities) in early childhood has been linked

to disruptive behavior problems later in life (Calkins & Fox, 2002; Eisenberg et al., 2009; Moffitt & Caspi, 2001; Suurland et al., 2015). The associations between maternal reports of children's temperament and externalizing behavior, and maternal RF also lend support to parenting programs with a focus on the parents' understanding of their child's mental states and how these mental states impact behavior. The prevention of child externalizing behavioral problems in (very) early childhood may help to reduce the cascading effects of these behavior problems later in life.

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Chapter 7

General Discussion and Summary

High levels of physical aggression during early childhood increase the chances of following persistent high disruptive behavioral trajectories throughout later childhood, adolescence and even adulthood (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Moffitt, Caspi, Harrington, & Milne, 2002). Therefore, timely intervention and prevention efforts are vital. To be able to confront the problem of aggression, it is crucial to study potentially malleable factors that may account for the initial manifestation and continuation of such behavior. This thesis focused on one such factor, parental reflective functioning, which has been associated with children's externalizing behavior (Benbassat & Priel, 2012; Ha et al., 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013) and can be considered a trainable ability (Katznelson, 2014).

The role of parental mentalizing or reflective functioning (RF) in children's socio-behavioral development has received increased attention in recent years. Parental RF can be regarded as the parents' capacity to make sense of their own and their child's mental states (i.e., feelings, emotions, intentions, needs) and to use this understanding to guide their responses to the child (Slade, 2005; Slade, Sadler, & Mayes, 2005). Maternal RF starts to develop during pregnancy and is predictive of postnatal maternal RF (Arnott & Meins, 2007, 2008; Steele & Steele, 2008). Parental RF has been related to various aspects of children's socio-behavioral development, for example behavioral regulation skills (Heron-Delaney et al., 2016; Suchman, DeCoste, Castiglioni, Legow, & Mayes, 2008; Suchman, DeCoste, & Mayes, 2009), and mentalization- or RF-abilities in children (Ensink, Bégin, Normandin, & Fonagy, 2016; Laranjo, Bernier, Meins, & Carlson, 2010; Meins & Fernyhough, 1999; Meins et al., 2003) and adolescents (Benbassat & Priel, 2012). Inadequate or lack of parental RF has been associated with children's behavioral problems (Benbassat & Priel, 2012; Ensink et al., 2016; Ha, Sharp, & Goodyer, 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013; Sharp, Fonagy, & Goodyer, 2006). So far, most studies linking parental RF to children's socio-behavioral development have focused on postnatal maternal RF. The first main contribution of the studies presented in this thesis is the focus on prenatal maternal RF, as well as postnatal maternal RF. For this thesis, potential associations between pre- and postnatal maternal RF and children's externalizing behavior were (re-)examined focusing on very young children from diverse socio-economic backgrounds.

Children growing up in families struggling with multiple complex problems have an increased risk of developing behavioral problems (Cabaj, McDonald, & Tough, 2014; Côté et al., 2006; Hay et al., 2011; Huijbregts, Séguin, Zoccolillo, Boivin, & Tremblay, 2008). The

fact that parental RF is often compromised in high-risk parents (Pajulo et al., 2012; Schechter et al., 2005; Suchman, DeCoste, Castiglioni, et al., 2010) in combination with the association between parental RF and children's externalizing behavioral problems, make parental RF a potentially interesting target for interventions aiming to prevent or reduce children's externalizing behavioral problems, like aggression. The second main contribution of the studies presented in this thesis is the in-depth investigation of multiple risk factors (combined and individually) in relation to maternal RF.

Violent or aggressive behavior not only raises major public health concerns and increased costs to society (Krug, Mercy, Dahlberg, & Zwi, 2002), it also has detrimental effects on the child, its development, and its family (Côté et al., 2006; Campbell, Spieker, Burchinal, Poe, & NICHD Early Child Care Research Network, 2006; NICHD Early Child Care Research Network, 2004). In toddlerhood, a subgroup of aggressive 'early-starter' children can already be identified. These children continue to show the most persistent and serious forms of aggression later in life (Aguilar, Sroufe, Egeland, & Carlson, 2000; Moffitt et al., 2002). With interventions aiming to reduce aggression being more effective when offered at a younger age (Hermanns, Ory, & Schrijvers, 2005), the importance of understanding how aggression unfolds at the earliest possible stages is further underlined. With its associations to children's socio-behavioral problems (Ha et al., 2011; Walker, Wheatcroft, & Camic, 2011), parental RF might be valuable in managing childhood aggression. Therefore, it seems important to investigate the role of maternal RF in the development of child physical aggression. The fact the maternal prenatal RF was examined in relation to child physical aggression and that child physical aggression was investigated from 6 months postpartum and onwards may be considered another important contribution of the studies presented in this thesis.

The mechanisms by which parental RF impact children's socio-behavioral development are still largely unknown. It was hypothesized that the (potential) link between parental RF and children's socio-behavioral development (particularly physical aggression) would be mediated and/or moderated by parenting behavior. Parental RF has been linked to more sensitive and adequate parenting behavior (Grienenberger, Kelly, & Slade, 2005; Huth-Bocks, Muzik, Beeghly, Earls, & Stacks, 2014; Slade, Belsky, Aber, & Phelps, 1999; Stacks et al., 2014). Inadequate parenting behavior and inadequate parental RF have both been associated with children's behavioral problems (Edwards & Hans, 2015; Feng, Shaw, & Silk, 2008; Healy, Murray, Cooper, Hughes, & Halligan, 2013; Hughes & Ensor, 2006; Keren & Tyano, 2012). Hence, parental RF may (partially) influence children's behavioral problems

through parenting behavior. The effects of parental RF may also be more pronounced when it is adequately translated into behavior and interactions with the child. As there were no studies available that investigated the potential moderator and/or mediator effects of parenting in the link between parental RF and children's behavioral problems, this may therefore be considered another distinctive contribution of the studies presented in this thesis.

To summarize, the main aims of this thesis were to investigate the effects of maternal RF on the development of (precursors of) behavioral problems – in particular aggression - from infancy onwards, and to examine whether potential effects of maternal RF on child aggression could be explained by parenting behavior. **Chapter 1** provides a more elaborate description of the background and aims of this thesis.

Main findings

The studies in this thesis are part of the Mother-Infant Neurodevelopment Study (*MINDS*) – Leiden. *MINDS* – Leiden aims to determine (1) which neurobiological, neurocognitive and social-environmental factors predict (directly, indirectly or in interaction) emotional and behavioral problems – specifically aggression – in early infancy, (2) the effects of an intensive RF-based home-visiting program for high-risk mothers on neurobiological, neurocognitive, emotional and behavioral development in children, and (3) which factors predict variation in effects of the home-visiting program on child emotional and behavioral outcomes. *MINDS* – Leiden was designed as a longitudinal randomized control trial. All participating families were being followed over a period of approximately four years, consisting of six assessment waves (the first assessment took place in the third trimester of pregnancy and the last assessment took place when the children were 3.5 - 4 years of age). A total of 128 low-risk and 147 high-risk families were included in the study. Based on elaborate screening for the presence of the following eight predefined risk factors during the first prenatal home visit, classification into high- and low-risk groups was achieved (World Health Organization, 2005, 2016): 1) positive screening on current psychiatric disorder(s) or substance use (alcohol, tobacco and/or drugs) during pregnancy; or 2) presence of two or more of the following risk factors: single status (biological father not involved), unemployment, financial problems, no secondary education, limited social support network (<4 individuals listed in network), and young maternal age (<20 years). In case only one risk factor was present - other than an indication for current psychiatric disorder(s) or substance use - women were discussed in a clinical expert meeting to determine whether

placement in the high-risk group was appropriate (n = 6). High-risk families were randomly assigned to the intervention (n = 65) or high-risk control group (n = 82). Demographic and mental health characteristics of the low-risk and high-risk groups were presented in **Chapter 2**. This chapter also described the design of *MINDS* – Leiden, the measures used, and the intervention program. Furthermore, this study may yield insights into effective, targeted, and tailor-made components of prevention programs, ultimately reducing the psychological and economic costs of mental health problems to society.

Chapter 3 describes the results of a comparison between first-time high-risk (HR) and low-risk (LR) mothers-to-be on prenatal RF and which psychosocial and environmental risk factors for the HR-women were specifically linked to prenatal RF. The sample consisted of 162 women (83 classified as HR). During the third trimester of pregnancy, maternal prenatal RF was assessed using the Pregnancy Interview – Revised (PI-R; Slade, 2007a), while risk factors were measured using a semi-structured psychiatric interview and various questionnaires. HR-women demonstrated lower prenatal RF-skills compared to LR-women. This finding was later replicated with a larger sample when the data collection for the first assessment wave of *MINDS* – Leiden was completed (see **Chapter 2**). Maternal education, size of social support network, and substance use during pregnancy were most strongly associated with maternal prenatal RF. HR-women appear to have a limited RF-capacity: the way they perceive and respond to information related to the upcoming motherhood and their future baby may have negative consequences for mother and child. Enhancing maternal prenatal RF may be an effective way to improve the mother's representations of her unborn child and their developing relationship, thereby easing the transition to motherhood.

The goals of the study described in **Chapter 4** were to examine whether maternal prenatal RF was related to postnatal maternal behavior in first-time mothers and their six-month-old infants during challenging (two teaching tasks and reengagement after stressor) and non-challenging tasks (a free play task with toys and a free play task without toys), and to what extent quality of maternal prenatal RF accounted for the negative impact of accumulated risk (defined as a sum-score of risk factors assessed prenatally) on maternal behavior. Mother-infant dyads (N = 133) were observed during free play, two teaching tasks, and the 'play' and 'reunion' or 'reengagement' episodes of the Still-Face Paradigm (SFP; Tronick, Als, Adamson, Wise, & Brazelton, 1978). Higher maternal prenatal RF was associated with more sensitivity and positive engagement during all tasks, and less

intrusiveness and internalizing-helplessness behavior during the teaching tasks and SFP-reengagement. Accumulated risk and maternal prenatal RF predicted shared variance in maternal behavior, although a few unique predictive effects were also observed for prenatal RF and for accumulated risk (depending on the task). Accumulated risk had an indirect effect on sensitivity during the teaching tasks and SFP-play through prenatal RF. These findings suggest not only that RF may be targeted prenatally in order to improve mother-infant interactions, but also that enhancing RF-skills may ameliorate some of the negative consequences from some more stable perinatal risk factors that influence parent-child interactions.

The study described in **Chapter 5** examined whether maternal prenatal RF predicted the development of infant physical aggression and whether maternal sensitivity and/or intrusiveness mediated or moderated this association. A total of 96 mother-infant dyads were included in the study. Maternal prenatal RF was measured with the PI-R (Slade, 2007a) around 27 gestational weeks, maternal behavior was observed during free play at 6 months postpartum, and infant physical aggression was assessed at 6, 12, and 20 months using maternal reports. In general, poor maternal prenatal RF was related to relatively high levels of reported infant physical aggression. Moderating effects were observed for maternal behavior: higher prenatal RF was particularly associated with lower levels of reported infant physical aggression among mothers who showed no or low signs of intrusiveness. However, for mothers who showed some intrusiveness in interaction with their infant, prenatal RF-level seemed to have little effect on reported infant physical aggression. Generally, mothers reported an increase in infant physical aggression between 6 and 12 months, except when they had both low maternal RF-skills and were relatively less sensitive. The results indicated that maternal prenatal RF is associated with (development of) infant physical aggression, and therefore it may be targeted in intervention programs aimed at reducing early physical aggression. Furthermore, the findings suggested that associations between maternal RF and children's socio-behavioral development should not be studied in isolation, as factors such as parenting behavior (but probably other factors as well) may have moderating effects.

In **Chapter 6**, the results of a study are described which investigated whether both maternal prenatal and postnatal RF can be regarded as a multidimensional construct, and if so, whether these RF-dimensions were differentially associated with children's temperament and externalizing behavior at 20 months postpartum. Prenatal and postnatal RF were assessed using the PI-R (Slade, 2007a) and Parent Development Interview Revised - short version (PDI-R2; Slade et al., 2003), while children's temperament and externalizing

behavior were measured with questionnaires filled out by the mother. The sample consisted of 123 first-time mothers and their 20-month-olds. Two dimensions were found for maternal prenatal RF, termed self-focused (maternal ability to mentalize about her own emotions and behaviors) and child-focused mentalization (maternal capacity to mentalize about her child's mental states and behavior). Three dimensions were observed for maternal postnatal RF, which were named relation-focused (mentalization about how dynamics in mental processes influence interpersonal interaction and behavior), self-focused, and child-focused mentalization. Prenatal total RF was negatively related to reported child physical aggression. Postnatal self-focused RF was positively associated with children's externalizing behavior and negative emotionality, while relation-focused RF was negatively associated with child physical aggression. The results indicated that it is important to look at specific RF-dimensions when examining the effects of maternal RF on children's behavioral development. Suggestions were made to further improve the measurement of maternal RF as a multidimensional construct.

Clinical implications

The results of our studies may have implications for clinical and more specific preventive practices. First of all, maternal RF seems an interesting candidate for incorporation in prevention and intervention programs aimed at reducing children's externalizing behavioral problems. Improvement of parental RF may stimulate adequate parenting behaviors and (subsequently) could reduce the chances of children developing behavioral problems. Improving parental prenatal RF may be especially interesting as this could ameliorate some of the negative consequences of more stable and/or less changeable perinatal risk factors.

RF-based parenting programs have been shown to generate positive effects on parental RF and parenting behavior in high-risk samples (Katznelson, 2014; Miller, 2008; Pajulo et al., 2012; Sadler et al., 2013; Sleed, Baradon, & Fonagy, 2013; Suchman, DeCoste, Castiglioni, et al., 2010). The primary aim of any RF-based program must be the development of a reflective stance in parents (Slade, 2007b). This would enable them to become more sensitive, regulating, and autonomy-promoting parents, ultimately resulting in positive effects on a range of developmental outcomes in the child (Ordway, Sadler, Dixon, Close, et al., 2014; Sadler et al., 2013; Sadler, Slade, & Mayes, 2006; Slade et al., 2005). There are various strategies to improve parental RF to help high-risk parents obtain more reflective and cognitively mature ways of thinking about themselves, their relationships,

and their new roles as parents (Markin, 2013; Sadler, Novick, & Meadows-Oliver, in press; Sadler et al., 2013; Sadler et al., 2006). For example, clinical care and counseling may include the clinician modeling a reflective stance, naming feelings in the mother and the infant, reviewing recorded mother-infant interactions, and put the mother's or infant's emotions that might underlie behaviors into words (Sadler et al., in press; Slade, 2007b).

Second, clinicians or therapists working with pregnant high-risk women may find it useful to assess their reflective capacities. This knowledge may enable them to help the mother-to-be gain reflective abilities as she matures as a mother and to ease the transition into motherhood (Sadler et al., in press). Furthermore, adequate parental RF-skills also provide parents with a framework to help them deal with child-rearing issues (Ordway, Sadler, Dixon, & Slade, 2014; Ordway, Webb, Sadler, & Slade, 2015). We recommend that RF-based interventions should start targeting parental RF prenatally in order to improve postnatal parent-infant interactions and reduce the chances of the child developing behavioral problems.

Given the emerging evidence of the importance of parental RF in early development, innovative ideas for promoting RF in high-risk families using low-cost methods ought to be further developed. At the same time, the current instruments for assessing parental RF could be refined further and less time-intensive measures should be developed with special attention for the multidimensionality of parental RF. This will enable future intervention research to track the development of (dimensions of) parental RF over the course of the interventions and to determine the optimal timing of different components of the intervention.

Limitations, scientific implications, and directions for future research

Some of the strengths of the studies presented here include the longitudinal design starting in pregnancy, the multi-method approach (interviews, observations, and maternal reports/ questionnaires), and the use of a heterogeneous sample consisting of both low-risk and high-risk mother-child dyads. Some critical notes should also be made when interpreting the results presented in this thesis. One limitation is that we made use of questionnaires filled out by the mother to assess (precursors of) physical aggression. The use of multiple informants would have been preferable (Kerr, Lunkenheimer, & Olson, 2007), particularly considering our finding presented in **Chapter 5**, which suggested that low reflective and low sensitive mothers may be less observant of their child's behavior (i.e., they did not report the commonly observed increase in physical aggression between 6 and 12 months). Direct

observation of infant physical aggression would further strengthen the findings presented here. The scope on socio-behavioral problems should also be widened and include different types of socio-behavioral problems. It is well-known that there is high comorbidity between different types of behavioral problems and this may be particularly evident among very young children. Internalizing problems may predispose towards externalizing problems later in life (and vice versa) (August, Realmuto, MacDonald, Nugent, & Crosby, 1996; Cummings, Caporino, & Kendall, 2014; Merikangas, Nakamura, & Kessler, 2009). Greater attention is also needed regarding the impact of paternal RF on children's socio-behavioral development, especially given the increased involvement of fathers in the upbringing of children. Even more so as there is evidence that the RF-abilities and parenting skills of fathers and mothers may have differential effects on children's socio-behavioral development (Benbassat & Priel, 2012, 2015; Esbjørn et al., 2013; Stover & Kiselica, 2014).

Although the studies included in this dissertation have brought us a step closer to a better understanding of how maternal RF impacts the development of (precursors of) behavioral problems, particularly physical aggression, they have also raised various questions that may give direction to future research. For example, more knowledge is necessary about the mechanisms through which maternal RF influences the development of early behavioral problems. In this thesis the focus has been primarily on parenting behavior in this respect. Yet, the potential role of child-related and other mother-related factors, such as emotional and behavioral regulation skills (physiological and behavioral), socio-cognitive abilities, or temperament, still remains largely unknown. Bidirectional effects must also be considered more explicitly, since children also play an active role in influencing their social environments (Lengua & Kovacs, 2005; Pardini, 2008).

Studies investigating the effects of parental RF on children's outcomes are broadening their scope from child attachment security to other aspects of children's socio-behavioral development, but this research area is still in its infancy. However, interesting theories have been opted regarding various mechanisms that may also play a role in the processes by which parental RF affects child adjustment and the development of behavioral problems. For example, it has been suggested that maternal RF stimulates in the child a better understanding of its own mind and the minds of others, thereby supporting its own developing RF-ability (Sharp & Fonagy, 2008; Sharp et al., 2006). Therefore, it may be possible that poor parental RF has an indirect impact on the development of behavioral problems through a reduced mentalization ability (Theory of Mind) in the children themselves. Other aspects of cognition (e.g., executive functioning, language) and emotion

regulation skills may also be affected by poor parental RF. Future research must therefore explore potential mediators and moderators in order to better understand mechanisms and conditions under which parental RF is associated with healthy child adjustment in order to be able to optimize the socio-behavioral development of children at risk for adverse developmental outcomes. Furthermore, it is recommended that future studies examine parental RF as a multidimensional construct with potentially differential links to parenting behavior and child socio-behavioral development (Borelli, St John, Cho, & Suchman, 2016; Suchman, DeCoste, Leigh, & Borelli, 2010).

Finally, more and especially even larger longitudinal studies, preferably starting in the prenatal period, to capture factors that influence trajectories of parental RF in association with the developmental trajectories of children's cognitive, social and behavioral abilities. Such studies would also be able to identify the mutual or reciprocal influences of parental RF and child factors across time.

Conclusions

The findings of this thesis contribute to our understanding of the effect of maternal RF on children's socio-behavioral development, specifically early physical aggression. From the findings presented in the studies, we may conclude the following:

First, maternal RF plays an important role in the development of early behavioral problems, especially physical aggression. Generally, better maternal RF seems to reduce the chances of developing physical aggression in early infancy. This includes not only postnatal RF, but also maternal RF-skills during pregnancy.

Second, pregnant women struggling with multiple, complex problems have limited maternal prenatal RF-abilities. This may potentially place them at risk for showing less adequate parenting skills and postnatal parental RF. As a result, this may possibly increase the risk of their child developing externalizing behavioral problems.

Third, it is important to recognize that parental RF is a multidimensional construct, with differential associations between the RF-dimensions and children's temperament and externalizing behavior. Future studies must determine whether and how RF-dimensions are related to different aspects of children's socio-behavioral development.

Overall, our findings strongly suggest that maternal RF plays a vital role in the likelihood of developing externalizing behavioral problems, especially physical aggression, in early childhood. They also support the notion that parental RF may offer an opportunity in managing childhood aggression.

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Samenvatting

Introductie

Het terugdringen van geweld en agressie is in de afgelopen jaren in toenemende mate een maatschappelijke prioriteit geworden (Krug, Mercy, Dahlberg, & Zwi, 2002). Agressie in de vroege kindertijd vergroot de kans op latere agressieproblemen en antisociaal gedrag (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Moffitt & Caspi, 2001; Moffitt, Caspi, Harrington, & Milne, 2002). In de peutertijd is er al een groep hoog agressieve kinderen te identificeren die later in de ontwikkeling de meer persistente en ernstigere vormen van agressie en antisociaal gedrag laat zien (Aguilar, Sroufe, Egeland, & Carlson, 2000; Moffitt et al., 2002). Het is daarom belangrijk om deze groep zo vroeg mogelijk in de ontwikkeling te herkennen en de opvoeding zo mogelijk te ondersteunen om latere, mogelijk ernstige gedragsproblemen te voorkomen. Het is van belang om veranderbare factoren te identificeren die samenhangen met het ontstaan en/of de instandhouding van het probleemgedrag. Het ouderlijk mentaliserend of reflectief functionerend vermogen (RF) is in dat kader een relevant concept. Zo is een laag RF-vermogen bij ouders in verband gebracht met externaliserend probleemgedrag bij kinderen (Benbassat & Priel, 2012; Ha, Sharp, & Goodyer, 2011; Meins, Centifanti, Fernyhough, & Fishburn, 2013) en is ouderlijk RF met behulp van interventies te beïnvloeden (Katznelson, 2014).

Ouderlijk RF wordt ook wel het "gedachtenlezend vermogen" van de ouder genoemd. Hiermee wordt bedoeld dat de ouder in staat is zowel de eigen mentale staat (gedachten, wensen, behoeften, intenties, gevoelens) als die van het kind te (h)erkennen en te begrijpen en dit begrip vervolgens als leidraad voor het eigen gedrag te gebruiken (Slade, Sadler, & Mayes, 2005). Al tijdens de zwangerschap begint ouderlijk RF zich normaal gesproken bij vrouwen te ontwikkelen, waarbij de vrouw vooral in het laatste trimester van haar zwangerschap haar toekomstige kind steeds meer zal zien als een individu met ontwikkelende behoeftes, eigenschappen en temperamentkenmerken (Pajulo et al., 2015; Slade, Cohen, Sadler, & Miller, 2009). In de postnatale periode zal de reflectieve moeder in staat zijn om haar eigen mentale staat te begrijpen, evenals de mentale staat van haar kind, en zij zal snappen hoe haar eigen mentale staat zich verhoudt tot die van haar kind, en hoe deze het gedrag van haarzelf en haar kind beïnvloeden (Ordway, Webb, Sadler, & Slade, 2015). Postnataal RF is ook gerelateerd aan ouderlijk gedrag (Grienenberger, Kelly, & Slade, 2005; Huth-Bocks, Muzik, Beeghly, Earls, & Stacks, 2014; Stacks et al., 2014). Over het algemeen gaat beter ouderlijk RF samen met adequater en responsiever ouderlijk gedrag

(Demers, Bernier, Tarabulsy, & Provost, 2010; Grienenberger et al., 2005; Slade, Belsky, Aber, & Phelps, 1999).

Ouderlijk RF lijkt een belangrijke rol bij de psychosociale ontwikkeling van het kind te spelen (Benbassat & Priel, 2012; Laranjo, Bernier, Meins, & Carlson, 2010; Sharp & Fonagy, 2008). Zo is postnataal RF van de moeder positief geassocieerd met gedragsregulatie bij het kind (Heron-Delaney et al., 2016; Suchman, DeCoste, Castiglioni, Legow, & Mayes, 2008; Suchman, DeCoste, & Mayes, 2009) en mentalisatie- of RF-vaardigheden bij kinderen (Ensink, Bégin, Normandin, & Fonagy, 2016; Laranjo et al., 2010; Meins & Fernyhough, 1999; Meins et al., 2003) en adolescenten (Benbassat & Priel, 2012). Een gebrek aan of inadequaat ouderlijk RF lijkt voorspellend voor minder gunstige psychosociale uitkomsten van het kind (Sharp & Fonagy, 2008), zoals gedragsproblemen (Benbassat & Priel, 2012; Ensink et al., 2016; Ha et al., 2011; Meins et al., 2013; Sharp, Fonagy, & Goodyer, 2006).

Hoe een gebrek aan ouderlijk RF de psychosociale ontwikkeling van het kind, in het bijzonder het ontstaan van probleemgedrag, beïnvloedt is echter tot op heden nog niet duidelijk. Er zou sprake kunnen zijn van een direct effect van ouderlijk RF op de psychosociale ontwikkeling van het kind, bijvoorbeeld tussen het mentaliserend vermogen van ouder en kind (Sharp & Fonagy, 2008), waarbij erfelijke componenten een rol zouden kunnen spelen. Het zou ook kunnen zijn dat het RF-vermogen van de ouder tot uiting komt in het ouderlijk gedrag en dat het effect van ouderlijk RF op de psychosociale ontwikkeling van het kind daarom (deels) via het ouderlijk gedrag verloopt. Inadequaat ouderlijk gedrag (zoals vijandigheid, intrusiviteit en negativiteit) wordt immers ook in verband gebracht met probleemgedrag bij kinderen (Edwards & Hans, 2015; Feng, Shaw, & Silk, 2008; Healy, Murray, Cooper, Hughes, & Halligan, 2013; Hughes & Ensor, 2006; Keren & Tyano, 2012). Er is daarom meer onderzoek nodig naar de rol van ouderlijk RF op de ontwikkeling van gedragsproblemen bij het jonge kind. In het kader van preventie moet er ook meer aandacht komen voor de rol van prenataal RF, aangezien verondersteld wordt dat de basis van de moeder-kind relatie al tijdens de zwangerschap wordt gevormd en er aangenomen wordt dat prenataal RF daarom ook nauw samenhangt met postnataal RF (Arnott & Meins, 2007, 2008; Steele & Steele, 2008).

Om het ontstaan van gedragsproblemen bij kinderen beter te begrijpen, is het belangrijk om meer inzicht te krijgen in de effecten van pre- en postnataal ouderlijk RF op de psychosociale ontwikkeling van kinderen. Kinderen uit gezinnen waarbij sprake is van complexe, meervoudige problematiek (zoals psychiatrische problematiek en/of middelen-misbruik van de ouders), de zogenaamde hoog-risico gezinnen, lopen een verhoogd risico

op het ontwikkelen van gedragsproblemen (Cabaj, McDonald, & Tough, 2014; Côté et al., 2006; Hay et al., 2011; Huijbregts, Séguin, Zoccolillo, Boivin, & Tremblay, 2008). Bovendien hebben ouders die kinderen onder ongunstige omstandigheden moeten opvoeden het vaak moeilijk om hun kinderen adequate zorg te kunnen bieden. Het feit dat laag of inadequaat ouderlijk RF is gerelateerd aan gedragsproblemen bij kinderen en het feit dat ouderlijk RF in hoog-risico families vaak verminderd is (Miller, 2008; Pajulo et al., 2012; Schechter et al., 2005; Suchman et al., 2010), maken ouderlijk RF tot een mogelijk belangrijk domein voor interventies. Voorts geldt dat vroege gedragsproblemen indicatief kunnen zijn voor het ontwikkelen van latere psychopathologie (Hahn et al., 2007) en dat interventies voor gedragsproblemen het meest effectief zijn als ze zo vroeg mogelijk in de ontwikkeling worden aangeboden (Beauchaine, Neuhaus, Brenner, & Gatzke-Kopp, 2008). Dit onderstreept de noodzaak voor studies naar de effecten van pre- en postnataal RF op de ontwikkeling van gedragsproblemen in de vroege kindertijd nog verder.

Doelen en opzet van het onderzoek

Het onderzoek zoals beschreven in dit proefschrift had als doel om meer inzicht te krijgen in het effect van het reflectief functioneren van de moeder op de ontwikkeling van (voorlopers van) gedragsproblemen, in het bijzonder agressief gedrag, in de vroege kindertijd. Hiervoor zijn in totaal vier deelonderzoeken uitgevoerd. In **Hoofdstuk 1** staan de achtergrond en aanleiding voor de uitgevoerde onderzoeken in meer detail beschreven.

De studies in dit proefschrift maken deel uit van een longitudinaal onderzoek naar de neurobiologische en neurocognitieve voorspellers van vroege gedragsproblemen. In deze studie, de 'Mother-Infant Neurodevelopment Study' (*MINDS*) – Leiden ofwel 'Een Goed Begin', worden tevens de effecten onderzocht van een intensief coachingsprogramma, dat hoofdzakelijk gericht is op het verbeteren van het ouderlijk RF bij vrouwen uit een hoog-risico milieu die hun eerste kind verwachten. **Hoofdstuk 2** beschrijft de achtergrond, het design, de methodiek en de onderzoekspopulatie van *MINDS* – Leiden.

Onderzoeksbevindingen

In **Hoofdstuk 3** worden de bevindingen van een studie beschreven waarin werd onderzocht of het niveau van prenataal ouderlijk RF verschilde tussen 83 aanstaande moeders met een hoog-risico profiel (HR) en 79 aanstaande moeders met een laag-risico profiel (LR). Verder werd onderzocht welke specifieke omgevings- en/of psychosociale risicofactoren het sterkst geassocieerd waren met prenatale RF-niveau. Zwangere vrouwen met een hoog-risico profiel waren minder goed in staat tot ouderlijk RF dan zwangere vrouwen met een laag-risico profiel. Daarnaast bleek dat hoe meer risicofactoren aanwezig waren, hoe lager het prenataal RF-niveau was. Een lager opleidingsniveau, een beperkter sociaal netwerk en middelengebruik (roken, alcohol en/of drugs) tijdens de zwangerschap bleken het sterkst geassocieerd met een lager niveau van prenataal RF in HR-moeders.

In **Hoofdstuk 4** wordt een onderzoek beschreven naar de samenhang tussen prenataal ouderlijk RF van de moeder en haar gedrag in interactie met haar 6-maanden oude kind tijdens verschillende taken. Tevens is onderzocht in hoeverre de kwaliteit van het prenataal RF de invloed van de mate van psychosociaal risico (gedefinieerd als de som-score van een achttal prenataal vastgestelde risicofactoren die geassocieerd worden met een ongunstige psychosociale ontwikkeling van het kind) op het ouderlijk gedrag van moeder kon verklaren. De steekproef bestond uit 133 moeders en hun eerste kind. Prenataal ouderlijk RF is gemeten met een interview tijdens het derde trimester van de zwangerschap. Het gedrag van moeder, waarbij onderscheid is gemaakt tussen sensitiviteit (de mate waarin de moeder op een tijdige en adequate wijze op de signalen van haar kind reageert), succesvolle betrokkenheid (de mate waarin moeder in staat is om haar kind succesvol te betrekken in de interactie of het spel), intrusiviteit (hoe ruw moeder met haar kind omgaat en in hoeverre zij interfereert met de behoeftes en wensen van haar kind) en hulpeloosheid (de mate waarin moeder opgeeft haar kind te troosten of nog verder bezig probeert te houden), is geobserveerd 6 maanden postpartum tijdens vrij spel, tijdens twee leertaken, en tijdens de 'play' en 'reunion' episoden van het 'Still-Face' Paradigma (SFP; Tronick, Als, Adamson, Wise, & Brazelton, 1978). Het SFP bestaat uit drie episoden van 2 minuten waarbij het kind in de maxi cosi zit; tijdens de 'play' episode wordt moeder verzocht met haar kind te spelen (zonder speelgoed), in de daaropvolgende 'still-face' episode wordt de moeder gevraagd een neutraal gezicht te houden en niet op haar kind te reageren of hem/haar aan te raken, daarop volgt de 'reunion' episode waarin moeder weer met haar kind mag interacteren en

spelen (zonder speelgoed). Een beter ouderlijk RF-vermogen tijdens de zwangerschap ging samen met meer sensitiviteit en succesvolle betrokkenheid tijdens alle taken en met minder intrusiviteit en hulpeloosheid tijdens de meer uitdagende taken (leertaken en 'reunion' episode van SFP). De kwaliteit van prenataal ouderlijk RF bleek gedeeltelijk de negatieve invloed van psychosociaal risico op het ouderlijk gedrag van moeder te verklaren. De mate van psychosociaal risico had een indirect effect op sensitiviteit tijdens de leertaken en 'play' episode via prenataal RF. De bevindingen suggereren dat het RF-vermogen van de moeder tijdens de zwangerschap een rol speelt bij postnataal sensitief en adequaat ouderlijk gedrag. Prenataal RF lijkt daarom een interessant domein voor interventies, omdat het verbeteren van ouderlijk RF tijdens de zwangerschap mogelijk de negatieve consequenties van meer stabiele of moeilijk veranderbare risicofactoren op ouder-kind interacties kan verlichten.

De studie die wordt beschreven in **Hoofdstuk 5** gaat in op relaties tussen prenataal ouderlijk RF van moeders en (voorlopers van) fysieke agressie in de vroege kindertijd. Hierbij is tevens gekeken of de veronderstelde invloed van prenataal ouderlijk RF op de ontwikkeling van (voorlopers van) fysieke agressie bij het kind gemedieerd of gemodereerd wordt door sensitief en/of intrusief gedrag van de moeder. De steekproef bestond uit 96 vrouwen die voor het eerst moeder zijn geworden en hun kind. Prenataal ouderlijk RF is tijdens het derde trimester van de zwangerschap gemeten met een interview. Sensitiviteit en intrusiviteit van moeder zijn geobserveerd tijdens een vrij spel taak toen de baby 6 maanden oud was. Om de fysieke agressie van het kind in kaart te brengen, heeft moeder hier op 6, 12 en 20 maanden vragenlijsten over ingevuld. Prenataal RF was negatief geassocieerd met de mate van gerapporteerde fysieke agressie van het kind op 6, 12 en 20 maanden. Dat wil zeggen dat naarmate de moeder beter kon reflecteren tijdens de zwangerschap er minder fysieke agressie bij het kind gerapporteerd werd. De link tussen prenataal ouderlijk RF en de fysieke agressie van het kind werd niet verklaard door het ouderlijk gedrag van de moeder. Toch hadden sensitiviteit en intrusiviteit een zogenaamd modererend effect; in het algemeen rapporteerden moeders een toename in (voorlopers van) fysieke agressie van 6 naar 12 maanden. Echter, wanneer de moeders zowel minder goed waren in RF tijdens de zwangerschap als relatief weinig sensitief waren, was dit niet het geval. Verder bleek prenataal ouderlijk RF alleen negatief aan de mate van gerapporteerde fysieke agressie van het kind gerelateerd voor de groep moeders die geen of beperkt intrusief gedrag lieten zien. Voor de groep moeders die wel intrusief gedrag lieten zien, bleek prenataal ouderlijk RF niet samen te hangen met de mate van gerapporteerde fysieke agressie van het kind. Dit zou er mogelijk op kunnen duiden dat wanneer het gedrag van de moeder niet is afgestemd op

haar prenataal gemeten RF-vermogen, dit de positieve "effecten" van het ouderlijke reflectief functioneren zouden kunnen beperken. Verder onderzoek is nodig om dit met meer zekerheid te kunnen zeggen. De resultaten van dit onderzoek suggereren tevens dat prenataal RF van moeders een belangrijke rol speelt bij de ontwikkeling van (voorlopers van) fysieke agressie in de vroege kindertijd. Naast het direct focussen op het managen van probleemgedrag bij het kind en het verbeteren van ouderlijk gedrag, zouden interventies gericht op het voorkomen en/of reduceren van fysieke agressie bij jonge kinderen ook aandacht kunnen besteden aan het verbeteren van het (prenataal) ouderlijk RF.

Tot op heden is ouderlijk RF hoofdzakelijk als een eendimensionaal construct bestudeerd. Er zijn echter aanwijzingen dat ouderlijk RF mogelijk uit meerdere factoren bestaat, zoals bijvoorbeeld een meer zelf-gerichte en een meer kind-gerichte component. Voor de studie beschreven in **Hoofdstuk 6** werd daarom onderzocht of prenataal en postnataal ouderlijk RF als multidimensionale constructen beschouwd kunnen worden en of deze mogelijke RF-dimensies verschillende samenhang vertonen met het temperament en externaliserend probleemgedrag van 20-maanden oude kinderen. Hiervoor zijn 123 moeder-kind paren onderzocht. Prenataal ouderlijk RF is tijdens het derde trimester van de zwangerschap gemeten met behulp van het 'Pregnancy Interview' (Slade, 2007a). Postnataal ouderlijk RF is 20 maanden postpartum in kaart gebracht middels het 'Parent Development Interview' (Slade, Aber, Berger, Bresgi, & Kaplan, 2003). Het temperament en externaliserend probleemgedrag van de kinderen zijn gemeten met vragenlijsten ingevuld door moeder. Voor prenataal ouderlijk RF werden er twee dimensies gevonden; 'kind-gerelateerd' RF (vermogen om te mentaliseren over de mentale staat en gedrag van het kind) en 'zelf-gerelateerd' RF (mentaliserend vermogen met betrekking tot de eigen mentale staat en gedrag). Voor postnataal RF werden er drie factoren gevonden; 'kind-gerelateerd' RF, 'zelf-gerelateerd' RF en 'relatie-gerelateerd' RF (vermogen om te mentaliseren over hoe de dynamiek in mentale processen de interpersoonlijke interactie en gedrag beïnvloed). Van het prenataal ouderlijk RF bleek alleen de totaalscore negatief geassocieerd te zijn met fysieke agressie van het kind (en dus niet kind- en zelf-gerelateerde dimensiescores). Postnataal 'zelf-gerelateerd' RF hing positief samen met externaliserend probleemgedrag en negatieve emotionaliteit van het kind, met andere woorden: hoe hoger de moeder scoorde op zelf-gerelateerd RF des te hoger ook de scores op externaliserend probleemgedrag en negatieve emotionaliteit bij het kind. Postnataal 'relatie-gerelateerd' RF was daarentegen negatief geassocieerd met fysieke agressie van het kind, dus hogere relatie-gerelateerd RF-scores van moeder hingen samen met minder gerapporteerde fysieke agressie bij het kind.

Deze bevindingen tonen aan dat het belangrijk is om naar de specifieke dimensies van ouderlijk RF te kijken, zeker wanneer het ouderlijk RF in relatie tot de psychosociale ontwikkeling van het kind betreft. Tevens worden er suggesties gedaan om het meten van specifieke ouderlijke RF-dimensies te verbeteren.

Implicaties

De bevindingen van de studies hebben een aantal mogelijke implicaties voor de preventie van agressie en de hulpverlening. Allereerst suggereren de resultaten dat ouderlijk RF een relevant onderdeel zou kunnen zijn voor preventie- en interventieprogramma's gericht op het voorkomen en/of reduceren van externaliserend probleemgedrag bij jonge kinderen. Ouderlijk RF kan al tijdens de zwangerschap gemeten worden en lijkt later ouderlijk gedrag en vroege fysieke agressie bij jonge kinderen te kunnen voorspellen. Dit maakt vroegtijdige interventie mogelijk. Het versterken van ouderlijke RF-vaardigheden zou mogelijk ook adequaat ouderlijk gedrag kunnen stimuleren en wellicht ook de kansen op de ontwikkeling van latere gedragsproblemen bij het kind kunnen verkleinen. Het versterken van ouderlijk RF zou daarnaast mogelijk ook een deel van de negatieve consequenties van meer stabiele of moeilijk veranderbare perinatale risicofactoren kunnen verlichten. Uit de resultaten gepresenteerd in dit proefschrift blijkt dat het "versterken" van ouderlijke RF-vaardigheden dan al prenataal zou kunnen of moeten beginnen.

Het doel van programma's gericht op het versterken van ouderlijk RF zou het stimuleren van een reflectieve houding moeten zijn (Slade, 2007b). Er zijn verscheidene technieken om ouders te helpen meer reflectieve en minder oppervlakkige wijzen van denken over zichzelf, hun relaties en de toekomstige/nieuwe rol als ouder aan te leren (Markin, 2013; Sadler, Novick, & Meadows-Oliver, in press; Sadler et al., 2013; Sadler, Slade, & Mayes, 2006). Een voorbeeld is het voordoen van een reflectieve houding tijdens het samen bekijken van opgenomen ouder-kind interacties waarbij de clinicus als "spreekbuis" van het kind of de ouder fungeert en daarbij mogelijke mentale staten die ten grondslag liggen aan het getoonde gedrag verwoordt (Sadler et al., in press; Slade, 2007b).

Met het groeiende bewijs dat ouderlijk RF een belangrijke rol in de vroege ontwikkeling speelt, groeit ook de vraag naar meer innovatieve en economisch verantwoorde manieren

om ouderlijk RF bij hoog-risico of kwetsbare families te versterken. Tegelijkertijd moet het bestaande instrumentarium om ouderlijk RF te meten verder worden verfijnd en moeten er ook minder tijdsintensieve methoden voor het meten van ouderlijk RF worden ontwikkeld waarbij rekening wordt gehouden met de multidimensionaliteit van het construct. Dit maakt het mogelijk om in de toekomst de ontwikkeling van (dimensies) van ouderlijk RF vóór en gedurende interventies in kaart te brengen en de optimale timing voor de diverse componenten van de interventie te bepalen.

Sterke punten van de hier gepresenteerde studies betreffen het longitudinale design, het gebruik van een heterogene steekproef bestaande uit hoog- en laag-risico gezinnen en het gebruik van verschillende onderzoeksmethoden (interviews, observaties en vragenlijsten). Er zijn echter ook een aantal beperkingen die in ogenschouw genomen moeten worden bij het interpreteren van de resultaten. Allereerst is fysieke agressie gemeten met vragenlijsten die door de moeder zijn ingevuld. Hoewel fysieke agressie relatief betrouwbaar middels ouderrapportage kan worden gemeten, zou het gebruik van meerdere informanten (Kerr, Lunkenheimer, & Olson, 2007) en/of aanvullende gedragsobservaties van fysieke agressie de gepresenteerde bevindingen verder versterken. Daarnaast zou de scope van het bestudeerde probleemgedrag vergroot moeten worden, aangezien er vaak sprake is van comorbide gedragsproblemen (met name bij zulke jonge kinderen, waar zelfs het onderscheid tussen verschillende vormen van gedragsproblematiek soms moeilijk te maken is), en omdat de aanwezigheid van internaliserend probleemgedrag ook de gevoeligheid voor latere externaliserende problematiek vergroot (en visa versa) (August, Realmuto, MacDonald, Nugent, & Crosby, 1996; Cummings, Caporino, & Kendall, 2014; Merikangas, Nakamura, & Kessler, 2009). Tot slot zijn in deze studies de vaders buiten beschouwing gelaten. Gezien het feit dat vaders in toenemende mate een rol in de opvoeding vervullen en dat er indicaties zijn voor differentiële effecten van het ouderlijk RF en ouderlijk gedrag van vaders en moeders op de psychosociale ontwikkeling van kinderen (Benbassat & Priel, 2012, 2015; Esbjørn et al., 2013; Stover & Kiselica, 2014), zal toekomstig onderzoek ook de rol van vaders op de ontwikkeling van gedragsproblemen moeten meenemen.

Hoewel de studies in dit proefschrift ons een stap dichter bij het begrip van de invloed van ouderlijk RF van de moeder op de ontwikkeling van (voorlopers van) gedragsproblemen, en specifiek fysieke agressie, hebben gebracht, hebben de bevindingen tevens vragen opgeroepen waarvoor meer onderzoek nodig is. Een van die vragen is welke onderliggende mechanismen een rol spelen bij de relatie tussen ouderlijk RF en de ontwikkeling van gedragsproblemen bij kinderen. We vonden geen duidelijk bewijs dat het

ouderlijk gedrag van moeder de link tussen prenataal ouderlijk RF en fysieke agressie bij het kind vormt. Dit zou te maken kunnen hebben met hoe en wanneer het ouderlijk gedrag van de moeder gemeten is, maar het zou ook kunnen zijn dat andere mechanismen hier een (grotere) rol in spelen.

Een alternatief onderliggend mechanisme zou bijvoorbeeld kunnen zijn dat het ouderlijk RF van de moeder het zelfbegrip en begrip van anderen in het kind stimuleert en daarmee de ontwikkeling van RF-vaardigheden in het kind faciliteert (Sharp & Fonagy, 2008; Sharp et al., 2006). Als dit proces in de vroege ontwikkeling wordt verstoord, dan loopt het kind mogelijk een verhoogd risico op het ontwikkelen van gedragsproblemen (Laranjo et al., 2010; Sharp & Fonagy, 2008; Slade, 2007b). Ouderlijk RF is ook gelinkt aan de emotionele- en cognitieve gedragsregulatie bij kinderen (Fonagy, Gergely, Jurist, & Target, 2002; Heron-Delaney et al., 2016; Suchman et al., 2008; Suchman et al., 2009). Het zou dus ook mogelijk kunnen zijn dat ouderlijk RF via (verstoorde) emotionele- en cognitieve regulatievaardigheden bij de kinderen een effect heeft op het ontwikkelen van gedragsproblemen. In vervolgonderzoek naar de mogelijke onderliggende mechanismen van de relatie tussen ouderlijk RF en de ontwikkeling van gedragsproblemen bij het kind zouden daarom ook meer neurocognitieve (bijvoorbeeld 'Theory of Mind' begrip van het kind) en neurobiologische factoren (zoals fysiologische en gedragsindicatoren voor zelfregulatie) meegenomen moeten worden. Vervolgstudies moeten dus niet alleen kijken naar ouderfactoren, maar ook naar neurocognitieve en neurobiologische factoren in het kind, naar de omgevingsfactoren waarin het kind opgroeit en de interactie tussen al deze verschillende factoren. Deze kennis zou vervolgens gebruikt kunnen worden om de psychosociale ontwikkeling en de kansen van kinderen die het risico lopen op het ontwikkelen van gedragsproblemen te versterken. Hiervoor moet ouderlijk RF als multidimensionaal construct onderzocht worden in relatie tot meer en andere aspecten van de vroege psychosociale ontwikkeling. Longitudinaal onderzoek is hiervoor nodig, bij voorkeur al startend tijdens de zwangerschap, zodat de in dit proefschrift gevonden invloed van ouderlijk RF van de moeder op de psychosociale ontwikkeling van het kind steeds verder kan worden ontrafeld.

Conclusie

De onderzoeken gepresenteerd in dit proefschrift hebben meer inzicht geboden in de invloed van het RF-vermogen van moeder op de ontwikkeling van (voorlopers van) gedragsproblemen in de vroege kindertijd, in het bijzonder fysieke agressie. Geconcludeerd kan worden dat het RF-vermogen van de moeder een belangrijke rol lijkt te spelen bij het ontwikkelen van (voorlopers van) gedragsproblemen, met name fysieke agressie. Zo lijkt, over het algemeen genomen, een beter prenataal RF-vermogen van de moeder samen te hangen met een kleinere kans op het ontwikkelen van vroege fysieke agressie. Daarbij lijkt het van belang om ouderlijk RF in de toekomst als een multidimensionaal construct te bestuderen, omdat er aanwijzingen zijn dat verschillende ouderlijke RF-dimensies mogelijk differentieel gerelateerd zijn aan de ontwikkeling van vroege gedragsproblemen.

Vrouwen die onder ongunstige omstandigheden hun eerste kind verwachten hebben doorgaans verminderde prenatale ouderlijke RF-vaardigheden. Dit zou ervoor kunnen zorgen dat ze een grotere kans lopen om na de geboorte van hun baby minder sensitief of adequaat ouderlijk gedrag te laten zien en dat ook het postnatale ouderlijk RF-niveau verminderd kan zijn. Hun kinderen zouden dan mogelijk ook een verhoogde kans kunnen hebben op het ontwikkelen van probleemgedrag. Onze bevindingen suggereren dat het bij de preventie en aanpak van vroege gedragsproblemen belangrijk zou kunnen zijn om ook te investeren in het verbeteren van het ouderlijk RF, bij voorkeur al tijdens de zwangerschap.

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Curriculum Vitae

Curriculum Vitae

Hanneke Smaling was born on January 17th, 1984 in Alkmaar, the Netherlands. After completing her secondary education (VWO) in 2002 at the Trinitas College in Heerhugowaard, she studied Psychology at the VU University Amsterdam. She obtained her Master's degree in Clinical Neuropsychology in 2007 and she completed the Master Organizational Psychology in 2008. During her study, she worked as a research assistant for Leiden University at the department of Clinical Child and Adolescent Studies on the project 'Neurotoxicity of leukemia treatment'. For her Master's degrees, Hanneke completed her internships at the Brijder Verslavingszorg (mental health institution for addiction care) and the CBE Group (global management consultancy firm). After completing her second Master, Hanneke worked several years as a Human Resources consultant. In 2011 she started working part-time on her PhD-project at the department of Clinical Child and Adolescent Studies of Leiden University. This project, part of the Mother–Infant Neuro-development Study (*MINDS* – Leiden), was supervised by prof. dr. Hanna Swaab, prof. dr. Stephanie van Goozen, dr. Stephan Huijbregts, and dr. Kristiaan van der Heijden, and resulted in the present thesis. Besides her work on the *MINDS* – Leiden, she worked from 2011 - 2016 as a part-time lecturer at the same department. Hanneke is currently working as a postdoctoral researcher at the VU medical center / EMGO+ Institute in Amsterdam.

Hanneke Smaling is op 17 januari 1984 geboren te Alkmaar. Na het behalen van haar VWO-diploma aan het Trinitas College te Heerhugowaard, is ze Psychologie gaan studeren aan de Vrije Universiteit Amsterdam. Ze heeft haar Master Klinische Neuropsychologie in 2007 behaald en de Master Arbeid & Organisatie Psychologie in 2008 afgerond. Tijdens haar studie werkte ze als onderzoeksassistente bij de afdeling Orthopedagogiek van de Universiteit Leiden op het project 'Neurotoxiciteit van de behandeling van leukemie'. In het kader van haar studie heeft Hanneke stage gelopen bij de Brijder Verslavingszorg en de CBE Groep (consultancy bureau). Na het afronden van haar studies heeft Hanneke enkele jaren gewerkt als 'Human Resources' adviseur. In 2011 is zij parttime gaan werken als promovenda bij de afdeling Orthopedagogiek van de Universiteit Leiden op het project 'Een goed begin' (*MINDS* – Leiden). Dit project werd uitgevoerd onder supervisie van prof. dr. Hanna Swaab, prof. dr. Stephanie van Goozen, dr. Stephan Huijbregts en dr. Kristiaan van der Heijden, en heeft geresulteerd in het huidige proefschrift. Naast haar werk op 'Een goed begin', heeft ze van 2011- 2016 bij dezelfde afdeling parttime gewerkt als docent. Hanneke is momenteel werkzaam als postdoctoraal onderzoeker bij het VU medisch centrum / EMGO+ Instituut te Amsterdam.

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