Do fathers matter?

In search of causes and consequences of parental sensitivity

Nicole Lucassen

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Do fathers matter?

In search of causes and consequences
of parental sensitivity

Doen vaders ertoe?

Op zoek naar oorzaken en gevolgen
van sensitief ouderschap

Proefschrift

ter verkrijging van de graad van doctor
aan de Erasmus Universiteit Rotterdam
op gezag van de rector magnificus

Prof.dr. H.G. Schmidt

en volgens besluit van het College voor Promoties.

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Chapter 1

Introduction

THE IMPORTANCE OF PARENTAL SENSITIVITY FOR CHILD DEVELOPMENT

Sensitivity is defined as the ability to accurately perceive and to interpret the signals implicit in the child's behavior and to respond to them promptly and appropriately (Ainsworth, Blehar, Waters, & Wall, 1978). Mary Ainsworth was the first researcher to define the concept of sensitivity along these lines. She carefully observed parental caregiving behavior and children's behaviors such as crying and exploration. Most importantly, she developed scales to rate caregiving behavior from detailed observations within families in naturalistic settings. Later, structured play tasks were developed which are now a frequently used method in observing parent-child interaction (Joosen, Mesman, Bakermans-Kranenburg, & Van IJzendoorn, 2012). Parents generally receive instructions to play with their child with or without toys for a duration ranging from 5 to 15 minutes. This method provokes interaction between parent and child and therefore assures the observation of interaction without the time investment of longer naturalistic observations.

Sensitivity is a key element of parenting. A highly sensitive parent responds promptly and appropriately to the communications of the child (Sroufe, Egeland, Carlson, & Collins, 2005). The sensitive parent is calm and provides an affectively secure base for the child. This may occur by verbal and bodily clues, for example acknowledging the child's accomplishments and letting the child know that he or she has the parent's support and confidence to do well. The parent might seek physical contact to give the child a sense of support. An insensitive parent fails to provide support. The parent might be passive, uninvolved, aloof, or otherwise unavailable to the child.

Parental sensitivity helps to create a secure base from which the child can safely explore the environment and form a positive sense of self (Ainsworth et al., 1978), and it is a key predictor of a secure parent-child attachment relationship. Higher levels of sensitive parenting behavior are associated with more optimal cognitive, behavioral, and socio-emotional outcomes of the child (Denham, Renwick, & Holt, 1991; Hubbs-Tait, Culp, Culp, & Miller, 2002; Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2012; NICHD Early Childcare Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004).

Most researchers study mothers, few study fathers. Moreover, studies on sensitivity in which mothers and fathers from the same families are included are relatively scarce (Martin, Ryan, & Brooks-Gunn, 2007). Yet, in the majority of families, children are raised by a mother *and* a father. Understanding the relation between mother and child or father and child is not fully possible without considering the network of relationships in which the individuals are embedded (Cox & Paley, 2003). Several studies have shown that mothers and fathers show modest, but significant concordance in sensitivity toward their children (e.g., Braungart-Rieker, Courtney, & Garwood, 1999; Schoppe-Sullivan et al., 2006). It may be that one parent models sensitive parenting to the other parent, or that parents hold similar value systems

with regard to the quality of parenting (Fox, Kimmerly, & Schafer, 1991). Van IJzendoorn and De Wolff (1997) showed that the quality of the parent-child relationship is not independent of the family system, although the association between the quality of the infant-mother attachment relationship and the infant-father attachment relationship was modest with a correlation of .17. Finally, parents are reciprocally influenced by psychopathology, marital conflict, and other family circumstances. Therefore, it is important to observe parent-child interaction in a family context.

PRENATAL RISK FACTORS FOR PARENTAL INSENSITIVITY

Knowledge about predictors of parent-child interaction may help identify families at risk for developing insensitive patterns of parenting (Jessee et al., 2010), which are associated with less optimal child development. Yet parent-child interaction is bidirectional, which makes it difficult to distinguish the contributions of parental factors and child factors to parent-child interaction. Several studies have shown that parenting not only affects child behavior, but the reverse is also true (Del Vecchio & Rhoades, 2010; Gadeyne, Ghesquière, & Onghena, 2004). In the current series of studies, we largely excluded effects of child factors by design as the antecedents of sensitivity were measured before the birth of the child. In this thesis, the focus is on *prenatally* assessed determinants of sensitive parenting of mothers and fathers with a special interest in the role of psychopathology and relationships within the family.

Psychopathology

Parenting problems are common in families with parental psychopathology (Berg-Nielsen, Vikan, & Dahl, 2002). Studies have repeatedly shown that depression and sensitivity are negatively associated in mothers and fathers. Depressed parents tend to be less sensitive and show more hostile attitudes toward their child (for meta-analyses, see Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Wilson & Durbin, 2010). Both concurrent depressive symptoms and past depressive symptoms are related to insensitivity; parenting appears to be impaired in non-depressed parents with an earlier history of depression (Lovejoy et al., 2000).

Substance use is also known to impact parenting. Parents with a current substance use disorder have shown difficulties accurately perceiving their children's signals and sensitively responding to them. Substance use is linked to lower sensitivity to environmental cues and interference with emotion regulation which are capacities central to sensitive parenting. These capacities can be lastingly impaired in the case of a history of substance use disorder (Mayes & Truman, 2002). A few studies focused on the effects of a history of substance use disorder on parenting behavior. Ammerman, Kolko, Kirisci, Blackson, and Dawes (1999) found that a history of substance use disorder in both mothers and fathers increased the potential of child abuse. Interestingly, they found no differences between parents with current diagno-

ses and those with past substance use disorder only. In this thesis we focus on the effects of past substance use disorder on sensitive parenting.

Relationships within the family

Parental psychopathology can affect the quality of relationships within the family. For example, depressive symptoms of one parent may be associated with the perception of the other parent that the partner is unavailable, unreliable, and unpredictable (Cummings, Keller, & Davies, 2005). Family functioning in turn may affect the quality of sensitive parenting (Belsky, 1984). Several studies found lower levels of social support of the partner or poor family functioning to be associated with less sensitivity toward the child (e.g., Crnic, Greenberg, Razogin, Robinson, & Basham, 1983; Pauli-Pott, Mertesacker, Bade, Bauer, & Beckmann, 2000).

Parental affective attitudes like criticism and emotional overinvolvement toward the child, conceptualized as expressed emotion, might affect parenting behavior. Expressed emotion is traditionally measured in relatives of a patient with a psychiatric illness (Kazarian, 1992). Patients whose relatives score high on expressed emotion have a higher risk for relapse after treatment (Asarnow, Goldstein, Tompson, & Guthrie, 1993; Barrelet, Ferrero, Szigethy, Giddey, & Pellizzer, 1990). The measure has been extended to the study of emotional attitudes of parents towards children and adolescents (Hibbs, Hamburger, Kruesi, & Lenane, 1993; Mah, Van IJzendoorn, Smith, & Bakermans-Kranenburg, 2013; Stubbe, Zahner, Goldstein, & Lechner, 1993). The assumption is that the way parents talk about their child indicates how they treat their child on a day-to-day basis (McCarty, Lau, Valeri, & Weisz, 2004). High expressed emotion is related to maternal coldness (Stubbe, Zahner, Goldstein, & Leckman, 1993), maternal critical behavior (Cruise, Sheeber, & Tompson, 2011), and mother-child attachment insecurity (Jacobsen, Hibbs, & Ziegenhain, 2000). The very few nonclinical studies that included fathers found no relation between expressed emotion and parenting (Hibbs et al., 1991; Rogosch, Ciccetti, & Toth, 2004). In this study we focus on the association of mothers' and fathers' expressed emotion during pregnancy with sensitive parenting in early childhood.

CONSEQUENCES OF PARENTAL SENSITIVITY

Besides studying prenatal risk factors for sensitivity, we are also interested in the consequences of sensitive parenting of mothers and fathers for child development. In the current series of studies we focus on different child developmental domains.

Sensitivity and infant-father attachment security

At the core of attachment theory is the claim that infants not only become attached to their mother but also to other caregivers who interact regularly with them (Van der Horst & Van der Veer, 2010). The first wave of studies on the correlates of infant-father attachment, how-

ever, showed a small association between paternal sensitivity and infant-father attachment security. Van IJzendoorn & De Wolff (1997) reported that the combined effect size across eight studies amounted to a correlation of .13. Recent studies on fathers showed mixed results, with some failing to find a significant relation between paternal sensitivity and attachment security (e.g., Braungart-Rieker, Garwood, Powers, & Wang, 2001; Volling, McElwain, Notaro, & Herrera, 2002), and others reporting a significant but modest association (e.g., Eiden, Edwards, & Leonard, 2002). As fathers seem to have become gradually more involved in positive engagement activities with their children over the last few decades, this might have affected the relationship with their child (Pleck, 2010).

Sensitivity and child executive functions

Executive functions (EF) is an umbrella term for several higher-order, self-regulatory functions such as inhibitory control, working memory, planning ability, and attention shifting (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012). EF, which develops rapidly in the first five years of life, plays an important role in everyday life (Huizinga & Smidts, 2010). Typically, EF is conceptualized within a biological framework in which the development of EF is a consequence of children's brain development. However, considering the impact of environmental input on children's brain development, it has been suggested that environmental influences, particularly early parent-child relationships, are likely to be crucial in understanding individual differences in children's EF (Matte-Gagné & Bernier, 2011; Schroeder & Kelley, 2010). We investigated the association between mothers' and fathers' negative and positive parenting and child's EF at age 4.

THE CURRENT STUDY

In the current series of studies, we examined possible prenatal risk factors for maternal and paternal insensitivity and the consequences of parental sensitivity for child development in the Generation R Study. This cohort was designed to identify determinants of growth, development, and health from fetal life onwards (Jaddoe et al., 2012). We observed sensitivity at 4 years of age in 752 families, in a subgroup of participants in which detailed measurements of child development were obtained. This subgroup included only children of Dutch national origin, meaning that the children, their parents, and their grandparents were all born in the Netherlands. The goal of this design was to reduce confounding and effect modification by ethnicity. The participating children were born between February 2003 and August 2005. This study population is one of the largest to date with data on observed sensitivity of both mother and father. The concepts measured in the current thesis are represented in Figure 1.

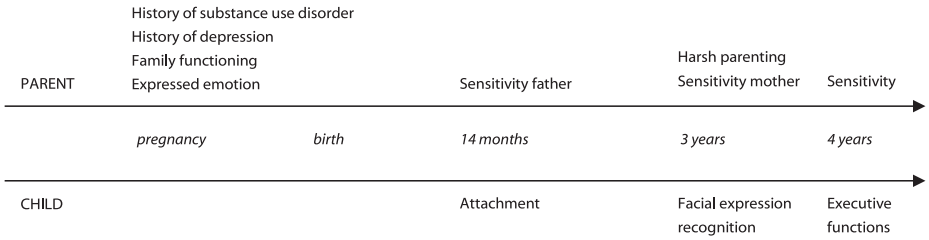

Figure 1. Concepts measured within the Generation R Study used in the current thesis
Note. All parent concepts are measured in mother *and* father from the same family, except for the sensitivity observations at 14 months (n = 558 mothers; n = 90 fathers) and 36 months (n = 710 mothers; n = 130 fathers) in which one parent per family was invited to participate.

Aim of this thesis

The general aim of this thesis is to provide more insight into the role of prenatal causes of parental insensitivity (Part I) and the consequences of parental sensitivity for child development (Part II) in the general population. We examine independent effects in mothers and fathers, controlling for family circumstances. In Chapter 2 prenatal risk factors for observed insensitivity in early childhood are examined: history of substance use disorder, history of depression, and family functioning. Chapter 3 represents a methodological paper on the measurement of expressed emotion during pregnancy. In Chapter 4 the relation between expressed emotion during pregnancy and observed sensitivity is addressed. Chapters 5, 6, and 7 focus on consequences of parental sensitivity. In Chapter 5 we examine independent and mediated effects of maternal depressive symptoms and sensitivity on children's ability to recognize facial expressions of emotions. This chapter focuses only on maternal sensitivity, not paternal sensitivity. In Chapter 6 the roles of maternal and paternal harsh and sensitive parenting in child executive functions are addressed. Chapter 7 is a meta-analysis examining the relation between paternal sensitivity and infant-father attachment security. The risk factors and consequences of parental (in-)sensitivity will be discussed against the background of our results in Chapter 8.

PART I

IN SEARCH OF CAUSES OF PARENTAL SENSITIVITY

Chapter 2

History of parental psychopathology and family functioning during pregnancy as predictors of observed parental sensitivity to the child

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Manuscript submitted for publication

Chapter 3

Assessing expressed emotion during pregnancy

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ABSTRACT

We assessed expressed emotion (EE) with an adapted version of the Five Minute Speech Sample in 847 pregnant women. The prevalence of high EE was 6%. High EE was significantly associated with having a first child, low income, maternal childhood trauma, and lack of parental emotional warmth during childhood.

INTRODUCTION

Expressed emotion (EE) is a construct which measures the amount of criticism, hostility, and emotional overinvolvement expressed by parents toward a family member of various ages with a psychiatric illness (Kazarian, 1992). EE research shows that patients whose relatives score high on EE have a higher chance of relapse after treatment (Asarnow, Goldstein, Tompson, & Guthrie, 1993; Barrelet, Ferrero, Szigethy, Giddey, & Pellizer, 1990; Leff, Kuipers, Berkowitz, Eberlein-Vries, & Sturgeon, 1982; Moline, Singh, Morris, & Meltzer, 1985).

The standard method to assess EE is the Camberwell Family Interview (CFI; Vaughn & Leff, 1976), which is a semi-structured interview conducted over 1.5 hours with the parents shortly after the patient's admission to a hospital. Due to the length of administering the CFI, the Five Minute Speech Sample (FMSS), which includes an assessment of criticism and emotional overinvolvement but not a separate construct of hostility (Magana et al., 1986), was used as a validated measure of EE (Malla, Kazarian, Barnes, & Cole, 1991). First, high levels of parental EE were found in psychiatric patients; later studies in non-clinical samples using the FMSS indicated that high maternal EE predicts insecure attachment and internalizing or externalizing behavior problems in children (Jacobsen, Hibbs, & Ziegenhain,. 2000; Vostanis & Nicholls, 1992). Also, in populations in which it was not possible to use the original assessment instrument of parental EE, adapted versions of the FMSS have been developed. For example, the Revised Five Minute Speech Sample (R-FMSS) for low birth weight children (St Jonn-Seed & Weiss, 2002), the Preschool Five Minute Speech Sample (PFMSS; Daley, Sonuga-Barke, & Thompson, 2003), and the Autism-Specific Five Minute Speech Sample (ASFMSS; Benson, Daley, Karlof, & Robison, 2011).

Until now, EE has not been used with regard to the unborn child. Prenatal assessment of EE is of potential importance to gain insight into the evolution of maternal EE. For example, previous EE studies showed that a mothers' report on the child can be influenced by child factors, like intellectual disabilities and behavioral problems (Baker, Heller, & Henker, 2000; Beck, Daley, Hastings, & Stevenson, 2004; Peris & Baker, 2000). Reversed causality, i.e., characteristics of the child influence maternal EE, cannot be fully ruled out by prenatal assessment, as in theory the intrauterine behavior of the fetus could affect the mother. Yet in contrast to previous clinical or population-based studies of the relation between EE and child behavior, reversed causality is much less likely to explain the observation in a study that assesses EE prenatally.

The main aim of this study was to introduce and test an adapted version of the FMSS that assesses EE during pregnancy. First, we describe the development and interrater reliability of the scoring procedure. We hypothesized that the intraclass correlation coefficient (ICC) would be comparable to those found in other EE reliability studies (Baker et al., 2000; Benson et al., 2011; Daley et al., 2003; Magana et al., 1986; McCarty, Lau, Valeri, & Weisz, 2004). Next, we investigated whether socio-demographic, psychopathology, childhood experiences, and family functioning, which have shown to be associated with postnatal EE, are also related to

prenatal EE. Since no golden standard exists for measuring EE during pregnancy, we used these associated factors as a proxy of construct validity.

METHODS

Sample

The study is embedded in the Generation R Study, a population-based prospective cohort study from fetal life onwards in Rotterdam, the Netherlands (Jaddoe et al., 2010). We collected 847 speech samples from a randomly selected subgroup of Dutch women. Children were born between February 2003 and August 2005 in Rotterdam, one of the major cities of the Netherlands.

The study was conducted in accordance with the guidelines proposed in the World Medical Association Declaration of Helsinki and has been approved by the Medical Ethics Committee of the Erasmus Medical Center, Rotterdam. Written informed consent was obtained from all participants.

Measures

Participants were visited at home close to the 30th week of gestation to assess EE. In piloting the FMSS in pregnant women, we found that almost all of the women stated that 5 minutes was too long. In the original FMSS it is functional to complete the total of 5 minutes, since parents sometimes continue to give different examples of how they relate to their children. In our pilot sample virtually all women remained silent after they had talked three minutes and noted that they could not mention anything else. In the three minute speech sample, one quarter of the women did not fill the three minutes with statements. After this pilot testing we shortened the five minutes instruction to three minutes.

The original instructions for the FMSS (Magana & Zaden, 1998) were slightly adapted to make it more applicable to pregnancy, i.e., we changed the present tense about the actual relation with the child to expectations in the future tense and shortened the five minutes instruction to three minutes: "In the next three minutes, I'd like you to tell me about your unborn child. What I would like to hear from you is what you expect or hope your child will be like and how you would like to relate to your child. After you begin to speak, I prefer not to answer any questions until after the three minutes". The parents' statements were scored using the two categories from the original FMSS procedure: Critisism and Emotional Over-involvement. Criticism (CRIT) consists of a negative initial statement a parent makes about the child or comments that contain disapproval, dislike, or annoyance expressed in content or tone during the sample. Emotional Overinvolvement (EOI) consists of emotional display, statements of attitude (i.e., statements of love or willingness to do anything for the child),

self-sacrificing or overprotective remarks, excessive detail, and excessive praise (i.e., five or more positive remarks).

In a pilot phase, after scoring 50 tapes according to FMSS guidelines, it emerged that the original scoring guidelines were not completely applicable. In the original FMSS the parents are asked to talk about the present, and statements about the past or future are not to be scored. By definition, parents in our study were asked to talk about the future. Hence, we scored statements about the future in the three minute speech sample in the same way as statements in the original FMSS. Also, many women made very elaborative remarks about the pregnancy and/or delivery despite the instruction to talk about expectations of their unborn child. This was similar to the subcategory 'excessive details' of EOI. We found a correlation between these pregnancy-related remarks and 'excessive details'($r = .15$; $p < .001$). These pregnancy-related remarks probably are a pregnancy-specific expression of 'excessive details'. Results including this category as part of EE were similar to those without this category (Supplementary Table 1). The full adapted protocol for scoring is available upon request.

Parity, family income, and educational level were collected at 12 weeks' gestational age. Family income was divided into three categories, using 'less than 1200 Euros net a month', which is at the social security level payment for a Dutch household, 'between 1,200-2,000 Euros net a month', and 'more than 2,000 Euros net a month'. Educational level was divided into three categories for highest education finished: 'primary education', 'secondary education', and 'higher education'.

Questionnaires about psychopathology, childhood trauma, perceived parental rearing, and family functioning were assessed at 20 weeks' gestational age. The Brief Symptom Inventory (BSI) is a validated self-report psychopathology questionnaire existing of nine symptom dimensions (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism) with a total of 53 items ranging from 0 to 4 (Derogatis, 1993). The Global Severity Index was used as a measure of overall psychological distress, which consists of a total weighted score obtained by the total score of all symptom dimensions of the BSI divided by the number of completed items (range 0-4). The internal consistency of the current sample was excellent ($\alpha = 0.94$).

Maternal childhood trauma was assessed with the validated Childhood Trauma Questionnaire – Short Form (CTQ; Bernstein et al., 1994). The measure consists of 34 items (range 1-5) covering five subscales: physical abuse, sexual abuse, emotional abuse, physical neglect, and emotional neglect. The internal consistency of the current sample was fair ($\alpha = 0.63$). A total weighted score was used, consisting of a weighted score of each subscale obtained by adding up the total scores of each subscale divided by the number of completed items per subscale and then by adding up the weighted scores of each subscale (range 5-25).

Perceived parental rearing was assessed by the short form of the original 81-item Egna Minnen Beträffande Uppfostran-Swedish (EMBU; memories on parenting questionnaire) (Arrindell et al., 2001). This is a validated 23-item inventory in which the mother rates each of

her parents separately on three scales: emotional warmth (range 6-24), rejection (range 7-28), and overprotection/control attempts (range 10-40). The internal consistency of the current sample was excellent (α = 0.96 - 0.99).

Actual family functioning was measured using the seventh subscale 'General Functioning' (GF) of the Family Assessment Device (FAD), a self-report questionnaire (Byles, Byrne, Boyle, & Offord, 1988). GF is a validated overall measure consisting of 12 items (range 1-4) of well-being and/or pathology of the family situation. A weighted score was used, obtained by the total score of items divided by the number of completed items (range 1-4). The internal consistency of the current sample was good (α = 0.89).

Data analysis

For interrater reliability, EE was scored with the slightly adapted version of the FMSS guidelines and categorized in low, borderline, and high EE according to the subscales 'Criticism (CRIT)' and 'Emotional Overinvolvement (EOI)' of the FMSS manual. Subjects obtained a borderline score if they met some of the criteria to obtain a high score, but did not qualify for a high EE score. Borderline scores are ultimately scored as low EE, but in the calculation of the ICC the original scores were used to obtain more variability. First, one of the co-authors, who was trained by members of the UCLA Family project, trained three raters. Interrater reliability of the three raters was calculated over 30 tapes, using a two-way mixed intra class correlation (ICC), as in previous FMSS studies. The raters were blind as to which tapes would be used to measure reliability. To study the association between high EE and possibly related variables, logistic regression analyses were used with the dichotomized EE scores (low versus high). For our analyses we used the Statistical Package for the Social Sciences (SPSS) version 18.

RESULTS

The ICC for the EE scorers was 0.69.

High EE was observed in 6.0% (n = 51) of participants: 3.8% (n = 34) of participants scored high on CRIT and 2.1% (n = 18) scored high on EOI; 0.1% (n = 3) scored high on both scales.

Descriptives of the study are presented in Table 1. Parental emotional warmth during childhood was negatively associated with the combined subscales (CRIT and EOI) of high EE. Low income and childhood trauma were positively associated with high EE. Additional analyses performed to investigate the association between the subscales CRIT and EOI and the same variables revealed that younger mothers were significantly more critical (OR = 0.9; 95% CI = 0.8 - 1.0; p = .04) and older mothers were significantly more emotionally overinvolved (OR = 1.3 ; 95%CI = 1.1 - 1.4; p < .01). High EE on EOI was significantly associated with psychopathology (OR = 3.4; 95% CI = 1.1 - 11.0; p = .04), childhood trauma, (OR = 1.4; 95% CI = 1.1 - 1.7; p < .01), emotional warmth of the father and mother during childhood (OR = 0.8;

Table 1. Prenatally high maternal expressed emotion in relation to selected determinants (n = 847)

Variable	*N*	%/Mean (*SD*)	High EE (n = 51; 6.0%)		High CRIT (n = 32; 3.8%)		High EOI (n = 18; 2.1%)	
			OR (95% CI)	*p*	*OR* (95% CI)	*p*	*OR* (95% CI)	*p*
Age (years)	847	31.8 (3.9)	1.0 (0.9-1.1)	.67	0.9 (0.8-1.1)	.04	1.3 (1.1-1.4)	< .01
First child	513	61.7	2.3 (1.2-4.6)	.02	3.4 (1.3-8.9)	.01	1.6 (0.6-4.7)	.35
Education								
Primary	16	1.9	2.5 (0.5-11.5)	.24	4.0 (0.9-18.9)	.08	-[1]	-
Secondary	269	31.8	1.0 (0.6-2.0)	.89	1.5 (0.8-2.9)	.18	-	-
Higher	562	66.3	Reference		Reference		-	-
Income								
<1200	19	2.4	3.7 (1.0-13.2)	.05	1.7 (0.2-13.4)	.60	6.2 (1.3-29.7)	.02
1200-2000	74	9.3	1.7 (0.7-4.3)	.24	2.2 (0.8-6.1)	.11	0.7 (0.1-5.6)	.76
>2000	700	88.3	Reference		Reference		Reference	
Psychopathology (BSI)	798	0.2 (0.2)	2.2 (0.8-5.9)	.10	1.1 (0.2-5.7)	.85	3.4 (1.1-11.0)	.04
Childhood trauma (CTQ)	762	6.6 (1.6)	1.2 (1.0-1.4)	.02	1.0 (0.8-1.3)	.83	1.4 (1.1-1.7)	< .01
EMBU[2]								
Emotional warmth father	738	17.6 (4.3)	0.9 (0.9-1.0)	< .01	1.0 (0.9-1.0)	.24	0.8 (0.8-0.9)	< .01
Emotional warmth mother	762	18.8 (3.8)	0.9 (0.9-1.0)	.01	1.0 (0.9-1.0)	.95	0.8 (0.7-0.9)	< .01
Rejection father	744	8.7 (2.6)	1.1 (1.0-1.2)	.07	1.0 (0.9-1.2)	.65	1.2 (1.1-1.3)	< .01
Rejection mother	763	8.7 (2.5)	1.0 (0.9-1.1)	.96	0.7 (0.5-1.0)	.06	1.2 (1.0-1.3)	.02
Overprotection father	729	20.4 (4.6)	1.0 (0.9-1.0)	.52	0.9 (0.9-1.0)	.14	1.1 (1.0-1.2)	.26
Overprotection mother	759	21.7 (4.9)	1.0 (0.9-1.0)	.56	1.0 (0.9-1.0)	.22	1.0 (0.9-1.1)	.39
Family stress (FAD)	787	1.4 (0.4)	1.8 (0.5-6.3)	.33	1.8 (0.4-7.9)	.44	1.7 (0.2-13.4)	.61

SD = standard deviation;
OR = odds ratio;
CI = confidence interval;
BSI = Brief Symptom Inventory;
CTQ = Childhood Trauma Questionnaire;
EMBU = Egna Minnen Beträffande Uppfostran;
FAD = Family Assessment Device;
High EE reflects the combined scales Critism and Emotional Overinvolvement.

[1] Insufficient numbers to calculate stable odds ratio.
[2] The scores reflect the perception of each of the parents in childhood of the pregnant woman.

95% CI = 0.8- 0.9; $p < .01$ and $OR = 0.8$; 95% CI = 0.7 - 0.9; $p < .01$), and rejection of the father and mother during childhood ($OR = 1.2$; 95% CI = 1.1 - 1.3; $p < .01$ and $OR = 1.2$; 95% CI = 1.0 - 1.3; $p = .02$).

We repeated our analyses with the borderline and high EE groups combined. This resulted in a prevalence of 47.1% ($n = 399$) high/borderline overall EE and 23.6% ($n = 200$) high/borderline CRIT and 30.5% ($n = 258$) for high/borderline EOI. Results changed slightly when high and borderline EE were combined. If anything, findings for CRIT EE were stronger, findings for EOI EE less marked (see Supplementary Table 2).

DISCUSSION

Results showed that the ICC for scoring EE during pregnancy was comparable to those found in other studies examining EE (Baker et al., 2000; Benson et al., 2011; Daley et al., 2003; Magana et al., 1986; McCarty et al., 2004), which supports the reliability of assessing EE during pregnancy with the slightly adapted procedure of the FMSS. As the results also show, 6.0% of all participants scored high on EE. This is lower compared to other studies using non-clinical samples, which found a range from 8% (Baker et al., 2000) to 27% (Wamboldt, O'Connor, Wamboldt, Gavin, & Klinnert, 2000) of mothers scoring high on EE toward their children. This might be explained by the difficulty or reluctance of pregnant women to express excessive emotions about their unborn child or it could be related to the absence of pronounced child factors during pregnancy that play a more prominent role in high EE after the child is born.

Overall classification of high EE showed significant associations with having a first child, income and maladaptive childhood experiences, suggesting that EE assessed during pregnancy may be seen as a central construct with many determinants. However, additional analyses performed within the subscales of EE showed differences in associated factors and no correlation between high EE on CRIT and EOI subscales. This indicates that overall EE might be seen as a general predictor, but also that CRIT and EOI are different constructs within EE. Support for a differential construct underlying EE subscales comes from postnatal studies assessing maternal EE toward children (St Jonn-Seed & Weiss, 2002; Wamboldt et al., 2000). Also, some studies examining EE in parents of young children questioned the reliability and validity of the EOI construct (Daley et al., 2003; McCarty et al., 2004), but our study, by contrast, found associations with EOI and several determinants.

Limitations

Some slight adjustments were made to adapt the FMSS for the assessment of EE in pregnant women. Therefore, it remains uncertain whether the construct of EE we coded is comparable to EE coded postnatally. No golden standard is available as the major change was the time of assessment. However, we found significant associations with factors that also were related

to postnatal EE, indicating construct validity. Also, the current study is a non-clinical sample with many higher educated participants, which may have reduced the prevalence of high EE.

Future directions

As we measured EE during pregnancy, reversed causality is much less likely to explain the association between child factors, like child behavior and cognitive problems and high maternal EE, that have been found in other studies (Baker et al., 2000; Beck et al., 2004; Peris & Baker, 2000). In future research it is important to study the stability of maternal EE from pregnancy to childhood. This will give more insight in maternal and child contributions to EE. Also, the predictive value of EE assessed during pregnancy on child outcomes like mother-child attachment, behavioral, emotional, and cognitive problems is of interest.

SUPPLEMENTARY TABLES

Supplementary Table 1. Prenatally high maternal expressed emotion in relation to selected determinants (pregnancy-specific remarks included) (*N* = 847)

			High EE (*n* = 80; 9.4%)		High CRIT (*n* = 32; 3.8%)		High EOI (*n* = 50; 5.9%)	
Variable	*N*	% / mean (*SD*)	*OR* (95% CI)	*p*	*OR* (95% CI)	*p*	*OR* (95% CI)	*p*
Age (years)	847	31.8 (3.9)	1.0 (1.0-1.1)	.39	0.9 (0.8-1.1)	.04	1.1 (1.1-1.2)	< .01
First child	513	61.7	2.3 (1.3-3.9)	< .01	3.4 (1.3-3.9)	.01	1.8 (1.0-3.5)	.07
Education								
Primary	16	1.9	2.1 (0.6-7.7)	.25	4.0 (0.9-18.9)	.08	0.9 (0.1-7.2)	.95
Secondary	269	31.8	0.8 (0.5-1.3)	.39	1.1 (0.5-2.4)	.81	0.6 (0.3-1.2)	.15
Higher	562	66.3	Reference		Reference		Reference	
Income								
< 1200	19	2.4	2.0 (0.6-7.2)	.27	1.7 (0.2-13.4)	.60	2.0 (0.4-8.9)	.37
1200-2000	74	9.3	1.1 (0.5-2.6)	.76	2.2 (0.8-6.1)	.11	0.5 (0.1-2.0)	.31
> 2000	700	88.3	Reference		Reference		Reference	
Psychopathology (BSI)	798	0.2 (0.2)	2.2 (0.8-4.4)	.15	1.2 (0.2-5.7)	.85	2.0 (0.8-5.3)	.16
Childhood trauma (CTQ)	762	6.6 (1.6)	1.1 (1.1-1.3)	.03	1.0 (0.8-1.3)	.83	1.2 (1.1-1.4)	< .01
EMBU*								
Emotional warmth father	738	17.6 (4.3)	1.0 (0.9-1.0)	.17	1.0 (0.9-1.0)	.24	0.8 (0.8-0.9)	< .01
Emotional warmth mother	762	18.8 (3.8)	1.0 (0.9-1.0)	.14	1.0 (0.9-1.0)	.95	0.8 (0.7-0.9)	< .01
Rejection father	744	8.7 (2.6)	1.1 (1.0-1.1)	.84	1.0 (0.9-1.2)	.65	1.2 (1.1-1.3)	< .01
Rejection mother	763	8.7 (2.5)	1.0 (0.9-1.1)	.93	0.7 (0.5-1.0)	.06	1.2 (1.0-1.3)	.02
Overprotection father	729	20.4 (4.6)	1.0 (0.9-1.1)	.80	0.9 (0.9-1.0)	.14	1.1 (1.0-1.2)	.26
Overprotection mother	759	21.7 (4.9)	1.0 (0.9-1.0)	.56	1.0 (0.9-1.0)	.22	1.0 (0.9-1.1)	.39
Family stress (FAD)	787	1.4 (0.4)	1.0 (0.3-3.5)	.95	1.8 (0.4-7.9)	.44	1.7 (0.2-13.4)	.61

SD = standard deviation;
OR = odds ratio;
CI = confidence interval;
BSI = Brief Symptom Inventory;
CTQ = Childhood Trauma Questionnaire;
EMBU = Egna Minnen Beträffande Uppfostran (*the scores reflect the perception of each of the parents in childhood of the pregnant woman);
FAD = Family Assessment Device
High EE reflects the combined scales Criticism and Emotional Overinvolvement

Supplementary Table 2. Prenatally high maternal borderline/high expressed emotion in relation to selected determinants (*N* = 847)

			Borderline/High EE (*n* = 399; 47.1%)		Borderline/High CRIT (*n* = 200; 23.6%)		Borderline/High EOI (*n* = 258; 30.5%)	
Variable	*N*	% / mean (*SD*)	*OR* (95% CI)	*p*	*OR* (95% CI)	*p*	*OR* (95% CI)	*p*
Age (years)	847	31.8 (3.9)	1.0 (0.9-1.0)	.67	0.9 (0.9-1.0)	< .01	1.0 (1.0-1.1)	.51
First child	513	61.7	1.2 (0.9-1.6)	.24	1.3 (0.9-1.9)	.10	1.0 (0.7-1.4)	.99
Education								
Primary	16	1.9	1.0 (0.3-2.5)	.91	2.1 (0.8-5.9)	.15	0.5 (0.2-1.9)	.52
Secondary	269	31.8	1.2 (0.9-1.7)	.11	1.2 (0.8-1.7)	.31	1.1 (0.8-1.5)	.35
Higher	562	66.3	Reference		Reference		Reference	
Income								
< 1200	19	2.4	2.5 (1.0-6.7)	.06	3.2 (1.3-7.9)	.01	0.9 (0.3-2.8)	.70
1200-2000	74	9.3	0.9 (0.6-1.5)	.65	1.2 (0.7-2.1)	.49	1.2 (0.4-3.5)	.69
> 2000	700	88.3	Reference		Reference		Reference	
Psychopathology (BSI)	798	0.2 (0.2)	2.5 (1.3-5.1)	< .01	2.2 (1.1-4.3)	.02	1.4 (0.7-2.6)	.31
Childhood trauma (CTQ)	762	6.6 (1.6)	1.0 (0.9-1.1)	.50	1.1 (1.0-1.2)	.33	1.0 (0.9-1.1)	.89
EMBU*								
Emotional warmth father	738	17.6 (4.3)	1.0 (1.0-1.0)	.43	1.0 (0.9-1.0)	.07	1.0 (1.0-1.0)	.58
Emotional warmth mother	762	18.8 (3.8)	0.9 (0.9-1.0)	.11	1.0 (0.9-1.0)	.07	1.0 (1.0-1.0)	.87
Rejection father	744	8.7 (2.6)	1.0 (1.0-1.1)	.54	1.0 (0.9-1.1)	.89	1.0 (1.0-1.1)	.45
Rejection mother	763	8.7 (2.5)	1.0 (1.0-1.1)	.80	1.0 (0.9-1.1)	.82	1.2 (1.0-1.3)	.02
Overprotection father	729	20.4 (4.6)	1.0 (1.0-1.0)	.95	1.0 (0.9-1.0)	.45	1.0 (1.0-1.1)	.58
Overprotection mother	759	21.7 (4.9)	1.0 (1.0-1.0)	.91	1.0 (1.0-1.0)	.37	1.0 (1.0-1.0)	.97
Family stress (FAD)	787	1.4 (0.4)	1.1 (0.5-2.3)	.74	1.7 (0.8-3.6)	.19	0.6 (0.2-1.4)	.21

SD = standard deviation;
OR = odds ratio;
CI = confidence interval;
BSI = Brief Symptom Inventory;
CTQ = Childhood Trauma Questionnaire;
EMBU = Egna Minnen Beträffande Uppfostran (*the scores reflect the perception of each of the parents in childhood of the pregnant woman);
FAD = Family Assessment Device.
High EE reflects the combined scales Criticism and Emotional Overinvolvement

Chapter 4

Expressed emotion during pregnancy predicts observed sensitivity of mothers and fathers in early childhood

Nicole Lucassen, Henning Tiemeier, Mariëlle Linting, Marian J. Bakermans-Kranenburg, Marinus H. van IJzendoorn, Vincent W.V. Jaddoe, Albert Hofman, Frank C. Verhulst, and Mijke P. Lambregtse-van den Berg

Manuscript submitted for publication

PART II

IN SEARCH OF CONSEQUENCES OF PARENTAL SENSITIVITY

Chapter 5

Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: the Generation R Study

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ABSTRACT

A vast body of literature shows that maternal depression has long-term adverse consequences for children. However, only very few studies have documented the effect of maternal depression on children's ability to process emotional expressions and even fewer incorporated measures of observed maternal sensitivity to further tease apart whether it is the symptoms per se or the associated impact via maternal sensitivity that affects children's developing emotion processing abilities. In a large community sample of Dutch preschoolers ($N = 770$), we examined independent and mediated effects of maternal depressive symptoms and sensitivity on children's ability to recognize emotional expressions using a nonverbal and a verbal task paradigm. Maternal depressive symptoms predicted less accurate emotion-labeling in children, while maternal sensitivity was associated with more accurate emotion-matching, especially for sadness and anger. Maternal sensitivity did not mediate the observed associations between mothers' depressive symptoms and children's emotion recognition, and effects were similar for boys and girls. Given that maternal depressive symptoms and sensitivity affected non-overlapping areas of young children's emotion recognition, prevention and intervention efforts should focus on both alleviating maternal depressive symptoms and improving maternal sensitivity at the same time in order to maximize benefit.

A large body of research has documented the association between maternal depression and adverse child outcomes at various ages (Beardslee, Gladstone, & O'Connor, 2011; Field, 1995; Goodman & Gotlib, 1999; Hay, Pawlby, Waters, & Sharp, 2008; Murray et al., 2011). Even infants of a few months old react negatively to signs of maternal depression as reflected in cognitive and motor developmental delays, negative emotionality, and insecure attachment relationship (Field, 1995; Tronick & Reck, 2009; Wan & Green, 2009; Weinberg & Tronick, 1998). During childhood and adolescence, maternal depression is consistently associated with cognitive and language delays (Brennan et al., 2000; Hay & Kumar, 1995), decreased academic achievement (Murray et al., 2010), interpersonal difficulties (Murray et al., 1999), and psychiatric disorders (Goodman et al., 2011). The above studies included both clinical and non-clinical samples of women. Although effects seem to be stronger for the clinically depressed, studies of community samples of women with self-reported depressive symptoms have also shown adverse outcomes in children (Downey & Coyne, 1990). For convenience, the term 'maternal depression' is used throughout the paper to refer to both types of studies. However, for our study we apply a more stringent terminology in reference to maternal depressive symptoms.

There are several mechanisms involved in the transmission of influences from maternal depression to child adjustment problems (for reviews, see Cummings & Davies, 1994; Elgar, McGrath, Waschbusch, Stewart, & Curtis, 2004; Goodman & Gotlib, 1999). According to Elgar et al. (2004), these mechanisms can be grouped into three sets of interrelated, mediating factors. The first one involves biological mechanisms such as genetic and in utero environmental influences, which run unidirectionally from mother to child. The second factor includes psychosocial mechanisms such as exposure to negative cognitions and behaviors, interaction between mother and child, parenting, family functioning, and modeling. These mechanisms are considered bidirectional with the capacity for mutual influences. The third group of mechanisms represents moderating, contextual factors such as social disadvantage or resources, which indirectly transmit mutual influences on maternal and child functioning. The present study focuses on the second group of mechanisms, more specifically on maternal sensitivity, as this is an important determinant of the quality of mother-child interactions (De Wolff & Van IJzendoorn, 1997). Given the significance of maternal responsiveness for children's optimal socioemotional development, it is not surprising that central to most theoretical proposals are that maternal depressive symptoms, particularly early in the child's life, have adverse effects on the mother-child interaction (Murray, 1992). It has been shown that depressed women are often less sensitive and responsive in their parenting skills than non-depressed women (Field, Healy, Goldstein, & Guthertz, 1990). They usually spend less time looking at their infants, touching them, and talking to them relative to non-depressed women (Cohn, Campbell, Matias, & Hopkins, 1990). In addition, they tend to exhibit less positive and more flat or negative emotions toward their children than non-depressed women (Campbell, Cohn, & Meyers, 1995; Hamilton, Jones, & Hammen, 1993). Even though depressed women can substantially vary in their interaction styles with their children (Field, Hernandez-

Reif, & Diego, 2006), there is converging evidence that postpartum depression has adverse effects on mother-child interaction (see reviews by Beck, 1995; Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Therefore, it is not surprising that some researchers hypothesized it is mothers' interaction style rather than the exposure to maternal depression per se that carries the adverse effect on child functioning (Murray & Cooper, 1997a; Murray, Fiori-Cowley, Hooper, & Cooper, 1996) or accounts for this association in part (Goodman & Gotlib, 1999; NICHD ECCRN, 1999).

A crucial yet under-examined area is to investigate whether maternal depression and sensitivity also impacts on children's ability to process emotional facial expressions. Processing emotional cues, e.g., facial expressions of others, is an important aspect of social functioning in humans (Haxby, Hoffman, & Gobbini, 2002; Philippot & Feldman, 1990). Younger children rely on facial expressions for information on the emotional state of others to a greater extent than on situational cues (Hoffner & Badzinski, 1989). Altered patterns in facial expression recognition (FER) have been reported in a wide range of child and adult clinical populations (for reviews, see Monk, 2008; Phillips, Drevets, Rauch, & Lane, 2003). Furthermore, biases in processing emotional stimuli are often regarded as an early marker of cognitive vulnerability for psychiatric disorders, such as depression (Joormann & Gotlib, 2007; Kujawa et al., 2011; for review, see Leppänen, 2006). Studies have shown that both negative and positive early experiences have an important role in shaping children's ability to recognize facial expressions (De Haan, Belsky, Reid, Volein, & Johnson, 2004; Pollak, Cicchetti, Hornung, & Reed, 2000; Pollak, Messner, Kistler, & Cohn, 2009). Children of depressed mothers experience an atypical emotional environment characterized by a high exposure to sad, angry, or neutral expressions and a low exposure to happy expressions compared with children of non-depressed mothers (Dawson et al., 2003; Field, 1995). Maternal depression during the first years of a child's life occurs at a time when mothers have an important role in the socialization of emotion regulation and expression (Denham, 1998). Thus, maternal depression during the preschool years may play an important role in the development of children's emotion perception (De Haan et al., 2004; Montague & Walker-Andrews, 2002).

Only few studies have investigated the potential role of maternal depression and sensitivity on children's ability to recognize facial expressions. Prior studies showed that although infants of depressed mothers were less likely to look at facial expressions displayed by their mother or a stranger, their elevated cortisol levels after such experimental situations indicated that they may have found these situations more stressful than infants of non-depressed mothers (Diego et al., 2004; Pickens & Field, 1995). Other studies found that infants of depressed mothers discriminated sad from happy expressions but did not perceive sad expressions as novel (Hernandez-Reif, Field, Diego, Vera, & Pickens, 2006). In addition, they discriminated less well between neutral and happy expressions than infants of non-depressed women (Bornstein, Arterberry, Mash, & Manian, 2011). Diego et al. (2002) assessed the effect of interaction style of depressed mothers on infants' perception of facial expressions. They observed that

infants of depressed mothers with an intrusive interaction style showed more differential responding to facial expressions of a stranger than infants of depressed mothers with a withdrawn interaction style. In childhood and early adolescence, following a negative mood induction daughters of depressed women exhibited attentional biases for negative emotions as well as experienced difficulties at recognizing negative emotions relative to children of non-depressed women (Joormann, Gilbert, & Gotlib, 2010; Joormann, Talbot, & Gotlib, 2007; Kujawa et al., 2011). In contrast, without a mood prime, children of mothers with a history of depression showed attentional biases away from negative emotions compared to children of mothers with no history of depression (Gibb, Benas, Grassia, & McGeary, 2009).

There is some suggestion that boys may be particularly vulnerable for the effects of maternal depression (for reviews, see Downey & Coyne, 1990; Grace, Evindar, & Stewart, 2003; Murray & Cooper, 1997b). Much of this knowledge comes from studies that have tended to focus on outcomes such as children's emotional and behavioral problems, cognitive functioning, or language abilities. Among the few studies that have looked at children's ability to process emotional expressions in relation to maternal depression, two included only female offspring (Joormann et al., 2010; Joormann et al., 2007), one observed attentional biases for sad faces only in daughters and not in sons of depressed mothers (Kujawa et al., 2011), and one did not find that sex moderated the effect of maternal depression on sad attentional biases in the offspring (Gibb et al., 2009). Of these studies only the one by Gibb et al. (2009) did not deploy sad mood induction.

The aim of the present study was to investigate the independent and mediated effects of mothers' depressive symptoms and observed sensitivity on young children's FER. Based on the literature, we hypothesized the following: i) higher levels of maternal depressive symptoms will be associated with lower levels of observed sensitivity; ii) children of mothers with high levels of depressive symptoms will recognize positive emotions (i.e., happiness) less accurately and negative emotions (i.e., sadness, anger, and fear) more accurately than children of mothers with no or low levels of depressive symptoms; iii) children of mothers with higher levels of observed sensitivity will recognize facial expressions, in general, more accurately than children of mothers with lower levels of observed sensitivity; iv) observed maternal sensitivity will partially mediate the association between maternal depressive symptoms and children's FER. Finally, we did not expect that sex will moderate the effect of maternal depression on children's FER, as no mood induction was used in the present study.

METHOD

Setting

The current investigation pertained to a subsample of children participating in the Generation R Study, a population-based prospective Dutch cohort from fetal life onwards (Jaddoe

et al., 2012). The subsample, known as the Generation R Focus Cohort, is ethnically homogeneous to exclude possible confounding or effect modification by ethnicity. All children were born between February 2003 and August 2005 and form a prenatally enrolled birth cohort (Jaddoe et al., 2008). The study was conducted in accordance with the guidelines of the World Medical Association Declaration of Helsinki and approved by the Medical Ethics Committee of the Erasmus Medical Center. Parental written informed consents were obtained for all participants.

Participants

The subgroup for the present study consisted of the 862 children and their mothers who attended the Focus Cohort assessments in our research center when children were approximately 3 years old. In 838 mothers, we had information on maternal depressive symptoms at one or more time points: in 796 during the early postnatal period (2-6 months postpartum) and in 747 at the child's age of 3 years. Information on maternal sensitivity when the child was 3 years old was available in 820 of the 838 women. At age 3 years, 673 children had useable accuracy data for emotion-matching and 770 for emotion-labeling.

Maternal depressive symptoms

Information on maternal depressive symptoms was obtained by postal questionnaires. Depressive symptoms were assessed using the depression scale of the Brief Symptom Inventory (BSI), the short version of the SCL-90-R (Derogatis & Melisaratos, 1983). The BSI is a 53-item validated self-report inventory in which participants rate the extent to which they have been bothered (0="not at all" to 4="extremely") in the past week by various symptoms. The instrument is widely used to assess psychological distress (De Beurs, 2004; Derogatis, 1993). The BSI depression scale includes the following six items: "feeling suicidal", "feeling lonely", "feeling blue", "having no interest in anything anymore", "feeling hopeless about the future", and "feeling worthless". Summed scores were divided by the number of completed items with a maximum of one missing item allowed as recommended in the manual (De Beurs, 2004). Since we wanted to test the hypothesis that mothers' observed sensitivity would mediate the associations between maternal depressive symptoms and children's FER, we focused on assessing maternal depressive symptoms during the child's lifetime. Previous literature emphasized the importance of both postpartum and concurrent depressive symptoms in relation to adverse child outcomes (Brennan et al., 2000; Brockington, 2004; Josefsson & Sydsjö, 2007). Therefore, in the present study we included assessments of maternal depressive symptoms at both time points. To define postpartum depressive symptoms, we computed an average score based on BSI depression scores assessed at 2 and 6 months postpartum (the correlation between the two measures was $r = .48$, $p < .001$). To define maternal depressive symptoms during the preschool period, we used maternal BSI depression scores assessed when the child was 3 years old (correlations between mothers' BSI depression scores in the

preschool period and at postpartum were $r = .37$ at 2 months; and $r = .31$ at 6 months, $p < .001$). Correlations between maternal BSI depression scores across the different time points are similar to those reported by Josefsson, Berg, Nordin, & Sydsjö (2001). Internal consistencies of the BSI depression scale for the present study were .80 at 2 months, .83 at 6 months, and .75 at 3 years. To test whether the BSI depression scale accurately tapped maternal depressive symptoms, we compared women's BSI depression score at 2 months postpartum to their score on the Edinburgh Postnatal Depression Scale (Cox, Holden, & Sagovsky, 1987), which was also administered at the same time (Blom et al., 2010). The correlation between the two measures was $r = .67$, $p < .001$. In analyses of maternal depression, we focused on examining women with high and clinically significant levels of symptoms compared to those with no or only mild depressive symptoms during their child's early years. According to the available norms for Dutch female non-patient groups, a raw BSI depression score between 0.67 and 1.79 corresponds to 'high levels' and between 1.80 and 4.00 to 'very high levels' of depressive symptoms. Women with a score > 0.80 typically meet criteria for clinically significant depression (De Beurs, 2009). Therefore, women with BSI depression scores of ≥ 0.67 at postpartum and/or in the preschool period were regarded as 'ever' experiencing high or clinically significant depressive symptoms, whereas women with BSI depression scores < 0.67 both at postpartum and in the preschool period were considered as having none or steady low levels of depressive symptoms. According to this, 39 of the 770 women included in the analyses reported high or clinically significant levels of depressive symptoms at postpartum ($n = 24$), in the preschool period ($n = 12$), or at both times ($n = 3$). To additionally examine the effect of subclinical symptoms of depression and the presence of a potential dose-response relationship between maternal depressive symptoms and other variables, we also analyzed continuous scores of maternal depressive symptoms. To this end, BSI depression scores in the postnatal and preschool period were combined into an average score (*z*-standardized) to reflect the general tendency of mothers to experience depressive symptoms during their child's preschool years.

Maternal sensitivity

At 3 years postpartum, maternal sensitivity was observed in our research center while mother-child dyads performed two tasks which were designed to be too difficult for the child: building a tower and an etch-a-sketch task. Mothers were instructed to help their child as they would normally do. Maternal sensitivity was coded from DVD recordings with the revised Erickson 7-point rating scales for Supportive Presence and Intrusiveness (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990). The subscales Supportive Presence and Intrusiveness were coded for each task. An overall sensitivity score was created by reversing the Intrusiveness scale, standardizing the scores on the subscales, and creating an average over both subscales and both tasks. A similar procedure was used by Alink et al. (2009). The two tasks were independently coded by 13 trained coders. Coders were blind

to maternal reports of depressive symptoms and children's performance on the FER tasks. Coders were extensively trained and regularly supervised. Reliability of coding was assessed directly after the training and at the end of the coding process to detect possible rater drift. For the tower task, the intercoder reliability (intraclass correlation coefficients, ICC) for both subscales was .68 on average directly after the training (n = 20) and .80 on average at the end of the coding process (n = 33), resulting in an overall ICC of .75 (n = 53). For the etch-a-sketch task, the ICC for both subscales was .84 on average directly after the training (n = 15) and .77 on average at the end of the coding process (n = 40).

Facial expression recognition (FER)

At age 3 years, children's FER was assessed in our research center during the same visit when maternal sensitivity was observed. A nonverbal emotion-matching task and a verbal emotion-labeling task were used to assess how accurately children recognize facial expressions of basic emotions. Color images of four basic emotions (happiness, sadness, anger, and fear) were presented on a screen and children responded using a touch-sensitive monitor. Stimuli were selected from a widely used facial stimulus set, the NimStim, on the basis of which identities demonstrated the best recognized pose for a particular emotion-category (Tottenham et al., 2009). Prior to the FER tasks, children were introduced to the idea of emotions and facial expressions by a trained experimenter. Further specifications of the task and stimulus material can be found in Székely et al. (2011).

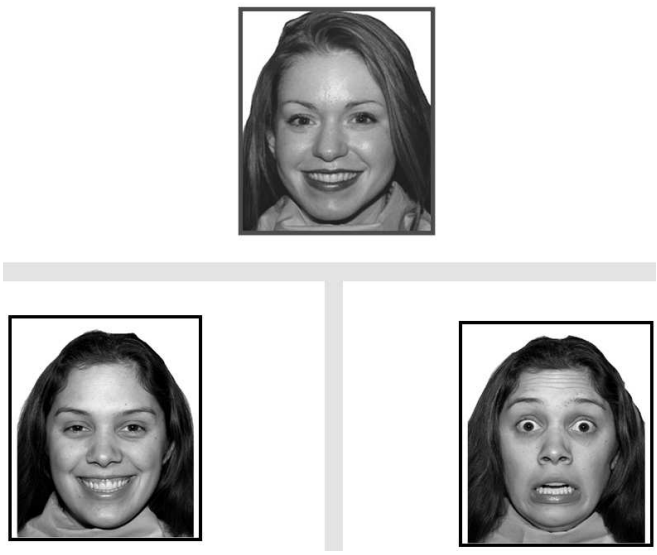

Figure 1. Emotion-matching task. Children were instructed to match 'who feels the same' by pointing to the face (bottom) that displayed the same emotion as the target face (top) on a touch-sensitive monitor.

In the *emotion-matching task,* children had to match the emotion of the target face with one of the two other faces (Figure 1). Sixteen trials of emotion-matching with two female and two male identity pairs and four basic emotions were included. Stimuli presentation was counterbalanced and randomized for emotion and identity. Prior to the emotion-matching task, a *shape-matching task* was presented as a screening for children's basic matching ability. The shape-matching task had the same parameters and layout as the emotion-matching task, only children had to match geometrical shapes. A practice trial and four test trials with different target shapes were included in a fixed order. Similar paradigms have been used previously by Hariri, Bookheimer, and Mazziotta (2000) and Herba, Landau, Russell, Ecker, and Phillips (2006).

In the emotion-labeling task, all four emotions (displayed by the same identity) were shown in each trial and children heard a voice-bit asking in a neutral voice which person was feeling happy, sad, angry or scared. Children were asked to point at the expression that matched this label (Figure 2). Sixteen trials were presented, four items for each of the four emotion-categories using two female and two male identities. Stimuli presentation was counterbalanced and randomized for emotion and identity. A similar paradigm has been used previously by Fries and Pollak (2004). To screen for children's basic labeling ability an animal-labeling task was included. This task was administered to children by their parent at age 30 months, six months preceding the FER assessments. Children were presented six black-and-white photos of animals and had to indicate which one of six pictures matched

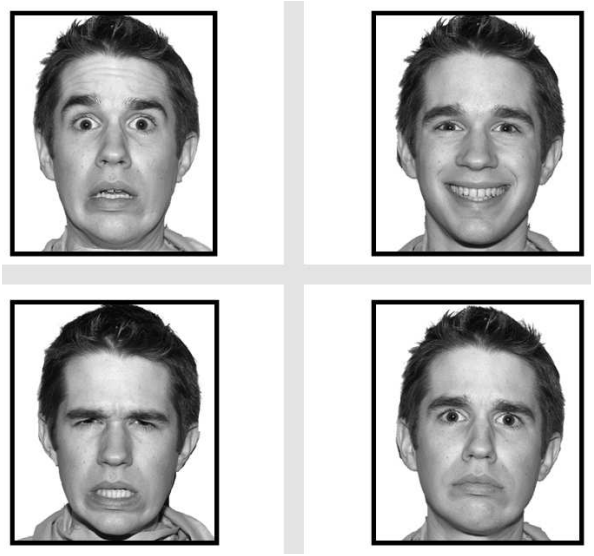

Figure 2. Emotion-labeling task. Children heard an emotion label (e.g., "Who feels happy?") and were required to point to the face whose affect corresponded with the label.

the name of an animal read out by a parent. There were six trials in total with a fixed stimulus order. Similar paradigms have been previously used by Widen and Russell (2003).

Statistical analyses

Relations between maternal depressive symptoms and sensitivity were first explored using linear regression models. Independent effects of maternal depressive symptoms and sensitivity on children's FER were examined using repeated measures ANOVAs. Outcome variables were accuracy scores (mean proportion correct) for matching and labeling happy, sad, angry, and fearful faces. Main predictors were maternal depressive symptoms and sensitivity. Dichotomous predictor variables were entered as between-subjects factors, continuous predictor variables were entered as covariates in the model. In case of a significant interaction effect between the predictor and emotion-category, separate linear regression analyses were run for each emotion to examine specificity of effect of the predictor. For these analyses we applied a Bonferroni correction to reduce errors due to multiple testing ($\alpha = 0.05/4 = 0.01$).

Interaction between the predictors and child sex was tested in all models. When this was not significant, we reported results from the model without the interaction term.

To examine whether the effect of maternal depressive symptoms on children's FER was mediated by sensitivity, we tested indirect effects of maternal depressive symptoms on children's FER via sensitivity using bootstrapping, a non-parametric resampling procedure. This method is preferred to alternative mediation tests (e.g., causal steps or normal theory approaches) as it respects the non-normality of the sampling distribution of the indirect effect (Preacher & Hayes, 2008; Shrout & Bolger, 2002). In addition, it has lower Type I error rates and greater power to detect indirect effects than alternative mediation tests (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). In the present study, we investigated the significance of mediation using 95% bias-corrected bootstrap confidence intervals for indirect effects and contrasts of indirect effects applying 5000 bootstrap samples. Analyses were carried out in SPSS using a macro developed by Preacher and Hayes (2008). Confidence intervals were used to determine indirect relationships between maternal depressive symptoms and children's FER including maternal sensitivity as a potential mediator. Indirect effects are present when the confidence intervals do not include 0. In our case, this meant that the indirect effect was significant at $p < .05$.

Covariates

Analyses including children's FER as outcome were adjusted for child's age, sex, shape-matching/animal-labeling accuracy, gestational age at birth, maternal age at intake, maternal education, marital status, parity, and maternal smoking during pregnancy. Most covariates were selected based on previous literature (Brennan et al., 2000; Campbell, Matestic, Stauffenberg, Mohan, & Kirchner, 2007). Shape-matching and animal-labeling accuracies were included to account for children's basic matching and labeling ability. Information on child's sex and gestational age at birth was obtained from midwives and obstetricians. Information on maternal education,

marital status, parity, and maternal smoking during pregnancy was collected via questionnaires. Child's age and shape-matching accuracy were assessed when the outcome, FER, was measured. Animal-labeling accuracy was assessed by the parent at age 30 months. Maternal education was coded as 'low' (primary education or no education), 'medium' (secondary education), or 'high' (college or university degree). Since there were only eight mothers (1%) in the low category, low and medium categories were collapsed for further analyses. Marital status was dichotomized into 'married or living with a partner' and 'living alone'. Parity was dichotomized into 'primiparous' and 'multiparous'. Maternal smoking was assessed in the first, second, and third trimester and summarized as 'yes, at least sometime during pregnancy' and 'never during pregnancy'. Percentages of missing data on the covariates ranged from 0.1% to 2.5%.

Non-response analysis

To examine patterns of non-response, we compared basic characteristics of children in the present sample ($N = 770$) to children who visited our research center at 3 years but did not have any (useable) FER data ($N = 92$). This latter group included 29 children to whom FER tasks were not administered due to time constraints, 7 children with incomplete FER data, and 56 children who had available FER data but were not included in analyses due to the following reasons: 6 children were tested at the beginning of the assessments using a different test procedure; 1 child was older than 45 months at the time of visit; 7 twins were randomly excluded from each participating twin pair to avoid biases due to paired data; 24 children without available information on maternal depressive symptoms; and 18 children without available information on maternal sensitivity. Children without useable FER data were on average 0.48 months older (t (860) = 2.92, $p = .004$) and were born 0.63 weeks earlier (t (105.17 – corrected for unequal group variances) = -2.77, $p = .007$) than children who had useable FER data. Furthermore, their mothers were slightly younger (mean difference = 0.84 years, t (860) = -2.02, $p = .044$) and less highly educated (54.5% vs. 67.7%, χ^2 (1) = 5.87, $p = .015$) than mothers of children with FER data. The two groups were comparable in terms of distribution of boys and girls, marital status, parity, and smoking during pregnancy (all p values > .05). Importantly, depressive symptoms and maternal sensitivity did not affect non-response (all p values > .05).

RESULTS

Descriptive statistics

Sample characteristics are presented in Table 1 separately for mothers with high and lower levels of depressive symptoms. Mothers with high levels of depressive symptoms were more often living alone (χ^2 (1) = 24.45, $p < .001$) and smoking during pregnancy (χ^2 (1) = 4.86, $p = .027$) than mothers with lower levels of depressive symptoms. Given that the animal-labeling task was mostly administered to children by their mothers at home, we examined whether mater-

Table 1. Sample characteristics according to high and low levels of maternal depressive symptoms

	Maternal depressive symptoms	
	High (n = 39)	Low (n = 731)
	% or *M* (*SD*)	% or *M* (*SD*)
Child characteristics		
Sex (boys)	33.3	51.4
Age (months)	37.66 (1.57)	37.49 (1.44)
Gestational age at birth (weeks)	39.39 (2.79)	40.12 (1.60)
Screening-task accuracy		
Animal-labeling	.93 (.11)	.95 (.12)
Shape-matching	.85 (.28)	.90 (.20)
Emotion-matching accuracy		
Happiness	.68 (.29)	.67 (.29)
Sadness	.62 (.30)	.59 (.29)
Anger	.53 (.33)	.62 (.29)
Fear	.61 (.33)	.65 (.29)
Emotion-labeling accuracy		
Happiness	.47 (.39)	.53 (.33)
Sadness	.40 (.32)	.52 (.33)
Anger	.42 (.38)	.56 (.36)
Fear	.36 (.35)	.45 (.33)
Maternal characteristics		
Age at intake (years)	32.17 (4.96)	32.06 (3.63)
Educational level (high)	53.8	68.2
Marital status (living alone)	17.9	2.8
Parity (primiparous)	61.5	62.1
Smoked during pregnancy (yes)	33.3	18.9

nal depressive symptoms (as assessed in the present study) were associated with children's animal-labeling accuracy. Results indicated that children's scores for animal-labeling were comparable between those children whose mothers experienced high levels of depressive symptoms (at postpartum and/or in the preschool period) and children whose mothers reported no or only mild depressive symptoms (mean difference = 0.01, t (761) = 0.632, p = .528). There was a significant but very weak negative correlation between mothers' continuous postpartum depression scores and children's animal-labeling accuracy (N = 725, r = -.093, p = .012), while mothers' concurrent depressive symptoms scores were not significantly correlated with children's animal-labeling accuracy (N = 686, r = .016, p = .674).

As shown in Table 1, children's performance for shape-matching and animal-labeling was close to ceiling level. In the present study, a ceiling-level performance on these screening-tasks was desired, as it indicated that most children were able to understand and perform

basic matching and labeling. This was necessary to be able to complete our FER tasks. Importantly, it also meant that a lower score on the FER tasks was not due to children's inability to match or label.

Maternal depressive symptoms and sensitivity

Mother's depressive symptoms predicted their observed sensitivity. Women with high levels of depressive symptoms were less sensitive when interacting with their children in a laboratory setting than women with no or mild depressive symptoms (B = -.246, SE = .111, p = .027). In addition, there was also a dose-response relationship between mothers' depressive symptoms and observed sensitivity, as higher levels of depressive symptoms also continuously predicted lower observed sensitivity (B = -.065, SE = .029, p = .027).

Single time-point analyses of maternal depression scores revealed that this association was primarily driven by postpartum levels of depressive symptoms (high vs. low: B = -.311, SE = .133, p = .020; continuous scores: B = -.072, SE = .027, p = .007). The concurrent association between mothers' depressive symptoms and observed sensitivity was in the same direction but did not reach statistical significance (high vs. low: B = -.210, SE = .174, p = .230; continuous scores: B = -.019, SE = .028, p = .501).

Maternal depressive symptoms and FER

Maternal depressive symptoms did not predict children's emotion-matching accuracy. However, maternal depressive symptoms significantly predicted children's emotion-labeling accuracy (Table 2). Children of mothers with high levels of depressive symptoms were less accurate at labeling emotions than children of mothers with no or mild symptoms. Analyses using continuous scores of maternal depressive symptoms confirmed this finding (Table 2). There were no significant interaction effects between maternal depressive symptoms and emotion-category on children's emotion-matching or emotion-labeling accuracies (all p val-

Table 2. Main effects of maternal depressive symptoms and maternal sensitivity on children's facial expression recognition

	Emotion-matching task		Emotion-labeling task	
	Main effects		Main effects	
	F ($df1$, $df2$)	p	F ($df1$, $df2$)	p
Maternal depressive symptoms				
Dichotomous (high vs. low)	0.040 (1,657)	.841	5.742 (1, 744)	.017
Continuous (z-score)	0.019 (1, 657)	.891	5.018 (1, 744)	.025
Maternal sensitivity (z-score)	8.664 (1, 661)	.003	0.355 (1, 749)	.551

Note. Main effects are between-subjects effects of predictors examined separately using repeated measures ANOVAs. All models were adjusted for child's age, sex, basic matching/labeling ability, gestational age at birth, maternal age, education, marital status, parity, and prenatal smoking.

ues > .05). Likewise, there was no significant interaction effect between mothers' depressive symptoms and child sex for emotion-matching or emotion-labeling accuracies (all *p* values > .05).

Next, we also ran separate regression models to determine whether the observed association between maternal depressive symptoms and children's emotion-labeling accuracy was driven by mothers' postnatal or concurrent depressive symptoms. Outcomes were children's accuracy scores for emotion-labeling, predictors were either postpartum or concurrent maternal depressive symptoms. Models were adjusted for the same covariates as analyses including the composite maternal depression measure. Results indicated that the observed link between the composite maternal depression score and children's overall emotion-labeling accuracy was mainly due to mothers' concurrent depressive symptoms (dichotomous BSI depression scores: F (1, 670) = 4.436, p = .036; continuous BSI depression scores: F (1, 670) = 5.976, p = .015). The effect of maternal postpartum depressive symptoms on children's emotion-labeling accuracy did not reach statistical significance (dichotomous BSI depression scores: F (1, 708) = 2.709, p = .100; continuous BSI depressions cores: F (1, 708) = 1.969, p = .161).

Maternal sensitivity and FER

Observed maternal sensitivity had a significant main effect on children's emotion-matching accuracy (Table 2). Children whose mothers were more sensitive generally matched emotions more accurately. In addition, the interaction effect of maternal sensitivity by emotion-category was also significant for emotion-matching accuracy (F Greenhouse-Geisser (2.9, 1912.6) = 8.648, p = .003). To specify the nature of the effect of maternal sensitivity on the different emotions, separate linear regressions were run for each emotion. Results indicated that children with more sensitive mothers especially matched sad faces (B = .046, SE = .017, p = .008) and angry faces (B = .061, SE = .017, p < .001) more accurately. Maternal sensitivity was not associated with children's emotion-labeling accuracy (all p values > .05). There was no significant interaction effect of maternal sensitivity by child sex on emotion-matching or emotion-labeling accuracy (all p values > .05).

Maternal depressive symptoms, maternal sensitivity, and FER

Results of the bootstrap analyses for emotion-matching accuracy are included in Appendix A and for emotion-labeling accuracy in Appendix B. Since all confidence intervals included 0, there was no evidence in the present sample that maternal sensitivity mediated the relationship between mothers' depressive symptoms and children's FER.

DISCUSSION

Despite the prevalence of maternal depression and its known negative effect on the offspring's emotional development, surprisingly few studies have examined the link between maternal depressive symptoms and young children's ability to accurately recognize emotional expressions. Furthermore, even fewer studies have incorporated measures of maternal sensitivity to further tease apart whether it is the depressive symptoms per se or the associated impact via maternal sensitivity that affects children's developing emotion processing abilities. Thus, using data from a large-scale prospective longitudinal study we examined the links between maternal depressive symptoms, observed maternal sensitivity, and preschoolers' ability to process emotional facial expressions.

In line with our first hypothesis, maternal depressive symptoms were negatively associated with maternal sensitivity as observed in a laboratory setting. Other large-scale epidemiological studies have also reported negative associations between maternal depressive symptoms and observed sensitivity (Campbell et al., 2004; Campbell, et al., 2007; NICHD ECCRN, 1999). Additionally, our results also supported the finding of a previous meta-analysis that even subclinical levels of depressive symptoms are related to less sensitive maternal behavior (Lovejoy et al., 2000). In the present study, this association was mainly explained by women's postpartum depressive symptoms. The negative impact of postpartum depression on mother-child interaction is well established in the literature (Beck, 1995). The present results extend this literature by suggesting that symptoms of postpartum depression, whether or not they reach diagnosable levels, may have long-term consequences for how women interact with their offspring.

Our second hypothesis that maternal depressive symptoms would be associated with lower recognition accuracy for positive emotions and higher recognition accuracy for negative emotions in the offspring was not supported by the results. Instead, maternal depressive symptoms were linked to reduced accuracy in the offspring for labeling all emotions even after controlling for basic labeling ability. Importantly, this association was mainly driven by concurrent assessment of maternal depressive symptoms. Most developmental studies have examined children's attentional biases in viewing emotional stimuli in relation to maternal depression. These studies all supported the presence of attentional biases for negative emotions, although the direction of this bias is still debated. Studies that used a negative mood induction found biased attention toward sad faces (Joormann et al., 2007; Kujawa et al., 2011), while those without a mood induction reported attentional biases away from sad faces (Gibb et al., 2009). These studies typically included two categories of emotion (i.e., happiness and sadness) except for the one by Gibb et al. (2009) which also included anger. In addition, they all examined school-aged children and young adolescents, while our participants were all of preschool age. One study that compared daughters of depressed women to daughters of never-depressed women in their ability to correctly identify happy, sad, and angry expressions of varying intensities reported that daughters of depressed women required greater intensities to correctly identify sad faces and made more

errors in identifying angry faces than daughters of never-depressed women (Joormann et al., 2009). In the present study, we used full intensity expressions given the young age of our participants. The above mentioned differences in study design make it difficult to compare our findings with these studies. Importantly, our observation of a generally reduced accuracy for labeling facial expressions fits with the results of a recent meta-analysis that reported robust global FER deficits among patients with major depression relative to healthy controls (Demenescu, Kortekaas, Den Boer, & Aleman, 2010).

Single time-point analyses revealed that the effect of maternal depressive symptoms on children's emotion-labeling accuracy was concurrent rather than long-lasting, at least in the present sample where the percentage of women reporting high or clinically meaningful levels of depressive symptoms was very low. The negative effect of concurrent maternal depression on the offspring is well documented in the literature (Brennan et al., 2000; Korhonen, Luoma, Salmelin, & Tamminen, 2012; Trapolini, McMahon, & Ungerer, 2007). Although the adverse consequences of postnatal depression for the child have also been widely shown, there is still contradiction as to whether these consequences are long-term or diminish over time along with the reduction or remission of maternal depressive symptoms (Luoma et al., 2001). Some studies suggested a long-term impact only when the depression is chronic (Brennan et al., 2000; NICHD ECCRN, 1999). Our lack of finding of a longitudinal effect for postnatal maternal depressive symptoms might be due to the fact that these symptoms were largely transient in the present low-risk sample (only three women reported high levels of depressive symptoms at both time points).

Noteworthy is that effects of maternal depressive symptoms emerged only on the verbal FER task. There is evidence that verbal and visuospatial FER abilities may follow different developmental trajectories in childhood (Vicari, Reilly, Pasqualetti, Vizzotto, & Caltagirone, 2000). One potential explanation for this differential development lies in the underlying neurobiology of verbal and nonverbal or visuospatial FER. Studies using task paradigms similar to our nonverbal FER task have consistently reported increased bilateral amygdala activation (Hariri et al., 2000; Hariri, Mattay, Tessitore, Fera, & Weinberger, 2003; Phillips et al., 2004), whereas paradigms similar to our verbal FER task have been associated with increased prefrontal activation (Guyer et al., 2008; Phan, Wager, Taylor, & Liberzon, 2002). Prefrontal brain structures modulate emotional behavior through shaping the activation of the amygdala (Herba & Phillips, 2004). One study found that maternal depression was related to lower frontal brain activation in the offspring, which partly mediated the link between maternal depression and child behavioral problems at age three years (Dawson et al., 2003). Although we did not examine brain activation patterns in the present study, it is plausible that maternal depressive symptoms lead to lower levels of prefrontal activation in children and our verbal FER task was more sensitive to such differences than our nonverbal FER task. This hypothesis should be tested in future studies. Alternatively, it could be that children of mothers with depressive symptoms had difficulties connecting appropriate verbal labels

to facial displays of emotion. Murray, Kempton, Woolgar, and Hooper (1993) found that the speech of depressed mothers was less focused on infant experience than that of well mothers. This may make it difficult for the developing child to create links between emotional experiences and appropriate verbal labels.

In the present study, we did not find evidence for a differential effect of maternal depressive symptoms on boys and girls in relation to their FER. Although gender differences have not been observed in rates of major depression during childhood, by adolescence girls are twice as likely to develop depressive disorders as boys (Lewinsohn, Clarke, Seeley, & Rhode, 1994). In parallel, a view emerging from previous reports on the effect of maternal depression on child outcome, is that boys may be particularly vulnerable to the adverse effects of maternal depression from infancy through adolescence in terms of cognitive development (Hay et al., 2008; Kurstjens & Wolke, 2001; Murray, Arteche, Fearon, Halligan, & Cooper, 2010), reaction to less efficient maternal interactions associated with the disorder (Murray et al., 1993), as well as school drop-out (Ensminger, Hanson, Riley, & Juon, 2003). However, a recent review suggests that maternal depression may signal differential risk for boys and girls depending on the outcome (Beardslee et al., 2011). As discussed in the introduction, gender differences in children's emotion processing in relation to maternal depression are quite inconsistent. Two studies focused only on girls (Joormann et al., 2009, 2007), one found an effect of maternal depression only for girls and not for boys (Kujawa et al., 2011), and one did not find sex differences at all (Gibb et al., 2009). Our study is consistent with the latest, which was incidentally the only study that, similar to ours, did not deploy negative mood induction.

Our third expectation that observed maternal sensitivity would be associated with more accurate FER in children was partially supported by the results. Children of more sensitive mothers performed better on our nonverbal FER task, especially at identifying sad and angry expressions. The NICHD ECCRN study (1999) also reported beneficial effects for maternal sensitivity on children's cognitive and social outcomes. Campbell et al. (2007) identified maternal sensitivity as an important, independent predictor of child outcome. Our finding that maternal sensitivity had a positive effect especially on identifying sad and angry faces may seem surprising at first glance. However, in one of our previous studies using the same sample (Székely et al., 2011) we reported that children found sad and angry faces the most difficult to identify on our nonverbal FER task. Thus, it may be that sensitive maternal behavior provides a more stimulating emotional environment, which in turn may further advance the development of nonverbal FER in children (De Haan et al., 2004).

Fourthly, although we had expected that, to some extent, maternal sensitivity would explain the link between maternal depressive symptoms and children's FER, our results did not provide evidence for this hypothesis. This is in contrast with studies that reported a mediating role for maternal sensitivity in the association between maternal depression and poor child outcome (Campbell et al., 2007). Nevertheless, our result is consistent with previous studies in suggesting that maternal sensitivity does not explain the link between maternal depression

and child outcome (Murray et al., 1999; NICHD ECCRN, 1999). Risk from depressed mother to child can also be transmitted via alternative pathways. Since the present study included a relatively low-risk sample and analyses were adjusted for contextual risk factors, we cannot comment on the role of contextual adversity in the transmission mechanism. Environmental factors, however, do not fully account for the risk posed to children of depressed mothers. Twin and adoption studies have suggested that genetics explain approximately 30% to 40% of the variance in adult major depression (Beardslee et al., 2011). Risk for depression is significantly higher among first-degree relatives and the highest among the offspring of depressed parents (Rice, Harold, & Thaper, 2002). In addition to the notion that children of depressed parents inherit the likelihood for depression per se, heritability also contributes significantly to vulnerabilities to depression (Goodman & Gotlib, 1999; Goodman, 2007). Biased processing of emotional expressions is often implicated as a vulnerability marker of depression (Leppänen, 2006) and is subserved by the same neural circuitry in the brain that is thought to be dysregulated in depression (Ressler & Mayberg, 2007).

In summary, maternal depressive symptoms and sensitivity both affected children's developing FER, but in different ways: maternal depressive symptoms had an overall negative effect on children's accuracy to label emotions, whereas sensitivity exerted more positive emotion-specific effects that were seen for the nonverbal FER task. The ability to accurately recognize emotional expressions is important for smooth social interaction and general well-being throughout life. For instance, in the same sample we found that children who labeled angry expressions more accurately at age 3 years were rated by their parents as more prosocial on the corresponding scale of the Strengths and Difficulties Questionnaire (Goodman, 1997) at age 5 (unpublished data). Identifying early predictors and correlates of young children's FER is important to increase our understanding of normal and pathological socio-emotional development.

Limitations

There are several strengths of the current study: it includes a large group of very young, typically developing children; maternal depressive symptoms were assessed prospectively from birth until the child's age of 3 years when the outcome, children's FER, was measured; maternal sensitivity was observed in our laboratory using structured interaction tasks; the outcome, children's FER, was assessed using computerized tasks specifically developed for this age group. However, despite these strengths we were faced with a number of limitations. Firstly, although an important strength of our investigation is that our hypotheses were tested within the context of a prospective longitudinal study with data on a range of important variables covering the first years of life for a large number of children, high or clinically relevant depressive symptoms were generally rare and predominantly transient. This strongly limits the generalizability of our findings to clinical populations. Yet, addressing our research questions within a less severely depressed population also allows for a more

direct test of the influence of maternal depressive symptoms, since the effects of contextual stressors (e.g., poverty, very low maternal education) are minimized. Furthermore, the fact that we found negative associations even between subclinical levels of maternal depressive symptoms and children's emotion-labeling accuracy emphasizes the importance of studying the links between maternal depression and children's FER and its relevance to the general population, as well as providing a conservative test of our hypotheses. Secondly, we relied on maternal self-reports of depressive symptoms. There are indications that self-report measures in community samples are more reflective of general "distress" rather than "true depression" (Atkinson et al., 2000). However, self-report measures are commonly used in epidemiological studies and the fact that maternal sensitivity and our outcome measures were independently assessed or observed minimizes any problems due to shared methods variance. Thirdly, we lacked information on maternal depressive symptoms between the first and the third year of the child's life. Given the episodic nature of depression, we may have missed some women who experienced elevated levels of depressive symptoms only during this time period (Brennan et al., 2000). Nevertheless, in the current study we had information on postpartum and concurrent symptoms of depressions, both of which have been shown to have important implications for poor child outcomes (Beck, 1998; Brennan et al., 2000; Korhonen et al., 2012; Murray et al., 1999; Teti, Gelfand, Messinger, & Isabella, 1995; Trapolini et al., 2007). Fourthly, no information was available on children's verbal ability, therefore, analyses including emotion-labeling accuracy were not adjusted for this variable. Previous studies found that maternal depression is associated with lower vocabulary scores in children (Brennan et al., 2000), which, in turn, may affect the identification of more subtle emotional expressions (Camras & Allison, 1985). However, the present study assessed the recognition of basic emotional expressions and, prior to the emotion-labeling task, experimenters made sure that children understood the emotion labels, referring to the four facial expressions they had to recognize throughout the task. Finally, we had only cross-sectional observations of maternal sensitivity. Ideally, the mediating variable is assessed before the outcome. In the present study, maternal sensitivity and children's FER were observed independently but during the same laboratory visit. However, possible reverse causality is generally less of a problem in negative studies.

Conclusion

Concurrent maternal depressive symptoms negatively impact young children's ability to verbally identify emotional expressions, while concurrent maternal sensitivity exerts a beneficial effect on children's ability to nonverbally identify emotional expressions. Given that maternal depressive symptoms and sensitivity affected non-overlapping areas of children's FER and maternal sensitivity did not explain the association between mothers' depressive symptoms and children's FER, prevention and intervention efforts should focus on both alleviating maternal depressive symptoms and improving maternal sensitivity at the same time in order to maximize benefit.

APPENDIX

Appendix A. Mediation analyses: Testing indirect effects of maternal depressive symptoms on children's emotion-matching accuracy including maternal sensitivity as a potential mediator

	Indirect effects of maternal depressive symptoms on emotion-matching via maternal sensitivity				
	TOTAL	HAPPY	SAD	ANGRY	FEARFUL
	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)
Maternal depressive symptoms					
Dichotomous (high vs. low)	-.0042 (-.0152, .0011)	-.0047 (-.0196, .0013)	-.0061 (-.0230, .0029)	-.0054 (-.0215, .0069)	.0016 (-.0026, .0125)
Continuous (*z*-scores)	-.0006 (-.0031, .0009)	-.0006 (-.0043, .0011)	-.0008 (-.0051, .0018)	-.0001 (-.0037, .0037)	-.0002 (-.0006, .0031)

Note. Models were adjusted for child's age, sex, shape-matching accuracy, gestational age at birth, maternal age, education, marital status, parity, and prenatal smoking

Appendix B. Mediation analyses: Testing indirect effects of maternal depressive symptoms on children's emotion-labeling accuracy including maternal sensitivity as a potential mediator

	Indirect effects of maternal depressive symptoms on emotion-labeling via maternal sensitivity				
	TOTAL	HAPPY	SAD	ANGRY	FEARFUL
	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)	Bootstrap estimate (95% CI)
Maternal depressive symptoms					
Dichotomous (high vs. low)	-.0019 (-.0119, .0022)	-.0028 (-.0157, .0029)	-.0017 (-.0146, .0041)	.0012 (-.0051, .0129)	-.0047 (-.0182, .0011)
Continuous (*z*-scores)	-.0004 (-.0033, .0004)	-.0006 (-.0041, .0006)	-.0004 (-.0038, .0006)	.0002 (-.0011, .0034)	-.0010 (-.0049, .0004)

Note. Models were adjusted for child's age, sex, animal-labeling accuracy, gestational age at birth, maternal age, education, marital status, parity, and prenatal smoking

Chapter 6

Executive functions in early childhood: The role of mothers' and fathers' parenting practices

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Chapter 7

The association between paternal sensitivity and infant–father attachment security: A meta-analysis of three decades of research

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ABSTRACT

For almost three decades the association between paternal sensitivity and infant-father attachment security has been studied. The first wave of studies on the correlates of infant-father attachment showed a weak association between paternal sensitivity and infant-father attachment security ($r = .13$, $p < .001$, $k = 8$, $N = 546$). In the current paper, a meta-analysis of the association between paternal sensitivity and infant-father attachment based on all studies currently available is presented, and the change over time of the association between paternal sensitivity and infant-father attachment is investigated. Studies using an observational measure of paternal interactive behavior with the infant, and the Strange Situation Procedure to observe the attachment relationship were included. Paternal sensitivity is differentiated from paternal sensitivity combined with stimulation in the interaction with the infant. Higher levels of paternal sensitivity were associated with more infant-father attachment security ($r = .12$, $p < .001$, $k = 16$, $N = 1355$). Fathers' sensitive play combined with stimulation was not more strongly associated with attachment security than sensitive interactions without stimulation of play. Despite possible changes in paternal role patterns we did not find stronger associations between paternal sensitivity and infant attachment in more recent years.

INTRODUCTION

Attachment security represents the child's trust in his or her caregiver, and is evident from the child's preferential desire for contact with the caregiver in times of stress and use of the caregiver as a "secure base" to explore the environment (Bowlby, 1969). Maternal sensitivity plays a crucial role in shaping the mother-infant attachment relationship. Sensitivity is defined as the ability to perceive and to interpret accurately the signals and communications implicit in the infant's behavior, and given this understanding, to respond to them appropriately and promptly (Ainsworth, Blehar, Waters, & Wall, 1978). Examples of sensitivity include contingent vocalizations, encouragement of the child's efforts, and soothing the infant in times of distress. The association between maternal sensitivity and the mother-infant attachment relationship is a frequently replicated finding, not only in correlational studies (see De Wolff & Van IJzendoorn, 1997, for a meta-analysis), but also in randomized experimental intervention studies. Interventions that most successfully manage to enhance the level of maternal sensitivity also create the largest increase in attachment security (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003), which suggests a causal relation between sensitivity and attachment.

At the core of attachment theory is the claim that infants not only become attached to their biological mother but also to other caregivers who interact regularly with them. Although biological mothers were the target of most studies on sensitivity and infant attachment, several studies focused on the role of paternal sensitivity in infant-father attachment. The first wave of studies on the correlates of infant-father attachment showed a weak association between paternal sensitivity and infant-father attachment security. Van IJzendoorn and De Wolff (1997) reported that the combined effect size across eight studies amounted to a correlation of .13, whereas the effect size for maternal sensitivity and infant-mother attachment was estimated to be $r = .24$ in a much larger set of 21 studies (De Wolff & Van IJzendoorn, 1997). More recent studies on fathers show mixed results, with some failing to find a significant relation between paternal sensitivity and attachment security (Braungart-Rieker, Garwood, Powers, & Wang, 2001; Volling, McElwain, Notaro, & Herrera, 2002), and others reporting a significant but modest association (Eiden, Edwards, & Leonard, 2002; Lucassen et al., 2010).

At least two reasons for the rather weak association between paternal sensitivity and attachment may be mentioned. First, fathers spend less time with their child compared to mothers, who are usually the primary caregiver. The link between their parenting behavior and the attachment relationship may be more tenuous than in the case of mothers. Research on infant attachment and sensitivity of highly involved fathers is scarce and equivocal (Cox, Owen, Henderson, & Margand, 1992; Lucassen et al., 2010). Second, fathers may interact with their infants in somewhat different ways compared to mothers. Traditionally fathers have been described as focused on stimulating and exploratory play interactions with their children, with less emphasis on emotional support and warmth (Grossmann, Grossmann, Kindler,

& Zimmermann, 2008). Mothers might relate to their infants with sensitive warmth, whereas fathers might choose sensitive stimulation as a way to promote feelings of security in their infants. Stimulation can be described as any activating interaction on the part of the parent directed toward the infant in order to promote his or her exploration or playful behavior (De Wolff & Van IJzendoorn, 1997).

Examining determinants of the attachment relationship with the infant is important, since several studies have shown positive correlates with a secure father-child attachment relationship. For example, children with a secure attachment relationship with their father have fewer behavior problems (Verschueren & Marcoen, 1999) and show higher levels of sociability (Lamb, Hwang, Frodi, & Frodi, 1982). In this paper, a meta-analysis of the association between paternal sensitivity and infant-father attachment is presented, elaborating on the meta-analysis conducted by Van IJzendoorn and De Wolff in 1997. Through cumulative meta-analysis (Borenstein, Hedges, Higgings, & Rothstein, 2009) we document the change in effect sizes across the past three decades of research. This cumulative meta-analysis is important for the field of father studies, as fathers seem to have become gradually more involved in positive engagement activities with their children over the last few decades, which might affect the relationship with their child (Pleck, 2010). In a cumulative meta-analysis, new research findings are added to what was previously known. Each time a new study is added, a separate meta-analysis is conducted (Muellerleile & Mullen, 2006). Typically, each new study reduces the confidence intervals around an increasingly precise estimate (Hanson & Broom, 2005). A cumulative meta-analysis has more statistical power, which is especially relevant to a set of studies in which small effect sizes are observed (Mulrow, 1994). Special attention in this analysis is given to the potentially different roles of paternal sensitivity and paternal sensitivity combined with stimulation. We expect that higher levels of paternal sensitive warmth, and in particular when co-occurring with sensitive stimulation, are associated with more infant-father attachment security.

METHOD

Dataset

For our meta-analysis, we systematically searched the databases PsycInfo, Social Sciences Citation Index, Educational Resources Information Center, and ProQuest Dissertations and Theses with the key words father, fathering, paternal, sensitivity, responsivity, synchrony, warmth, parenting, and attachment in the title or abstract. We searched the online available integrative statements of the paper symposia organized at the biennial meetings of the Society for Research in Child Development (2009 – 2011). Furthermore, we used the search engine Google Scholar with the keywords father, sensitivity, and attachment to identify relevant studies. In addition to the electronic searches, we searched recently published books on

Table 1. Infant-father attachment studies: Descriptives and effect sizes

Author(s)	*N*	Measurement of sensitivity S = sensitivity SS = sensitivity & stimulation	Age observation sensitivity (months)	Design C = concurrent P = predictive	Age Strange Situation Procedure (months)	Secure (%)	Effect size (*r*)
* Belsky (1983)	51	Overall engagement, response, stimulation, care giving, positive affection (SS)	1, 3, 9	P	13	63	.11
* Easterbrooks (1984)	75	Emotional supportiveness, quality of assistance (SS)	20.5	C	20.5	66	.00
* Goossens (1990)	75	Sensitivity (S)	15	C	15	64	.26
* Cox (1992)	33	Sensitivity, warmth, level of activity, stimulation (SS)	3	P	12.5	63	.43
* Grossmann (1992)	46	Interactive smoothness, empathy (S)	2, 6, 10	P	18	41	.03
* Volling (1992)	113	Responsiveness, stimulation (SS)	3, 9	P	13	80	.16
* Schneider Rosen (1993)	62	Paternal acceptance, quality of assistance (SS)	21.5	C	21.5	69	.00
* Caldera (1995)	90	Positive regard, sensitivity to nondistress, intrusiveness (SS)	6	P	18	68	.16
Braungart-Rieker (2001)	86	Sensitivity, intrusiveness (SS)	4	P	13	68	.11
Volling (2002)	62	Sensitivity, intrusiveness (SS)	12.5	C	12.5	60	.00
Eiden (2002)	220	Sensitive responding, negative affect, positive involvement (S)	13.5	C	13.5	61	.14
Kochanska (2005)	100	Responsiveness (S)	7	P	15	66	.00
Schoppe-Sullivan (2006)	91	Sensitivity (S)	12	C	12	64	.17
Wong (2009)	62	Sensitivity (S)	3.5	P	13	64	.24
Hazen (2010)	105	Sensitivity (S)	8	P	13.5	59	.00
Lucassen (2010)	84	Sensitivity, cooperation (SS)	14	C	14	68	.20

Note. References marked with an asterisk indicate studies included in the meta-analysis conducted by Van IJzendoorn and De Wolff (1997)

attachment, fathering, or parenting with contributions from international experts on these topics (Cummings & Cummings, 2002; Grossmann et al., 2008; Lamb & Lewis, 2010; Parke, 2002). Infant-father attachment studies conducted before 1996 were derived from the first meta-analysis on this topic by Van IJzendoorn and De Wolff (1997). Lastly, the reference lists of the collected papers were searched for relevant studies. We finished the search in May 2011.

We detected 1613 studies with our search terms. Our search was restricted to studies using an observational measure of paternal interactive behavior with the infant, and the gold standard assessment of attachment security, the Strange Situation Procedure (SSP, Ainsworth et al., 1978). After examining the abstracts of all studies, 22 studies were relevant for our meta-analysis. Six studies presented data on (partly) overlapping samples. When samples of studies were overlapping, the papers that reported on the largest groups of participants were included in our meta-analysis. We found one dissertation abstract (ProQuest document ID: 2105027951) with measurements of sensitivity and attachment in 'parents' but it was unclear whether fathers were included in the study, and this graduate work was not available for purchase at the request of the author, thus we could not determine what type of measurements were used. Finally, we identified 16 pertinent effect sizes on 1355 subjects, which are presented in Table 1.

Moderators

We coded the following study characteristics: year of publication, sample size, the age of the child at the time of assessment of attachment security (for the purpose of moderator analysis age was split in two sets: younger than 16 months of age versus 16 months and older), study design (concurrent versus predictive), percentage of secure infant-father attachment relationships, and measurement of sensitivity (sensitivity or sensitivity combined with stimulation). The selection of these moderator variables was based on theoretical and empirical reasons. We focused on the child's age as a moderator since the quality of the relationship between father and child may depend on the developmental phase of the child. Also, the meta-analysis of infant-mother dyads (De Wolff & Van IJzendoorn, 1997) showed that the age of the infants at the time of the attachment assessment was a significant moderator with older infants showing stronger effect sizes. A concurrent study design may show stronger effect sizes than a predictive design because a possibly bi-directional association between sensitivity and attachment could contribute to the strength of the observed effects in a concurrent design. Also, the meta-analysis of De Wolff and Van IJzendoorn (1997) found that a shorter time interval between the sensitivity and attachment assessments showed stronger effect sizes. All of the included studies used either a predictive or a concurrent design; none of the studies used a combination of predictive and concurrent measurements. Lastly, as described in the Introduction, we distinguished studies in which the traditional concept of sensitivity (warmth, emotional support, responsiveness) was observed from studies in which the quality of stimulating and exploratory play was additionally observed.

Data-analysis

The Comprehensive Meta-Analysis (CMA) program was used to transform the results of the individual studies into the common metric of Pearson's product-moment correlation coefficients (*r*) and to combine weighted effect sizes (Borenstein et al., 2009). Heterogeneity across studies was assessed using the *Q*-statistic. Significance tests were performed through random effects models (Borenstein et al., 2009). We computed the 95% confidence interval around the mean effect size. *Q*-statistics and their *p*-values were also computed to assess differences between combined effect sizes for specific subsets of study effect sizes grouped by moderators. Contrasts were only tested when at least two of the subsets consisted of at least four studies (Bakermans-Kranenburg et al., 2003). Again, random effects model tests were used. For continuous moderators, Fisher's *Z*-scores were used in weighted least squares meta-regression analyses. The "trim and fill" method was used to test the influence of possible adjustments of the sets of studies for publication bias (Duval & Tweedie, 2000a, 2000b). No outliers (standardized *z*-values smaller than -3.29 or larger than 3.29; Tabachnick & Fidell, 2001) were found for study effect sizes.

RESULTS

Table 2 presents the combined effect size of the 16 studies, as well as confidence intervals, homogeneity tests, and contrast tests. The combined effect size for the association between paternal sensitivity and infant-father attachment was $r = .12$ (95% CI .06, .17, $k = 16$, $N = 1355$,

Table 2. Meta-analytic results on the association between paternal sensitivity and infant-father attachment security

	k	*N*	*r*	*Confidence interval 95%*	*Homogeneity Q*	*Contrast Q*	*Contrast P*
Total set	16	1355	.12**	.06, .17	12.80		
Sensitivity measure						0.00	.96
sensitivity	7	569	.12**	.03, .20	6.04		
sensitivity + stimulation	9	786	.12**	.05, .19	6.77		
Design						0.02	.89
concurrent	7	669	.12**	.05, .20	4.85		
predictive	9	686	.11**	.04, .19	7.94		
Age SSP						1.15	.28
12 to 15 months	12	1082	.13**	.07, .19	10.25		
18 months and older	4	273	.06	-.06, .18	1.40		

* $p < .05$
** $p < .01$

$p < .001$). The set of study outcomes was homogeneous, Q (15) = 12.80, $p = .60$. Using the trim and fill method (Duvall & Tweedie, 2000a, 2000b), we did not find asymmetry in the funnel plot (precision plot, random effects), which suggested the absence of a potential publication bias.

Moderator analyses did not show significant contrasts for measurement of sensitivity, the age of the child at the time of assessment of attachment security, and study design (see Table 2). The meta-regressions with the continuous moderators 'year of publication', 'percentage secure', 'age of the child at the time of assessment of attachment', and 'sample size' did not show significant effects either (z = -0.25, $p = .80$, z = 0.89, $p = .38$, z = -1.44, $p = .15$, and z = 0.09, $p = .93$, respectively).

A cumulative meta-analysis confirmed the absence of an association between year of publication and effect size. In Figure 1 the development of the combined effect size across time is presented, and a trend toward stronger associations between paternal sensitivity and infant security did not appear to be present.

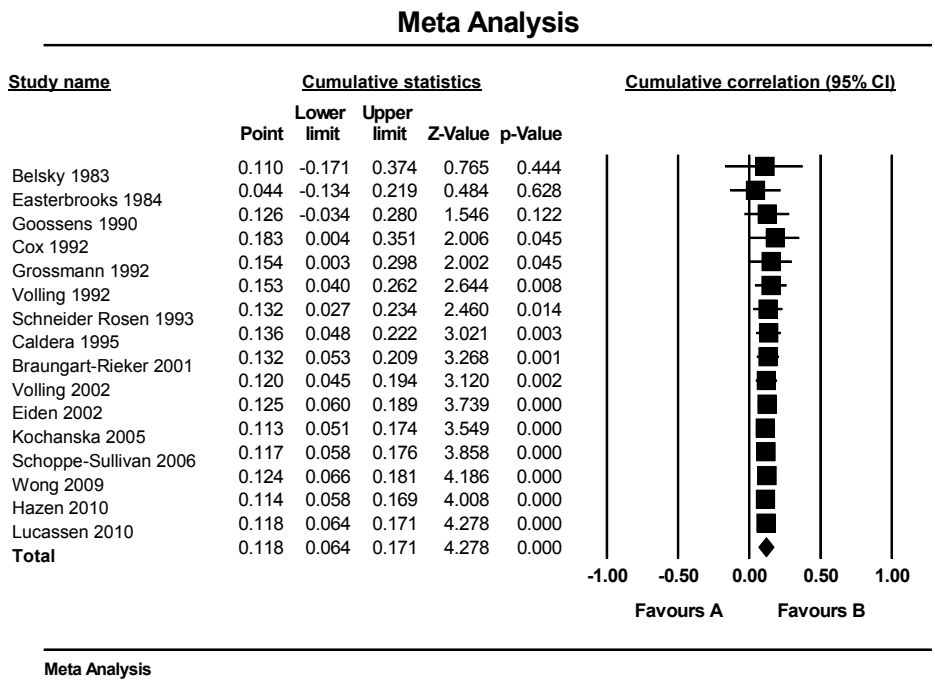

Figure 1. Forest plot of the studies included in the cumulative meta-analysis with the effects sizes and 95% confidence intervals

Note. The combined effect size is $r = .12$; $k = 16$; $N = 1355$; $p < .001$

DISCUSSION

In this meta-analysis, we showed that higher levels of paternal sensitivity were associated with more infant-father attachment security. The association between sensitivity and attachment security was reliable, but weak. Yet, this finding contributes to the field of father research in several ways. First, this meta-analysis included twice as many studies with more than twice as many infant-father dyads compared to the meta-analysis conducted by Van IJzendoorn and De Wolff in 1997. Thus, it provides an update of studies on paternal sensitivity and attachment. Second, we were able to examine whether a trend toward stronger associations between paternal sensitivity and infant attachment security would emerge across the past three decades. Although family sociologists report on increased participation in positive engagement activities of the father with their child (Pleck, 2010), we failed to find evidence for its increasing effect on infant attachment. This might, however, be influenced by selective participation of fathers in family research. Fathers who participate in research tend to be more involved in family life than nonparticipating fathers (Costigan & Cox, 2001) which might result in less variability in parenting behaviors like sensitivity. Third, because of the larger number of studies on fathers we were able to differentiate the traditional assessment of sensitivity from sensitivity combined with stimulation which is suggested to be a paternal 'specialization' (Grossmann et al., 2008; Naber, Van IJzendoorn, Deschamps, Van Engeland, & Bakermans-Kranenburg, 2010). However, we failed to find evidence for the hypothesis that fathers' sensitivity combined with stimulation during play and other challenging situations promotes attachment security more than sensitive interactions without stimulation; nor did other moderator analyses (year of publication, sample size, the age of the child at the time of assessment of attachment security, percentage secure, and study design) show significant effects. It should be noted that these moderator analyses need to be interpreted with caution because of the small number of studies. The relatively small number of studies is a general limitation of this meta-analysis.

The quality of parenting behavior accounts for a small portion of the explained variance in individual differences in attachment security. The small effect size of the association between paternal sensitivity and infant-father attachment seems to imply that little can be gained from prevention or intervention strategies directed at increasing paternal sensitivity. Nevertheless, interventions based on small effect sizes can yield substantial benefits. A striking example was shown in a major biomedical research on the association between aspirin intake and risk of myocardial infarction (heart attack). Although the effect size of .034 was considered to be very small, it suggested that 3.4% fewer persons who would probably experience a heart attack will not experience it if they follow the regimen as prescribed in the aspirin treatment condition (Rosnow & Rosenthal, 1989). As Rose described (in his discussion of the "prevention paradox"; 1981), even moderate alterations of modest risk factors can achieve major public health benefits.

The significant and replicable effect of modest size may be relevant as few father determinants of infant-father attachment are established and because a secure attachment relationship is predictive for positive developmental outcomes of the child. Moreover, sensitivity is amenable to interventions. Intervention studies aimed at increasing sensitivity and attachment security in mothers and their infants appeared to be effective, and more successful sensitivity interventions were also more effective in enhancing infant attachment security (Bakermans-Kranenburg et al., 2003). Interventions involving fathers appeared to be more effective than interventions focusing on mothers only. The number of intervention studies on fathers is too small to be included in a meta-analysis in a way similar to the meta-analysis on mother-infant interventions (Bakermans-Kranenburg et al., 2003). Although most studies in the current meta-analysis had a predictive design with the assessment of sensitivity conducted several months before the Strange Situation Procedure, only experimental intervention studies can establish a causal relation.

Besides sensitivity and stimulating play, other determinants may facilitate a secure infant-father attachment relationship. Previous studies have shown that fathering is influenced, more than mothering, by contextual factors in the family such as marital satisfaction (Belsky, 1996) and co-parental relationship quality (Brown, Schoppe-Sullivan, Mangelsdorf, & Neff, 2010). Studies focusing on the family system (e.g., Schoppe-Sullivan et al., 2006) might give more insight into the specific role of the father in the development of the child. Such studies could also examine whether the father has a more direct or a more buffering effect on child development. Future research should focus on the causal relation between paternal sensitivity and infant-father attachment, as well as other possible determinants of infant-father attachment security. Given the few extant studies looking at the infant-father attachment relationship, we recommend that future studies utilize a family systems perspective (Cowan, 1997) in the continuing search for the multiple predictors of infants' secure attachments to their fathers.

Chapter 6

General discussion

In the current series of studies, we examined prenatal risk factors for parental insensitivity and consequences of sensitivity for child development in a large family cohort. We observed sensitivity in fathers and mothers. In this chapter the results are summarized and discussed, followed by methodological considerations of the study and implications for research and practice.

MAIN FINDINGS

We studied prenatally assessed determinants of sensitive parenting of fathers and mothers. The following determinants of parenting in early childhood were studied: history of substance use disorder, history of depression, family functioning, and expressed emotion. The associations of substance use, depression, and poor family functioning with parenting have frequently been studied. However, much less is known about the relation between psychopathology and family functioning assessed *before* the birth of the child and parenting, i.e., when they cannot have been affected by child characteristics. In particular, the relation between expressed emotion during pregnancy and parenting has never been studied before although parental expressed emotion is easily influenced by child problems.

A high score on emotional overinvolvement during the prenatal phase was associated with lower levels of parental sensitivity four years later. Criticism, the other dimension of expressed emotion, was not related to sensitive parenting behavior. Also, poorer prenatal family functioning was associated with less sensitive parenting. Furthermore, if father or both parents had a history of substance use disorder, mothers were less sensitive.

The results of the analyses stratified for parent gender showed differential effects for mothers and fathers. Emotional overinvolvement during pregnancy in mothers was associated with lower maternal *supportive* parenting (degree of positive regard and emotional support), while prenatal emotional overinvolvement in fathers was related to higher paternal *intrusive* parenting (degree of respect for the child's autonomy). Furthermore, in mothers a history of substance use disorder was related to less sensitive parenting behavior. Likewise, we observed that poor family functioning, which is strongly related to parental psychopathology, influenced mother's parenting in early childhood. Paternal psychopathology was not associated with father's sensitivity to the child, however we showed that past substance use of the father was related to maternal sensitivity. In contrast, mothers did not have a significant effect on father's sensitivity.

Besides studying prenatal risk factors for insensitivity, we were also interested in the consequences of sensitive parenting of mothers and fathers on child development. Our meta-analysis on the association between paternal sensitivity and the infant-father attachment relationship showed that higher levels of paternal sensitivity were associated with more infant-father attachment security. In our study on the relation between parenting and child

executive functions, less sensitive parenting of the mother and harsher parenting of the father predicted lower scores on emergent metacognitition and inhibitory self-control in early childhood. In our study on the effects of maternal depressive symptoms and sensitivity on children's ability to recognize facial expressions of emotions, we focused solely on mothers. Maternal depressive symptoms predicted less accurate emotion-labeling in children, while maternal sensitivity was associated with more accurate emotion-matching, especially for sadness and anger.

RESEARCH ON FATHERING

Based on prior reviews on fathering, Pleck (2010) suggested that four essential research issues should be taken into account when studying the role of fathers: the independence of the role of the father in a family perspective, bidirectional effects in parent-child dyads, measurement of parenting, and selection bias. Selection bias and the measurement of parenting will be discussed in the section on methodological considerations. Here, the independent role of the father in a family perspective and possible bidirectional effects will be discussed.

The independent role of the father in a family perspective

The assumption that fathers make a unique contribution to child development has existed in the social sciences since the 1940s (Pleck, 2010). The role of the father in child development has shifted from breadwinner through gender-role model to the nurturing father (Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008). An important question is to what extent the effects of fathering are independent of the effects of mothering. Up until now, there is not much scientific evidence that sensitive fathers make a unique contribution to the child's development (Parke, 2002; Pleck, 2010). Studies involving both mothers and fathers, using identical methods and measurement procedures, are scarce (Notaro & Volling, 2000). Reviews on the association between fathering and child outcomes show that analyses are often not controlled for maternal variables (Amato & Rivera, 1999; Marsiglio, Amato, Day, & Lamb, 2000; Sarkadi et al., 2008). For example, Amato and Rivera (1999) identified 68 studies, 47 of which did not adequately control for maternal behavior. In examining associations between risk factors and fathering, or between fathering and child outcomes, mothering or maternal factors need to be taken into account because fathering is correlated both with mothering and child outcomes (or the risk factors). So it might be that only mothering, not fathering, influences child outcomes directly. In the current series of studies we adjusted for maternal variables to identify the independent contribution of the father.

Our findings suggest that paternal sensitivity could not be predicted by our prenatal risk factors. In our studies on the consequences of sensitivity, we found evidence that paternal harsh (negative) parenting independently affected child executive functions in early child-

hood, while sensitive (positive) paternal parenting did not. Previous studies confirm the finding that paternal negative parenting affects child development and behavior above maternal parenting (e.g., Chang, Schwartz, Dodge, & McBride-Chang, 2003; Ramchandani et al., 2013). The link between father's *sensitive* parenting and child outcomes is less clear. Some studies found an association between paternal sensitive parenting behavior and child development, controlling for maternal variables (e.g., NICHD Early Childcare Research Network [ECCRN], 2004; Tamis-LeMonda, Shannon, Cabrera, & Lamb, 2004), while others did not (e.g, Bell & Belsky, 2008; Ramchandani et al., 2013; this dissertation). It has been suggested that fathers interact with their children in different ways than mothers (e.g., Grossmann, Grossmann, Kindler, & Zimmermann, 2008; Paquette, 2004; Ramchandani et al., 2013). Traditionally mothers relate to their children with sensitive warmth, whereas fathers might choose stimulating, challenging, or exploratory play behavior to interact with their child. The latter types of interaction combined with positive encouragement and discipline are known to be related to positive child development (Paquette, 2004).

Our results, strengthened by suggestions in previous studies, indicate that fathers do matter, but less so because of their sensitivity. Fathers might not typically function as a 'second mother'. Note that these results and interpretations are based on two-parent families in the current cultural context. It would be interesting to study family situations in which the mother is absent or in which the father is the primary caregiver, to examine whether the hypothesis of specific mothering and fathering roles still holds, because the suggested differences between mothers and fathers may be explained by differences in investment in time and (caregiving) activities with the index child.

Bidirectional effects

Historically, developmental researchers considered children to be passive recipients of parenting practices: correlations between parent and child behaviors were viewed as parents influencing the child's development over time (Pardini, 2008). One of the first and most influential researchers who emphasized the significance of studying bidirectional parent-child effects in developmental research was Richard Bell. Bell (1968) reviewed studies on human and animal research indicating that patterns of parenting vary based on characteristics of the offspring. Later studies also showed that parenting not only affects child behavior, but also the other way around (e.g., Del Vecchio & Rhoades, 2010; Gadeyne, Ghesquière, & Onghena, 2004; Pardini, 2008). However, empirical studies that examine bidirectional influences between parents and children are rare. The correlational nature of many studies on parenting and child development makes it difficult to confer the direction of effects and possible causation (Rutter, 2007).

In the current studies on *risk factors* for insensitive parenting, we aimed at decreasing the influence of child factors by a design in which antecedents of sensitivity were measured before the birth of the child. Diagnoses of history of psychopathology, reports of family

functioning, and parental expressed emotion were assessed in the prenatal phase, which largely ruled out effects of the index child as the child was not present yet. In our studies on *consequences* of parenting, paternal sensitivity was related to infant-father attachment security. In our meta-analytic study, nine studies that used a predictive design and seven studies that used a concurrent design were included. A meta-analysis on sensitivity and attachment interventions (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003) showed that interventions that were effective in enhancing parental sensitivity were also more effective in enhancing attachment security, which supports the concept of a causal relation between parenting and child attachment security. In our study on parenting and executive functions, we found an association between paternal harsh parenting and child executive functions one year later. In this same study, maternal sensitivity and executive functions were concurrently assessed and significantly related. Although it can be argued that the child's executive functioning affects parenting behavior, longitudinal studies have indicated that the direction of the associations is mostly the other way around (e.g., Bernier, Carlson, & Whipple, 2010). To exclude possible bidirectional effects, bidirectional pathways between sensitivity and child outcomes across time need to be investigated.

METHODOLOGICAL CONSIDERATIONS

The strengths and limitations of the various studies in this thesis have been described in the specific chapters. Here, more general methodological considerations will be addressed.

Measurement of parenting

In the current series of studies, we observed parent-child interaction in 752 families, with useable data of 743 fathers and 623 mothers, one of the largest family cohorts in which sensitivity was observed in both mothers and fathers. Observation of parenting is preferred to self-report (e.g., Marsiglio et al., 2000). Mothers' and fathers' self-reports of parenting are more vulnerable to reporter bias. Parents may report socially desirable parenting behavior ("fake good"; Miller-Perrin & Perrin, 1999). Observations of parent-child interaction are not influenced by parental characteristics such as mood (Aspland & Gardner, 2003) or the ability of parents to reflect on their behavior (Hoff, Laursen, & Tardif, 2002). Also, parents are often asked to estimate the frequency of behaviors (e.g., items representing positive and negative parenting) over longer periods of time, which is a cognitively difficult task (Morsbach & Prinz, 2006). Finally, self-report of parenting tends to measure parental attitudes more than parent's actual behaviors toward the child (Hoff et al., 2002).

In our studies, parental sensitivity was measured during two semi-structured tasks: the etch-a-sketch task (4 minutes) and the tower building task (3 minutes). Thus, we observed mothers' and fathers' parenting for a total of 7 minutes, which is a limitation of our study.

It has been questioned whether less than 15 minutes might accurately represent the parent's predominant parenting behavior (e.g., Notaro & Volling, 1999). However, logistical and financial constraints made observing sensitivity for a longer duration in fathers *and* mothers in over 700 families impossible.

We used structured play to observe parent-child interaction. Structured play tasks are frequently used for observation of parent-child interaction (Joosen, Mesman, Bakermans-Kranenburg, & Van IJzendoorn, 2012). This method elicits interaction between parent and child and therefore assures the observation of interaction without the time investment of longer naturalistic observations. A possible shortcoming of structured play settings is that it may limit the observation of sensitivity to distress, whereas child distress is particularly important to the concepts of sensitivity and attachment (Bowlby 1969). However, Joosen et al. (2012) showed that across various settings, including settings provoking child distress (e.g., Still Face Paradigm; Tronick, Als, Adamson, Wise, & Brazelton, 1978), the same underlying construct of sensitive parenting may be observed.

The rating scales for sensitivity are based on observations of mothers. It is generally assumed that these scales can be applied to measure sensitivity in fathers as well (Parke, 2002). In fact, many researchers used this rating scale to observe father's parenting behavior. Based on our research findings, it is questionable whether it is father's *sensitive* parenting behavior which is of importance for the child. Research indicates that mother-child interaction focuses on warmth and sensitivity, while father-child interaction is more commonly characterized by playful interaction. The role of the father might be embedded more in stimulating and exploratory parenting behavior than in sensitive interaction as conceptualized by Mary Ainsworth.

Selection bias

The possibility of selection bias (a threat to the internal validity) in our study needs to be discussed. When the relation between the determinant and the outcome is different in those who participated in a study and those who were eligible but did not participate, selection bias occurs. Of the women who were eligible for participation in the Focus Cohort, about 80% (N = 1232, Jaddoe et al., 2012) participated in the first round of measurements. Of these families, 752 also participated in the 4-year home visit, during which sensitivity was observed. Non-response analyses indicated that both initial non-response and attrition were selective. Relatively highly educated families with a relatively high household income were more likely to participate. However, selective non-response is only a problem if the associations differ in the group of participants and the group that was lost to follow-up. Wolke and colleagues (2009) showed for several outcomes that the validity of prediction from longitudinal analyses was only marginally affected by attrition and that most prospective studies can probably rely on the data of respondents still in the sample.

Another possible limitation that needs to be mentioned is the generalizability of our findings (external validity). The studies described in this thesis were conducted within a subgroup of the Generation R Study, a relatively homogeneous subsample of families with a relatively high socioeconomic status and children of Dutch national origin. The homogeneity of this sample might restrict generalizability of our findings to less advantaged and ethnically diverse populations. For example, the relation between depression and parenting (Lovejoy et al., 2000) and the relation between parenting and child outcomes (Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2012) appeared to be different in families with a lower socioeconomic background compared to families with a higher socioeconomic background. These studies indicate that our findings on the associations between risk factors and parenting and between parenting and child outcomes might not be representative of the general population. Research in more diverse populations is needed to further examine the risk factors and consequences of sensitivity.

Confounding bias

Effects of confounding, defined as an explanation of the apparent effect by an underlying third factor that is associated with both the predictor and the outcome, have to be considered. Although we controlled for several confounding factors, such as socio-economic status, recent psychopathology, and cognitive and behavioral development of the child, other possible confounders were not assessed, such as parental personality characteristics, pregnancy-related risk factors such as a mistimed or unwanted pregnancy, parental attachment representation, and the influence of broader family dynamics including siblings and grandparents. Also, gene-environmental correlations, defined as genetically influenced child or parent characteristics that might shape the parenting environment of the child (Rutter, Moffitt, & Caspi, 2006), cannot be excluded.

Causal inference

The issue of causal inference is closely related to the issue of confounding bias. The most important criterion of causality is that the cause has to precede the effect in time (Rothman & Greenland, 1998). The majority of the studies presented in the current thesis had a longitudinal design. In our search of causes of parental sensitivity, antecedents of sensitivity were measured before the birth of the child which largely excluded the influence of child factors. However, causality cannot simply be inferred from longitudinal associations. These associations may be the results of underlying confounding factors. For example, children of mothers with a history of substance use might have a genetic predisposition for emotional maladjustment, which is expressed in mother-child interaction and might influence mother's sensitivity. Thus, inferring causality from the associations we found is basically impossible. Intervention studies or (quasi-) experimental studies are needed to establish causality. However, these are not always ethical or feasible. In these cases natural experiments might

be helpful to examine possible underlying mechanisms of associations (Rutter, 2007), for example studies on adoptee samples in which genetic mediation is excluded.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The current series of studies have shown that it is important to observe parent-child interaction in a family context. As discussed above, our results suggest that fathers matter less for sensitivity and possibly do not function as a 'second mother'. In future research, it would be interesting to examine this proposition. For example, Ryan, Martin, and Brooks-Gunn (2006) studied the nonsubstitutability of parents in their research on the consequences of parenting on the child's cognitive development. They classified fathers and mothers as supportive or nonsupportive based on a median split on the supportiveness variable for both genders combined in the following combinations: A) Both father and mother supportive; B) Unsupportive father, supportive mother; C) Supportive father, unsupportive mother; and D) Both parents unsupportive. The extent to which paternal and maternal supportiveness are replaceable is indicated by the comparison of groups B and C. Future research would be enhanced by studying parents *in combination* to identify interactions between the effects of mothers' and fathers' parenting that are not visible in studies of main effects (Martin et al., 2007).

Mother-child and father-child interactions are embedded in broader family dynamics, including coparenting practices, siblings, and grandparents. Supportive coparenting, defined as confirming the other parent's competence, respecting their contributions and opinions, upholding their decisions, and demonstrating cooperative strategies toward dealing with parenting and childrearing-related issues is distinct from parenting (McHale et al., 2002). Mothers and fathers from families in which levels of supportive coparenting are high show more sensitive parenting behavior to their child. Coparenting has proven to explain unique portions of the variance in various aspects of parenting and child development above and beyond the effects of parenting (Caldera & Lindsey, 2006; Karreman, van Tuijl, van Aken, & Dekovic, 2008). Future research on family risk factors and consequences of parenting would be enhanced by taking into account the broader family dynamics, including coparenting practices, siblings, and grandparents.

With respect to measuring parenting, researchers should use instruments including measurements of parenting aspects which are suggested to be a specialization on the part of the father (e.g., stimulation, exploration), as well as aspects focused on the parenting part of the mother (e.g., sensitive warmth, emotional support). The overwhelming majority of parenting instruments are based on mothering. The few instruments that are developed to specifically measure fathers' parenting are tested in small sample sizes, are not validated, and no or very few studies have been conducted on child developmental outcomes (e.g., Grossmann et al.,

2002; Paquette & Bigras, 2010). The validation of fathering measures is an important task for future research.

Clinically, an important finding from the current series of studies is the significance of risk factors for maternal insensitivity and the consequences of maternal sensitivity for child development. Knowledge about the determinants and consequences of sensitivity may be used for the development of prevention and intervention programs to enhance parenting behavior. In our studies, a history of substance use, poor prenatal family functioning, and emotional overinvolvement during pregnancy were all related to less maternal sensitivity. In turn, maternal insensitivity was related to less optimal executive functions and to less emotion labeling capacities of the young child. Previous studies have shown that lower levels of sensitive parenting are associated with more problems in the cognitive, behavioral, and socio-emotional development of the young child (Denham, Renwick, & Holt, 1991; Hubbs-Tait, Culp, Culp, & Miller, 2002; Mesman et al., 2012; NICHD, 2004; Tamis-Lemonda, Shannon, Cabrera, & Lamb, 2004). Also, lower maternal sensitivity predicts less infant-mother attachment security (Bakermans-Kranenburg et al., 2003; De Wolff & Van IJzendoorn, 1997). Given the importance of maternal sensitivity for child development, mothers may benefit from interventions focused on enhancing sensitivity. Sensitivity interventions in early childhood have proven to be effective (for a meta-analysis, see Bakermans-Kranenburg et al., 2003). Interestingly, a modest number of sessions (less than 5 sessions) are as effective as a larger number of sessions, which implies that intensive and frequent sessions are not required to increase maternal sensitivity. It might be argued that sensitivity interventions are not only beneficial during the first years of the child's life, but already during the prenatal phase. Pregnant women identified with risk factors for poorer mother-child interaction might benefit from a parenting intervention program. However, sensitivity interventions starting in the prenatal phase turn out to be less beneficial than interventions starting in a later phase of the child's life (Bakermans-Kranenburg et al., 2003).

The effect sizes of the associations between the prenatal risk factors and maternal sensitivity examined in this thesis were relatively small. Other maternal, paternal, and family characteristics might be of (more) importance for the quality of maternal parenting. As strong risk factors for maternal insensitivity are not identified in the current series of studies, the role of other possible (cumulative) risk factors in nonclinical populations needs to be examined before we can recommend prenatally based preventive programs to enhance sensitivity.

IN SEARCH OF CAUSES AND CONSEQUENCES OF PARENTAL SENSITIVITY: DO FATHERS MATTER?

Our findings indicate that prenatal risk factors do not predict paternal sensitivity. In our studies on the consequences of sensitivity for child development, we showed that higher

levels of paternal sensitivity were weakly associated with more infant-father attachment security. Also, more paternal harsh parenting, but not paternal insensitivity, was related to less optimal executive functions of the child. Together, these results suggest that for fathers the mechanisms affecting paternal sensitivity and its consequences for child development might not be similar to the mechanisms in mothers. However, fathers do matter for maternal sensitivity. Based on our findings, as well as previous research, we suggest that fathers in the current cultural context do not typically function as a 'second mother'.

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Appendices

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SUMMARY

Sensitivity is a key element of parenting. Sensitivity is defined as the ability to accurately perceive and to interpret the signals implicit in the child's behavior. A highly sensitive parent responds promptly and appropriately to the communications of the child. Higher levels of sensitive parenting are associated with more optimal cognitive, behavioral, and socio-emotional outcomes of the child. Most researchers study mothers, few study fathers. Moreover, studies on sensitivity in which mothers and fathers from the same families are included are relatively scarce. In the majority of families, children are raised by a mother *and* a father. Understanding the relationship between mother and child or father and child is not fully possible without considering the network of relationships in which the individuals are embedded. In the current series of studies, we examined prenatal risk factors and consequences of maternal and paternal sensitivity. All studies presented in this thesis were conducted within the Generation R Study, a prospective longitudinal cohort study in which children and their parents are followed from pregnancy onwards. Below, a brief summary of the main results per chapter is presented.

Part I focused on *risk factors* for parental insensitivity. In **Chapter 2**, we addressed the question whether psychopathology and family functioning prior to the birth of the child are related to sensitive parenting of mothers and fathers in early childhood. Parents with a current substance use disorder or a current depression have shown to be less sensitive toward their child. However, few studies have been conducted on the association between a history of psychopathology and sensitivity. Family functioning, closely related to parental psychopathology, may also affect the quality of sensitive parenting. Knowledge about predictors of poor parent-child interaction may help identify families at risk for developing insensitive patterns of parenting, which are associated with less optimal child development. We found that if father or both parents were diagnosed with a history of substance use disorder, maternal parenting was less sensitive in early childhood. Also, poorer family functioning was associated with less maternal sensitive parenting. Paternal sensitivity could not be predicted by parental psychopathology. These findings underscore the importance of studying parents separately as well as in a family system.

In **Chapter 3**, we introduced and tested an adapted version of the *Five Minute Speech Sample* that assesses expressed emotion during pregnancy. Expressed emotion is a measure which traditionally refers to affective attitudes and behaviors like criticism, hostility, and emotional overinvolvement of relatives toward a family member with a psychiatric illness. The measure has been extended to emotional attitudes of parents toward children with the assumption that the way parents talk about their child is indicative of the way they treat their child on a day-to-day basis. The original instructions for the Five Minute Speech Sample were slightly adapted to make it more applicable to pregnancy. The parents' statements were scored using the two categories from the original Five Minute Speech Sample procedure:

criticism and *emotional overinvolvement*. A classification of high criticism was given when the parent was critical about characteristics and behaviors of his or her unborn child. High emotional overinvolvement was scored if the parents' statements indicated a pattern of overprotected and overinvolved behavior. Results showed that the interrater reliability for scoring expressed emotion during pregnancy was comparable to those found in other studies examining expressed emotion which supports the reliability of assessing expressed emotion during pregnancy with the slightly adapted procedure of the Five Minute Speech Sample. Furthermore, we showed that criticism and emotional overinvolvement are different constructs within expressed emotion. In future research it is important to study the stability of maternal expressed emotion from pregnancy to childhood as this will give more insight in maternal and child contributions to expressed emotion. Also, the predictive value of expressed emotion assessed during pregnancy on parental sensitivity and child outcomes like behavioral, emotional, and cognitive problems is of interest.

In **Chapter 4**, we examined the relation between mothers' and fathers' expressed emotion during pregnancy and observed sensitive parenting behavior in early childhood. Parental sensitivity was represented by *supportiveness* and *intrusiveness*. Supportiveness refers to the degree to which positive regard and emotional support to the child is expressed; intrusiveness refers to the degree to which the parent lacks respect for the child's autonomy. This study was the first to examine the influence of prenatal expressed emotion on parenting behavior. Moreover, this was one of the first studies to include expressed emotion in fathers. Parental emotional overinvolvement during pregnancy was associated with less sensitive parenting in early childhood. Prenatal emotional overinvolvement in fathers was associated with more *intrusive* parenting, while emotional overinvolvement during pregnancy in mothers was associated with less *supportive* parenting. Traditionally, mothers and fathers appear to engage in different types of interaction with their children, starting from the early phase of a child's life. Fathers have been described as focused on stimulating and exploratory play interactions with their children, with less emphasis on emotional support and warmth, whereas emotional support and warmth are assumed to be mothers' specialization. Our results, in line with previous research findings, indicate that in mothers and fathers different dimensions of sensitivity are negatively affected by emotional overinvolvement.

Besides studying possible causes of insensitivity, we were also interested in the consequences of sensitive parenting of mothers and fathers for child development. **Part II** focused on consequences of parental sensitivity on different child developmental domains. In **Chapter 5**, we investigated the effects of maternal sensitivity and maternal depression on children's ability to process emotional expressions. Processing emotional cues, e.g., facial expressions of others, is an important aspect of social functioning. Young children rely on facial expressions for information on the emotional state of others to a greater extent than on situational cues. Children of depressed mothers experience an atypical emotional environment characterized by a high exposure to sad, angry, or neutral expressions and a

low exposure to happy expressions compared with children of non-depressed mothers. An important mechanism through which risk is transmitted from depressed mother to child is through their interactions. The aim of the present study was to investigate the independent and mediated effects of mothers' depressive symptoms and observed sensitivity on young children's facial expression recognition. Child emotion recognition was assessed using a non-verbal and a verbal task paradigm. We found that maternal depressive symptoms predicted lower child accuracies for verbally labelling emotions, while maternal sensitivity was associated with more accurate nonverbal matching of emotions, especially sadness and anger. It has been reported in previous research that children found sad and angry faces the most difficult to identify on our non-verbal facial expression recognition task. Thus, it may be that sensitive maternal behavior provides a more stimulating emotional environment, which in turn may further stimulate the development of non-verbal facial expression recognition in children. Maternal sensitivity did not mediate the observed associations between mothers' depressive symptoms and children's emotion recognition accuracy.

Chapter 6 focused on the relation between mothers' and fathers' sensitive and harsh parenting and child's executive functions. We explored the specific influence of positive and negative parenting on three core dimensions of EF: *emergent metacognition*, *inhibitory self-control*, and *flexibility*. Emergent metacognition represents the child's developing ability to initiate, plan, organize, implement, and sustain future-oriented problem solving. Inhibitory self-control represents a child's ability to modulate actions, responses, emotions, and behavior via appropriate inhibitory control. Flexibility represents a child's ability to move flexibly among actions, responses, emotions, and behavior. Less sensitive parenting of the mother and harsher parenting of the father were related to lower scores of emergent metacognition and inhibitory self-control. Parenting was not associated with flexibility. This study extends previous research on the association between parenting and executive functions with a focus on the role of the father and the independent effects of mothers and fathers on child EF.

In **Chapter 7** we presented a meta-analysis of the association between paternal sensitivity and infant-father attachment based on all studies currently available. Attachment security represents the child's trust in his or her caregiver, and is evident from the child's preferential desire for contact with the caregiver in times of stress and use of the caregiver as a 'secure base' to explore the environment. Maternal sensitivity plays a crucial role in shaping the mother-infant attachment relationship, but the first wave of studies on the correlates of infant-father attachment showed a weak association between paternal sensitivity and infant-father attachment security. This meta-analysis is important for the field, as fathers seem to have become gradually more involved in positive engagement activities with their children over the last few decades, which might affect the relationship with their child. Paternal sensitivity was differentiated from paternal sensitivity combined with stimulation in the interaction with the infant, because fathers may interact with their infants in somewhat different ways compared to mothers. Traditionally fathers have been described as focused on stimulating and

exploratory play interactions with their children, with less emphasis on emotional support and warmth. Mothers might relate to their infants with sensitive warmth, whereas fathers might choose sensitive stimulation as a way to promote feelings of security in their infants. We showed that higher levels of paternal sensitivity were associated with more infant-father attachment security. Fathers' sensitive play combined with stimulation was not more strongly associated with attachment security than sensitive interactions without stimulation of play. Despite possible changes in paternal role patterns we did not find stronger associations between paternal sensitivity and infant attachment in more recent years.

Chapter 8 highlighted the main findings and provides an interpretation of these findings in a broader context. In addition, this chapter discussed relevant methodological issues and concludes with implications for future research and clinical practice.

SAMENVATTING (SUMMARY IN DUTCH)

Sensitiviteit speelt een belangrijke rol in de opvoeding van kinderen. Sensitiviteit is het vermogen van de ouder om open te staan voor de signalen van het kind en daarop snel en adequaat te reageren. De sensitieve ondersteuning door de ouder van het kind kan zowel verbaal zijn als fysiek. Verbale ondersteuning uit zich bijvoorbeeld in het geven van complimenten of in het aanmoedigen van het kind. De ouder kan ook fysieke ondersteuning geven, bijvoorbeeld door dichter bij het kind te gaan zitten als er samen een puzzel wordt gemaakt. Een weinig sensitieve ouder slaagt er niet in om het kind ondersteuning te geven. Deze ouder is bijvoorbeeld passief of ongeïnteresseerd in interactie met het kind.

Sensitiviteit is een belangrijke voorspeller voor de kwaliteit van de gehechtheidsrelatie, de emotionele band van het kind met de ouder. Kinderen van sensitieve ouders doorlopen een meer optimale cognitieve en sociaal-emotionele ontwikkeling en hebben minder gedragsproblemen. Minder sensitieve ouders gebruiken vaker hardhandige strategieën als ze grenzen stellen aan het gedrag van hun kind en hebben een grotere kans hun kind te mishandelen.

Studies naar de rol van opvoeding in de ontwikkeling van jonge kinderen richten zich vaak op de sensitiviteit van moeder en minder vaak op de sensitiviteit van vader. Onderzoeken waarbij moeders en vaders uit hetzelfde gezin worden geobserveerd zijn helemaal schaars, terwijl in de meeste gezinnen het kind wordt opgevoed door een moeder *en* een vader. De kwaliteit van de relatie tussen moeder-en- kind en vader–en-kind zou in het bredere gezinsverband moeten worden onderzocht omdat deze relaties elkaar beïnvloeden en niet los van elkaar te zien zijn.

Dit proefschrift

In het eerste deel van dit proefschrift zijn prenatale voorspellers van sensitiviteit van moeder en vader onderzocht. Het tweede deel van het proefschrift is gericht op gevolgen van sensitief opvoeden. Alle studies uit dit proefschrift zijn uitgevoerd binnen de Generation R Studie, een prospectieve longitudinale cohortstudie waarin kinderen en hun ouders vanaf de zwangerschap worden onderzocht.

Prenatale voorspellers van sensitiviteit

De sensitiviteit van de ouder kan worden beïnvloed door zowel ouder- als kindfactoren. Factoren die met ouders te maken hebben zijn bijvoorbeeld depressie en de manier waarop ouders onderling met elkaar omgaan. Factoren die meer aan het kind kunnen worden toegeschreven zijn bijvoorbeeld temperament en probleemgedrag. In onderzoek naar voorspellers van sensitiviteit moet rekening worden gehouden met het samenspel van ouderfactoren en kindfactoren. Door ouders al bij het onderzoek te betrekken vóór de geboorte van het kind, worden factoren die met het kind te maken hebben zoveel mogelijk uitgesloten in het

onderzoek naar sensitiviteit, omdat het kind nog niet geboren is. Op deze manier kan de invloed van de ouder op sensitief opvoeden zoveel mogelijk worden onderscheiden van de invloed van het kind.

Middelenmisbruik, depressie, gezinsfunctioneren en sensitiviteit

Misbruik van alcohol of drugs door de ouder kan van invloed zijn op de opvoeding en op de ontwikkeling van het kind. Misbruik van alcohol of drugs hangt samen met een lagere gevoeligheid voor signalen uit de omgeving en met problemen in de emotieregulatie. Deze vaardigheden staan centraal in sensitief ouderschap. Er zijn aanwijzingen uit eerder onderzoek dat middelenmisbruik deze vaardigheden langdurig kan verstoren. Zelfs nadat alcohol- of drugsmisbruik is gestopt, zouden de effecten op de opvoeding nog aanwezig kunnen zijn. Ook depressie van de ouder kan invloed hebben op de wijze waarop de ouder met het kind omgaat. Ouders met depressieve symptomen neigen minder sensitief en juist meer vijandig te zijn in de interactie met hun kind.

In **Hoofdstuk 2** wordt onderzocht of alcohol- of drugsmisbruik in het verleden, depressie in het verleden en gezinsfunctioneren tijdens de zwangerschap invloed hebben op sensitief opvoeden van moeder en vader als hun kind 4 jaar oud is. Met behulp van een klinisch interview is tijdens de zwangerschap vastgesteld bij moeder en vader of zij in het verleden misbruik hebben gemaakt van drugs of alcohol. Ook is onderzocht of zij ooit een depressie hebben gehad. Tenslotte hebben moeder en vader tijdens de zwangerschap onafhankelijk van elkaar gerapporteerd hoe zij vinden dat hun gezin functioneert.

Onze resultaten wezen uit dat middelenmisbruik van vader in het verleden een negatieve invloed heeft op de sensitiviteit van moeder in de interactie met hun 4-jarige kind. Moeder was het minst sensitief als beide ouders in het verleden alcohol of drugs misbruikten en het meest sensitief als geen van de ouders een verleden had van middelenmisbruik. Ook bleek uit ons onderzoek dat wanneer het gezin tijdens de zwangerschap minder goed functioneerde, moeder vier jaar later minder sensitief was. Een depressie in het verleden bij moeder of vader had geen invloed op de sensitiviteit van moeder of vader. Geen enkele risicofactor uit onze studie voorspelde de sensitiviteit van vader.

Het meten van expressed emotion tijdens de zwangerschap

Hoofdstuk 3 is een beschrijving van een instrument waarmee *expressed emotion* ('geuit gevoel') tijdens de zwangerschap in kaart kan worden gebracht. Het instrument om expressed emotion te bestuderen is van oudsher gebruikt om de houding en het gedrag van gezinsleden ten opzichte van een ander gezinslid met een psychische stoornis in kaart te brengen. Tegenwoordig wordt dit instrument ook breder ingezet in bijvoorbeeld gezinnen met kinderen zonder een problematische psychische achtergrond.

In de huidige studie zijn de originele instructies aangepast om het instrument ook te kunnen gebruiken tijdens de zwangerschap. Hierbij werd aan de (aanstaande) moeder en vader

gevraagd wat zij verwachten of hopen hoe het kind zal zijn en hoe zij de toekomstige relatie met hun kind zien. Antwoorden van ouders op deze vraag werden beoordeeld op twee dimensies: kritiek en emotionele overbetrokkenheid. Kritiek verwijst naar kritische uitspraken van de ouder over het karakter en het gedrag van het nog ongeboren kind. Emotionele overbetrokkenheid werd gescoord wanneer de ouder zich te beschermend of te betrokken opstelde ten opzichte van het ongeboren kind.

De interbeoordelaarsbetrouwbaarheid van het instrument bleek vergelijkbaar met die van eerdere studies. Daarnaast is in deze studie aangetoond dat kritiek en emotionele overbetrokkenheid verschillende dimensies zijn binnen het concept expressed emotion. In vervolgonderzoek is het belangrijk aandacht te besteden aan de stabiliteit van expressed emotion vanaf de zwangerschap tot in de kindertijd, omdat het inzicht kan geven in de invloed van ouder-en kindfactoren op mogelijke veranderingen in expressed emotion. Daarnaast is het belangrijk te onderzoeken welke invloed expressed emotion gedurende de zwangerschap heeft op de ontwikkeling van het kind, bijvoorbeeld door al te hooggespannen verwachtingen bij de ouder, en welke rol sensitief opvoeden hierin speelt.

Expressed emotion als voorspeller van sensitiviteit

In **Hoofdstuk 4** is onderzocht of expressed emotion van moeder en vader tijdens de zwangerschap een voorspeller is van sensitiviteit op 4-jarige leeftijd van het kind. Aanstaande ouders die emotioneel overbetrokken waren bleken vier jaar later minder sensitief te zijn. Meer specifiek: emotionele overbetrokkenheid van vader was gerelateerd aan meer *intrusief* opvoeden. Deze vaders lieten hun kind minder vrij en hadden minder respect voor de zelfstandigheid van het kind. Emotionele overbetrokkenheid van moeder hing samen met minder *ondersteunend* opvoeden van het kind. Deze moeders waren minder positief tegenover hun kleuter dan moeders die geen emotionele overbetrokkenheid toonden tijdens de zwangerschap. In eerdere studies is verondersteld dat de interactie tussen moeder en kind en tussen vader en kind verschillend is. Vaders zouden zich meer richten op stimulerend en explorerend gedrag in de interactie met hun kind, terwijl moeders zich meer richten op ondersteuning en warmte. Onze resultaten suggereren dat emotionele overbetrokkenheid tijdens de zwangerschap invloed heeft op verschillende dimensies van sensitief opvoeden door moeders en vaders.

Gevolgen van sensitiviteit

Behalve mogelijke voorspellers van sensitief opvoeden zijn ook de gevolgen van sensitief opvoeden van moeders en vaders op de ontwikkeling van het kind van belang.

Depressiviteit, sensitiviteit en emotieherkenning van het kind

Het vermogen om emoties, zoals blijdschap, boosheid en verdriet, te herkennen is een belangrijk aspect in het sociaal functioneren. Jonge kinderen vertrouwen sterk op gezichtsuit-

drukkingen van de mensen om hen heen. Kinderen van moeders met depressieve klachten (zoals vermoeidheid, interesseverlies en negatieve gedachten) ervaren vaker verdrietige of boze gezichtsuitdrukkingen en minder vaak blije gezichtsuitdrukkingen dan kinderen van moeders die geen depressieve klachten hebben. Dit kan gevolgen hebben voor het vermogen van kinderen om emoties in anderen te herkennen. Een mogelijk mechanisme in de relatie tussen depressiviteit van de moeder en emotieherkenning van het kind is de sensitiviteit van de moeder: depressie beïnvloedt de sensitiviteit van de moeder wat vervolgens weer de emotieherkenning van het kind beïnvloedt. In **Hoofdstuk 5** is onderzocht of depressieve klachten van de moeder tijdens de zwangerschap en in de periode na de geboorte van het kind samenhangen met het vermogen van het kind om emoties te herkennen. Daarnaast is onderzocht wat de rol van sensitiviteit van de moeder hierbij is.

Uit de resultaten bleek dat kinderen van moeders die depressieve klachten hadden, minder goed waren in het benoemen van emoties. Maar de invloed van de depressieve klachten van de moeder op de emotieherkenning van het kind was niet toe te schrijven aan de sensitiviteit van moeder. Wel was het zo dat kinderen van sensitieve moeders nauwkeuriger waren in het koppelen van twee identieke emoties, in het bijzonder het koppelen van verdrietige gezichten en het koppelen van boze gezichten. Dit is een verrassend resultaat. Maar eerder onderzoek heeft laten zien dat kinderen juist de verdrietige en boze gezichten het moeilijkst vinden om te herkennen. Misschien stimuleert een meer sensitieve moeder de ontwikkeling van emotieherkenning van kinderen waardoor juist deze kinderen beter in staat zijn om emoties te herkennen

Sensitiviteit, hardhandig opvoeden en executief functioneren van het kind

Executieve functies is een verzamelnaam voor controlefuncties, zoals het onderdrukken van impulsen, het plannen van gedrag en het richten van de aandacht. Executieve functies zijn cognitieve processen die nodig zijn voor doelgericht, efficiënt en sociaal aangepast gedrag. In **Hoofdstuk 6** is de relatie van sensitief en hardhandig opvoedingsgedrag van moeders en vaders met het executief functioneren van hun 4-jarige kind onderzocht. We hebben gekeken naar de invloed van positief opvoedingsgedrag (sensitief opvoeden) en negatief opvoedingsgedrag (hardhandig opvoeden, zoals schreeuwen tegen het kind of uitschelden) op drie dimensies van executief functioneren: *ontluikende metacognitie*, *zelfcontrole* en *flexibiliteit*. Ontluikende metacognitie is het groeiend vermogen van het kind om zelf problemen op te lossen. Kinderen die lager scoren op deze dimensie hebben bijvoorbeeld moeite met activiteiten of taken die meer dan één denkstap vereisen. Zelfcontrole richt zich op het vermogen van een kind om eigen emoties en gedrag onder controle te houden. Een kind met woedeaanvallen of driftbuien heeft een lagere score op zelfcontrole. Flexibiliteit is het vermogen van een kind om gedrag en emoties flexibel aan te passen aan een veranderende omgeving. Een kind dat niet flexibel is kan makkelijker van streek raken in nieuwe situaties.

Uit deze studie bleek dat wanneer moeder minder sensitief was en vader hardhandiger, het kind lager scoorde op ontluikende metacognitie en op zelfcontrole. Er was geen samenhang met de flexibiliteit van het kind. Deze studie is één van de eerste studies waarin zowel de invloed van opvoeden door moeder als door vader op het executief functioneren van het kind is onderzocht.

Sensitiviteit en vader-kind gehechtheid

Het ontstaan van een gehechtheidsrelatie, de emotionele band van het kind met de ouder, is een belangrijke stap in de opvoeding en ontwikkeling van het kind. **Hoofdstuk 7** is een meta-analyse naar de samenhang tussen sensitiviteit van vader en de kwaliteit van de gehechtheidsrelatie van het kind met zijn vader. In deze meta-analyse zijn resultaten uit verschillende studies naar sensitiviteit van vader en de kwaliteit van de gehechtheidsrelatie met vader tot één overkoepelende uitkomst gecombineerd. Er wordt in de literatuur verondersteld dat moeders meer gericht zijn op het geven van warmte en verzorging, terwijl vaders zich meer zouden richten op het stimuleren van exploratie door het kind. In de meta-analyse is onderzocht of de samenhang tussen sensitiviteit *met* stimulerend opvoedingsgedrag en gehechtheid sterker is dan de relatie tussen sensitiviteit *zonder* stimulatie en gehechtheid. Sensitievere vaders bleken veiliger gehechte kinderen te hebben. Stimulatie van spel en exploratie bleek daarbij geen beslissende rol te spelen.

Doen vaders ertoe? Op zoek naar oorzaken en gevolgen van sensitief ouderschap

Uit onze studies naar prenatale voorspellers van sensitiviteit is gebleken dat risicofactoren tijdens de zwangerschap de sensitiviteit van vaders niet voorspellen. Wat vaders doen en laten voor de geboorte van het kind doet er wel toe voor de sensitiviteit van moeders. Verder is de opvoedingsstijl van vaders wel degelijk van belang voor de gehechtheidsrelatie van het kind en voor de ontwikkeling van executief functioneren.

Er is in eerdere onderzoeken verondersteld dat bij moeders met name sensitief opvoeden een belangrijke rol speelt in de ontwikkeling van het kind, terwijl vaders in hun interactie met het kind meer gericht zijn op spel, uitdaging, en stimulatie tot verkenning van de wereld om het kind heen. Ook uit dit proefschrift blijkt dat vaders, in de huidige culturele context, andere opvoeders zijn dan moeders.

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LIST OF PUBLICATIONS AND SUBMITTED MANUSCRIPTS

Cents, R. A. M., Kok, R., Tiemeier, H., Lucassen, N., Székely, E., Bakermans-Kranenburg, M. J., Hofman, A., Jaddoe, V. W. V., Van IJzendoorn, M. H., Verhulst, F. C., & Lambregtse-Van den Berg, M. P. *Variations in maternal 5-HTTLPR affect observed parenting*. Manuscript submitted for publication.

Keizer, R., Lucassen, N., Jaddoe, V. W. V., & Tiemeier, H. *Father involvement and toddler's behavioral and emotional problems: Are sons and daughters differentially affected?* Manuscript submitted for publication.

Kok, R., Lucassen, N., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Ghassabian, A., Govaert, P., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Tiemeier, H. *Parenting, corpus callosum and executive function in preschool children*. Revised manuscript submitted.

Lambregtse-Van den Berg, M. P., Lucassen, N., Kuipers-Nap, M. F., Dingemans, P. M. A. J., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Tiemeier, H. (2013). Assessing expressed emotion during pregnancy. *Psychiatry Research, 205*, 285-288.

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Székely, E., Lucassen, N., Tiemeier, H., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Kok, R., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., & Herba, C. M. (in press). Maternal depressive symptoms and sensitivity are related to young children's facial expression recognition: the Generation R Study. *Development and Psychopathology*.

ABOUT THE AUTHOR

Nicole Lucassen was born on June 2nd, 1979 in De Bilt. She passed her secondary school in Leiden in 1997. After obtaining her propaedeutic diploma of Pedagogy at the Amsterdam University of Applied Sciences in 1998, she started her study Child and Family Studies at Leiden University. She obtained her Master's degree in 2002. After her study she traveled through Australia and New Zealand. From 2003 to 2007, Nicole worked as a researcher at the Dutch Family Council, a non-profit organization specialized in family research. In 2007 she started her PhD project at the Generation R Study for the Department of Child and Adolescent Psychiatry/Psychology of the Erasmus University Medical Center in Rotterdam in collaboration with the Centre for Child and Family Studies at Leiden University. In 2009 she was awarded a Fulbright Grant to visit the Department of Developmental Psychology at the University of Michigan. As part of her PhD training, she obtained a Master's degree in Epidemiology from the Netherlands Institute for Health Sciences in 2010.

Nicole Lucassen is married to Onno Beugelsdijk. They have two sons: Marijn (July, 2nd, 2010) and Thomas (December, 8th, 2012).

PHD PORTFOLIO

Name PhD student	Nicole Lucassen
Erasmus MC Department	Child and Adolescent Psychiatry/Psychology
Research School	Netherlands Institute for Health Sciences (NIHES)
PhD period	2007-2013
Promoters	Prof.dr. H. Tiemeier
	Prof.dr. M.H. van IJzendoorn
	Prof.dr. M.J. Bakermans-Kranenburg
Supervisor	Dr. M.P. Lambregtse-van den Berg

	Year	Workload (ECTS)
1. PhD training		
Research Skills		
MSc Epidemiology, NIHES		
Erasmus Summer Program		
Principles of Research in Medicine	2008	0.7
Methods of Public Health Research	2008	0.7
Health Economics	2008	0.7
Genome Wide Association Analysis	2008	1.4
Conceptual Foundation of Epidemiologic Study Design	2008	0.7
Cohort Studies	2008	0.7
Case-control Studies	2008	0.7
Introduction to Public Health	2008	0.7
Principles of Genetic Epidemiology	2008	0.7
Primary and Secondary Prevention Research	2008	0.7
Introduction to Decision-making in Medicine	2008	0.7
Core curriculum		
Study Design	2008	4.3
Classical Methods for Data-analysis	2008	5.7
Methodological Topics in Epidemiologic Research	2008	1.4
Modern Statistical Methods	2008	4.3
Public Health Research: Analysis of Population Health	2008	1.9
Public Health Research: Analysis of Determinants	2008	1.9
Public Health Research: Intervention Development and Evaluation	2008	1.9

In-depth courses		
Psychiatric Epidemiology	2009	1.1
Planning and Evaluation of Screening	2009	1.4
Attachment and Developmental Psychopathology: Theory, Research, and Clinical Applications, Leiden University	2008	5.0
Structural Equation Modelling, Amsterdam University	2010	10.0

National and international conferences, seminars, and workshops: Participation and presentation

Research Meetings, The Generation R Study Group, Rotterdam, the Netherlands	2007- 2012	1.0
Minnesota Symposium on Child Psychology, Minneapolis, USA: 'The origins and organization of adaptation and maladaptation'	2009	0.3
Science Meeting of the European Science Foundation (ESF) European Child Cohort Network (EUCCONET) Workshop, Vienna. Oral presentation: 'Fathers in the Generation R Study: Behavioral and cognitive research in a prospective cohort study from fetal life onwards'	2010	1.0
Symposium, Education and Child Studies, Leiden University: 'The power of early experiences: On brain plasticity, sensitive periods, and biobehavioral recovery from early trauma'	2010	0.1
Biennial Meeting of the Society for Research in Child Development, Montreal, Canada. Poster presentation: 'Paternal sensitivity, depression and anxiety predict infant-father attachment security'	2011	0.6
Early Biennial Meeting SIG 5 Learning and Development in Early Childhood, Utrecht, the Netherlands. Oral presentation in symposium: 'The importance of sensitive parenting in child development. Evidence from the Generation R Study'.	2012	1.0

2. Teaching Activities

Workshops and lectures

Erasmus University Rotterdam (EUR), Institute of Psychology Guest lecture 'Opvoeden in cultureel perspectief'	2007	0.5
Erasmus University Rotterdam (EUR), Institute of Psychology Guest lecture 'Does the father matter?'	2007	0.5
Leiden University, Education and Child Studies Guest lecture 'Vaders'	2010-2011	0.3
Erasmus University Medical Center VO.3 Workshop 'Normal development of children'	2011-2012	0.5

Supervising Bachelor's theses

Inge Reinink, thesis title: "The association between maternal depressive symptoms and maternal sensitive parenting: The Generation R Study", Erasmus University Medical Cente	2011	2.0
Janna Eilander, thesis title: "Sensitiviteit, affectregulatie en gehechtheid", Leiden University, Education and Child Studies	2011	1.0

Supervising Master's theses

Anja Mann, thesis title: "Gender differences in infant attachment and sensitivity", Leiden University, Education and Child Studies	2009	1.5
Raquel Mosso, thesis title: "The prediction of maternal sensitivity at 36 months by postnatal mother and child factors", Erasmus University Rotterdam	2009	1.5
Sanne Zaadnoordijk, thesis title: "Betrokkenheid van vaders in de opvoeding: Is er een effect op sensitiviteit?", Leiden University, Education and Child Studies	2011	3.0

Training of students

Observing and coding parental sensitivity	2009	3.0

Note. 1 ECTS (European Credit Transfer System) is equal to a workload of 28 hours

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