

PRENATAL MATERNAL FAMILY STRESS AND INTERNALIZING PROBLEM BEHAVIOR IN
YOUNG CHILDREN: A MULTIPLE MEDIATION MODEL

Prenatal Maternal Family Stress and Internalizing Problem Behavior in Young Children: A Multiple
Mediation Model

Master Thesis Child and Family Studies

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December 12, 2011

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Preface

This master thesis is the result of research conducted within the Generation R Study. Within the Generation R Study, the growth, development, and health of nearly 10,000 children in Rotterdam are examined. With this master thesis, I will complete the master Education and Child Studies: Child and Family Studies at Leiden University.

During my bachelor's degree study at Radboud University Nijmegen, I developed an interest in the impact of adverse family conditions on children. In the light of this interest, I chose a master study that could further educate me on this subject. The master Education and Child Studies: Child and Family studies at Leiden University was suitable to my interest. As the moment arrived to select a project for my master thesis, my attention was drawn to the Generation R Study. Numerous variables were tested over the course of child development, giving me the possibility to develop a research question that was completely based on my own interest.

First, I would like to thank my supervisor drs. Jolien Rijlaarsdam for guiding me throughout this process. Her advice and feedback were of great help. I am especially thankful for the freedom she gave me to write and plan this master thesis on my own. Additionally, I would like to thank prof. dr. Bakermans-Kranenburg, as the internal supervisor, for the collaboration and the feedback she provided. Third, I would like to thank Jolien Steenweg – de Graaff and Ank Ringoot, for the opportunity to contribute to their projects as part of my data collection. Finally, I would like to thank Joep, my parents, and brother for all the support and pep talks. They gave me the motivation and confidence I needed. In particular, I would like to thank my mother, for always knowing exactly how I felt.

I hope you as a reader find this master thesis enjoyable and interesting to read.

Danielle M. Pol

Amsterdam, December 12, 2011

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Abstract

Previous research found a broad range of postnatal parental risk factors for the development of internalizing problems in children, but much remained unclear about the influence of prenatal parental characteristics on child internalizing problems. In the current study it is proposed that prenatal maternal (family) stress is associated with postnatal maternal characteristics (i.e. maternal depressive symptoms and maternal parenting stress), thereby posing a risk for the development of internalizing problem scores in young children. First, gender differences on child internalizing problem scores were tested. Furthermore, the moderating role of child gender in the association between prenatal maternal family stress and child internalizing problem scores was examined. Finally, the mediating roles of maternal depressive symptoms and maternal parenting stress in the association between prenatal maternal family stress and child internalizing problem scores were examined in a multiple mediation model. The current study was conducted within the Generation R Study, a population-based cohort from fetal life onwards. Mothers reported on prenatal family stress at 20 weeks of gestation, depressive symptoms at 6 months postpartum, parenting stress at 18 months postpartum, and child internalizing problem scores were measured when the child was 3 years of age. In the present study, 2,776 families participated, from which 48.6% had boys. The proposed multiple mediation model was tested using bootstrapping analyses. No significant gender differences were found for child internalizing problem scores. In addition, results showed that child gender did not moderate the association between prenatal family stress and child internalizing problem scores. Furthermore, results supported the proposed multiple mediation model. The association between prenatal maternal family stress and child internalizing problem scores was partly mediated through maternal depressive symptoms ($B = 0.21$, 95% CI = 0.09 – 0.36), and parenting stress ($B = 0.69$, 95% CI = 0.53 – 0.89). In conclusion, we found that lower levels of family functioning experienced by mothers prenatally placed children at risk of developing internalizing problem scores. In addition, we found that part of this association was explained by maternal postnatal depressive symptoms, and maternal postnatal parenting stress.

Keywords: prenatal maternal family stress, child internalizing problem scores, maternal depressive symptoms, maternal parenting stress

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Chapter I: Introduction

Parents are confronted with many situations in their lives that ask for adaptation, such as irritating daily hassles or moving to a new home (Resick, 2001). When adapting to these situations is difficult or impossible, stress may occur (Mulder et al., 2002). For example, parents may experience stress because of relationship strain or unhealthy family functioning (Henrichs, 2011). Stressors can vary in nature and severity; from major life events (e.g. divorce) to daily hassles (e.g. relationship strain) (Mulder et al., 2002; Resick, 2001). Daily hassles have been found to be better proximal measures of stress and affect a person's health more rapidly than major life events (Huizink, Robles de Medina, Mulder, Visser & Buitelaar, 2003).

The risks of parental postnatal stress for the development of children have been well documented. Previous research found that postnatal parental stress (e.g. anxiety or depression) negatively affected child functioning (e.g. child psychopathology, cognitive development, and behavioral development) (Kurstjens & Wolke, 2001; Ramchandani et al., 2008; Wanless, Rosenkoette & McClelland, 2003). Furthermore, research pointed out that postnatal family stressors are associated with child internalizing problems by evoking feelings of self-blame, hopelessness and low expectations in children (Bayer, Sanson & Hemphill, 2006; Gutteling et al., 2005; Leve, Kim & Pears, 2005). If children develop these problems at an early preschool age (ages 2-3 years), this may set children on a course of psychopathology (Mesman, Bongers & Koot, 2001; Mesman & Koot, 2001).

Next to postnatal parental stress, prenatal parental stress affects child development (Henrichs, 2009). Previous literature showed that prenatal maternal stress was associated with adverse emotional, behavioral and mental outcomes in young children (Bergman, Sarkar, O'Connor, Modi & Glover, 2007; Gutteling et al., 2005; Huizink et al., 2003; O'Connor, Heron, Golding, Beveridge & Clover, 2002; O'Connor, Heron, Glover & The Alspac Study Team, 2002; Van den Bergh & Marcoen, 2004). Furthermore, maternal stress during pregnancy was significantly associated with child internalizing problems, such as anxiety (Van den Bergh & Marcoen, 2004).

However, gaps remain in the literature on the association between prenatal maternal stress and early child development. First, questions remain in the literature about mechanisms underlying the association between maternal stress during pregnancy and child postnatal development (Bergman et al., 2007). The association between prenatal stress and child postnatal development that was found in previous studies, may be explained by postnatal maternal factors such as depression and anxiety (Rice et al., 2010). Therefore, we should further examine possible mediating factors in the association between prenatal stress and child postnatal development. Second, previous research on maternal stress during pregnancy was mostly retrospectively based (Gutteling et al., 2005; Huizink et al., 2004; O'Connor et al., 2002). Retrospective measurement of perceived stress is undesirable because of possible biases in memory recall of participants (Bergman et al., 2007). Third, results of previous studies are often based on small sample sizes. Furthermore,

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most previous studies did not control for confounding variables (Huizink et al., 2004; O'Connor et al., 2002). Therefore, findings may be less generalizable to the population and other variables may account for the results that were previously found. Fourth, previous research examined child internalizing problems from late childhood onward. Few studies focused on child internalizing problems in preschool children. Therefore, further investigation of pathways to child internalizing problems in the preschool period is needed (Sterba, Prinstein & Cox, 2007; Zahn-Waxler, Klimes-Dougan & Slattery, 2000). Finally, previous studies that examined gender differences in the development of child internalizing problems at an early age could not find consistent empirical evidence for such a difference. Whereas some researchers found that, across early and middle childhood, boys and girls did not differ on internalizing problems, others suggest that girls experience fewer internalizing problems (Mesman, Bongers & Koot, 2001; Sterba et al., 2007). Therefore, more research is needed to examine possible gender differences in early child internalizing problems.

The current study addresses these limitations and gaps in previous literature on the influence of prenatal maternal stress on early child development. First, by examining the association between maternal stress during pregnancy and child internalizing problem scores. Second, we assessed whether the association between stress experienced by mothers prenatally and child internalizing problem scores could be explained by postnatal maternal characteristics. Third, we used a population based cohort in which data was collected prospectively. Fourth, we used a large population based cohort and controlled for possible confounding variables. Fifth, we assessed child internalizing problem scores at the preschool age. Finally, we assessed possible gender differences in early child internalizing problem scores.

Maternal depressive symptoms as a candidate mediator

Maternal depression is a prevalent disorder affecting 8% to 10% of all women between 25 and 44 years of age (Carter & Garrity-Rokous, 2011). The most common depressive symptoms are sadness, fatigue, and pessimism (Keller & Nesse, 2005).

Previous studies that examined predictors of depressive feelings, extensively focused on stress-depression associations. Researchers found that stress may play a triggering role in the development of depression (Hammen & Watkins, 2008). Research also showed that maternal depression was predicted by romantic relationship stress (Joiner et al., 2006). Dobson and Dozois (2008) support this finding by showing a reliable association between marital discord and depressive symptoms. Whereas most research focused on the relation of postnatal stressors on maternal depressive symptoms, research showed that also prenatal stress can serve as a risk factor (Dobson & Dozois, 2008; Melville et al., 2010).

It is well-documental that maternal depressive symptoms are associated with poor child outcomes (Frye & Garber, 2005). For instance, multiple studies have found that offspring of depressed parents are at increased risk of internalizing problems compared to children of non-depressed parents (Foster et al., 2008;

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Frye & Garber, 2005; Silk et al., 2011; Silk et al., 2006; Wachs et al., 2009). These children of depressed parents are at 3- to 4-fold risk of developing depressive symptoms and anxiety disorders during childhood (Silk et al., 2011).

In summary, previous studies showed that (prenatal) relationship stressors predict maternal depressive symptoms, which in turn are associated with an increased risk of the development of internalizing problems in their children. It is however unknown, whether this (partial) mediation also applies to general family stress during pregnancy and child internalizing problem scores. The current study can add to this knowledge.

Maternal parenting stress as a candidate mediator

Parenting stress refers to a parent's view of experiencing the parenting role as stressful (Levendosky & Graham-Bermann, 1998). The perceived stress results from the demands of being a parent (Costa, Weems, Pellerin & Dalton, 2006; Guthermuth Anthony et al., 2005). The symptoms of parenting stress can vary. For example, a mother may feel overwhelmed by the parenting demands and may be consistently unhappy with her life (Mulsow, Caldera, Pursley & Reifman, 2002).

Previous researchers that examined predictors of parenting stress found that parenting stress is highly affected by environmental factors (Levendosky & Graham-Bermann, 1988). Environmental factors that may increase the experience of parenting stress are marital disruption (Guthermuth Anthony et al., 2005), and psychological distress (McPherson, Lewis, Lynn, Haskett & Behrend, 2009). These results indicate that the examination of marital discord and existing stressors may be important in research on predictors of parenting stress. This idea is in line with the view of Abidin (1992), who proposed that parenting stress is determined by parenting relevant stressors such as strain in the marital relationship.

Next, previous literature has shown that maternal parenting stress is one of the most important environmental factors associated with the well-being of a child (Mulsow et al., 2002). High parenting stress is typically associated with behavioral problems in children (Cardoso, Padilla & Sampson, 2010). Levendosky and Graham-Bermann (1998) found that parenting stress significantly predicted child internalizing problems. Guthermuth-Anthony et al. (2005) supported this notion and found a significant association between parenting stress and child internalizing problems, independently of parenting behaviors, such as discipline tactics and nurturing strategies to promote psychological growth of the child.

In summary, previous research suggests that family stress precedes perceived parenting stress, which in turn puts children at risk of the development of internalizing problems. However, it is unknown whether this postulated mediating role of parenting stress in the association between family stress and child internalizing problem scores, applies to prenatal family stress as well. The current study can add to this knowledge.

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Current study

In the current study, a model is proposed in which maternal depressive symptoms, and parenting stress, mediate the association between prenatal maternal family stress and early child internalizing problem scores (Figure 1). First, we hypothesized that no significant differences would be found between boys and girls on early child internalizing problem scores, and in the association between prenatal family stress and child internalizing problem scores. Second, we hypothesized that prenatal family stress is associated with child internalizing problem scores through its relationship with maternal depressive symptoms. Third, we hypothesized that prenatal family stress is associated with child internalizing problem scores through its relationship with maternal parenting stress. Hypotheses were tested in families participating in an ongoing population-based cohort study.

Chapter II: Methods

Design

The current study was conducted within the Generation R Study, a population-based cohort from foetal life onwards (Jaddoe et al., 2010). Pregnant women living in the study area in Rotterdam, the Netherlands, with an expected delivery date between April 2002 and January 2006, were approached to participate. The study has been approved by the Medical Ethical Committee of the Erasmus Medical Center, Rotterdam. Written informed consent was obtained from all adult participants.

Population for analysis

In the Generation R Study, 4,815 mothers reported on child internalizing problem scores. We excluded participants without data on family functioning ($n = 668$), maternal depressive symptoms ($n = 1,113$), and maternal parenting stress ($n = 156$). In addition, we excluded all twins ($n = 98$), yielding a sample for analysis of $n = 2,780$. Following bootstrapping analyses were repeated in a sample without exclusion of participants lacking data on our selected variables to check the possibility of attrition bias.

Measures

Prenatal maternal family stress. Information on prenatal family stress was obtained by postal questionnaires at 20 weeks of gestation. To assess family functioning and associated stressors, mothers filled out the ‘General Functioning’ (GF) subscale of the Family Assessment Device (FAD). The ‘General Functioning’ subscale is a validated self-report measure of family health and pathology as well as individual perceptions of family functioning concerning essential tasks (Henrichs, 2011). Previous research found good test-retest reliability ($r = .71$) (Miller, Epstein, Bishop & Keitner, 1985) and construct validity supporting the GF subscale (Byles, Burne, Boyle & Offord, 1988). The GF subscale consists of 12 items, from which half represent healthy family functioning and the other half unhealthy family functioning (Henrichs, 2011). Items

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are rated on a 4-point scale: 1 (strongly agree), 2 (agree), 3 (disagree) and 4 (strongly disagree). Examples of items are: 'We cannot talk to each other about the sadness we feel'; 'We avoid discussing our fears and concerns', and 'There are lots of bad feelings in the family' (Epstein, Baldwin & Bishop, 1983). Respective items were summed and divided by the amount of completed items to derive a total GF score. A higher score represents a higher level of prenatal maternal family stress. The internal consistency of the 'General Functioning' subscale in the present sample was good ($\alpha = .86$) (Gliem & Gliem, 2003).

Child internalizing problems. Mothers filled out the Dutch version of the Child Behavior Checklist for toddlers (CBCL/1.5-5) when the child was 3 years of age (Achenbach & Rescorla, 2000). The CBCL is a 99-item self-administered parents-report questionnaire. Items are rated on a 3-point scale: 0 (not true), 1 (somewhat or sometimes true) and 2 (very true or often true), based on the preceding two months. Examples of items are: 'Complaints about feeling lonely'; 'Refuses to talk', and 'Cries a lot'. Good reliability and validity for the English and Dutch CBCL/1.5-5 was found in previous research (Achenbach & Rescorla, 2000; Tick, van der Ende, Koot & Verhulst, 2007). The internalizing problem score that is used in this study is based on raw item scores on four syndrome scales (of the total of seven syndrome scales) of the CBCL; 'Emotionally Reactive', 'Anxious/Depressed', 'Somatic Complaints' and 'Withdrawn'. Respective items were summed to derive the internalizing problems score. A higher score represents a higher severity in child internalizing problem behavior. The internal consistency of the internalizing problem scores in the current study was $\alpha = .81$, which is good (Gliem & Gliem, 2003).

Maternal depressive symptoms. Information on maternal depressive symptoms was obtained at six months postpartum using the 6-item 'Depression' scale from the Brief Symptom Inventory (BSI) (Derogatis & Melisaratos, 1983). In this study, we used a Dutch translation of the BSI (De Beurs, 2006). The BSI is a validated self-report measure consisting of 53 items, which is widely used in clinical research settings. The items define a spectrum of depressive symptoms in the preceding seven days and are rated on a 5-point scale: 0 (not at all), 1 (a little bit), 2 (moderately), 3 (quite a bit) and 4 (extremely). Examples of items are: 'Feeling no interest in things'; 'Feelings of worthlessness', and 'Feeling hopeless about the future' (Derogatis & Melisaratos, 1983). Previous research found good test-retest reliability ($r = .71 - .89$) and validity supporting the Dutch BSI (De Beurs, 2006). The items define a spectrum of depressive symptoms in the preceding seven days. Respective items were summed and divided by the amount of completed items to derive a total depressive symptoms score. A higher score represents a higher severity in maternal depressive symptoms. The internal consistency of the 'Depression' subscale in our sample was excellent ($\alpha = .96$) (Gliem & Gliem, 2003).

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Parenting stress. Mothers filled out the Nijmeegse Ouderlijke Stress Index- Kort (NOSIK) at 18 months postpartum, which assesses the level of maternal stress in a parent child relationship (De Brock, Vermulst, Gerris & Abidin, 1992). The NOSIK is the Dutch version of the Parenting Stress Index-Short Form (Abidin, 1983). Items were rated on a 4-point Likert scale: 0 (strongly disagree), 1 (a little agree), 2 (rather agree) and 3 (strongly agree). Examples of items are ‘Parenthood of this child is harder than I thought’; ‘I have more problems in raising my children than I thought’ and ‘I often do not understand my child’. Previous research found good reliability and validity ($\alpha = .95$) in support of the NOSIK (De Brock et al., 1992). We used the parenting domain of the NOSIK which comprises 11 items. Scores were summed and divided by the number of completed items. A higher score represents a higher level of maternal parenting stress. The internal consistency of the parenting domain in the present study was $\alpha = .69$, which is acceptable (Gliem & Gliem, 2003).

Covariates. The choice of potential confounding variables was determined a priori and based on previous research (Henrichs et al., 2011; Huizink et al., 2003). We included data on child gender, child’s age at the assessment of outcome, parity, marital status, maternal education, family income and child national origin. Parity was categorized into two categories: ‘firstborn’ and ‘later born’. Maternal education was categorized into three categories according to the definitions of Statistics Netherlands (2003): ‘low education’ (no education, primary school or \leq three years secondary school), ‘middle education’ ($>$ three years secondary school, intermediate vocational training) and ‘high education’ (higher vocational training or university degree). Family income was defined by the total net month income of the household and classified into three categories ‘low’ ($<1,200$ €), ‘middle’ (1,200-2,000 €), and high ($>2,000$ €). Child national origin was based on the country of birth of the child’s parents, which was assessed by questionnaire. A child was classified as ‘Dutch’ if both of the parents were born in the Netherlands. A child was classified as ‘non-Dutch’ if one of the parents was born abroad. If both parents were born abroad, the country of birth of the child’s mother decided on child national origin. The ‘non-Dutch’ children were further differentiated into ‘other Western’ (such as European and North American), and ‘non-Western’ (such as Moroccan, Turkish, Indonesian or Surinamese) origins according to definitions of Statistics Netherlands (2004).

Analyses

First, data-inspection of scores was performed and outliers were examined. Extreme scores on child internalizing problems were excluded ($n = 4$), yielding a population for analysis of $n = 2,776$. Second, in order to resemble a symmetric distribution, we applied transformations on variables with a skewed distribution. The CBCL ‘Internalizing’ scale had a positively skewed distribution. We applied a square root transformation on the scores. The distributions of the FAD ‘General Functioning scale’, NOSIK and the BSI ‘Depression’ scale were right skewed and therefore, logarithm transformations were applied. Third, dummy variables were made for the categorical covariates. Finally, missing values of covariates were examined.

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Single imputation was performed by replacing missing data on categorical covariates by the median (McKnight, McKnight, Sidani & Figuerdo, 2007). The fraction of missing data was less than 10 percent for all selected covariates, except for family income (11.4% missing data).

First, we computed descriptive statistics. Next, we examined the correlation between continuous variables, using Pearson correlation coefficients. In order to examine possible differences within categorical covariates on child internalizing problem scores, we performed ANOVA analyses and independent samples t-tests. Associations between categorical variables were assessed using chi-square tests.

Possible gender differences in child internalizing problem scores were assessed using an independent samples t-test. In addition, we examined possible differences between boys and girls in the association between prenatal maternal family stress and child internalizing problem scores, using regression analyses.

Figure 1 represents the conceptual framework of our proposed multiple mediation model. Testing multiple mediators can provide a more precise assessment of mediation effects in comparison to a single mediation, since it is unlikely that a single mediator can completely explain the association between the independent and dependent variable (MacKinnon, Lockwood, Hoffman, Wes & Sheets, 2002; MacKinnon, Fairchild & Fritz, 2007). To test the proposed model, bootstrapping analyses were performed. Bootstrapping is a nonparametric resampling procedure, in which repeated samples from the data set are drawn and the indirect effect in each resampled data set is estimated (Preacher & Hayes, 2008). All path coefficients are unstandardized (i.e. *B*) (Afhayes, 2011). In the current study, bootstrapping was performed using a SPSS script developed by Preacher and Hayes (2008). In line with previous research, we used 5,000 re-samples, since the estimates are more stable when using a larger number of re-samples (Preacher & Hayes, 2008; Preacher & Hayes, 2004). All statistical analyses were performed using SPSS Statistics 18.

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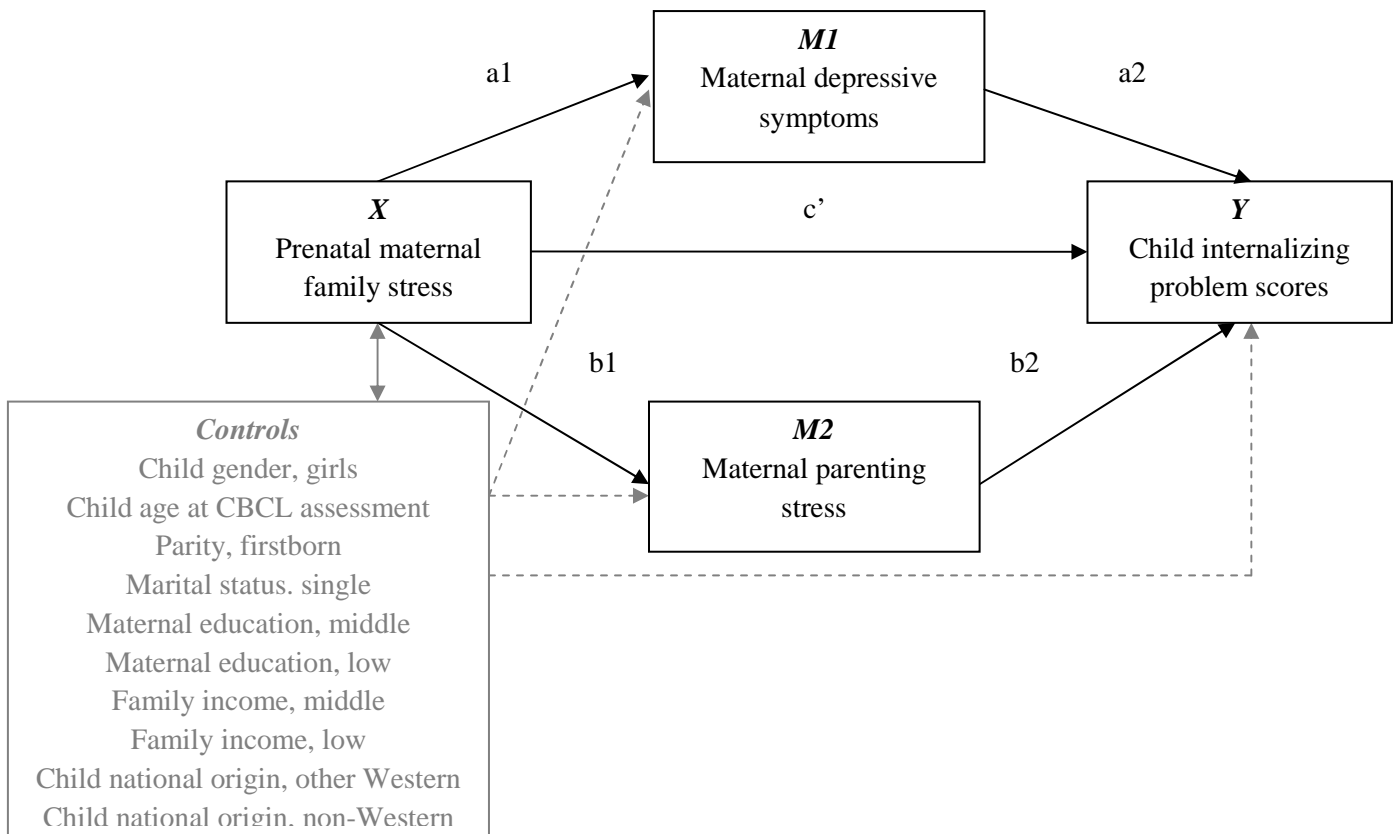


Figure 1. Multiple Mediation of Prenatal Maternal Family Stress on Child Internalizing Problem Scores by Maternal Depressive Symptoms and Maternal Parenting Stress

Chapter III: Results

Sample

The characteristics of the current sample are presented in Table 1. Median scores were 4.0 (range = 0.0 – 30.9) for child internalizing problem scores, and 1.3 (range = 1.0 – 4.0) for prenatal family stress. The mean age of children in this sample at the assessment of internalizing problem scores was 36.4 months ($SD = 1.0$). In the current sample, 48.6% of the children were boys. Seventy-one percent of children were Dutch, 10.1 % other Western, and 18.8 % non-Western. Sixty-three percent of mothers in the current sample were highly educated, 25.6 % middle, and 11.3 % low educated. Of all families, 78.3 percent had a high family income, 14.6 % middle, and 7.2 % low. Seven percent of the couples in our sample were single.

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Table 1

Sample Characteristics

	<i>n</i> ¹	<i>MED (100% range) / %</i>
Prenatal maternal family stress (score)	2,776	1.3 (1.0-4.0)
Child internalizing problems (score)	2,776	4.0 (0.0-30.9)
Maternal depressive symptoms (score)	2,776	0.0 (0.0-4.0)
Maternal parenting stress (score)	2,776	0.2 (0.0-2.6)
Child gender	2,776	
Boys (%)	1,349	48.6
Girls (%)	1,427	51.4
Child age at assessment of outcome (mo.)	2,766	36.4 (1.0)*
Parity	2,776	
Firstborn (%)	1,051	38.7
Later born (%)	1,667	61.3
Marital status	2,776	
Married / living together (%)	2,531	93.5
Single (%)	177	6.5
Maternal education	2,776	
High (%)	1,724	63.1
Middle (%)	701	25.6
Low (%)	309	11.3
Family income	2,776	
High (%)	1,925	78.3
Middle (%)	359	14.6
Low (%)	176	7.2
Child national origin	2,776	
Dutch (%)	1,968	71.1
Other Western (%)	280	10.1
Non Western (%)	521	18.8

Note. * Mean (SD).

¹ Data were missing on parity (2.1%), marital status (2.4%), maternal education (1.5%), family income (11.4%), and child national origin (0.3%).

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Bivariate analysis

Correlations between continuous variables are presented in Table 2. Prenatal maternal family stress was statistically significantly correlated with early child internalizing problem scores ($r = .22, p < .01$). This result indicates that the more prenatal family stress mothers experienced, the more child internalizing problem scores they reported. Also, prenatal maternal family stress was significantly correlated with the two proposed mediators maternal depressive symptoms ($r = .25, p < .01$), and parenting stress ($r = .23, p < .01$). Specifically, the more prenatal family stress mothers experienced the more depressive symptoms and parenting stress they reported. Both maternal depressive symptoms ($r = .20, p < .01$), and parenting stress ($r = .30, p < .01$) were correlated with child internalizing problem scores. These findings show that the more depressive symptoms or parenting stress mothers experienced, the more child internalizing problem scores they reported. Furthermore, results showed that there was a statistically significant correlation between the two proposed mediators ($r = .32, p < .01$). Specifically, the more depressive symptoms mothers experienced, the more parenting stress they reported. All correlations were in the expected direction.

Table 2

Correlations between Prenatal Maternal Family Stress, Child Internalizing Problem Scores, Mediators, and Child Age at Assessment of Outcome (n = 2,776)

	1.	2.	3.	4.	5.
1. Prenatal maternal family stress	-				
2. Child internalizing problem scores	.22**	-			
3. Maternal depressive symptoms	.25**	.20**	-		
4. Maternal parenting stress	.23**	.30**	.32**	-	
5. Child age at assessment of outcome (mo.)	.06**	.04*	.04*	.05*	-

Note. * $p < .05$, ** $p < .01$.

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ANOVA analyses demonstrated that background variables that were included as covariates were related to child internalizing problem scores. Maternal education, $F(3, 2734) = 20.95, p < .01$, and family income, $F(3, 2460) = 30.63, p < .01$ were significantly related to child internalizing problem scores. Specifically, mothers with a low educational level reported on the average higher internalizing problem scores than mothers with a middle or high educational level. Next, mothers with a low family income, reported higher internalizing problem scores on the average, than mothers with a middle or high family income. Also, child national origin was significantly related to child internalizing problem scores, $F(3, 2769) = 24.58, p < .01$. On the average, mothers with children from non-Western national origin, higher child internalizing problem scores than mothers with children from Western or other Western national origin.

Furthermore, single mothers reported higher levels of internalizing problem scores than married or cohabiting mothers (mean internalizing problem scores = 2.29 ($SD = 1.08$) vs. 1.87 ($SD = 1.03$), $t(2,706) = -5.19, p < .01, d = 0.40$). In addition, firstborn children were rated as having higher levels of internalizing problem scores than later born children (mean internalizing problem scores = 2.00 ($SD = 1.02$) vs. 1.73 ($SD = 1.07$), $t(2,716) = -6.48, p < .01, d = 0.26$).

Finally, we examined possible associations with covariates. Findings showed that child national origin was positively related to family income $\chi^2(4, N = 2,453) = 524.72, p < .001$, maternal education $\chi^2(4, N = 2,734) = 248.61, p < .001$, and marital status $\chi^2(2, N = 2,708) = 123.10, p < .001$. On the average, couples with children from Western origin, had a higher family income, higher maternal educational level, and were more often married or living together than couples with children from other Western or non-Western national origin. In addition, we found that marital status was positively related to family income $\chi^2(2, N = 2,393) = 337.49, p < .001$, maternal education $\chi^2(2, N = 2,679) = 64.32, p < .001$, and parity $\chi^2(1, N = 2,652) = 19.65, p < .001$. On the average, married couples or couples who were living together had a higher family income, higher maternal educational level, and had more often firstborn children than mothers without a partner. Finally, results showed that maternal education was positively related to family income $\chi^2(4, N = 2,437) = 480.04, p < .001$ and parity $\chi^2(2, N = 2,683) = 6.10, p < .05$. On the average, mothers with a high educational level had a higher family income and more often firstborn children than mothers with a middle or low educational level.

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Gender differences

The current findings showed that boys ($M = 1.92$, $SD = 1.03$) and girls ($M = 1.87$, $SD = 1.06$) did not significantly differ in internalizing problems $t(2,774) = 1.24$, $p = .22$. In addition, results showed that child gender did not moderate the association between prenatal family stress and child internalizing problem scores, $\beta = -.01$, $t(2,773) = -0.35$, $p = .72$.

Given the above, the following bootstrapping analyses for testing the proposed multiple mediation model were not stratified for gender.

Bootstrapping analyses

Figure 2 and Table 3 show the direct effects of maternal prenatal family stress on child internalizing problem scores (path c'), and the indirect effects of maternal prenatal family stress on child internalizing problem scores through the proposed mediators maternal depressive symptoms and maternal parenting stress. Maternal prenatal family stress was associated with children's internalizing problem scores when testing both unmediated ($B = 2.62$, $p < .01$) and mediated models ($B = 1.72$, $p < .01$). In addition, prenatal maternal family stress was positively related to maternal depressive symptoms ($B = 0.30$, $p < .01$), and maternal parenting stress ($B = 0.22$, $p < .01$) (a1 and b1 paths). Furthermore, maternal depressive symptoms ($B = 0.70$, $p < .01$) and maternal parenting stress ($B = 3.12$, $p < .01$) were significantly associated with child internalizing problem scores (a2 and b2 paths). The partial effects of the covariates on child internalizing problem scores (see Table 3) show that low maternal education ($B = 0.14$, $p = .03$), and parity ($B = 0.31$, $p < .01$) were significant covariates.

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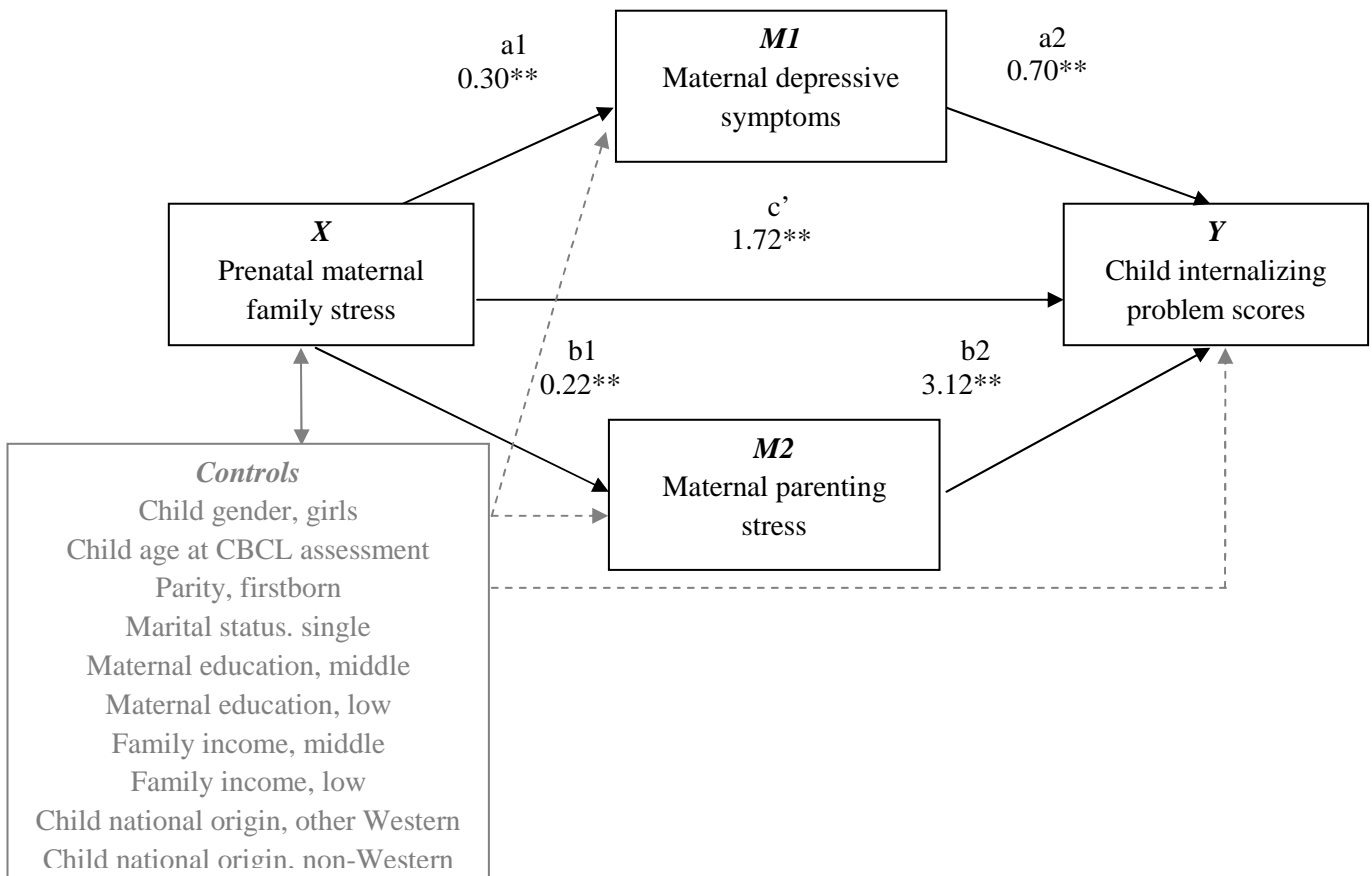


Figure 2. Multiple Mediation of Prenatal Maternal Family Stress on Child Internalizing Problem Scores by Maternal Depressive Symptoms and Maternal Parenting Stress

Note. Path coefficients are unstandardized (i.e. B).

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

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Table 3

Total Effect, Direct Effects, and Partial Effects of Prenatal Maternal Family Stress on Child Internalizing Problem Scores in a Multiple Mediation Model^a

Pathways	Estimate ¹	SE	p (two tailed)
Total effect (unmediated model)			
PMFS → CIPS ²	2.62	0.28	< .01
Direct effect of PMFS on CIPS (c' path) (mediated model)			
PMFS → CIPS ³	1.72	0.28	< .01
Direct effects (a1 and b1 paths)			
PMFS → maternal depressive symptoms	0.30	0.03	< .01
PMFS → maternal parenting stress	0.22	0.02	< .01
Direct effects of mediators on CIPS (a2 and b2 paths)			
Maternal depressive symptoms	0.70	0.19	< .01
Maternal parenting stress	3.12	0.24	< .01
Partial effects of control variables on CIPS			
Child gender: Girls	-0.02	0.04	.66
Child age at CBCL assessment	0.02	0.02	.40
Parity: Firstborn	0.31	0.04	< .01
Marital status: Single	0.07	0.08	.41
Maternal education, high ref.:			
Middle	0.08	0.04	.07
Low	0.14	0.07	.03
Family income, high ref.:			
Middle	-0.05	0.06	.37
Low	0.15	0.09	.08
Child nation origin, Dutch ref.:			
Other Western	0.04	0.06	.54
Non-Western	0.10	0.05	.06

Note. ^a5,000 re-samples. PMFS = prenatal maternal family stress; CIPS = child internalizing problem scores.

¹Unstandardized regression coefficient of effects of PMFS, mediators, and control variables on CIPS.

²The total effect of PMFS (independent variable) on CIPS (outcome) in an unmediated model.

³The direct effect of PMFS on CIPS (c' in figure 2).

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Table 4 shows that the indirect effects of prenatal maternal family stress on child internalizing problem scores through maternal depressive symptoms ($B = 0.21$, 95% CI = 0.09 – 0.36), and parenting stress ($B = 0.69$, 95% CI = 0.53 - 0.89) were statistically significant. These results show that part of the association between prenatal maternal family stress and child internalizing problem scores can be explained by maternal depressive symptoms, and maternal parenting stress. Bootstrapping analyses in a sample without exclusion of participants lacking data on our selected variables also showed a significant mediating role of maternal depressive symptoms ($B = 0.16$, 95% CI = 0.01 – 0.33) and maternal parenting stress ($B = 0.42$, 95% CI = 0.28 – 0.60) in the association between prenatal maternal family stress and child internalizing problem scores.

Table 4

Mediation of the Effect of Prenatal Maternal Family Stress on Child Internalizing Problem Scores through Maternal Depressive Symptoms, and Maternal Parenting Stress (ab paths)^a

Mediator	Data ¹	Boot ²	SE	BCa 95% Confidence intervals	
				Lower	Upper
Maternal depressive symptoms	0.21	0.21	0.07	0.09	0.36
Maternal parenting stress	0.69	0.69	0.09	0.53	0.89
Total	0.90	0.90	0.11	0.69	1.15

Note. ^a5,000 re-samples.

BCa = bias corrected and accelerated.

¹Indirect effect calculated in the original sample.

²Mean of the indirect effect estimates calculated across all bootstrap samples.

Chapter IV: Discussion

As outlined previously, the risks of postnatal family stressors on the development of internalizing problems in children have been well documented (Bayer, Sanson & Hemphill, 2006; Gutteling et al., 2005; Leve, Kim & Pears, 2005). However, few studies examined the influence of prenatal parental stress on child postnatal development (Huizink, Mulder & Buitelaar, 2004).

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Furthermore, it remains unclear which mechanisms can explain the association between prenatal parental stress and child internalizing problems (Rice et al., 2010). In the present study we examined maternal depressive symptoms and parenting stress as underlying mechanisms of the association between prenatal family stress and child internalizing problems.

First, we measured possible gender differences in child internalizing problem scores. The present study did not find significant differences between boys and girls on internalizing problem scores at preschool age, or in the association between prenatal maternal family stress and child internalizing problem scores, which was consistent with our hypotheses. The current findings support previous studies reporting no significant differences between boys and girls on internalizing problems (Sterba et al., 2007). A possible explanation for this finding could be that prominent gender differences in internalizing problems do not emerge until later in life. In adolescence, girls were found to be more likely as boys to experience internalizing problems (Mesman et al., 2001).

Next, our hypothesis that the association between prenatal maternal family stress and child internalizing problem scores would be mediated through postnatal maternal depressive symptoms was confirmed. First, we found that mothers experiencing higher levels of prenatal family stress are more likely than mothers experiencing lower levels of prenatal family stress, to report depressive symptoms postnatal. This result is similar to findings from previous research that showed a relation between parental stress and parental depression (Dobson & Dozois, 2008; Hammen & Watkins, 2008; Joiner et al., 2006; Melville et al., 2010). Next, the present study found that mothers with depressive symptoms are more likely to report higher on child internalizing problem scores. This finding is consistent with previous studies showing that maternal depression forms a risk for the development of internalizing problems in children (Foster et al., 2008; Frye & Garber, 2005; Silk et al., 2011; Silk et al., 2006; Wachs et al., 2009). The present finding of a mediating role of maternal depressive symptoms in the relation between prenatal family stress perceived by mothers and child internalizing problem scores could be explained by the following. It may be that the experience of family stress prenatal influences the well-being of a mother, which makes her more vulnerable for developing depressive (Mao, Zhu & Su, 2010). In turn, a socialization process in which the depressed mother expresses negativity may put children at risk of developing internalizing problems (Rigter 2002; Silk et al., 2011).

Finally, we found that the parent's perception of the parenting role as stressful (Levendosky & Graham-Bermann, 1998), mediated the association between prenatal family stress perceived by mother and child internalizing problem scores, which is consistent with our hypothesis. First, results of the present study confirm suggestions in previous research of an association between parental stressors (e.g. marital disruption and psychological distress) and parenting stress (Abidin, 1992; Guthermuth

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Anthony et al., 2005; McPherson et al., 2009). Next, results of the present study support previous studies suggesting that children of mothers with parenting stress were at increased risk of developing internalizing problems (Guthermuth-Anthony et al., 2005; Levendosky & Graham, 1998). The mediating role of maternal parenting stress in the association between prenatal family stress perceived by mothers and child internalizing problem scores may be explained by an underlying trait (e.g. low hardiness) in mothers. Hardiness refers to a personality trait which makes adults perceive stressors as controllable challenges for growth (Gazzaniga & Heatherton, 2006). The personality trait of low hardiness may make mothers more sensitive to viewing stressors as hard and under external control. Thereby, these mothers may be more prone to perceive and report higher levels of prenatal family stress, postnatal parenting stress, and depressive symptoms. Moreover, these mothers may view the problem behavior of their children as more difficult, which may incline mothers to report higher child internalizing problem scores.

Findings in the present study can be placed in the theory of developmental psychopathology, which examines the origins and developmental pathways of disordered behavior and individual adaptation (Van den Bergh, 2010). Developmental psychopathology proposes that disordered behavior develops gradually by transactions between the child and the environment (Van den Bergh, 2010). Consistently, the present study examined maternal pathways to the development of problem behavior (i.e. child internalizing problem scores), and showed that maternal factors influenced the internalizing problem scores in children. Next, the current study approached the developmental psychopathology principles of equifinality and multifinality. The principle of equifinality posits that diverse risk factors can be associated with a single outcome. Multifinality suggests that one risk factor can be associated with diverse outcomes, depending on the context (Hudson & Rapee, 2005; van den Bergh, 2010). By examining the association between family stress perceived by mothers and the two proposed mediators (i.e. maternal depressive symptoms and maternal parenting stress), we dealt with the principle of multifinality. Specifically, we found that the single experience of prenatal stress could be associated with multiple maternal outcomes, which is comparable to multifinality. By analyzing the association between the two proposed mediators (i.e. maternal depressive symptoms and maternal parenting stress) and child internalizing problem scores, we approached the principle of equifinality. Specifically, we found that multiple maternal risk factors could be associated with one child outcome (i.e. internalizing problem scores), which is parallel to the principle of equifinality.

Next to the developmental psychopathology perspective, results of the current study can be placed in the theory of the family risk factor approach. This perspective posits that one or more risk factors can work together in the development of psychopathology in a family member. Specifically, family relationship patterns from several family domains, such as couple relationships and parent-

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child relationships, combine to account for the maladaptation in a child (Cicchetti & Cohen, 2006). For example, inter-parental conflict and parenting hassles were found to be family risk factors for the development of child internalizing problems at preschool age (Hudson & Rapee, 2005). The current study integrated the theory of the family risk factor approach into a multiple mediation model in which an influence of multiple maternal risk factors on child internalizing problem scores at preschool age was found.

In summary, findings in the current study are comparable to the perspectives of the developmental psychopathology and the family risk factor approach. First, the present study showed that child internalizing problem scores at preschool develop as a result of a transaction between maternal factors and the child, which is comparable to the developmental psychopathology perspective. Second, our results show a resemblance to the developmental psychopathology principles of multifinality and equifinality. Specifically, we showed that the single experience of prenatal stress was associated with multiple maternal outcomes (i.e. multifinality), in turn, these multiple maternal factors were related to the single child outcome of internalizing problem scores (i.e. equifinality). Finally, the current study showed that multiple family risk factors work together in the prediction of child internalizing problem scores, which is comparable to the perspective of the family risk factor approach.

The present study has several strengths. Our study was embedded in a large prospective population-based cohort, which increases the extent to which our results may be generalized to a broader population. Using data from this population-based cohort enabled us to conduct a prospective examination of a large sample of economically and ethnically diverse children across a time span of 3,5 years. In addition, we were able to account for numerous confounders. Finally, the current study can add to the existing literature by examining the temporal prospective relation between prenatal maternal family stress and early child internalizing problem scores, and possible mechanisms that may explain this relationship.

Besides the previously mentioned strengths, the present study has limitations. First, as is often the case within large-scale studies, data relied on parental reports. For example, associations between maternal depressive symptoms and child internalizing problem scores could be influenced by a tendency on the part of stressed or depressed mothers towards describing their children more negatively (Costa et al., 2006; Krain & Kendall, 2000; O'Connor et al., 2002). However, prenatal maternal family stress, maternal depressive symptoms, maternal parenting stress, and child internalizing problem scores were assessed at different points in time. For example, depressive symptoms were measured at 6 months postpartum and child internalizing problem scores were measured at three years of age. Future research may improve the current research approach by

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including multiple informants or observational measurements to decrease the possibility of reporter bias.

Second, although we examined multiple maternal mediators of the association between prenatal family stress and child internalizing problem scores, it is likely that important mediators exist that are beyond the scope of the present study. First, insecure attachment to a caregiver could be taken into account as a mediating factor in future research, since previous studies indicated that attachment could be of influence on the development of internalizing problems in children (Cassidy & Shaver, 2008). In addition, we examined the influence of maternal factors on child internalizing problem scores. Future research could integrate paternal factors in a multiple mediation model. For example, previous research found that paternal depression was associated with child development (Ramchandani et al., 2008; Wanless et al., 2003). However, in comparison to the scope of the present study, other researchers found that maternal psychopathology had significantly larger effects on child internalizing problems in early childhood than paternal psychopathology (Connell & Goodman, 2002).

Finally, the present study did not take co-morbidity into account. Co-morbidity holds that one or more disorders exist within a person at the same time. Previous research found high co-morbidity rates of internalizing disorders. For example, anxiety disorders exist frequently with depression (Ollendick & King, 1994; Rigter, 2002). Therefore, previous research suggested that co-morbidity may have important implications for longitudinal studies with a focus on child internalizing problems. First, the pathways to the development of internalizing problems, and the consequences of these problems, could be different for children with one disorder compared to children in which multiple disorders exist. Second, suggestions for treatment following from the results of research could differ between children with one disorder and children with multiple disorders, since the predictors of change due to treatment may differ (Ollendick & King, 1994). Ideally, our study should have examined co-morbidity. With the current use of a total internalizing problem score, we could not examine whether a child was suffering from a single or more disorders, and which specific anxiety disorder (e.g. separation anxiety) or other disorders (e.g. ADHD, depression or behavior disorders) were experienced (Ollendick & King, 1994; Rigter, 2002).

Results of the present study may have important implications for prevention and intervention efforts, future research, and society. First, results of the present study show that early maternal factors are of influence on internalizing problem scores in young children. Current findings suggest that for prevention and early intervention efforts, couples should be monitored on family stressors during pregnancy, as well as psychological distress symptoms postnatally. Next, programs on child internalizing problems should integrate a focus on parents.

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Moreover, findings in the current study may be beneficial for social sciences and the developmental psychopathology perspective in two ways. First, we showed mechanisms in the development of child internalizing problem scores at preschool age, which is a developmental period that received little attention in previous studies. Second, we assessed the influence of family stress on child internalizing problem scores in the prenatal stage, which is a relatively young area of interest in social sciences. Current findings add to the existing literature and suggest that further examination of the association between prenatal factors and child postnatal development is needed.

Finally, our results may have implications for society. We showed that family functioning perceived by mothers in the prenatal stage, has an influence on the perceived internalizing behavior of their children. Thereby, we showed that maternal factors early in a child's life, may impact the behavior of a child later on. In addition, our results suggest that a healthy parental psychological health (i.e. minimize stress and depressive feelings) is important in order to avoid a possible negative impact on the behavior of children.

Findings in the present study support the need for future research to further investigate the influence of prenatal parental factors on child development. Furthermore, future research is needed to replicate the results of the current study with multiple informants, observational techniques and interview measurements. Next, as been previously mentioned, important mediators could exist in the association between prenatal family stress and early child internalizing problems which were beyond the scope of our study. Therefore, the model should be optimized in future research by including new factors. First, protective factors could be taken into account. For instance, research may examine which factors protect a mother from experiencing negative consequences of stress. Next, research may test which factors are protective in the development of child internalizing problems. For example, child characteristics, quality of parent-child relationships and ecological factors may be taken into account (Cassidy & Shaver, 2008). Second, coping and resilience could be integrated in the current multiple mediation model. Coping research conceptualizes that how individuals respond and deal with stress, is caused by a combination of environmental and individual characteristics (Aldwin, 2007). In the diathesis stress model, it is conceptualized that multiple factors work together in the development of psychopathology: vulnerability factors and stress factors (Bergh, van den, 2010). Future research could examine these factors based on the current model. Third, the role of attachment could be integrated in the current multiple mediation model. Previous research suggested that insecure attachment to a caregiver places children at risk of the development of internalizing problems (Cassidy & Shaver, 2008). Finally, future research could investigate how parental factors are of influence on, and transmitted to children. For example, the multiple mediation model could be optimized by explaining the process in which depressed feelings in parents are transmitted to children. Previous

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research suggested transmission through genetics or socialization processes such as insecure attachment, modeling and information transmission (Rigter, 2002).

In conclusion, we found that lower levels of family functioning as experienced by mothers places children at risk of developing internalizing problems. In addition, we found that part of this association was explained by maternal postnatal depressive symptoms, and by maternal parenting stress.

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