

Once and Again

History of Rearing Experiences and Psychosocial Parenting Resources at Six Months in Primiparous Mothers

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Abstract

Animal and human studies suggest that parenting style is transmitted from one generation to the next. The hypotheses of this study were that (1) a mother's rearing experiences (G1) would predict her own parenting resources (G2) and (2) current maternal mood, motivation to care for her offspring, and relationship with her parents would underlie this association. In a subsample of 201 first-time mothers participating in the longitudinal Maternal Adversity, Vulnerability and Neurodevelopment project, we assessed a mother's own childhood maltreatment and rearing experiences (G1) using the Childhood Trauma Questionnaire and the Parental Bonding Instrument. At 6 months postpartum, mothers completed questionnaires on parenting stress (G2), symptoms of depression, maternal motivation, and current relationship with their own parents. The sample consisted of mostly high socioeconomic status mothers recruited from Montréal ($n = 135$) or Hamilton ($n = 66$), Canada, with an age range from 18 to 43 years ($M = 29.41$, $SD = 4.85$ years). More severe maltreatment and less supportive rearing by the mother's parents (G1) predicted increased parenting stress at 6 months (G2). These associations were mediated through distinct psychosocial pathways: maltreatment (G1) on parenting stress (G2) through symptoms of depression ($Z = 2.297$; $p = .022$); maternal rearing (G1) on parenting stress (G2) through maternal motivation ($Z = -2.155$; $p = .031$) and symptoms of depression ($Z = -1.842$; $p = .065$); and paternal rearing (G1) on parenting stress (G2) through current relationship with the father ($Z = -2.617$; $p = .009$). Maternal rearing experiences predict a mother's own parenting resources through distinct psychosocial pathways, including depressed mood, maternal motivation, and social support.

Keywords Childhood maltreatment · Maternal cognition · Maternal motivation · Parenting stress · Social support · Symptoms of depression

The intergenerational transmission of parenting style is a well-established framework for understanding the development of parental behaviors in both humans and other mammals. According to this model, there is continuity in different types of parenting

behaviors: in how one generation raises their offspring (G1) and in how those offspring in turn raise their own offspring (G2) (Belsky et al. 2009; Buchanan 1998). From an evolutionary perspective, this transmission of behavioral strategies might support the reproductive success of the next generation: the environment in which a child grows up might serve as a cue for anticipated future environments and potential challenges when the child becomes a parent themselves. The evolutionary theory of socialization (Belsky et al. 1991) further assumes flexibility in response to contextual variables, such as the amount, availability, and reliability of social support, which might be related to early life experience, and which can in turn influence later parenting resources. However, the psychosocial mechanisms underlying this transmission are still not fully understood. In this study, we hypothesized that maternal rearing experiences would predict later parenting resources and that three pathways in this association would act in parallel: maternal mood, conceptualization and motivational aspects of parenting behaviors (e.g., maternal care regulation strategies), and current relationship with the parents (Fig. 1).

Intergenerational Transmission of Parenting Style

In rodents, parental care is primarily characterized by a combination of discrete behaviors carried out by the mother, such as nursing of the pups, building a nest for warmth and protection, active pup retrieval to the nest, and licking and grooming of the pups. All of these activities were shown to influence offspring development (Bagot et al. 2009; Caldji et al. 1998; Francis et al. 1999; Liu et al. 1997, 2000), including female reproductive behaviors (Cameron et al. 2008a, 2008b). Moreover, maternal behavior begets maternal behavior; increasing evidence suggests that individual differences in maternal care are transmitted from one generation to the next (Chapman and Scott 2001). Indeed, rats that experience reduced levels of licking and grooming (LG) from their biological or adoptive mother (through cross-fostering) exhibit low levels of

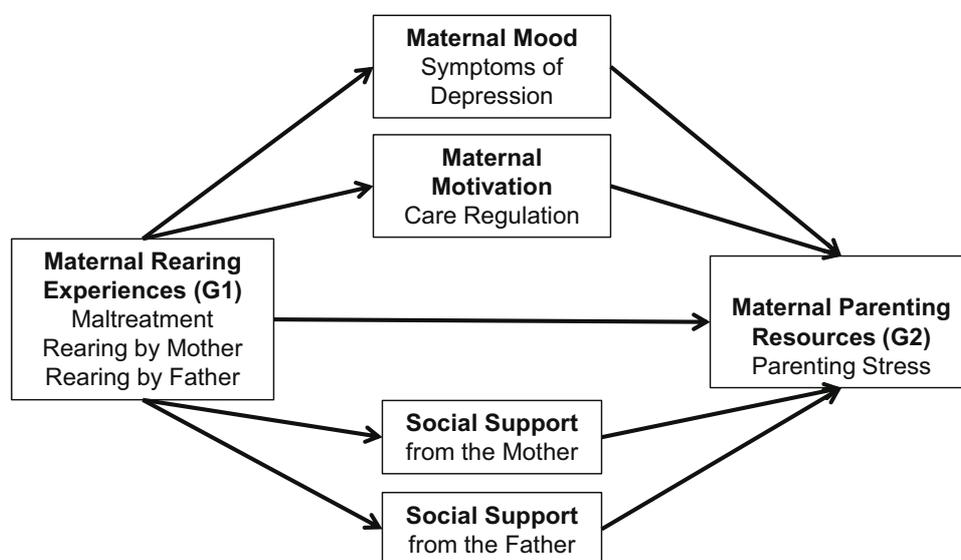


Fig. 1 Hypothesized model of how maternal rearing experiences (G1) might be transmitted to the next generation (G2)

LG towards their own offspring, thus perpetuating the quality of maternal investment across multiple generations (Champagne et al. 2003; Francis et al. 1999).

Research has also demonstrated intergenerational transmission of maternal care in nonhuman primates (e.g., Maestripieri 2005). Female rhesus macaques that experienced harsh and abusive parenting behaviors from their biological or foster mothers were more likely to abuse their own infants. Some proposed mechanisms for the intergenerational transmission of parental care in macaques include neuroendocrine alterations, social status within the group, and experiential learning (Maestripieri 1998; Thierry et al. 2004).

In addition to the intergenerational transmission of *parenting style*, there is a host of literature on the intergenerational transmission of *attachment*. From an evolutionary perspective, the attachment system developed in order to increase survival of infants and young children through physical closeness to their attachment figures to reduce feelings of fear, anxiety, and distress (Simpson and Belsky 2016). Similar to the intergenerational transmission of parenting style, there are intergenerational effects of attachment: a mother's own attachment representation is a key predictor of her infant's attachment style later on (Main et al. 1985). This indicates that maternal patterns of sensitive responsiveness seem to be intergenerationally transmitted: mothers who respond sensitively and contingently to their infants' needs and who themselves have a secure attachment representation are more like to raise securely attached children. Accordingly, a meta-analysis found that 75% of mothers and infants had matching secure versus insecure attachment classifications (van IJzendoorn 1995).

Although rates of intergenerational transmission of attachment and of parenting behaviors vary across species, an average of 30–45% of parenting behaviors are thought to be transmitted to the next generation in humans (Afifi et al. 2014; van IJzendoorn et al. 1992). Whereas some human studies considered the intergenerational transmission of warm and sensitive parenting style (Belsky et al. 2005; Chen et al. 2008; Conger et al. 2009; Jeon and Neppel 2016; Kerr et al. 2009), most other studies focused on the transmission of child maltreatment (e.g., Bailey et al. 2012; Banyard 1997; DiLillo and Damashek 2003; Ertem et al. 2000; Kim 2009; Lang et al. 2010; Seay et al. 2016). At the same time, there is much debate on whether childhood maltreatment follows a general or specific pattern. For instance, Newcomb and Locke (2001) reported a moderate to strong association between a general factor of "experience of child maltreatment" and a general factor of subsequent "poor parenting style." In contrast, Kim et al. (2010) found that the transmission of physical neglect and abuse followed a type-specific pattern, more akin to the rodent model of experiential learning.

The cycle of child maltreatment also has strong implications for society and child welfare. Parents with a childhood history of abuse and neglect have higher rates of being reported to Child Protective Services for child maltreatment themselves (Widom et al. 2015). Further, adverse childhood experiences can have cumulative effects on physical and mental health (Chartier et al. 2010; Choi et al. 2017). This cycle not only applies to the transmission of child maltreatment, but also to mother-daughter bonding (Miller et al. 1997). Results on the intergenerational transmission of parenting style have been broadly replicated in different countries and in different sociodemographic and socioeconomic backgrounds (Afifi et al. 2014; Conger et al. 2009; Ertem et al. 2000).

Parenting Resources

Although animal models of intergenerational transmission of parenting style can be useful for studying direct modeling and neuroendocrine alterations, humans as cooperative breeders have evolved unique intergenerational psychosocial interactions affecting parenting behaviors which warrant investigation. In attempting to understand how the intergenerational transmission of parenting style in humans may occur, Belsky's framework of parenting behavior (Belsky 1984) might be especially relevant. Within his framework, the following three determinants of parenting style have been described: (1) the mother's own personal and psychological resources, (2) the characteristics of the child, and (3) contextual sources of stress and support. Belsky further applies the determinants of parenting style in his evolutionary model, with contextual stress influencing parenting behaviors, which then influence interpersonal and behavioral development of the child. The distal cause (contextual stress) of the proximate cause (altered parenting behavior) serves the ultimate function of contextually responsive interpersonal and reproductive fitness in a stressful, material- and social-resource-restricted environment (Belsky et al. 1991). Here it is important to revisit the view of Maestripieri (1998) that "hypotheses concerning the adaptive significance of a trait imply that the trait is genetically controlled," yet it is unlikely that variance in abuse and neglect is explained to any great extent by genetics (Van Wert et al. 2019). When considering intergenerational transmission of parenting style, we hypothesize that maternal childhood experiences of maltreatment and the levels of care and protection received from mothers and fathers affect the mothers' personal and psychological resources. One indicator of parenting resources is self-reported parenting stress, which might deplete the mother's own personal and psychological resources and thus increase the risk for maladjusted parenting strategies.

Parenting stress can be defined as the psychological distress caused by the demands of being a parent, which is qualitatively distinct from other forms of distress and is experienced in various degrees by all parents (Deater-Deckard 1998). Parenting stress has been associated with child developmental outcomes, presumably through parenting style (Deater-Deckard 1998). For instance, mothers who report high levels of parenting stress and low levels of social support provided significantly less social stimulation to their children than mothers who had low levels of stress and high levels of social support (Adamakos et al. 1986). Parents experiencing higher levels of parenting stress are also more likely to use harsh or maladaptive parenting behaviors and to endorse authoritarian (high authority) parenting style (Belsky et al. 1996; Conger et al. 1995; Deater-Deckard 1998; Mackler et al. 2015; Neece et al. 2012). Finally, parenting stress has been associated with negative affect, decreased positive parenting behaviors, and more child-directed aggression (Berkout and Kolko 2016), and it might play a role in the etiology of child abuse and neglect (Deater-Deckard 1998). Physically abusive mothers reported more parenting stress and less social support than nonabusive mothers (Chan 1994). Moreover, parenting stress and anger expression were strongly positively correlated with child abuse potential (Rodriguez and Green 1997). In sum, parenting stress is an important determinant of parenting behavior and child developmental outcomes. Because subjective levels of parenting stress are relatively easy and economical to measure, they might be a suitable indicator of parenting resources in the study of intergenerational transmission of parenting style in humans.

Psychosocial Mechanisms in the Intergenerational Transmission of Parenting Style

Drawing inferences from animal models, within which the mother's own early experience of care is strongly predictive of her subsequent display of offspring care (Francis et al. 1999; Maestripieri 2005; Saltzman and Maestripieri 2011), one could hypothesize a strong direct effect of the mother's own early care experience on her levels of parenting stress and subsequently on her personal and psychological parenting resources. However, two important features need to be taken into account when comparing animal and human parenting research. First, whereas other mammalian species typically abandon care and their offspring shortly after weaning or before offspring sexual maturity, human parents are often engaged with their children well beyond offspring self-sufficiency, providing social and material support. Second, conditional evolutionary theory posits that there are multiple paths to a given outcome, depending on preceding conditions. In humans, multiple potential psychosocial mechanisms in the transmission of parenting style are easily accessible through self-report questionnaires. Thus, here we examine three potential psychosocial pathways in the intergenerational transmission of maternal parenting style in humans: current relationship of the mother with her parents after giving birth, conceptualization of mothering (e.g., cognition and motivation), and maternal mood.

Social Support

Social support promotes the adaptation to parenthood during the first years after childbirth and is often provided by the parents' parents (grandparents), with almost two thirds of parents receiving emotional, financial, or informal childcare support from their own parents (Parkes et al. 2015; Wheelock and Jones 2002). Indeed, less-frequent grandparental support mediated the association between socioeconomic characteristics and parenting stress, particularly among migrants who might not have direct access to their grandparents because of geographical distance (Parkes et al. 2015). These findings that grandparental support decreases parenting stress are complemented by a study that found that grandmaternal maladaptive parenting behaviors (e.g., psychological control) increased externalizing symptoms in grandchildren, which was mediated through the mother's increased potential for abuse and punitive discipline (Seay et al. 2016). Finally, Racine et al. (2018) reported that high levels of social support during pregnancy might buffer the effects of childhood adversities on antepartum health risk. In short, given the typical life-long social and material interaction with parents, we hypothesize that the intergenerational transmission of parenting resources is mediated through the mother's current relationship with her own parents.

Maternal Cognition and Motivation

A second pathway in the intergenerational transmission of parenting style may be through the mother's own conceptualization of mothering, such as parenting-related cognitions and motivation. The mother's conceptualizations of mothering can be shaped by early experiences, model learning, or executive functioning (Gonzalez et al. 2012). Social Cognitive Theory states that humans learn from other humans

through observation (Bandura 1986). Thus, a mother may have learned and adopted some of the maternal behaviors she has experienced from her own parents. This pathway of intergenerational transmission could be adaptive or maladaptive. On the one hand, a mother could care for her child because it is congruent with her own personal child-rearing values, which she acquired from observing her own parents. On the other hand, she could apply abusive behaviors because her parents were abusive during her own childhood (Noll et al. 2009; Pears and Capaldi 2001). Some aspects of this pathway from rearing experiences to rearing resources might be detectable through the measurement of the motivational strategies a mother applies to regulate maternal care. Hence, we hypothesize maternal care regulation as a second pathway in the intergenerational transmission of parenting resources.

Maternal Mood

Finally, intergenerational transmission of parenting style may be mediated through mental well-being, such as depressed mood or its neurobiological correlates. In a meta-analysis involving more than 80,000 mother-child dyads, Goodman et al. (2011) confirmed significant but small effects of maternal depression on child behavioral problems, including internalizing and externalizing problems, as well as general psychopathology. The authors argued that these small effects might be due to moderating effects of child characteristics, such as age and gender, and the socioeconomic environment. The effects of maternal depression on offspring behavior are probably also mediated through maternal parenting style. For instance, maternal depression has been linked to increased levels of harsh and inconsistent parenting behaviors and attachment problems (Santona et al. 2015) complemented by lower levels of maternal warmth, emotional expression, and playful interactions (Lovejoy et al. 2000); changes in maternal attitudes (Cost et al. 2016); and a variety of other disturbances in mother-child interaction patterns (Field 2010), including shorter breastfeeding duration (Jonas et al. 2013).

Hypotheses

Because of the relative scarcity of studies investigating potential pathways in the intergenerational transmission of parenting style, the aims of this study were (1) to determine how different indicators of a mother's own childhood rearing experiences, including childhood maltreatment, and maternal and paternal rearing style (G1), affect a mother's psychosocial parenting resources (G2)—specifically, perception of her own child as a source of stress; and (2) to analyze the role of three different psychosocial mechanisms in this association (Fig. 1), considering the current relationship with her own parents (social resources), conceptualization of parenting behaviors (cognitive-motivational resources), as well as coexisting maternal symptoms of depression (affective resources). Our first hypothesis was that adverse maternal rearing experiences (G1)—specifically, maternal experiences of childhood maltreatment and low-quality maternal and paternal rearing style—would all be associated with a mother's reports of increased parenting stress (G2). In our second hypothesis we expected that the association between maternal childhood experiences (G1) and parenting stress (G2) would be

mediated through the mother's current relationship satisfaction with her parents, conceptualization of parenting behaviors, and maternal symptoms of depression.

To test these hypotheses, we included first-time mothers participating in the longitudinal prospective Maternal Adversity, Vulnerability and Neurodevelopment (MAVAN) project, who provided retrospective data on childhood maltreatment and perceived parental rearing style, as well as prospective data on perception of their own first child as a source of stress, symptoms of depression, current relationship with mother and father, and cognitive-motivational components of parenting behaviors (maternal care regulation). This sample and the 6-month time point were chosen because recent first-time mothers are still in a phase of adaptation to having a newborn baby and the presence of another child is unlikely.

Methods

Sample and Procedures

The final sample consisted of 201 first-time mothers, representing a subsample of 498 families participating in the MAVAN project. In this longitudinal prospective study, pregnant women were recruited during the second trimester of pregnancy in Montréal and Hamilton, Canada, between 2003 and 2005 and were followed up regularly into the child's puberty. Inclusion criteria for the mothers were to be 18 years and older and fluent in English or French. Exclusion criteria included serious obstetric complications, extremely low birth weight, prematurity, or any congenital disease of the child at birth. To be included in the current study, mothers had to give birth to their first child ($N = 281$) and provide data on the Childhood Trauma Questionnaire (Bernstein et al. 1997) or the Parental Bonding Instrument (Parker et al. 1979) ($N = 237$). Because we were interested in maltreatment by the parents of the mother, we excluded 41 mothers with scores above the cutoff for medium strain on CTQ physical neglect (score > 9) or sexual abuse (score > 7). These two exclusion criteria were applied because physical neglect might be biased by early socioeconomic status and thus not be indicative of parenting quality per se; and because the CTQ did not assess whether the sexual abuse was conducted by a parent, another close person, or a stranger. Number of participants excluded is illustrated in a flow chart (Fig. 2). The age of the mothers at birth ranged from 18 to 43 years ($M = 29.41$ years; $SD = 4.85$ years). Participants' characteristics are provided in Table 1.

The mothers completed the CTQ and PBI at a prenatal or early postnatal assessment (independent variables; see measures description below). The maternal outcome measure included perception of the child as a source of stress, as assessed by the Parental Stress Scale (PSS; Berry 1995) at 6 months postpartum. To measure potential mediators in the association between maternal childhood experiences and parenting stress, mothers were asked to complete the Centre of Epidemiological Studies Depression Scale (CES-D; Radloff 1977), the subscales for relationship satisfaction with mother (G1) and father (G1) from the Childbearing Attitudes Questionnaire (CAQ; Ruble et al. 1990), and the internalization score of the Maternal Care Regulation Questionnaire (MCR; Ryan and Connell 1989), all of which were completed at 6 months. Maternal age at birth, family income, and maternal education at 6 months were explored as

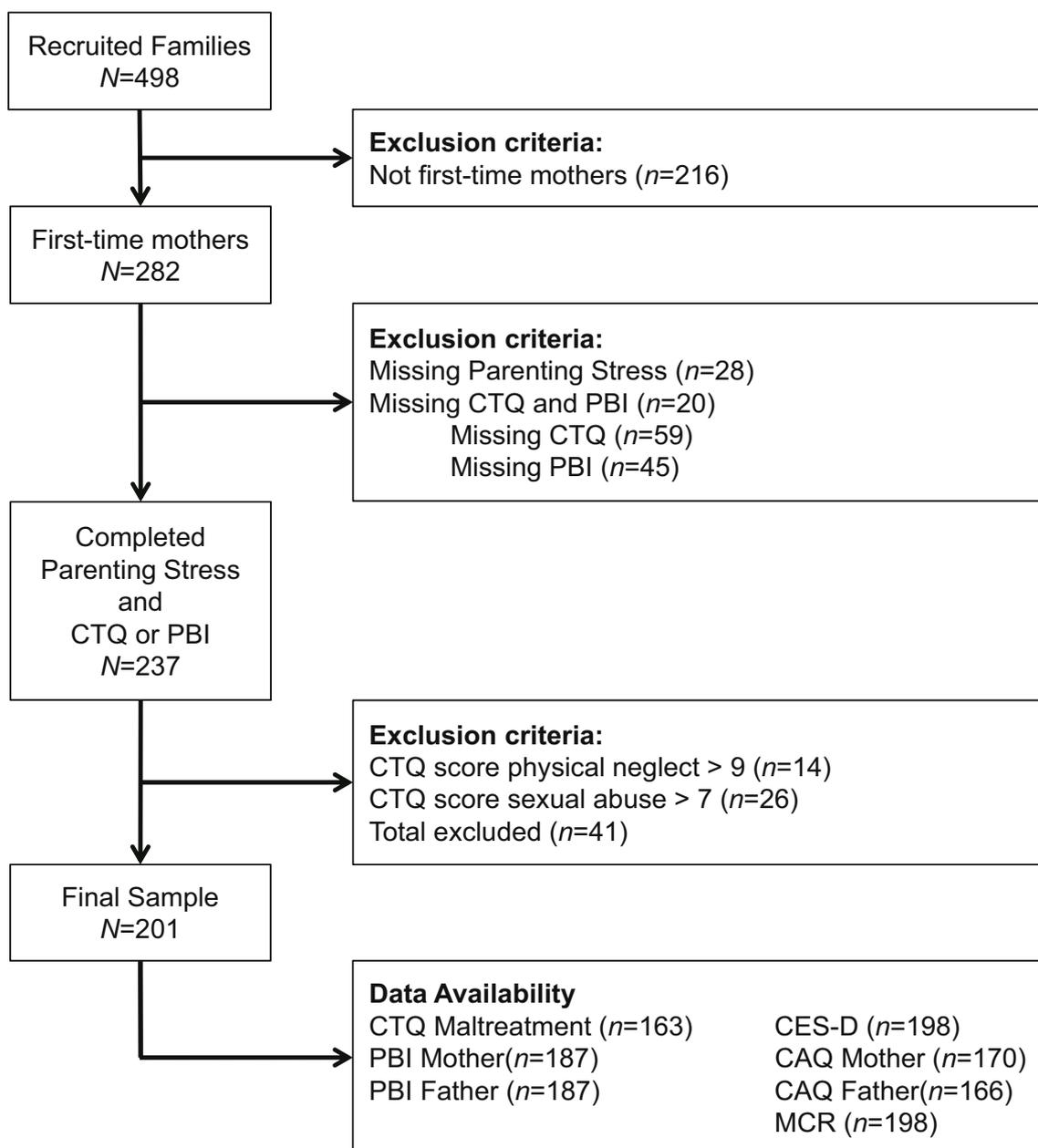


Fig. 2 Flow chart of study participants

potential covariates. All mothers gave written informed consent at study enrollment. The protocol was approved by the ethical committees at the Douglas Mental Health University Institute for the Montréal cohort and St. Joseph's Hospital for the Hamilton cohort. (More detailed information on the design of this prospective human cohort study is given in O'Donnell et al. 2014.)

Measures

Maternal Parenting Stress We assessed maternal perception of her child as a source of stress using the PSS (Berry 1995). The PSS consists of 18 items assessing stress and enjoyment associated with the child and motherhood, which are rated on a 5 point Likert scale ranging from 1 (agree strongly) to 5 (disagree strongly). Because the focus of this study was parenting stress, we explored the structure of the questionnaire by

Table 1 Participants' Characteristics

		<i>N</i>	% (valid)
Data Collection Site	Montréal	135	67.2
	Hamilton	66	32.8
Offspring Gender	Boys	91	45.3
	Girls	110	54.7
Maternal Education	High school diploma or less	21	10.9
	Some community college (CC)	19	9.9
	Completed CC or some university	57	29.7
	University degree	95	49.5
	Missing	9	4.5
Family Income at 6 months ^a	High Income	128	63.7
	Low Income	61	30.3
	Missing	12	6.0

^aLow Income defined according to Stats Canada

conducting a principal component factor analysis (varimax rotation with Kaiser-normalization) across the 18 items for the 6-month time point and identified two meaningful factors with an Eigenvalue greater than 1. The first factor consisted of negatively connoted items implying perception of the child as a source of stress (e.g., “the major source of stress in my life is my child” or “having a child has been a financial burden”); the second factor included positively connoted items suggesting that the child is a source of enjoyment (e.g., “I am happy in my role as a parent” or “I feel close to my child”). Thus, we constructed one score for “Parenting Stress” by computing a mean score across the negatively connoted items. Internal consistency was good (Cronbach’s $\alpha > 0.7$). This variable was used as the outcome measure, with high scores indicating more parenting stress.

Maltreatment Exposure to maltreatment presumably by the parents was assessed with the Childhood Trauma Questionnaire (CTQ; Bernstein et al. 1994, 1997), which measures childhood traumatic events on 28 items summarized into five scales, including exposure to neglect (physical, emotional) and abuse (physical, emotional, sexual) on a 5-point Likert scale ranging from 1 (never true) to 5 (very often true), with higher scores indicating more severe exposure. Aiming to focus on parenting-related adverse experiences, we excluded mothers who reported moderate-to-high levels of either physical neglect (score > 9) or sexual abuse (score > 7) on the CTQ. Thus, only scores related to emotional abuse, emotional neglect, and physical abuse were retained in the analyses. Those three scores were integrated into a total maltreatment score by extracting the first principal component across the three measures (Maltreatment) using a principal component extraction. Maltreatment was examined as one of the three independent variables measuring maternal rearing experiences.

Parental Rearing Style The Parental Bonding Instrument (PBI; Parker et al. 1979) is a self-report retrospective questionnaire measuring perceived maternal and paternal

parenting style during the first 16 years of life on two dimensions (“care” and “overprotection”), which we used to assess parental rearing experiences. The original version of the questionnaire consists of 25 items (12 items for care and 13 items for overprotection), with respondents rating different statements on a Likert scale ranging from 0 to 3, with higher scores indicating higher levels of care or overprotection, respectively. Compared with the original version, the questionnaire applied in MAVAN contained one fewer item for the overprotection dimension (“let me go out as often as I wanted”). Despite the retrospective nature of the PBI, the psychometric properties are considered good and the questionnaire is applied routinely in a great variety of studies (Parker et al. 1979). The PBI scorings were found to be stable across a 20-year period and not to be biased by becoming a parent (Parker 1989) or by a history of depression (Murphy et al. 2010). To obtain total scores from the PBI for mother and father, we averaged the subscales for care and overprotection (reversed) for each parent. We then subjected the maternal and paternal total scores to a principal component analysis (PCA), in which we rotated the scores orthogonally (varimax rotation) to obtain two independent scores for maternal and paternal rearing style, which were then investigated as two of the three independent variables measuring maternal rearing experiences.

Maternal Symptoms of Depression Maternal symptoms of depression were assessed using the CES-D (Radloff 1977), which assessed maternal symptoms of depression on 20 items applying a Likert scale ranging from 0 to 3, with a higher score indicating more severe depressive symptoms. The questionnaire is a widely used instrument to assess symptoms of depression and has been shown to have good psychometric properties in adults (Knight et al. 1997). The symptoms of depression score was used as a mediator in the association between maternal childhood experiences and maternal parenting stress.

Maternal Care Regulation A cognitive-motivational component of parenting behaviors was assessed with the MCR Questionnaire. The MCR questionnaire is adapted from Ryan and Connell’s (1989) internalization construct and assesses motivational components of maternal care regulation on eight items measured on a five-point Likert scale ranging from 1 (disagree strongly) to 5 (agree strongly). Items were integrated into an internalization score, with high scores indicating that the mothers have high internalization of maternal care regulation. For instance, they reported caring for their child because it is an important personal goal in their life or because it reflects their own personal values as compared with being motivated by external judgments (e.g., other people would be upset), or to avoid negative feelings, such as guilt or shame. The internalization score was examined as a potential mediator in the association between maternal early rearing experiences and maternal parenting stress.

Current Relationship with the Parents The quality of the mother’s current relationship with her parents (G1), especially with regard to received support and childcare, was assessed at 3 and 6 months using the CAQ (Ruble et al. 1990) subscales for relationship with mother and relationship with father. Both scales originally consisted of four items measured on a Likert scale ranging from 1 to 7. Because we were interested in the current relationship rather than the lifetime relationship, we

excluded one item (“I have always felt very close to my mother/father”) and thus used the three items “My mother/father has been a great source of support,” “My mother/father does not agree with me on child-rearing practices,” and “I try to avoid spending a lot of time with my mother/father” in an average current relationship with mother/father score. The two latter items were reversed so a high score would indicate better relationship quality. Cronbach’s alpha was 0.76 for relationship with the mother and 0.67 for relationship with the father. If the value at 6 months was missing, it was estimated by the value measured at 3 months. The stability for the CAQ has been demonstrated in a previous paper (Cost et al. 2016). The mean CAQ scores were used as mediators in the association between maternal childhood experiences and maternal parenting stress.

Covariates Potential covariates tested included maternal age at birth, maternal education, family income category at 6 months postpartum, and child gender. Family income was rated on 18 different categories ranging from no revenue to at least CDN \$100,000 at the prenatal assessment and at 48 months. We compared these ratings with the cutoff for low-income category provided by Statistics Canada (Statistics Canada 2006) to categorize family income into “low-income” and “high-income.” Maternal educational level was measured using four categories. Because of the high proportion of mothers with a university degree, we grouped mothers into “with university degree” and “no university degree.” Finally, we assessed maternal age at the prenatal assessment and child gender at the first assessment after giving birth.

Statistical Analyses

We examined our first hypothesis using one linear regression model per independent variable, predicting parenting stress by maltreatment, maternal rearing experience, or paternal rearing experience. We then examined our second hypothesis that the effects of maternal childhood experiences on maternal parenting stress would be mediated through maternal symptoms of depression, internalization of maternal care regulation, or current relationship with her parents using bootstrap mediation models (Preacher and Hayes 2008). The models estimated the total effects and the direct effects of a given maternal rearing experience (maltreatment, maternal or paternal rearing) on parenting stress, as well as the total and specific indirect effects of this association through a parallel mediation of maternal symptoms of depression, maternal care internalization, relationship with the mother (for maltreatment and maternal rearing), and relationship with the father (for maltreatment and paternal rearing). We used bias-corrected 95% confidence intervals for all estimated effects generated from 10,000 bootstrap samples and generated a Sobel test for each mediation model to obtain *p* values based on normal theory tests for specific indirect effects. Model residuals were visually explored for normality distribution and homoscedasticity in a full linear regression model with parenting stress as dependent variable and the respective maternal rearing experience measure, as well as the mediators as independent variables. A correlation matrix between all study variables is provided in Table 2. All analyses were performed using IBM SPSS Statistics Software (release 22.0.0.0; IBM New York),

including the SPSS macro PROCESS for estimating indirect effects in mediation models (Hayes 2012; Preacher and Hayes 2008).

Results

Preliminary analyses showed that none of the potential covariates were correlated with the dependent and independent variables. They were thus not included in further analyses. The correlation matrix suggests that all maternal childhood rearing experiences were associated with parenting stress at 6 months postpartum, with equally strong associations with both PBI maternal rearing ($r_{187} = -.288$; $p < .001$), and CTQ maltreatment ($r_{163} = .275$, $p < .001$), and the weakest association was PBI paternal rearing ($r_{187} = -.144$; $p = .049$).

All postulated mediators were associated with parenting stress, with a large effect for maternal symptoms of depression ($r_{198} = .462$; $p < .001$), and medium effect sizes for internalization of maternal care regulation ($r_{198} = -.291$; $p < .001$), CAQ relationship with the mother ($r_{170} = -.265$; $p < .001$) and CAQ relationship with the father ($r_{166} = -.242$; $p = .002$). All associations were in the expected direction.

Notably, only PBI maternal rearing was correlated with all postulated mediators, in line with previous reports of the pervasive associations of maternal care with multidimensional outcomes. In contrast, PBI paternal rearing correlated with symptoms of depression and CAQ relationship with the father. Finally, CTQ maltreatment correlated with symptoms of depression, CAQ relationship with mother, and CAQ relationship with father. All correlation coefficients and levels of significance are provided in Table 2.

We found that primiparous mothers excluded because of missing data or scores on physical neglect (>9) or sexual abuse (>7) had a lower mean age ($t_{276} = -2.557$; $p = .011$), had higher levels of depression ($t_{67.011} = 3.161$; $p = .002$), and had lower relationship satisfaction with their mother ($Z = -4.088$; $p < .001$) and father ($Z = -2.936$; $p = .003$). In addition, they had higher scores on all CTQ scales (all $p < 0.05$) and lower scores on PBI maternal and paternal care and higher scores on PBI maternal overprotection (all $p < .05$). Based on our exclusion criteria, these patterns were to be expected: exposure to physical neglect and sexual abuse during childhood would be related to more adversity reported on the other early life adversity scales and reduced mental well-being.

Hypothesis 1: Maternal Childhood Experiences (G1) Affect a Mother's Perception of Her Child as a Source of Stress (G2)

In line with the preliminary analyses, a higher maternal CTQ maltreatment score during childhood was associated with higher levels of maternal parenting stress ($F_{1, 161} = 5.964$; $p = .016$) and higher PBI maternal rearing quality related to decreased levels of parenting stress ($F_{1, 185} = 17.937$; $p < .001$). In contrast, PBI paternal rearing quality was not associated with levels of maternal parenting stress ($F_{1, 185} = 2.259$; $p = .135$). All regression coefficients are provided in Table 3.

When all maternal rearing experiences were included in a stepwise regression model (stepwise criteria: probability of F to enter $\leq .05$; probability of F to remove $\geq .10$), we

Table 2 Correlation Matrix: Independent, Dependent, and Mediating Variables. Above dashes: sample size; Below dashes: Spearman's correlation coefficients between study variables

	CTQ		PBI		CES-D		MCR		CAQ		PSS	
	Maltreatment	Paternal Rearing	Maternal Rearing	Paternal Rearing	Depressive Symptoms	Internalization	Relationship w/ Mother	Relationship w/ Father	Parenting Stress			
CTQ Maltreatment	–	149	149	149	160	161	136	133	163			
PBI Maternal Rearing	–.201*	–	187	184	184	184	163	160	187			
PBI Paternal Rearing	–.403***	–.004	–	184	184	184	163	160	187			
CES-D Depressive Symptoms	.332***	–.191**	–.160*	–	–	195	167	163	198			
MCR Internalization	–.041	.205**	.048	–.225**	–	–	167	163	198			
CAQ Relationship Mother	–.336***	.459***	.114	–.123	.179*	–	–	160	170			
CAQ Relationship Father	–.470***	.184*	.418***	–.075	.120	.530***	–	–	166			
PSS Parenting Stress	.275***	–.288***	–.144*	.462***	–.291***	–.265***	–.242**	–	–			

* $p < .05$; ** $p < .01$; *** $p < .001$

Abbreviations: CAQ: Childbearing Attitudes Questionnaire; CES-D: Centre of Epidemiological Studies Depression; CTQ: Childhood Trauma Questionnaire; MCR: Maternal Care Regulation; PBI: Parental Bonding Instrument; PSS: Parental Stress Scale

Table 3 Regression Models with Parenting Stress as Dependent Variable and Maltreatment, Maternal Rearing, and/or Paternal Rearing as Predictors

	<i>B</i>	<i>SE(B)</i>	β	<i>t</i>	<i>p</i>
Maltreatment					
Total Effect Model (<i>N</i> = 163; $R^2 = 0.036$)					
(Constant)	2.070	0.050		41.451	<0.001
CTQ Maltreatment	0.122	0.050	0.189	2.442	0.016
Full Model (<i>N</i> = 122; $R^2 = 0.320$)					
(Constant)	2.435	0.301		8.080	<0.001
CTQ Maltreatment	0.007	0.054	0.011	0.130	0.897
CES-D Depressive Symptoms	0.033	0.007	0.410	5.045	<0.001
MCR Internalization	-0.059	0.028	-0.175	-2.154	0.033
CAQ Relationship Mother	-0.060	0.045	-0.111	-1.334	0.185
CAQ Relationship Father	-0.065	0.040	-0.143	-1.627	0.107
Maternal Rearing					
Total Effect Model (<i>N</i> = 187; $R^2 = 0.088$)					
(Constant)	2.066	0.043		47.591	<0.001
PBI Maternal Rearing	-0.184	0.044	-0.297	-4.235	<0.001
Full Model (<i>N</i> = 157; $R^2 = 0.285$)					
(Constant)	2.092	0.246		8.518	<0.001
PBI Maternal Rearing	-0.072	0.051	-0.115	-1.420	0.158
CES-D Depressive Symptoms	0.026	0.005	0.348	4.937	<0.001
MCR Internalization	-0.069	0.023	-0.220	-3.044	0.003
CAQ Relationship Mother	-0.062	0.040	-0.123	-1.534	0.127
Paternal Rearing					
Total Effect Model (<i>N</i> = 187; $R^2 = 0.012$)					
(Constant)	2.066	0.045		45.716	<0.001
PBI Paternal Rearing	-0.068	0.045	-0.110	-1.503	0.135
Full Model (<i>N</i> = 154; $R^2 = 0.293$)					
(Constant)	2.327	0.216		10.755	<0.001
PBI Paternal Rearing	0.045	0.047	0.074	0.959	0.339
CES-D Depressive Symptoms	0.028	0.005	0.370	5.214	<0.001
MCR Internalization	-0.077	0.022	-0.244	-3.431	0.001
CAQ Relationship Father	-0.108	0.037	-0.228	-2.940	0.004

Total Effect Model: total effect of independent variable on dependent variable; Full model: model including independent variable as well as examined mediators

found the strongest effect for PBI maternal rearing ($B = -.164$; $SE = .051$; $\beta = -.257$; $t = -3.240$; $p = .001$) with an additional significant effect of CTQ maltreatment ($B = .105$; $SE = .050$; $\beta = .165$; $t = 2.084$; $p = .039$). PBI maternal rearing and CTQ maltreatment predicted 10.6% of the variance in maternal parenting stress (adjusted $R^2 = .094$), suggesting that other factors, such as affective, social, and cognitive aspects, may contribute to the vast majority of variance in parenting stress.

Hypothesis 2: The Association between Maternal Childhood Experiences and a Mother's Perception of Her Child as a Source of Stress Is Mediated by Symptoms of Depression, Internalization of Maternal Care, and Current Relationship Quality with the Parents

The full regression models, including parenting stress as the dependent variable and with maternal rearing experiences and all potential mediators as independent variables, are provided in Table 3. All models were significant (CTQ maltreatment: $F_{5, 116} = 10.926$; $p < .001$; PBI maternal rearing: $F_{4, 152} = 15.161$; $p < .001$; PBI paternal rearing: $F_{4, 149} = 15.419$; $p < .001$), explaining between 26.6% and 29.1% of the variance in maternal parenting stress, much more than was explained by rearing experiences alone (Table 3). In comparison to the total effect models, the significant effects of CTQ maltreatment and PBI maternal rearing were no longer significant, indicating full mediation through the suggested pathways. All results are illustrated in Fig. 3. Table 4 provides estimates and 95% confidence intervals for total effects, direct effects, and indirect effects.

The association between CTQ maltreatment and parenting stress was fully mediated through maternal symptoms of depression (effect = .062; $SE = .027$; $Z = 2.297$; $p = .022$), but none of the other mediators (internalization of maternal care regulation: effect = .008; $SE = .012$; $Z = .694$; $p = .488$; CAQ relationship mother: effect = .016; $SE = .014$; $Z = 1.107$; $p = .268$; CAQ relationship father: effect = .032; $SE = .022$; $Z = 1.475$; $p = .140$) (Fig. 3a).

At the same time, internalization of maternal care regulation fully mediated the association between PBI maternal rearing and parenting stress (effect = $-.035$; $SE = .016$; $Z = -2.155$; $p = .031$) (Fig. 3b). There was a trend for mediation through maternal symptoms of depression (effect = $-.035$; $SE = .019$; $Z = -1.843$; $p = .065$); however, although the confidence intervals for this mediator did not include zero, suggesting significance, the Sobel test p value was greater than .05. The discrepancy might be due to the relatively small sample size ($N = 157$) of our analyses, in which case the Sobel test does not perform well. As in the mediation models, bootstrapping confidence intervals provide more reliable results (Hayes 2012). We found no mediation through CAQ relationship with the mother (effect = $-.039$; $SE = .026$; $Z = -1.488$; $p = .137$).

Finally, despite a nonsignificant total effect, we found a significant indirect effect of PBI paternal rearing on parenting stress through CAQ relationship with the father (effect = $-.061$; $SE = .023$; $Z = -2.617$; $p = .009$), but none of the other mediators (symptoms of depression: effect = $-.031$; $SE = .019$; $Z = -1.596$; $p = .110$; internalization of maternal care regulation: effect = $-.007$; $SE = .013$; $Z = -.556$; $p = .578$) (Fig. 3c).

Discussion

The aim of this study was to examine two hypotheses on maternal early rearing experiences and subsequent psychosocial parenting resources. Our first hypothesis that maternal childhood rearing experiences (G1) would affect the mother's perception of stress as a parent (G2) was supported: increased maternal childhood maltreatment and

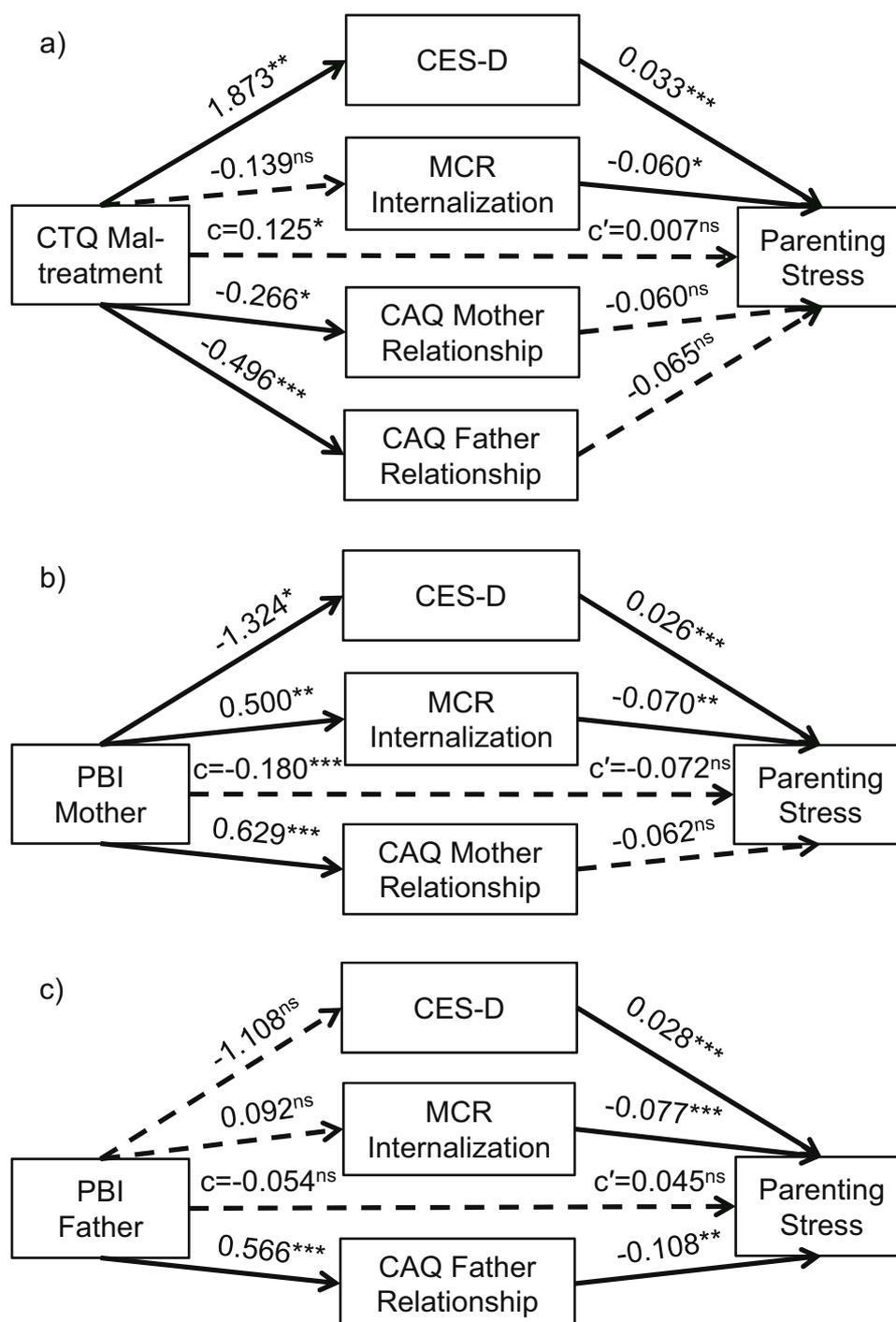


Fig. 3 Mediation models for the association between (a) CTQ maltreatment (G1); (b) PBI rearing from the mother (G1); (c) PBI rearing from the father (G1) and parenting stress (G2). Depicted are nonstandardized path coefficients obtained from multiple linear regression models. * $p < .05$; ** $p < .01$; *** $p < .001$

lower-quality rearing style of the mother, but not the father, was associated with higher levels of parenting stress at 6 months postpartum in primiparous mothers. We found some support for our second hypothesis that the effects of the maternal childhood environment on parenting stress would be mediated by maternal symptoms of depression, internalization of maternal care regulation, and current relationship with her parents. However, for each indicator of maternal rearing experience we only found one or two distinct pathways leading to parenting stress, in contrast to our hypothesis that all pathways would act in parallel. Specifically, we found that maternal childhood

Table 4 Mediation Models with parenting stress as dependent variable, and maltreatment, maternal rearing and paternal rearing as independent variables. Provided are path coefficients (B) with bootstrapping standard errors (SE) and bias-corrected 95% confidence intervals (95% CI)

	CTQ Maltreatment			PBI Maternal Rearing			PBI Paternal Rearing					
	B	SE	95% CI		B	SE	95% CI		B	SE	95% CI	
			lower	upper			lower	upper			lower	upper
Total Effect	0.125*	0.058	0.011	0.239	-0.180*	0.048	-0.275	-0.085	-0.054	0.049	-0.151	0.043
Direct Effect	0.007	0.054	-0.100	0.114	-0.072	0.051	-0.172	0.028	0.045	0.047	-0.048	0.138
Indirect Effects												
CES-D Depressive Symptoms	0.062*	0.029	0.017	0.131	-0.035*	0.018	-0.078	-0.004	-0.031	0.020	-0.077	0.001
MCR Internalization	0.008	0.011	-0.004	0.045	-0.035*	0.018	-0.080	-0.008	-0.007	0.012	-0.035	0.014
CAQ Relationship Mother	0.016	0.020	-0.005	0.081	-0.039	0.031	-0.113	0.010	-	-	-	-
CAQ Relationship Father	0.032	0.024	-0.005	0.089	-	-	-	-	-0.061*	0.026	-0.119	-0.015

Path coefficients (effect), bootstrapping standard errors (Boot SE), and bias-corrected bootstrapping 95% confidence intervals (95% CI)
 * $p < 0.05$ (as indicated by 95% CI not including the value 0)

maltreatment was associated with more symptoms of depression, which in turn related to increased parenting stress. At the same time, warmer and more supportive rearing by the mother was linked with increased internalization of maternal care regulation and also fewer symptoms of depression, both of which were in turn independently associated with decreased parenting stress. Finally, we found an indirect effect of rearing by the father on parenting stress through current relationship with the father: higher-quality rearing by the father predicted increased current relationship satisfaction with the father, which was linked to reduced parenting stress. These three pathways of intergenerational transmission support the evolutionary contention that contextual stress in the environment engenders parental behavior, which then alters child development for functioning within a stressful environment as an adult (Belsky et al. 1991). Further, these pathways refer to the hypothesis of the intergenerational transmission of attachment. One of the core hypotheses of attachment theory is that attachment experiences during childhood have an influence on socio-emotional functioning later in life, including parenting style. Thus, attachment relationships with, for example, the parents during childhood act as role models that will influence and shape parental interactions with and attachment to their own children (Main et al. 1985; van IJzendoorn and Bakermans-Kranenburg 2019).

As we see in our results, mothers who have experienced suboptimal care from their own parents do in fact report higher levels of parenting stress as adults; thus the mothers' own upbringing has simultaneously created the conditions of greater stress while preparing them to function in those conditions. In turn, higher-quality maternal and paternal rearing ratings were associated with less parenting stress in our study. Less parenting stress, in turn, would then facilitate secure attachment.

Maternal Early Rearing Experiences, Later Psychosocial Parenting Resources, and the Intergenerational Transmission of Parenting Style

We were able to extend previous findings on intergenerational transmission of parenting style to psychosocial parenting resources—specifically, parenting stress. Both more-severe childhood maltreatment and lower-quality rearing by the mother's mother (G1) were related to higher levels of parenting stress in the mother (G2), whereas there was no direct association with low-quality rearing by the father (G1) on parenting stress in the mother (G2). High-quality rearing provided by a mother's mother (G1) seems to have the strongest effects on maternal psychological resources regarding her own parenting behaviors, which is in accordance with previous findings of an intergenerational transmission of maternal care in humans and rodents (Francis et al. 1999; Lomanowska et al. 2017). In addition, there was an effect of childhood maltreatment on subsequent parenting stress.

We found that the variance in parenting stress explained by maternal childhood experiences was considerably smaller (<10%) than the measures of intergenerational transmission reported in previous human studies (30–45%) (Belsky et al. 2009; Oliver 1993). Even after considering potential mediators, the maximum explained variance only approached 30%. Several reasons might be responsible for this discrepancy and should be investigated in future studies. First, many other factors might contribute to the intergenerational transmission of parenting style that were not investigated in the current study, such as support by the child's father (Cost et al. 2018), genetics (Van Wert et al. 2019), or breastfeeding (Jonas et al. 2013). These include biological factors

(e.g., the programming of endocrine pathways or genetic heritability; Gonzalez et al. 2012), additional social factors (e.g., relationship satisfaction with and support by the father of the child or other family members and friends; Cost et al. 2018) or other environmental factors (such as persistent poverty or migrant status). Second, the study sample consisted of low-risk mothers with low rates of childhood abuse and neglect as well as generally high-quality childhood rearing experiences by both parents, which is in contrast to the studies on the intergenerational transmission of harsh and aggressive parenting style (Chan 1994; Parkes et al. 2015; Steele et al. 2016). Third, this study was based on a community sample of families with generally high socioeconomic status, although in our sample income or education were not associated with rearing experiences or parenting stress. Fourth, we only examined parenting stress as the outcome variable, but it is only one of many variables in a complex phenotype of parenting (Unternaehrer et al. 2019). Although parenting stress was not related to observational measures of overall maternal sensitivity at 6 months, as described previously (Gonzalez et al. 2012), we found a significant correlation of parenting stress with playful interactions and communication at 6 months (data not shown), which is consistent with previous work that found impaired mother-child interactions in parents with high levels of parenting stress (Lang et al. 2010; Lutz et al. 2012). We argue that parenting stress strongly reflects a mother's personal and psychological everyday resources, which can be associated with maltreatment, harsh or suboptimal parenting style, but is not a direct behavioral measure thereof (Deater-Deckard 1998). It would be worthwhile to ask the offspring to complete the PBI and CTQ when they reach adolescence to get directly comparable measures.

Maltreatment, Symptoms of Depression, and Maternal Parenting Stress

The association between maternal childhood maltreatment and parenting stress was fully mediated through symptoms of depression. This pathway indicates that childhood maltreatment could program psychoneuroendocrine systems, which may put an individual at a higher risk for impaired mental well-being, independent of being a mother (Carr et al. 2013; Kessler et al. 1997; Kim et al. 2010; McLaughlin et al. 2010; Tyrka et al. 2013). In turn, having more symptoms of depression could decrease the psychological resources for parenting behaviors (Buist 1998; Goodman et al. 2011; Lovejoy et al. 2000). For instance, Gonzalez et al. (2012) demonstrated that maternal early life experiences were indirectly related to maternal sensitivity through altered hypothalamic-pituitary-adrenal axis function and spatial working memory. At 6 months postpartum a mother might still be adapting to the new situation, in which higher levels of depression could result in a faster depletion of affective and cognitive resources, resulting in more stress related to being a parent, which is a cognitive and affective task. Indeed, mothers suffering from depression demonstrate more negative and disengaged parenting behaviors in addition to less-positive interactions with their children (Lovejoy et al. 2000), and also alterations in maternal attitudes and mother-infant interactions (Cost et al. 2016; Fleming et al. 1988). Hence, mothers who experienced childhood maltreatment in their family environment and who show early signs of depression could benefit from psychotherapeutic treatment and interventions increasing mental well-being, supportive parenting patterns, and secure mother-child attachment. There is strong evidence that even relatively brief, evidence-based interventions can increase

parental sensitivity and parent-child attachment security (Bakermans-Kranenburg et al. 2003). Particularly relevant to the current study, such interventions increase maternal sensitivity even among mothers presenting with very high levels of psychosocial maladjustment (Moss et al. 2011). Thus, we argue that interventions could also be tailored for depressed mothers with a history of maltreatment.

Notably, childhood maltreatment showed the strongest association with symptoms of depression measured on the CES-D (Table 2), as compared with parental rearing style. This effect was mainly driven by emotional neglect, explaining around 10% of the variance in symptoms of depression. Since the emotional neglect scale refers to having no family member who was emotionally available, this finding underlines the importance of having at least one attachment figure in the family; having emotional, accessible, and contingent support in early life thus seems crucial for later mental well-being and socioemotional functioning, including parenting skills. and might compensate for other forms of adversity (Drury 2012; Kochanska and Kim 2013; van IJzendoorn and Bakermans-Kranenburg 2019).

Rearing Style by the Mother (G1), Maternal Motivation, Symptoms of Depression, and Parenting Stress (G2)

We found effects of rearing style of the mother's mother (G1) on parenting stress (G2) through both maternal symptoms of depression and internalization of maternal care regulation. The effects of maternal care on mood, affective state, and the stress response have been demonstrated in human and animal studies (Enns et al. 2002; Meaney 2001). One mechanism that might underlie the intergenerational transmission of parenting style could be epigenetic adaptations of candidate pathways, such as hypothalamic-pituitary-adrenal or oxytocinergic pathways, which are also implicated in mental health (Champagne et al. 2006; Meaney 2001; Szyf et al. 2007; Unternaehrer et al. 2015; Weaver et al. 2004).

Our results further suggest an additional pathway through internalization of maternal care regulation, a cognitive-motivational component of maternal parenting behaviors. We found that maternal childhood experiences relating to her own mother (G1) shaped the mother's (G2) motivational strategies to care for her own child. For instance, high-quality maternal rearing could result in identifying more strongly with the mother's role. As such, she would care for her infant because it agrees with her personal goals, beliefs, and values, and she would be less susceptible to applying strategies targeted to avoid negative external evaluation or negative feelings such as shame or guilt. This pathway thus indicates a model in the intergenerational transmission of parenting style, potentially shaping maternal attitudes, self-efficacy, and motivation. In light of results from studies showing that parents can learn to alter their behavior following well-designed interventions (Bakermans-Kranenburg et al. 2003), we argue that this would be a great starting point for an intervention targeted at decreasing maternal parenting stress in mothers who did not receive appropriate care by their own mothers. Owing to research on mind-mindedness (McMahon and Meins 2012), one might expect parenting interventions targeting parents' perceptions of their child to be especially relevant in the context of parenting stress. Indeed, supporting parents' capacity to mentalize effectively about their child is thought to be positively associated with parenting characteristics as well as the parent-child relationship (Rosenblum et al. 2008).

Rearing Style by and Current Relationship with the Father (G1) and Parenting Stress (G2)

Despite a nonsignificant effect of rearing by the father (G1) on parenting stress (G2), we found a significant indirect effect through current relationship with the father. This finding is interesting in light of recent research on father involvement and paternal care on offspring outcomes (Martin et al. 2010). For instance, father involvement and father-child interactions significantly contribute to positive child development, including mental health (Scourfield et al. 2016), language development (Tamis-LeMonda et al. 2004), school performance (McConnell and Kerig 2002), and different aspects of children's social development (Isley et al. 1999). The importance of an involved father may be even more apparent when the mother suffers from mental health problems. Indeed, father involvement has been identified as a buffering factor for the risk stemming from maternal depression when predicting offspring behavioral problems (Mezulis et al. 2004), even at later stages of development. An earlier study also reported a protective effect of father-adolescent relationship quality on behavioral problems when mothers were depressed (Tannenbaum and Forehand 1994). Based on our findings, we suggest that stronger father involvement during childhood shapes the relationship with the father when the mother has her own child, and that this increased relationship quality reduces maternal parenting stress levels. Notably, future research should consider relationship satisfaction and the involvement of the child's father (G2), which might be influenced by maternal expectations formed during her own childhood.

Strengths and Limitations

This study has some limitations. First, based on our exclusion criteria as well as the attrition rate, our sample size was strongly reduced; however, when we included all primiparous women in the mediation analysis, the results did not change in interpretation but were even more significant, probably because of an increased power linked to larger sample size. Second, we used self-report questionnaires that might not be representative of maternal parenting style and might suffer from different informant biases, such as social desirability, mood bias, or retrospective recall. Third, we focused on parenting stress as reported by the mothers. It would be highly relevant to investigate whether the same pathways apply to fathers as well. Fourth, we measured our mediators at the same time as our outcome variable; thus, the temporal order of a classical mediation pathway does not apply. But since we were interested in finding out whether the associations were mediated by concurrent symptoms of depression, relationship with the parents, and maternal motivation, we chose to include variables measured at the same time as the outcome variable. Fifth, not all measures on the early rearing environment were completed at the prenatal assessment. However, time of completion did not moderate the association between rearing experiences and parenting stress, and scores were highly correlated between time points in mothers who completed the questionnaire twice (data not shown). Sixth, since this was an observational study, we could not apply any manipulation of the predictors for ethical reasons. Last, our results need to be replicated in different geographical, sociodemographic, and ethnic settings to be more generalizable. In addition, generalizability might be limited to the fact that we summarized maltreatment based on the CTQ physical abuse,

emotional abuse, and emotional neglect scales, and that we excluded mothers reporting at least some strain caused by sexual abuse and physical neglect, both of which might be related to contexts outside the family environment.

This study also has numerous strengths. First, our study included not only one specific maternal rearing experience, but three aspects of the maternal rearing environment: maltreatment, maternal rearing, and paternal rearing. Second, we investigated three potential psychosocial mediators (affective, cognitive-motivational, and social) of maternal early rearing experiences on later psychosocial parenting resources. Indeed, our findings indicate that there are distinct pathways in the effects of early experiences on later parenting resources depending on the components of rearing environment investigated, indicating different intervention approaches for different problematic early environments. Third, by excluding mothers with at least some strain in physical neglect and sexual abuse, we argue that the maltreatment construct studied here was indeed related to how the mothers experienced the parenting style of their own parents, rather than childhood sociodemographic adversity or sexual abuse by non-family members. Fourth, the inclusion of paternal rearing style adds to the growing interest of father involvement in childcare and offspring developmental outcomes. Last, maternal and paternal rearing style are strongly correlated, such that it is difficult to separate the effects of maternal and paternal rearing from one another. We used an innovative approach to overcome this problem by applying an orthogonal rotation of the two scales for PBI mother and PBI father to assess maternal or paternal rearing more distinctively.

Conclusion

In this study we identified distinct pathways in the effects of maternal early rearing experiences on later psychosocial parenting resources, examining different maternal childhood rearing experiences and psychosocial mediators on parenting stress. The findings suggest that mothers who have been maltreated during childhood could benefit from a psychotherapy intervention targeted to reduce symptoms of depression in order to reduce mood disturbances and parenting stress. Mood-focused interventions in combination with cognitive-behavioral therapies targeting maternal motivation and the mother's conceptualization of motherhood might also be helpful for mothers who have experienced low quality in the rearing environment provided by their own mothers. Finally, for mothers who have received low-quality care from their fathers and subsequently have a strained paternal relationship, interventions might focus on relationship repair where possible or other sources of social support. Our findings have valuable implications for interventions targeted at improving parenting resources. Therapists should not only consider a mother's own early rearing experience but should target her current mood, maternal care motivation, and current relationship with her parents or other sources of social support.

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References

- Adamakos, H., Ryan, K., Ullman, D. G., Pascoe, J., Diaz, R., & Chessare, J. (1986). Maternal social support as a predictor of mother-child stress and stimulation. *Child Abuse & Neglect*, *10*(4), 463–470.
- Affifi, T. O., MacMillan, H. L., Boyle, M., Taillieu, T., Cheung, K., & Sareen, J. (2014). Child abuse and mental disorders in Canada. *Canadian Medical Association Journal*, *186*(9), E324–E332.
- Bagot, R. C., van Hasselt, F. N., Champagne, D. L., Meaney, M. J., Krugers, H. J., & Joels, M. (2009). Maternal care determines rapid effects of stress mediators on synaptic plasticity in adult rat hippocampal dentate gyrus. *Neurobiology of Learning and Memory*, *92*(3), 292–300.
- Bailey, H. N., DeOliveira, C. A., Wolfe, V. V., Evans, E. M., & Hartwick, C. (2012). The impact of childhood maltreatment history on parenting: A comparison of maltreatment types and assessment methods. *Child Abuse & Neglect*, *36*(3), 236–246.
- Bakermans-Kranenburg, M. J., van IJzendoorn, M. H., & Juffer, F. (2003). Less is more: Meta-analyses of sensitivity and attachment interventions in early childhood. *Psychological Bulletin*, *129*(2), 195–215.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs: Prentice-Hall.
- Banyard, V. L. (1997). The impact of childhood sexual abuse and family functioning on four dimensions of women's later parenting. *Child Abuse & Neglect*, *21*(11), 1095–1107.
- Belsky, J. (1984). The determinants of parenting: A process model. *Child Development*, *55*(1), 83–96.
- Belsky, J., Steinberg, L., & Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development*, *62*(4), 647–670.
- Belsky, J., Woodworth, S., & Crnic, K. (1996). Trouble in the second year: Three questions about family interaction. *Child Development*, *67*(2), 556–578.
- Belsky, J., Jaffee, S. R., Sligo, J., Woodward, L., & Silva, P. A. (2005). Intergenerational transmission of warm-sensitive-stimulating parenting: A prospective study of mothers and fathers of 3-year-olds. *Child Development*, *76*(2), 384–396.
- Belsky, J., Conger, R., & Capaldi, D. M. (2009). The intergenerational transmission of parenting: Introduction to the special section. *Developmental Psychology*, *45*(5), 1201–1204.
- Berkout, O. V., & Kolko, D. J. (2016). Understanding child directed caregiver aggression: An examination of characteristics and predictors associated with perpetration. *Child Abuse & Neglect*, *56*, 44–53.
- Bernstein, D. P., Fink, L., Handelsman, L., Foote, J., Lovejoy, M., Wenzel, K., et al. (1994). Initial reliability and validity of a new retrospective measure of child abuse and neglect. *American Journal of Psychiatry*, *151*(8), 1132–1136.
- Bernstein, D. P., Ahluvalia, T., Pogge, D., & Handelsman, L. (1997). Validity of the Childhood Trauma Questionnaire in an adolescent psychiatric population. *Journal of the American Academy of Child and Adolescent Psychiatry*, *36*(3), 340–348.
- Berry, J. O. (1995). The parental stress scale: Initial psychometric evidence. *Journal of Social and Personal Relationships*, *12*(3), 463–472.
- Buchanan, A. (1998). Intergenerational child maltreatment. In Y. Danieli (Ed.), *International handbook of multigenerational legacies of trauma* (pp. 535–552). Boston: Springer US.
- Buist, A. (1998). Childhood abuse, postpartum depression and parenting difficulties: A literature review of associations. *Australian & New Zealand Journal of Psychiatry*, *32*(3), 370–378.
- Caldji, C., Tannenbaum, B., Sharma, S., Francis, D., Plotsky, P. M., & Meaney, M. J. (1998). Maternal care during infancy regulates the development of neural systems mediating the expression of fearfulness in the rat. *Proceedings of the National Academy of Sciences (USA)*, *95*(9), 5335–5340.
- Cameron, N. M., DelCorpo, A., Diorio, J., McAllister, K., Sharma, S., & Meaney, M. J. (2008a). Maternal programming of sexual behavior and hypothalamic-pituitary-gonadal function in the female rat. *PLoS One*, *3*(5), e2210.
- Cameron, N. M., Fish, E. W., & Meaney, M. J. (2008b). Maternal influences on the sexual behavior and reproductive success of the female rat. *Hormones and Behavior*, *54*(1), 178–184.
- Carr, C. P., Martins, C. M., Stingel, A. M., Lemgruber, V. B., & Juruena, M. F. (2013). The role of early life stress in adult psychiatric disorders: A systematic review according to childhood trauma subtypes. *The Journal of Nervous and Mental Disease*, *201*(12), 1007–1020.
- Champagne, F. A., Francis, D. D., Mar, A., & Meaney, M. J. (2003). Variations in maternal care in the rat as a mediating influence for the effects of environment on development. *Physiology & Behavior*, *79*(3), 359–371.

- Champagne, F. A., Weaver, I. C., Diorio, J., Dymov, S., Szyf, M., & Meaney, M. J. (2006). Maternal care associated with methylation of the estrogen receptor- α 1b promoter and estrogen receptor- α expression in the medial preoptic area of female offspring. *Endocrinology*, *147*(6), 2909–2915.
- Chan, Y. C. (1994). Parenting stress and social support of mothers who physically abuse their children in Hong Kong. *Child Abuse & Neglect*, *18*(3), 261–269.
- Chapman, D. A., & Scott, K. G. (2001). The impact of maternal intergenerational risk factors on adverse developmental outcomes. *Developmental Review*, *21*(3), 305–325.
- Chartier, M. J., Walker, J. R., & Naimark, B. (2010). Separate and cumulative effects of adverse childhood experiences in predicting adult health and health care utilization. *Child Abuse & Neglect*, *34*(6), 454–464.
- Chen, Z.-Y., Liu, R. X., & Kaplan, H. B. (2008). Mediating mechanisms for the intergenerational transmission of constructive parenting: A prospective longitudinal study. *Journal of Family Issues*, *29*(12), 1574–1599.
- Choi, N. G., DiNitto, D. M., Marti, C. N., & Choi, B. Y. (2017). Association of adverse childhood experiences with lifetime mental and substance use disorders among men and women aged 50+ years. *International Psychogeriatrics*, *29*(3), 359–372.
- Conger, R. D., Patterson, G. R., & Ge, X. (1995). It takes two to replicate: A mediational model for the impact of parents' stress on adolescent adjustment. *Child Development*, *66*(1), 80–97.
- Conger, R. D., Belsky, J., & Capaldi, D. M. (2009). The intergenerational transmission of parenting: Closing comments for the special section. *Developmental Psychology*, *45*(5), 1276–1283.
- Cost, K. T., Plamondon, A., Unternaehrer, E., Meaney, M., Steiner, M., Fleming, A. S., et al. (2016). The more things change, the more things stay the same: Maternal attitudes 3 to 18 months postpartum. *Acta Paediatrica*, *105*(7), e320–e327.
- Cost, K. T., Jonas, W., Unternaehrer, E., Dudin, A., Szatmari, P., Gaudreau, H., et al. (2018). Maternal perceptions of paternal investment are associated with relationship satisfaction and breastfeeding duration in humans. *Journal of Family Psychology*, *32*(8), 1025.
- Deater-Deckard, K. (1998). Parenting stress and child adjustment: Some old hypotheses and new questions. *Clinical Psychology: Science and Practice*, *5*(3), 314–332.
- DiLillo, D., & Damashek, A. (2003). Parenting characteristics of women reporting a history of childhood sexual abuse. *Child Maltreatment*, *8*(4), 319–333.
- Drury, S. S. (2012). Maternal sensitivity and attachment: Softening the impact of early adversity. *Journal of the American Academy of Child and Adolescent Psychiatry*, *51*(7), 670–672.
- Enns, M. W., Cox, B. J., & Clara, I. (2002). Parental bonding and adult psychopathology: Results from the US National Comorbidity Survey. *Psychological Medicine*, *32*(6), 997–1008.
- Ertem, I. O., Leventhal, J. M., & Dobbs, S. (2000). Intergenerational continuity of child physical abuse: How good is the evidence? *Lancet*, *356*(9232), 814–819.
- Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: A review. *Infant Behavior & Development*, *33*(1), 1–6.
- Fleming, A. S., Ruble, D. N., Flett, G. L., & Shaul, D. L. (1988). Postpartum adjustment in first-time mothers: Relations between mood, maternal attitudes, and mother-infant interactions. *Developmental Psychology*, *24*(1), 71–81.
- Francis, D., Diorio, J., Liu, D., & Meaney, M. J. (1999). Nongenomic transmission across generations of maternal behavior and stress responses in the rat. *Science*, *286*(5442), 1155–1158.
- Gonzalez, A., Jenkins, J. M., Steiner, M., & Fleming, A. S. (2012). Maternal early life experiences and parenting: The mediating role of cortisol and executive function. *Journal of the American Academy of Child and Adolescent Psychiatry*, *51*(7), 673–682.
- Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: A meta-analytic review. *Clinical Child and Family Psychology Review*, *14*(1), 1–27.
- Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling. www.afhayes.com/public/process2012.pdf. Accessed 28 January 2016.
- Isley, S. L., O'Neil, R., Clatfelter, D., & Parke, R. D. (1999). Parent and child expressed affect and children's social competence: Modeling direct and indirect pathways. *Developmental Psychology*, *35*(2), 547–560.
- Jeon, S., & Neppl, T. K. (2016). Intergenerational continuity in economic hardship, parental positivity, and positive parenting: The association with child behavior. *Journal of Family Psychology*, *30*(1), 22–32.
- Jonas, W., Mileva-Seitz, V., Girard, A. W., Bisceglia, R., Kennedy, J. L., Sokolowski, M., et al. (2013). Genetic variation in oxytocin rs2740210 and early adversity associated with postpartum depression and breastfeeding duration. *Genes Brain & Behavior*, *12*(7), 681–694.

- Kerr, D. C., Capaldi, D. M., Pears, K. C., & Owen, L. D. (2009). A prospective three generational study of fathers' constructive parenting: Influences from family of origin, adolescent adjustment, and offspring temperament. *Developmental Psychology, 45*(5), 1257–1275.
- Kessler, R. C., Davis, C. G., & Kendler, K. S. (1997). Childhood adversity and adult psychiatric disorder in the US National Comorbidity Survey. *Psychological Medicine, 27*(5), 1101–1119.
- Kim, J. (2009). Type-specific intergenerational transmission of neglectful and physically abusive parenting behaviors among young parents. *Children and Youth Services Review, 31*(7), 761–767.
- Kim, P., Leckman, J. F., Mayes, L. C., Newman, M. A., Feldman, R., & Swain, J. E. (2010). Perceived quality of maternal care in childhood and structure and function of mothers' brain. *Developmental Science, 13*(4), 662–673.
- Knight, R. G., Williams, S., McGee, R., & Olaman, S. (1997). Psychometric properties of the Centre for Epidemiologic Studies Depression Scale (CES-D) in a sample of women in middle life. *Behaviour Research and Therapy, 35*(4), 373–380.
- Kochanska, G., & Kim, S. (2013). Early attachment organization with both parents and future behavior problems: From infancy to middle childhood. *Child Development, 84*(1), 283–296.
- Lang, A. J., Gartstein, M. A., Rodgers, C. S., & Lebeck, M. M. (2010). The impact of maternal childhood abuse on parenting and infant temperament. *Journal of Child Adolescent Psychiatric Nursing, 23*(2), 100–110.
- Liu, D., Diorio, J., Tannenbaum, B., Caldji, C., Francis, D., Freedman, A., et al. (1997). Maternal care, hippocampal glucocorticoid receptors, and hypothalamic-pituitary-adrenal responses to stress. *Science, 277*(5332), 1659–1662.
- Liu, D., Diorio, J., Day, J. C., Francis, D. D., & Meaney, M. J. (2000). Maternal care, hippocampal synaptogenesis and cognitive development in rats. *Nature Neuroscience, 3*(8), 799–806.
- Lomanowska, A. M., Boivin, M., Hertzman, C., & Fleming, A. S. (2017). Parenting begets parenting: A neurobiological perspective on early adversity and the transmission of parenting styles across generations. *Neuroscience, 342*, 120–139.
- Lovejoy, M. C., Graczyk, P. A., O'Hare, E., & Neuman, G. (2000). Maternal depression and parenting behavior: A meta-analytic review. *Clinical Psychology Review, 20*(5), 561–592.
- Lutz, K. F., Burnson, C., Hane, A., Samuelson, A., Maleck, S., & Poehlmann, J. (2012). Parenting stress, social support, and mother-child interactions in families of multiple and singleton preterm toddlers. *Family Relations, 61*(4), 642–656.
- Mackler, J. S., Kelleher, R. T., Shanahan, L., Calkins, S. D., Keane, S. P., & O'Brien, M. (2015). Parenting stress, parental reactions, and externalizing behavior from ages 4 to 10. *Journal of Marriage and Family, 77*(2), 388–406.
- Maestripieri, D. (1998). Parenting styles of abusive mothers in group-living rhesus macaques. *Animal Behavior, 55*(1), 1–11.
- Maestripieri, D. (2005). Early experience affects the intergenerational transmission of infant abuse in rhesus monkeys. *Proceedings of the National Academy of Sciences (USA), 102*(27), 9726–9729.
- Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood and adulthood: A move to the level of representation. In I. Bretherton & E. Waters (Eds.), *Growing points of attachment theory and research* (pp. 66–106). Monographs of the Society for Research in Child Development, 50 (1–2, Serial No. 209).
- Martin, A., Ryan, R. M., & Brooks-Gunn, J. (2010). When fathers' supportiveness matters most: Maternal and paternal parenting and children's school readiness. *Journal of Family Psychology, 24*(2), 145–155.
- McConnell, M. C., & Kerig, P. K. (2002). Assessing coparenting in families of school-age children: Validation of the Coparenting and Family Rating System. *Canadian Journal of Behavioural Science/Revue Canadienne des Sciences du Comportement, 34*(1), 44.
- McLaughlin, K. A., Green, J. G., Gruber, M. J., Sampson, N. A., Zaslavsky, A. M., & Kessler, R. C. (2010). Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) III: Associations with functional impairment related to DSM-IV disorders. *Psychological Medicine, 40*(5), 847–859.
- McMahon, C. A., & Meins, E. (2012). Mind-mindedness, parenting stress, and emotional availability in mothers of preschoolers. *Early Childhood Research Quarterly, 27*(2), 245–252.
- Meaney, M. J. (2001). Maternal care, gene expression, and the transmission of individual differences in stress reactivity across generations. *Annual Review of Neuroscience, 24*, 1161–1192.
- Mezulis, A. H., Hyde, J. S., & Clark, R. (2004). Father involvement moderates the effect of maternal depression during a child's infancy on child behavior problems in kindergarten. *Journal of Family Psychology, 18*(4), 575.

- Miller, L., Kramer, R., Warner, V., Wickramaratne, P., & Weissman, M. (1997). Intergenerational transmission of parental bonding among women. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*(8), 1134–1139.
- Moss, E., Dubois-Comtois, K., Cyr, C., Tarabulsky, G. M., St-Laurent, D., & Bernier, A. (2011). Efficacy of a home-visiting intervention aimed at improving maternal sensitivity, child attachment, and behavioral outcomes for maltreated children: A randomized control trial. *Development and Psychopathology, 23*(1), 195–210.
- Murphy, E., Wickramaratne, P., & Weissman, M. (2010). The stability of parental bonding reports: A 20-year follow-up. *Journal of Affective Disorders, 125*(1–3), 307–315.
- Neece, C. L., Green, S. A., & Baker, B. L. (2012). Parenting stress and child behavior problems: A transactional relationship across time. *American Journal on Intellectual and Developmental Disabilities, 117*(1), 48–66.
- Newcomb, M. D., & Locke, T. F. (2001). Intergenerational cycle of maltreatment: A popular concept obscured by methodological limitations. *Child Abuse & Neglect, 25*(9), 1219–1240.
- Noll, J. G., Trickett, P. K., Harris, W. W., & Putnam, F. W. (2009). The cumulative burden borne by offspring whose mothers were sexually abused as children: Descriptive results from a multigenerational study. *Journal of Interpersonal Violence, 24*(3), 424–449.
- O'Donnell, K. A., Gaudreau, H., Colalillo, S., Steiner, M., Atkinson, L., Moss, E., et al. (2014). The maternal adversity, vulnerability and neurodevelopment project: Theory and methodology. *Canadian Journal of Psychiatry, 59*(9), 497–508.
- Oliver, J. E. (1993). Intergenerational transmission of child abuse: Rates, research, and clinical implications. *American Journal of Psychiatry, 150*(9), 1315–1324.
- Parker, G. (1989). The parental bonding instrument: Psychometric properties reviewed. *Psychiatric Developments, 7*(4), 317–335.
- Parker, G., Tupling, H., & Brown, L. B. (1979). Parental bonding instrument. *British Journal of Medical Psychology, 52*(Mar), 1–10.
- Parkes, A., Sweeting, H., & Wight, D. (2015). Parenting stress and parent support among mothers with high and low education. *Journal of Family Psychology, 29*(6), 907–918.
- Pears, K. C., & Capaldi, D. M. (2001). Intergenerational transmission of abuse: A two-generational prospective study of an at-risk sample. *Child Abuse & Neglect, 25*(11), 1439–1461.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891.
- Racine, N., Madigan, S., Plamondon, A., Hetherington, E., McDonald, S., & Tough, S. (2018). Maternal adverse childhood experiences and antepartum risks: The moderating role of social support. *Archives of Women's Mental Health, 21*(3). <https://doi.org/10.1007/s00737-018-0826-1>.
- Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401.
- Rodriguez, C. M., & Green, A. J. (1997). Parenting stress and anger expression as predictors of child abuse potential. *Child Abuse & Neglect, 21*(4), 367–377.
- Rosenblum, K. L., McDonough, S. C., Sameroff, A. J., & Muzik, M. (2008). Reflection in thought and action: Maternal parenting reflectivity predicts mind-minded comments and interactive behavior. *Infant Mental Health Journal, 29*(4), 362–376.
- Ruble, D. N., Brooks-Gunn, J., Fleming, A. S., Fitzmaurice, G., Stangor, C., & Deutsch, F. (1990). Transition to motherhood and the self: Measurement, stability, and change. *Journal of Personality and Social Psychology, 58*(3), 450–463.
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*(5), 749–761.
- Saltzman, W., & Maestripieri, D. (2011). The neuroendocrinology of primate maternal behavior. *Progress in Neuro-Psychopharmacology & Biological Psychiatry, 35*(5), 1192–1204.
- Santona, A., Tagini, A., Sarracino, D., De Carli, P., Pace, C. S., Parolin, L., et al. (2015). Maternal depression and attachment: The evaluation of mother-child interactions during feeding practice. *Frontiers in Psychology, 6*, 1235.
- Scourfield, J., Culpin, I., Gunnell, D., Dale, C., Joinson, C., Heron, J., et al. (2016). The association between characteristics of fathering in infancy and depressive symptoms in adolescence: A UK birth cohort study. *Child Abuse & Neglect, 58*, 119–128.
- Seay, D. M., Jahromi, L. B., Umana-Taylor, A. J., & Updegraff, K. A. (2016). Intergenerational transmission of maladaptive parenting strategies in families of adolescent mothers: Effects from grandmothers to young children. *Journal of Abnormal Child Psychology, 44*(6), 1097–1109.

- Simpson, J. A., & Belsky, J. (2016). Belsky's attachment theory within a modern evolutionary framework. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (3rd ed., pp. 91–116). New York: Guilford Press.
- Statistics Canada (2006). Income and Earnings. <https://www12.statcan.gc.ca/census-recensement/2006/rt-td/inc-rev-eng.cfm2018>. Accessed 28 January 2016.
- Steele, H., Bate, J., Steele, M., Dube, S. R., Danskin, K., Knafo, H., et al. (2016). Adverse childhood experiences, poverty, and parenting stress. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement*, *48*(1), 32–38.
- Szyf, M., Weaver, I., & Meaney, M. (2007). Maternal care, the epigenome and phenotypic differences in behavior. *Reproductive Toxicology*, *24*(1), 9–19.
- Tamis-LeMonda, C. S., Shannon, J. D., Cabrera, N. J., & Lamb, M. E. (2004). Fathers and mothers at play with their 2- and 3-year-olds: Contributions to language and cognitive development. *Child Development*, *75*(6), 1806–1820.
- Tannenbaum, L., & Forehand, R. (1994). Maternal depressive mood: The role of the father in preventing adolescent problem behaviors. *Behaviour Research and Therapy*, *32*(3), 321–325.
- Thierry, B., Singh, M., & Kaumanns, W. (2004). *Macaque societies: A model for the study of social organization*. Cambridge: Cambridge University Press.
- Tyrka, A. R., Burgers, D. E., Philip, N. S., Price, L. H., & Carpenter, L. L. (2013). The neurobiological correlates of childhood adversity and implications for treatment. *Acta Psychiatrica Scandinavica*, *128*(6), 434–447.
- Unternaehrer, E., Meyer, A. H., Burkhardt, S. C., Dempster, E., Staehli, S., Theill, N., et al. (2015). Childhood maternal care is associated with DNA methylation of the genes for brain-derived neurotrophic factor (BDNF) and oxytocin receptor (OXTR) in peripheral blood cells in adult men and women. *Stress*, *18*(4), 451–461.
- Unternaehrer, E., Cost, K. T., Bouvette-Turcot, A. A., Gaudreau, H., Massicotte, R., Dhir, S. K., . . . & Levitan, R. D. (2019). Dissecting maternal care: Patterns of maternal parenting in a prospective cohort study. *Journal of Neuroendocrinology*, e12784.
- van IJzendoorn, M. H. (1995). Adult attachment representations, parental responsiveness, and infant attachment: A meta-analysis on the predictive validity of the adult attachment interview. *Psychological Bulletin*, *117*(3), 387–403.
- van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2019). Bridges across the intergenerational transmission of attachment gap. *Current Opinion in Psychology*, *25*, 31–36.
- van IJzendoorn, M. H., Goldberg, S., Kroonenberg, P. M., & Frenkel, O. J. (1992). The relative effects of maternal and child problems on the quality of attachment: A meta-analysis of attachment in clinical samples. *Child Development*, *63*(4), 840–858.
- Van Wert, M., Anreiter, I., Fallon, B. A., & Sokolowski, M. B. (2019). Intergenerational transmission of child abuse and neglect: A transdisciplinary analysis. *Gender and the Genome*. <https://doi.org/10.1177/2470289719826101>.
- Weaver, I. C. G., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma Jr., S., & S., et al. (2004). Epigenetic programming by maternal behavior. *Nature Neuroscience*, *7*(8), 847–854.
- Wheelock, J., & Jones, K. (2002). 'Grandparents are the next best thing': Informal childcare for working parents in urban Britain. *Journal of Social Policy*, *31*(3), 441–463.
- Widom, C. S., Czaja, S. J., & DuMont, K. A. (2015). Intergenerational transmission of child abuse and neglect: Real or detection bias? *Science*, *347*(6229), 1480–1485.

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