



# From Negative Emotionality to Aggressive Behavior: Maternal and Paternal Parenting Stress as Intervening Factors

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## Abstract

Child temperament plays a key role in the development of psychopathology, notably through transactions with the family environment. In particular, temperamental negative emotionality is a documented antecedent of child aggressive behavior, with parenting stress sometimes proposed to play a mediating role in this association. However, research has mostly addressed bivariate associations and seldom considered the full chain linking child negative emotionality to aggression through parenting stress. In addition, most relevant studies have focused on mothers; therefore, possible combined contributions of maternal and paternal stress, such as interactive effects, are under-investigated. Addressing these gaps, this longitudinal multi-informant study aimed to examine the mediating role of maternal parenting stress, paternal parenting stress, and their interaction in the association between infant negative emotionality and child aggression. Among 186 mostly White middle-class families (98 boys), infant negative emotionality was reported by mothers and fathers at 15 months, both parents reported on their own parenting stress at 3 years, and child aggression was assessed by teachers in the first grade of elementary school. The results revealed a moderated mediated pathway, such that there was a significant indirect effect of child negative emotionality on aggression through paternal stress, however only when maternal stress was also high. These findings suggest that the risk of negative emotionality translating to aggressive behavior is magnified when both parents experience high levels of stress in their parenting role. The results also underscore that both parents play significant yet different roles in the process linking early negative emotionality to subsequent aggression.

**Keywords** Negative emotionality · Aggression · Parenting stress · Moderated mediation

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A consensual notion in developmental psychopathology is that child temperament, consisting of biologically based individual differences in reactivity and self-regulation, exerts an influence on child typical and atypical development (Rothbart & Bates, 2006). The connections between difficult temperament and subsequent maladjustment in children are indeed well documented, notably those between negative emotionality and externalizing behavior problems such as aggression (Sanson et al., 2004, 2010). However, researchers are moving away from a perspective in which temperament is perceived to have a simple direct effect on child psychopathology toward more sophisticated models that purport that the development of psychopathology results from an interplay between intrinsic child characteristics and environmental factors, notably parental and family factors (Cicchetti & Cohen, 1995; Sameroff, 2009). It is, therefore, expected that early constitutional dispositions to negative affect eventually give rise to aggressive behavior through a process of mutual exacerbation between child dispositions

and parental factors such as parenting stress (Coplan et al., 2003; Kiff et al., 2011; Stone et al., 2016). This hypothesis has, however, received relatively little convincing support, for several reasons. First, most of the literature examining associations among child temperament, parenting stress, and child externalizing problems has examined bivariate associations between two of these constructs only. Much of this literature is also based on mono-informant and often cross-sectional designs, which may inflate effect sizes considerably. In addition, relevant studies have largely neglected fathers. Addressing these gaps, this study set out to examine the mediating role of maternal and paternal parenting stress in the association between infant negative emotionality and teacher-reported child aggression at school entry.

## Child Temperament and Aggression

Externalizing behavior problems are the most common and persistent form of maladjustment in childhood and constitute major risk factors for psychopathology in adolescence and adulthood (Kokko & Pulkkinen, 2000; Reef et al., 2011). Among different externalizing manifestations, aggressive behavior is of particular concern given its multiple associations with problems in other areas including emotional, social, and academic maladjustment (Eisner & Malti, 2015; Tremblay et al., 2005). It is, therefore, critically important to identify the factors that lead to the development of aggression. One factor that can be identified as early as infancy and shows robust predictive associations with subsequent aggression is temperament, more specifically negative emotionality (Malti & Rubin, 2018). Negative emotionality is a core aspect of temperament that refers to high-intensity negative reactions and encompasses features such as predisposition to anger and irritability (Paulussen-Hoogbeem et al., 2007; Rothbart et al., 1994). Numerous studies have shown that negative emotionality early in life is predictive of subsequent externalizing behavior (Eisenberg et al., 2009; Gallitto, 2015; Shaw et al., 2001; Wichstrøm et al., 2018) including aggression (Perhamus & Ostrov, 2021; Vitaro et al., 2006).

A central question, then, is how an early disposition to negative affect becomes translated into aggression. From a developmental psychopathology perspective, child maladjustment develops via transactions between children and their environments (Hinshaw, 2008). It is proposed that child temperament elicits differential parental reactions that can set in motion developmental cascades with implications for child psychopathology (Klein et al., 2018). As children who struggle with negative emotionality show frequent fussy or angry behavior that can be challenging for parents to manage, parenting stress is proposed to play a pivotal role in the

developmental process linking early negative emotionality to later aggression (Krahé et al., 2015; Neece et al., 2012).

## Parenting Stress as a Vehicle between Child Negative Emotionality and Aggression

Parenting stress is considered to be both a cause and a consequence of child adverse behavioral manifestations (Dollberg & Keren, 2020; Krahé et al., 2015; Stone et al., 2016). Indeed, children showing high and frequent negative affect may cause stress to their parents as they react strongly and negatively to parental limit-setting, are intolerant of parental delays in responding to their needs, and are difficult to soothe (Kiff et al., 2011). In keeping with these claims, empirical studies reveal that parents who report more negative affect in their child also report experiencing more parenting stress, whether concurrently (Andreadakis et al., 2020) or prospectively (Oddi et al., 2013). Although nearly all relevant studies have focused on mothers, similar links can be observed in fathers as well (McBride et al., 2002; Solmeyer & Feinberg, 2011). Thus, maternal and paternal parenting stress may result in part from interacting with a child showing frequent and intense negative affect.

Parenting stress could, therefore, constitute a mediating factor between child early negative emotionality and later aggression, given that parenting stress may promote the development of externalizing symptoms in children, whether through inadequate parenting, negative role-modelling of aggressive behavior in conflict situations, marital discord witnessed by the child, and so on. In line with this, an abundant literature has documented that parenting stress is related to child externalizing behavior (Mackler et al., 2015; Neece et al., 2012; Tharner et al., 2012). The robustness of these links needs further investigation however, given some methodological considerations. First, a striking aspect of the literature on parenting stress and child externalizing is how frequently these two constructs are reported by parents. In addition, while child externalizing is sometimes assessed through both maternal and paternal reports, parenting stress rarely is. Therefore, most studies, sometimes cross-sectional, use maternal parenting stress to predict mother-reported child problems or a combined score of mother- and father-reported child problems. This may inflate associations substantially given that parents' appraisal of their child's behavior is heavily influenced by their own psychological functioning (Valloton et al., 2016).

Thus, the link between parenting stress and child externalizing may be overestimated to a degree due to the frequent reliance on maternal reports. Supporting this view, when both within- and cross-reporter correlations are reported, associations between one parent's parenting stress and the other parent's ratings of child problems are generally

weaker than within-reporter associations (Neece et al., 2012; Tsotsi et al., 2019; Valloton et al., 2016). Likewise, relations with parental stress are stronger when child externalizing is reported by parents than by children (Buodo et al., 2013) or teachers (Shaw et al., 2001). Therefore, with the aim of conducting a stringent test of the proposed mediation model, we used a combination of maternal and paternal reports to assess infant negative emotionality, both parents' appraisal of their respective parenting stress, and teacher reports of child aggression.

## Combined Effects of Mothers and Fathers

In addition to lessening shared method variance concerns, a conceptual advantage of assessing both parents' stress is the possibility to investigate their combined influences. It is now widely acknowledged that both mothers and fathers contribute in important ways to their children's development (Volling & Cabrera, 2019). These contributions can be additive, such that each parent contributes to child adjustment over and above the other parent's contribution (Flouri et al., 2019). However, moderation effects can also be hypothesized. Martin et al. (2007) argue that children in two-parent families experience a home environment that naturally blends their two parents' influences. According to these authors, a study of interactive effects between parents more closely approximates children's real experiences than a study of additive effects, as one may expect family interactions to produce a synergistic dynamic in which one parent's influence on the child modulates that of the other parent (Martin et al., 2007). Thus, the detrimental influence of one parent's parenting stress might be offset by low parenting stress, or compounded by high parenting stress, in the other parent.

To our knowledge, interactive effects between maternal and paternal parenting stress have yet to be examined, which is expected given the often noted scarcity of research on fathers' parenting stress (Dollberg & Keren, 2020; Stone et al., 2016; Tsotsi et al., 2019). There is, however, evidence of interactive effects in studies considering maternal and paternal depression or anxiety in relation to child maladjustment. These studies suggest that the risk for child maladjustment conferred by one parent's psychological symptoms is enhanced when the other parent also shows high levels of symptomatology (Feldman et al., 2020; Gere et al., 2013). Following this reasoning, one may hypothesize a negative multiplicative effect between maternal and paternal parenting stress, such that any relation between one parent's stress and child aggression will be magnified by the other parent's stress.

Accordingly, the current study tested a moderated mediation model, in which the relation between negative emotionality in infancy and child aggression at school entry is

mediated by the interaction between maternal and paternal stress in the preschool period. To obtain conservative estimates not inflated by shared methods, we used a combination of maternal and paternal reports to assess infant negative emotionality and teacher reports of child aggression. We expected that early negative emotionality would forecast subsequent aggression and that this association would be mediated by the interaction of maternal and paternal parenting stress, such that the mediation would be more pronounced when both parents reported higher levels of stress.

## Method

### Participants

A sample of 186 biparental families took part in this study (98 boys, 88 girls). Participating families were recruited from birth lists of a large Canadian metropolitan area, randomly generated and provided to the research team by the Ministry of Health and Social Services. Criteria for participation were full-term pregnancy and the absence of any known disability or developmental delay in the infant. Families received a letter describing the project and were then contacted by phone; 39% of contacted families agreed to participate. Mothers were aged 31.70 years on average ( $SD=3.86$ ), and fathers 33.95 years ( $SD=5.10$ ). On average, mothers had 16.00 years of education ( $SD=2.07$ ; 60% held a college degree), and fathers 15.73 ( $SD=2.38$ ; 68% held a college degree). A similar proportion (63%) of parents living in the same Canadian province hold a college degree ([www.stat.gouv.qc.ca](http://www.stat.gouv.qc.ca)). Mean annual family income was in the CND\$60,000 to CND\$79,000 bracket, near the mean family income in Canada, which was \$74,600 for the years of data collection. Most parents (92.3% of mothers, 83.6% of fathers) reported being White (with 1% to 5% of mothers and fathers reporting Caribbean, African, Asian, Arabic or mixed origins), while about 70% of the local population is White ([http://ville.montreal.qc.ca/portal/page?\\_pageid=6897,67887653&\\_dad=portal&\\_schema=PORTAL](http://ville.montreal.qc.ca/portal/page?_pageid=6897,67887653&_dad=portal&_schema=PORTAL)). A composite index of family socioeconomic status (SES) was derived by standardizing and averaging maternal education, paternal education, and family income.

These families were part of an on-going longitudinal study of child development (Bernier et al., 2020). In the current study, we report on child temperament assessed when children were aged approximately 15 months (T1;  $M=15.48$  months,  $SD=0.75$ ), parenting stress at 3 years (T2;  $M=36.72$  months,  $SD=0.86$ ), and child aggression in the first grade of elementary school (T3;  $M=85.60$  months,  $SD=3.10$ ). Data were collected between 2007 and 2013. Among the initial 186 families, all mothers and 150 fathers reported on their child's temperament at T1. At T2, 148

mothers and 111 fathers reported on their parenting stress. Finally, 119 school teachers reported on child aggression at T3. Families with missing mother, father, or teacher data were characterized by lower SES ( $p=0.002$ ) and higher maternal parenting stress ( $p=0.026$ ). When other observed variables predict the probability of missingness, data can be considered missing at random (Rioux & Little, 2021). Therefore, data were considered missing at random and handled with multiple imputation. As per current best practices (Enders, 2010), family SES and maternal parenting stress were used as auxiliary variables in the imputation equation (as described below), which minimizes bias in the estimation of missing data. No other significant differences were found between families with or without missing data on key study variables or sociodemographic characteristics (maternal and paternal age, ethnicity, child sex, family size;  $ps > 0.16$ ).

## Procedure

At T1 and T2, families were visited in their homes. Parents were given questionnaires to be completed separately by mothers and fathers and returned by mail to our laboratory in separate prepaid envelopes. These questionnaires included the child temperament (T1) and parenting stress (T2) measures described below. When children were in first grade (T3), their teachers were asked to report on their aggressive behavior at school. Teachers were invited to fill out the questionnaire and to return it by mail to our laboratory. The study protocol received ethical approval by the research ethics committee of the Faculty of Arts and Sciences, University of Montreal and parental written informed consent was obtained prior to participation.

## Measures

**Negative Emotionality** When children were 15 months old, their mothers and fathers completed the *Infant Characteristics Questionnaire*, 13–24-month version (ICQ; Bates et al., 1979). The ICQ is a parental report of child temperament comprised of 32 items rated on a 7-point Likert scale, tapping into four dimensions: difficultness, unadaptability, persistence, and social fear. As in previous studies of the antecedents of externalizing behavior (Gallitto, 2015; Lipscomb et al., 2012; Shaw et al., 2001; Vitaro et al., 2006), we used the difficultness subscale of the ICQ as an indicator of negative emotionality. The 16 items of this subscale tap into fussiness, irritability, and unpredictability. Internal consistency in this sample was  $\alpha=0.85$  for mothers and 0.80 for fathers. As in Vitaro et al. (2006), maternal and paternal reports of child negative emotionality showed good convergence,  $r=0.49$ ,  $p < 0.001$ . Consequently, maternal and paternal reports were averaged to obtain more accurate estimates of child temperament and avoid multiple testing.

**Parenting Stress** When children were aged 3 years, mothers and fathers completed the *Parenting Stress Index – Short Form* (PSI-SF; Abidin, 1995), a 36-item questionnaire (1–5 scale) designed to assess parents' felt stress in relation to their parenting role. Of note, 12 of the 36 items can be grouped under a "child" subscale, referring to parents' negative perceptions of their child's behavior (child as problematic, hard to manage). Given this conceptual proximity with the ICQ's child difficultness subscale used to index negative emotionality, we removed these 12 items and computed a total score with the remaining 24 items (e.g., "I feel trapped by my responsibilities as a parent"; "Since having this child, I feel that I am almost never able to do things that I like to do"). Internal consistency was  $\alpha=0.86$  for mothers and 0.87 for fathers. These two scores were kept separate for analyses.

**Child Aggression** When children were in first grade, their teachers completed the 14-item aggression subscale of the *Social Behavior Questionnaire* (SBQ; Tremblay et al., 1991) used in the National Longitudinal Survey of Children and Youth (Statistics Canada, 1996). Using a 3-point Likert scale, this subscale taps into aggressive behavior such as fighting, hitting, or blaming others. Internal consistency was  $\alpha=0.71$ . The teacher-rated SBQ shows good internal consistency, good test–retest reliability, and good convergent validity with peer sociometric assessments and maternal ratings of child aggression (Tremblay et al., 1991, 1992).

## Analytic Plan

Variable distributions were screened first. Next, all missing data (including maternal, paternal and teacher reports) were estimated with multiple imputation in SPSS 25. We used 20 imputations and a wide set of auxiliary variables in the imputation model (including family SES and maternal parenting stress as per the attrition analysis above) to make the missing-at-random assumption tenable and maximize the precision of imputed data (Enders, 2010). Zero-order correlations were then computed to identify potential covariates and examine bivariate associations between study variables.

Then, the hypotheses were tested with a series of ordinary least squares (OLS) regressions and the bias-corrected bootstrapping procedure recommended by Hayes (2013). We used conditional process analysis with the PROCESS macro in SPSS 25 (10,000 bootstraps, 95% confidence intervals [CI]) to test our hypothesized moderated mediation model. Given that PROCESS does not provide standardized coefficients, all scores were first converted to Z-scores so that the estimates of direct and indirect paths would be interpretable as standardized.

**Table.1** Descriptive Statistics for Key Study Variables

Variable	Mean	Standard deviation	Observed range
Negative emot – M	2.99	0.69	1.38 – 5.25
Negative emot – F	3.08	0.61	1.63 – 5.13
Negative emot – M & F	3.02	0.61	1.44 – 5.19
Parenting stress – M	2.09	0.59	1.10 – 4.08
Parenting stress – F	2.14	0.57	1.08 – 3.42
Child aggression	1.51	0.32	1.00 – 2.77

Negative emot=child negative emotionality, M=mother report, F=father report, M & F=average of mother and father reports

## Results

### Preliminary Analyses

Screening of variable distributions identified one univariate outlier on mother-reported negative emotionality, one on father-reported negative emotionality, one on maternal parenting stress, and two on child aggression. These were five different children. Following Tabachnick and Fidell’s (2013) recommendations, these extreme scores were substituted with the highest observed values that fell within 3.29 standard deviations of the mean. The resulting descriptive statistics after multiple imputation are displayed in Table 1. All distributions were normal. For descriptive purposes, this table presents maternal and paternal reports of child negative emotionality, as well as their average. As mentioned above, the average score was used in all subsequent analyses. Mean levels of parenting stress did not differ significantly between mothers and fathers,  $t(184) = 0.36, p = 0.715$ . These variables were kept separate to test the hypotheses.

Next, we examined whether potential sociodemographic confounds (child sex, family size, parents’ age, and family SES) needed to be included in analyses. Family size, parents’ age, and family SES were not significantly related to any main study variable. However, child sex was associated with maternal parenting stress and child aggression: mothers of girls reported lower parenting stress,  $t(184) = 2.18, p = 0.031$  and boys were considered more aggressive by their teachers,  $t(184) = 3.39, p < 0.001$ . Consequently, child sex was covaried in the main analyses.

We next examined the inter-correlations among the main study variables (Table 2). Child negative emotionality was positively associated with paternal ( $r = 0.38, p < 0.001$ ) though not maternal parenting stress ( $r = 0.09, p = 0.361$ ). Of note, child negative emotionality remained significantly associated with paternal parenting stress when child temperament was reported by mothers only ( $p < 0.001$ ). Child negative emotionality was positively associated with later aggression ( $r = 0.24, p = 0.021$ ), and aggression was unrelated to

**Table.2** Zero-Order Correlations among Key Study Variables

	2	3	4	5 <sup>a</sup>
1. Negative emotionality	0.09	0.38***	0.24*	0.04
2. Maternal parenting stress	—	0.50***	0.13 <sup>†</sup>	-0.18*
3. Paternal parenting stress	—	—	0.08	0.09
4. Child aggression	—	—	—	-0.35***
5. Child sex	—	—	—	—

<sup>a</sup>Biserial correlations (1 = boy; 2 = girl)

<sup>†</sup> $p < 0.10$ . \*  $p < 0.05$ . \*\*\*  $p < 0.001$

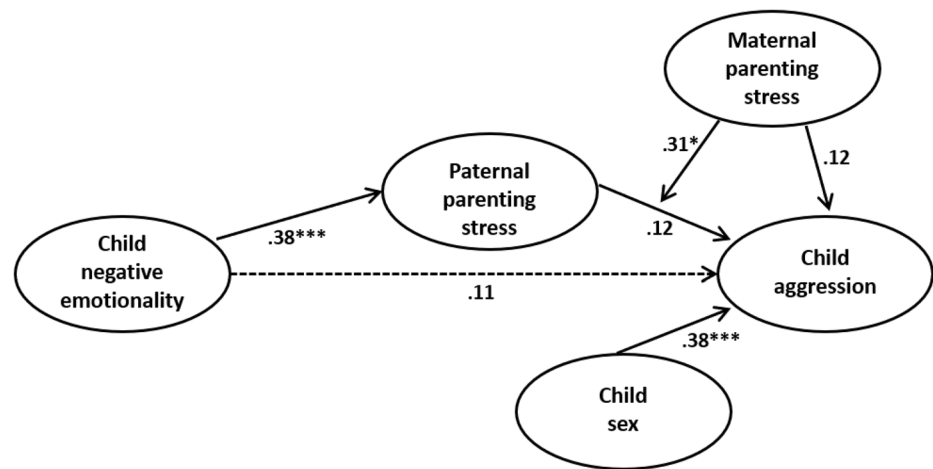
paternal ( $r = 0.08, p = 0.781$ ) or maternal parenting stress ( $r = 0.13, p = 0.061$ ). Lastly, maternal and paternal parenting stress were significantly correlated ( $r = 0.50, p < 0.001$ ).

### Main Analyses

Given the relatively modest sample size and the related need to preserve degrees of freedom, we first conducted exploratory regression analyses to determine which parsimonious model would be tested. In line with the bivariate correlations, a series of OLS regressions revealed that controlling for child sex, negative emotionality had a significant direct association with aggression,  $\beta = 0.23, p = 0.023$ , and with paternal,  $\beta = 0.42, p < 0.001$ , although not maternal stress,  $\beta = 0.11, p = 0.224$ . These analyses also revealed that while controlling for child sex and negative emotionality, there was a significant interaction between maternal and paternal stress in predicting child aggression,  $\beta = 0.30, p = 0.039$ . Overall, these analyses indicated that paternal though not maternal stress could mediate the association between child negative emotionality and subsequent aggression, and that this mediating effect could be moderated by maternal stress. Consequently, we tested a model according to which the association between child negative emotionality and aggression would be mediated by fathers’ parenting stress, however only at certain levels of mothers’ parenting stress. Child sex was covaried in this model given its links to child aggression and maternal parenting stress.

Figure 1 displays the results of this model. Negative emotionality was no longer directly associated with aggression after accounting for parenting stress,  $\beta = 0.19, p = 0.148$ . Together with the significant relation between negative emotionality and paternal stress ( $\beta = 0.38, p < 0.001$ ), this suggests that the initially significant association between negative emotionality and aggression was mediated by paternal stress. However, the lack of a significant association between paternal stress and child aggression, combined with the significant interaction between maternal and paternal stress,  $\beta = 0.26, p = 0.030$ , revealed that paternal stress mediated the association between negative emotionality and aggression but only at certain levels of maternal stress. This was

**Fig. 1** Final model linking child negative emotionality to later aggression through paternal and maternal parenting stress



\*  $p < .05$ . \*\*\*  $p < .001$ .

confirmed by the significant index of moderated mediation,  $\beta = 0.16$ , 95% CI: 0.03 – 0.33.

Therefore, we probed the conditional indirect effect of negative emotionality on aggression through paternal stress at 10th, 25th, 50th, 75th, and 90th percentiles of maternal stress. These analyses revealed that the indirect effects of child negative emotionality on aggression through paternal stress was significant only above the 75<sup>th</sup> percentile of maternal stress,  $\beta = 0.17$ , 95% CI: 0.02 – 0.37. In other words, there was a significant indirect effect of negative emotionality on aggression through paternal stress only when maternal stress was also high.

## Discussion

It has been argued that early individual differences in negative emotionality foster suboptimal transactions with the environment that increase risk for the development of aggression in children (Lahey et al., 2008). Because parents and children shape each other during development, parental stress has been proposed to play a central role in these transactions, such that child difficult temperament would induce parenting stress which, in turn, would promote child aggression (Coplan et al., 2003). The current study tested a longitudinal model consistent with such a process. Aiming to more closely approximate children's real experiences in their family (Martin et al., 2007), we considered both maternal and paternal stress. The results revealed a moderated mediated pathway, such that there was a significant indirect effect of child negative emotionality on aggression through paternal stress, however only when maternal stress was also high (above the 75th percentile).

Although causality cannot be inferred based on this non-experimental design, the pattern of results observed is

consistent with a developmental psychopathology process by which negative emotionality in infancy increases the risk for aggression in school because it causes stress to fathers, which in turn increases aggression in children, though only when mothers also experience high parenting stress. Ryan et al. (2006) highlighted that examining whether associations between one parent's influence and child functioning vary according to the other parent's influence may allow for the identification of effects that are unidentifiable in studies of main effects. This was the case here: analyses considering only maternal or only paternal stress, or their additive effects, would have yielded inconclusive results: neither was significantly associated with child aggression and therefore, neither could have mediated the pathway linking negative emotionality to subsequent aggression. However, by considering interactive effects, we were able to identify a family-level dynamic by which fathers felt more parenting stress when their child showed high negative affect (according to both parental reports) and that *if* their spouse also felt high parenting stress, then this combination predicted later child aggression.

There is a vast literature examining parents' joint contributions to child adjustment, which often addresses the links between parental and child psychopathology. Although most studies examine the independent roles of both parents, an interactive approach has long been advocated (Goodman & Gotlib, 1999). The underlying hypothesis is that the disadvantage conferred by living with one struggling parent could be diminished, even offset, by a second parent who is well adjusted or conversely, be exacerbated if the second parent also struggles psychologically. In line with this, Feldman et al. (2020) reported a phenomenon similar to that observed here: they found that paternal depression was not associated with child externalizing behavior overall but did predict child externalizing when maternal depression was relatively high

as well. This moderation effect, however, was found with parental reports of child externalizing and did not replicate with teacher reports. The current results add significantly to these by suggesting that maternal parenting stress multiplies the association between paternal stress at preschool age and child aggression in school and that this can be observed with teacher reports of aggression (thus, is not attributable to shared method variance). Importantly, our findings further suggest that this multiplicative effect accounts for the longitudinal associations between infant negative emotionality and child aggression almost six years later.

There are different ways in which the combination of paternal and maternal parenting stress could increase the risk for aggression in children experiencing high negative emotionality. Certainly, stressed parents could struggle to display the kind of nurturing but firm parenting (consistent and adequate behavioral limit-setting coupled with warmth) that can help emotionally reactive children regulate their affect and behavior, thus protecting them against the development of aggression. Tsotsi et al. (2019) further argue that these parenting deficiencies may be particularly manifest in challenging situations when parents perceive their children as especially demanding or have to discipline them. These arguments appear relevant to our results given that children high on negative emotionality are likely to trigger such situations more often than others. In other words, child negative emotionality could create caregiving situations that are especially difficult for stressed parents to handle. In doing so, negative emotionality may interfere with parents' capacity to display the very kind of parenting that highly emotional children need for their negative emotionality not to turn into aggression. Certainly, the risk will be potentiated if both parents face the same caregiving struggles as a result of experiencing high parenting stress, as this will create an especially poor fit between the child's temperament and his or her social environment.

Other pathways are plausible, however. A highly stressed parent may expose the child to a range of suboptimal behaviors such as irritability with spouse or siblings, rough handling of household objects, negative conversational content, and others. Even when such behaviors are not directed at the child, they can be witnessed and may heighten children's own stress response, which can eventually be translated into behavior problems (Crnic et al., 2005). These parental behaviors can also hamper marital harmony and family cohesion, thereby creating a suboptimal family environment unlikely to help emotionally reactive children learn to regulate their affect and behavior. In addition, parents displaying such stress-related behavior constitute negative models for their children, who can learn to imitate such behavior through social learning (Patterson et al., 1984). Importantly, the current results suggest that these mechanisms are more potent when both parents experience high parenting stress.

This increased risk is conceivably due to the lack of a caregiver who, due to better adjustment to the parenting role, could either diminish his or her spouse's stress-related reactions or mitigate their consequences by providing the child with more optimal experiences. Mothers experiencing high parenting stress themselves may, instead, be less involved in child care and less supportive of their spouse, allowing for a stronger influence of fathers' parenting stress on the child, as suggested by our results.

Non environmentally mediated mechanisms could also be at play, instead of or (more likely) in addition to environmental processes. If both parents possess a genetic vulnerability to excessive physiological or psychological arousal, they may be at risk of experiencing high parenting stress and thus creating a suboptimal family environment, *while also* transmitting to their child a double genetic vulnerability to heightened arousal (Krahé et al., 2015). This vulnerability, in turn, could be implicated in child negative emotionality and aggression (Vitaro et al., 2006). Hence, genetic risk in the two parents could place children at dual risk genetically as well as environmentally, thereby creating a set of conditions particularly conducive to the development of aggression and other forms of child maladjustment.

Given that the links between parenting stress and child externalizing are greater when there is a degree of shared method variance (Stone et al., 2016), it is not unexpected that neither parent's stress directly predicted aggression in this study, where child aggression was reported by teachers four years after the assessment of parenting stress. Only stress in both parents led to a significant prediction. In fact, one may reasonably assume that any mechanism linking parenting stress to child aggression has a more potent influence when both parents experience stress in their parenting role. Therefore, in line with studies that suggest that parenting interventions with both parents have stronger effects than those targeting only one parent (Lundahl et al., 2008), we submit that interventions aiming to reduce stress among parents of children showing behavioral difficulty (e.g., Kazdin & Whitley, 2003) should include both parents (Besnard et al., 2013).

Explanations for why infant negative emotionality was linked to increased parenting stress in fathers but not mothers are speculative at this point. A methodological account appears unlikely, given that the index of infant negative emotionality was a composite of mothers' and fathers' reports and in fact, paternal parenting stress was equally related to negative emotionality when the latter was reported by mothers only. The specificity of the links to paternal stress can therefore reasonably be assumed to reflect a true phenomenon.

One possibility for the specific links observed here may be that because women more readily seek social support than men (Nolen-Hoeksema, 2012; Tamres et al., 2002), mothers

may be more inclined to reach out for support when they perceive their child to be difficult. In turn, support in the context of child difficulty is a known buffer against parenting stress (Boyd, 2002). A different hypothesis is that if most mothers in the sample were primary caregivers (information that was unfortunately not gathered), they may have been more confident in their parenting skills, due to enhanced practice (Meunier & Roskam, 2009). Thus, while generally agreeing with their spouse on their child's objective level of negative emotionality (as indicated by the moderate concordance between maternal and paternal reports;  $r=0.49$ ,  $p<0.001$ ), mothers may have been less subjectively affected by it due to greater confidence in their ability to handle a fussy or irritable infant. Along similar lines, more time spent with the child should bring about more opportunities not only to practice parenting skills in challenging situations but also to have positive, enjoyable interactions with the child. These interactions can provide a context in which to interpret child negative emotional manifestations when they arise and offer primary caregivers a more balanced view of their child's characteristics, including challenging and rewarding aspects. Such a nuanced understanding of the child's positive and negative attributes can be expected to protect mothers against the development of strong parenting stress despite an acknowledgement of the child's demanding aspects. These accounts are, however, speculative, as available information does not allow for teasing apart parental gender and primary/secondary caregiver status. As fathers are becoming increasingly involved in child care (Parke, 2020), one can no longer take for granted that mothers are primary caregivers and future studies should systematically ask about primary and secondary caregiver status with biparental couples.

In addition to this lack of information on care arrangements, this study presents other limitations that limit the scope of its conclusions. First, the temperament measure that was used is based on a conception of temperament that has since been revised and the dominant model of temperament is now that proposed by Rothbart and colleagues (e.g., Putnam et al., 2006). However, despite the ongoing debate about the conceptualization and measurement of temperament, the notion of negative emotionality is agreed upon (Paulussen-Hoogeboom et al., 2007) and therefore, all models of temperament include a dimension that corresponds to that assessed here, albeit labelled differently. As mentioned earlier, studies have often successfully used Bates et al.'s (1979) difficultness scale as an indicator of negative emotionality to predict child externalizing behavior (e.g., Gallitto, 2015; Lipscomb et al., 2012; Shaw et al., 2001; Vitaro et al., 2006). We also assessed infant temperament using parental reports. As highlighted by Schoppe-Sullivan et al. (2007), there are at least two sources of variation in parental reports of child temperament: the child's dispositions and the

parent's appraisal of these dispositions. There is, indeed, indication that parental appraisals of child temperament converge to a degree with objective assessments (Pauli-Pott et al., 2003; Penela et al., 2015). In the current study, the fact that temperament was indexed by a composite of both parents' reports further suggests that at least a portion of what was assessed probably reflects infants' objective dispositions. Though, the paternal and maternal reports of negative emotionality that we averaged to obtain the index used in analyses were only moderately correlated ( $r=0.49$ ). Therefore, although the use of this index reduced mono-informant concerns, a substantial portion of each parent's perception of the child's temperament was excluded. Future studies with larger samples should test and compare alternative models based on different operationalizations of child temperament such as objective biological markers, common variance across maternal and paternal reports, and variance unique to mothers' and fathers' perceptions. Some of these models might suggest, for example, a mediating role of maternal stress moderated by paternal stress.

A different issue is that this study was not genetically informative, and approximately 40% of the variance in teacher-reported aggression at school entry is heritable (Brendgen et al., 2006). Therefore, although we cannot assess the relative weight of the genetic and environmental explanations put forward earlier, both types of influences are likely to be at play. In addition, the design was longitudinal but not cross-lagged; accordingly, directionality is suggested but not demonstrated and causality cannot be inferred. Superior designs would involve the assessment of temperament, stress, and aggression at several time points each in order to account for autoregressive effects. Furthermore, we studied a non-clinical sample of middle-class families, with also an over-representation of White parents compared to the local general population. Mean levels of negative emotionality, parenting stress, and child aggression were relatively low – more diverse or clinical samples would likely yield more variation and larger effect sizes. Indeed, the obtained path estimates were relatively modest in size, suggesting that the model examined here is only one of many that can account for the display of aggressive behavior by young children when they enter school. Lastly, we did not assess the regulatory component of temperament and therefore could not test temperament by temperament interactions involving the reactive and regulatory systems of temperament. Because well-developed regulation skills can protect highly negative children from deleterious behavioral consequences (Diaz et al., 2017), it is conceivable that highly negative infants who nonetheless present adequate self-regulatory capacity cause less stress to their parents.



## Conclusions

Research shows that maladaptive child and parental behavior have mutually escalating effects (Krahé et al., 2015; Mackler et al., 2015; Neece et al., 2012; Stone et al., 2016). This study suggests that these effects start early, as their roots can be traced back in infancy in the form of child negative emotionality. Importantly, prior studies have almost exclusively relied on parental reports of child behavior problems. The current results are the first to our knowledge to suggest that with time, the deleterious effects of infant negative emotionality and parenting stress have consequences that are not confined to the parent–child relationship and instead, cascade into behavioral implications observed by teachers years later.

It has been at least twenty years since researchers began highlighting that fathers were neglected in studies linking parental stress to child externalizing behavior (Morgan et al., 2002) but recent studies continue to note the lack of father data as a frequent limitation of this literature (e.g., Dollberg & Keren, 2020; Tsotsi et al., 2019). In the current study, the assessment of both parents' stress and the consideration of their interactive effects allowed for the observation that each parent's stress may play a different role in the mechanisms that set the stage for child aggression. The results suggested that negative emotionality in infancy does not always cause stress to mothers and that mothers' parenting stress may not directly increase aggression in children – however, mothers' parenting stress does contribute to the process, as paternal stress appears to play a mediating role between child negative emotionality and aggression only when it is accompanied by high stress in the mother. Thus, while fathers' parenting stress was found to play an especially pivotal role in the parent–child transactions allowing for negative emotionality to unfold into aggressive behavior, the results suggested that high levels of stress in mothers could magnify this risk. While reiterating the suggestion that interventions aiming to reduce stress among parents of behaviorally difficult children should strive to include both parents, such potentiation of risk is a reminder that elucidating the developmental pathways to child maladjustment requires consideration of family-wide processes.

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**Data availability** N/A.

**Code availability** N/A.

## Compliance with Ethical Standards

**Ethical Approval** This study's procedures were approved by the research ethics committee, Faculty of Arts and Sciences, University of Montreal.

**Consent for Participate** All parents provided written consent to participate in this study.

**Consent to Publication** N/A.

**Conflicts of Interest** None to declare.

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