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Does Temperament Moderate the Relation between Preschool Parenting and School-Age Self-Regulation? Contrasting Diathesis-Stress and Differential Susceptibility Models

Orlanda Cruz , Isabel Abreu-Lima , Catarina Canário , and Margaret Burchinal 

SYNOPSIS

Objective. Children vary in how sensitive they are to environmental influences. Child temperament is an individual difference factor that appears to moderate the impact of environment on early child development. This study contrasts the “diathesis-stress/dual risk” and “differential susceptibility” models in examining difficult temperament as a moderator of the relation between preschool parenting and school-aged child persistence. **Design.** A longitudinal design included 61 typically developing Portuguese children (31 girls) assessed when they were toddlers (Time 1 at 1–3 years), preschoolers (Time 2 at 4–6 years), and school aged (Time 3 at 8–10 years). At Time 1, parents were recruited and interviewed. At Time 2, semi-structured mother-child interactions were observed, and preschool teachers rated children’s temperament. At Time 3, children’s task persistence was rated by their elementary teachers. **Results.** Difficult temperament moderated the association between mother-child interactions and child persistence, with stronger associations for children with more difficult temperaments. **Conclusions.** Consistent with the diathesis-stress model, results reveal that high levels of positive parenting reduce the risk of low self-regulation associated with difficult temperament.

INTRODUCTION

The idea that children respond differently to the same rearing environments is quite consistent in the literature (Pluess, 2015). Children differ in the extent to which parental socialization practices relate to the development of children’s cognitive and social skills, with child temperament being one of the most frequently identified moderators (Slagt, Dubas, Deković, & van Aken, 2016). The moderating role of temperament has led to questions about whether to characterize moderation in terms of differential susceptibility or dual risk models and whether these models can be useful in describing the development of self-regulation skills. Studies of the moderating effect of child temperament in the association between parenting and child development and adjustment have focused on a variety of child outcomes such as social competence, behavior problems, school achievement, and socio-cognitive functioning but have not been extended to include self-regulation during school

years. Consequently, the present study analyzes interactions between child temperament and sensitive and stimulating parenting in the prediction of children's task persistence in primary school and examines the pattern of these interactions vis-à-vis the diathesis-stress and differential susceptibility models.

Focusing on sensitivity to stressful and supportive environments, two models have been advanced to account for differences in children's sensitivity to parenting. Both models stress that (1) children with temperamental characteristics usually associated with difficult temperament (e.g., negative emotionality, impulsivity) are more vulnerable and more likely to be affected by the environment than children without those attributes and (2) for children without those characteristics (e.g., low-risk), parenting is less strongly related to child outcomes. The difference between the two models involves child outcomes for the high-risk individuals who experience the most positive environments (Roisman et al., 2012). The differential susceptibility model postulates that high-risk individuals will have the most optimal outcomes, even better than those of low risk with the most positive environments (Belsky, 2005; Belsky & Pluess, 2009, 2013; Meany, 2010; Pluess & Belsky, 2010). The diathesis-stress model postulates that high-risk individuals who experience the most positive environments will have similar outcomes as the low-risk ones who also experience the most positive environments (Monroe & Simons, 1991). In other words, positive environments can narrow the gap associated with individual risk factors under the diathesis-stress model but produce better outcomes for high-risk than for low-risk individuals according to the differential susceptibility model. For example, Roisman and colleagues (2012) examined difficult temperament as an individual risk factor that moderates associations between school-age outcomes and early parental sensitivity using the NICHD Study of Early Child Care sample (NICHD Early Child Care Research Network, 2005). The results reveal evidence for the diathesis-stress model for parent ratings of social skills and direct assessments of academic skills and evidence for the differential susceptibility model for teacher ratings of social and academic skills. The difference between the two models in these analyses involved whether the high-risk children with the most positive parenting appeared to catch up (diathesis-stress model) or exceed the low-risk children with the most positive parenting (differential susceptibility model). To assess the difference between the two models, the interaction between the predictor variable and the moderator variable needs to be identified as an ordinal interaction, consistent with the diathesis-stress model, or a disordinal interaction, consistent with the differential susceptibility model (Widaman et al., 2012).

To date, research has supported both the diathesis-stress and the differential susceptibility models, depending, at least, on the dimensions of child temperament, the child outcome domain, the age of the child when temperament and parenting were assessed, as well as the methods used to collect parenting data (Kochanska, Boldt, Kim, Yoon, & Philibert, 2015; Rabinowitz, Drabick, Reynolds, Clark, & Olino, 2016; Rioux, Castellanos-Ryan, Parent, & Séguin, 2016; Slagt et al., 2016). For example, both difficult temperament and negative emotionality mark how children are shaped by parenting, although negative emotionality appears to be a less strong marker of differential susceptibility, especially when assessed after infancy (Slagt et al., 2016). Kochanska and colleagues (2015) found that, for children higher in the susceptibility marker (biobehavioral risk, a composite of a genetic marker and anger proneness observed in laboratory), the variations in positive parenting were associated with four outcome measures of children's acceptance of parental socialization. However, only for one of

these measures, the pattern of interactions according to the differential susceptibility model was found, the remaining being consistent with the diathesis-stress model. Additionally, differences in child sensitivity to negative and positive parenting depending on temperament characteristics were found regardless of the method used to assess parenting. Differences were stronger when parenting was assessed through direct observations (Slagt et al., 2016). In a review of 14 studies focusing on the prediction of externalizing behaviors and substance use at ages 12–18, Rioux and colleagues (2016) found that studies fitting the differential susceptibility model were those assessing temperament and family environment in childhood, whereas studies that supported the diathesis-stress model assessed these variables in adolescence.

Both cognitive and social outcomes were addressed in prior research as a function of earlier and later assessments of both temperament and parenting, but self-regulation has not been directly studied as an outcome. Self-regulation, a set of the abilities such as focusing and maintaining attention, regulating emotion and social behavior, and persisting on relevant tasks, has been implicated as a crucial developmental outcome that underlies both social and cognitive development (Blair & Raver, 2015). Children are expected to learn to regulate their behavior to acquire expected social skills, avoid behavior problems, and be able to learn from their environment to acquire cognitive and academic skills. So, the examination of self-regulation as an outcome is important when considering the role of individual risk factors, such as difficult temperament, moderating the impact of parenting. Children with difficult temperaments face greater challenges in learning to self-regulate and thus are likely to be even more responsive to either positive or negative parenting. Persistence is one of the most important dimensions of self-regulation because it is the ability of the child to engage and to follow-through activities that involve attention and effort, such as chores, academic work, and other problem-solving tasks (Martin, Ryan, & Brookes-Gunn, 2013). Child persistence is a key skill, inherent to social and academic adjustment. Children with high and stable persistence trajectories from 5 to 10 years of age are more likely to show low and stable levels of externalizing problems (Zhou et al., 2007). Being able to engage and persist in academic activities seems to be essential for children to acquire the knowledge and skills needed at school. Children's persistence appears as a significant predictor of early academic skills (Martin et al., 2013), school readiness (Blair & Raver, 2015; Mokrova, O'Brien, Calkins, Leerkes, & Marcovitch, 2013), and school success (Li, Onaga, Shen, & Chiou, 2009). Task persistence assessed at preschool age has been associated with obtaining a college degree (McClelland, Acock, Piccinin, Rhea, & Stallings, 2013).

Evidence shows that the development of task persistence is related to parent-child interactions. For instance, children whose mothers were more sensitive and stimulating during a free-play situation showed greater persistence to complete a series of cognitive tasks between ages 1 and 3 (Martin et al., 2013). Similarly, greater persistence to approach a difficult task at age 3 was shown by children whose mothers offered adequate and positive feedback and praised children's efforts and achievements during a challenging task at age 2 (Kelley, Brownell, & Campbell, 2000). Children whose mothers offered more emotional support during a problem-solving game showed greater persistence in challenging activities at age 3 (Mokrova, O'Brien, Calkins, Leerkes, & Marcovitch, 2012).

Children's age when the outcome measures and temperament characteristics are assessed seems to be relevant to research in light of the diathesis-stress and differential susceptibility models, although available data are scarce and allow no solid conclusions. Some authors argue that differential susceptibility could be more pronounced when

temperament is assessed during infancy. Two possible explanations can be drawn from the literature (Slagt et al., 2016). It could be that susceptible individuals remain susceptible throughout their lives but that negative emotionality no longer acts as a marker of vulnerability if measured after infancy. Taking into account the notion of sensitive period (Bornstein, 1989), another possible explanation is that high-risk individuals may be more susceptible to environmental factors at certain times of their life than in other periods. It appears that temperament might be a stronger risk factor under adverse environments during early or middle childhood than during adolescence (Rioux et al., 2016).

Concerns about selection bias are growing in developmental science studies. It is very likely that parents who provide more positive parenting also provide many other positive environmental supports and even shared genes that could account for observed associations between parenting and child outcomes. Studies of early child care are required to address such potential selection bias issues by including baseline characteristics of the family and parents as covariates (Burchinal, Magnuson, Powell, & Hong, 2015). It is likely that studies regarding these important epigenetic issues would also benefit from careful attention to potential selection bias.

Finally, issues of informant bias may also be a problem in prior research. Much of the research on parenting has depended on both maternal ratings of child temperament and observations of mother-child interactions (e.g., Pluess & Belsky, 2010; Roisman et al., 2012). It is likely that maternal personality characteristics influence both sets of assessments and may introduce bias into analyses that use the mother as the source of both individual risk factors and quality of the environment.

This study addresses some of these concerns. The diathesis-stress and differential susceptibility models are contrasted in analyses of preschool teacher-rated temperament as a moderator of the association between preschool mother-child interactions and school-age teacher ratings of persistence. Different informants provide the measures of individual risk, environmental factors, and child outcomes. Self-regulation is examined regarding the child's ability to engage and persist with school-related tasks. By directly examining self-regulation, this study provides an important link between theories of early development of social and cognitive skills relative to both parenting and temperament. Finally, the study was conducted in Portugal, providing an opportunity to examine these important issues in a western country with a somewhat similar, but not identical, culture to the United States.

A longitudinal design was used in a sample of Portuguese typically developing children. We hypothesized that child temperament would significantly moderate the effects of maternal sensitivity and stimulation on child persistence. We predicted that children with difficult temperament would be more sensitive to variations in parenting than children with easy temperament, although no specific expectations regarding the form of the interactions (diathesis-stress versus differential susceptibility) were formulated.

METHOD

Participants

Participants were drawn from a larger longitudinal investigation on family and non-family predictors of child engagement, which included three time points of data collection: toddlerhood (1-3 years old), preschool (4-6 years old), and school age (8-10 years

old). At Time 1, a two-step recruitment process was implemented. In the first step, 15 child care centers with separate classrooms for 1-year-olds and 2-year-olds were randomly selected from the list of child care centers in the Metropolitan Area of Porto, Portugal, available from the Office of Social Security. In the second step, two boys and two girls were randomly selected in each classroom. From these classrooms, 120 infants and their families were recruited.

This study included the 61 typically developing children (30 boys and 31 girls) who had complete longitudinal data on the variables under consideration across the three time points. Comparisons of the 61 children included in this study and the 59 children whose data were incomplete indicated two differences. The mothers of the included children were significantly older ($M = 32.13$ years versus $M = 29.64$ years, $p < .05$) and better educated ($M = 11.66$ years of schooling versus $M = 9.98$ years of schooling, $p < .05$).

In Time 1, children's age ranged from 15 to 40 months ($M = 26.61$ months, $SD = 6.44$). Time 2 took place 3 years later when children were in preschool and their ages ranged between 54 and 79 months ($M = 68.11$ months, $SD = 5.70$). Time 3 occurred 4 years after Time 2 when children attended elementary school (Portuguese children enter elementary school at 6 years) and their ages ranged from 113 to 136 months ($M = 120.00$ months, $SD = 4.28$). Mothers' age at Time 1 ranged from 20 to 42 years ($M = 32.13$ years, $SD = 4.02$) and their years of schooling ranged from 3 to 18 ($M = 11.66$ years, $SD = 4.32$). Although compulsory schooling in Portugal is currently of 12 years, corresponding to the end of high school, by the time this study initiated, compulsory schooling was only of 9 years.

Procedure

Home visits were conducted during Time 1 and Time 2 to collect information regarding family demographic characteristics, home environment quality, and child development. At Time 2, observations of the mother-child interactions were recorded on three different days, and children's temperament was rated by the preschool teachers. Finally, children's task persistence was rated by the 53 participating elementary teachers at Time 3, the majority of whom completed data regarding only one child; six completed data regarding two children, and one completed data regarding three children.

Measures

Mother-child interactions. Mothers' sensitivity and stimulation behaviors were observed in a dyadic play standardized situation. At Time 2, mothers were invited to come to preschool on three different days. They were asked to play with their child in a quiet room, in the same way they would at home. A box with a set of age-appropriate toys was provided, and mothers were instructed to explore all the toys available. After 10 min of play, the observer requested that mothers ask the child to put the toys back into the box. The session finished 5 min after this instruction was given. The three 15-min sessions were videotaped.

The Teaching Styles Rating Scale (TSRS; McWilliam, Scarborough, Bagby, & Sweeney, 1998) was used to rate mother-child interactions. The TSRS is an observational measure that includes 18 items, including ratings of the extent to which the mother was responsive to child interests and emotions, elaborated on child behaviors,

was directive, and showed positive affect toward the child. Items were either rated on a 7-point scale with four anchors (1 = *never*, 3 = *occasionally*, 5 = *often*, and 7 = *most of the time*) or on a 5-point scale with three item-specific anchors (for instance, for item Positive Expression, the anchors were 1 = *looks blank when communicating*, 3 = *communicates with little affect or expressiveness*, and 5 = *very frequently smiles and uses pleasing voice inflection when communicating*). After watching each 15-min session, a trained research assistant rated all items. In 25% of the observation sessions, two raters were used. Percent agreement, within one scale point, ranged from 92% to 100% ($M = 98.10\%$), and weighted kappa ranged from .62 to .84 ($M = .74$). Disagreements were solved by a senior researcher.

The 5-point scale items were converted into a 7-point scale by prorating. Data for the three observation sessions were averaged, the mean rating per item being computed for each mother. A principal component analysis with Varimax rotation yielded two factors with eigenvalues over 1, namely sensitivity ($\alpha = .90$) and stimulation ($\alpha = .75$) (Cruz, Aguiar, & Barros, 2004). Composite scores for each factor were computed for each mother by averaging the respective items. As these scores were highly correlated ($r = .64$), they were combined into a single score of Sensitive-Stimulating Parenting ($\alpha = .85$). A previous study revealed that higher scores on this scale were positively correlated with children's engagement in day care interactions and negatively associated with non-engagement behaviors (Cruz & Aguiar, 2009).

Child temperament. Preschool teachers rated children's temperament at Time 2 using the Child Personality Scale (CPS, Dibble & Cohen, 1974). This measure was highly correlated with parents' report about child behavior (Dibble & Cohen, 1974). The CPS was translated into Portuguese and found reliable by Pinto, Cruz, and Bairrão (2004) and by Cruz and Pinto (2006). The CPS contains 48 items that are rated on a 7-point Likert scale, ranging from 0 (*never*) to 6 (*always*). The items assess children's attention, activity, sociability, adaptability, and emotional expression. An overall score of temperament was created by averaging the 48 items (after reflecting appropriate items) with higher scores indicating easier temperament ($\alpha = .90$) and lower scores indicating difficult temperament ($\alpha = .90$). Children with difficult temperament, as opposed to easy temperament, tended to be less attentive, more active, more fearful and socially withdrawn, less compliant in routine activities, and less positive in emotional expression.

Child persistence. Elementary teachers rated child persistence using the Persistence Subscale of the School Age Temperament Inventory (SATI, McClowry, 1995) at Time 3. This subscale evaluates the capacity of a child to fulfill tasks and responsibilities (McClowry, 1995), such as willingness to do household chores, homework, assume responsibilities, complete assignments, follow-through projects, and resist frustration. This measure has been shown to be moderately and positively associated with academic performance, regardless of gender, and to be moderately and negatively associated with disruptive classroom behavior (Lyons-Thomas & McClowry, 2012). The SATI was translated into Portuguese and found reliable by Lima, Lemos, and Guerra (2010). The Persistence subscale is composed of 11 items assessed on a 5-point Likert scale (1 = *never* to 5 = *always*). An overall persistence score was created by averaging the 11 items ($\alpha = .96$). Higher scores indicate higher task persistence.

Covariates

Home environment quality. The Infant-Toddler version of the HOME Inventory (IT-HOME; Caldwell & Bradley, 2003) was used to measure the quality of family environment at Time 1. The HOME Inventory is a widely used instrument for describing the quality and quantity of stimulation and support available to a child in the home environment (Totsika & Sylva, 2004). It was translated into Portuguese, and previous studies reported an internal consistency of .90 for the global score, as well as strong correlations with maternal education ($r = .62$) and modest associations with children's developmental quotient ($r = .43$) (Cruz, Abreu-Lima, Barros, Costa, & Pacheco, 2011). Two trained research assistants visited family homes and conducted semi-structured interviews. In all cases, the child was present and awake. The 45 items of the IT-HOME are recorded on a dichotomous scale (0 = *absent*; 1 = *present*). The total score represents the sum of all items ($\alpha = .85$).

Family demographic characteristics. At Time 1, mothers were asked to report their age and years of schooling.

Child developmental quotient. The Portuguese adaptation of the Griffiths Mental Developmental Scales (Griffiths, 1984, 1996) was administered to children at Time 1 to obtain a global score of child development. This instrument covers birth to 8 years of age and provides scores on six subscales: locomotor, personal-social, language, eye and hand coordination, performance, and practical reasoning, this last subscale being used only for children older than 2. Items on the subscales are recorded on a dichotomous scale (success or failure) according to instructions presented in the Manual. Raw scores are computed for each subscale, by adding succeeded items, and converted into a developmental quotient by adjusting for children's chronological age. A global developmental quotient is calculated by averaging all subscale developmental quotients ($\alpha = .83$). The Griffiths scales were individually administered to all children in quiet rooms at the daycare centers, by two trained research assistants. The Portuguese version used in this study has been used in previous research (e.g., Pinto, Pessanha, & Aguiar, 2013).

Plan of Analysis

Pearson bivariate correlations were calculated to examine relations between the study variables. To assess the interaction effect between mother-child interactions and child temperament in the prediction of child persistence, and the interaction as disordinal or ordinal, according to the differential susceptibility or the diathesis-stress models, the methodology developed by Widaman et al. (2012) was followed. First, a standard parameterization regression equation was performed to assess mother-child interactions (predictor variable), child's temperament (moderator), and their interaction predicting child persistence, in a model considering home environment quality, mothers' age and education, and child developmental quotient as covariates. Variables included in the standard parameterizations regression equation were mean-centered. The interaction term was probed by examining conditional effects at low (1 *SD* below the mean) and high (1 *SD* above the mean) levels of the moderator (Aiken & West, 1991).

Second, to further probe the interaction term, the regression model was re-parametrized centering the predictor variable at the crossover point, using the nonlinear regression function. Data were then provided regarding the crossover point and its standard error, which is relevant to calculate an interval estimate of the crossover point and enables a better evaluation of the interaction (Widaman et al., 2012). Results were interpreted considering that an ordinal interaction (diathesis-stress model) has the crossover of predicted values at the boundary or outside the range of observed values on the predictor variable in the study, whereas a disordinal interaction (differential susceptibility model) has the crossover of predicted values within the observed range of values on the predictor variable.

RESULTS

Preliminary Analyses

Means, standard deviations, and ranges for all variables are reported in Table 1. Table 2 presents correlation coefficients among covariates, mother-child interactions, child's temperament, and child's persistence. Home environment, mother-child interactions, and children's temperament are moderately associated with task persistence. No association was found between mother-child interactions and children's temperament.

Standard Parametrizations Equation

After entering all predictors, the final equation revealed mother-child interactions and children's temperament as significant predictors of child persistence. Furthermore, it revealed a significant interaction between mother-child interactions and children's

TABLE 1
Descriptive Statistics for All Variables for Participants and Excluded Cases

	Cases with complete data (<i>n</i> = 61)		Cases not included (<i>n</i> = 59)
	<i>M</i> (<i>SD</i>)	<i>Min-Max</i>	<i>M</i> (<i>SD</i>)
Time 1			
Home environment	36.84 (6.74)	19-45	33.53 (8.10)
Mothers' age	32.13 (4.02)	20-42	29.64 (6.08)
Mothers' education (years)	11.66 (4.32)	3-18	9.98 (4.50)
Child developmental quotient	105.45 (10.17)	84.21- 132.25	101.61 (9.23)
Time 2			
Mother-child interactions	5.14 (.44)	3.53-5.74	4.93 (.43) ¹
Child temperament	4.42 (.60)	2.35-5.63	4.21 (.55) ²
Time 3			
Child chronological age (months)	120.00 (4.28)	113-136	117.69 (2.69)
Child persistence	3.91 (.84)	1.64-5.00	3.90 (.95) ³

¹*n* = 20; ²*n* = 36; ³*n* = 15.

TABLE 2
Correlations between Predictors and Child Persistence ($N = 61$)

	1	2	3	4	5	6
1. Home environment	-					
2. Mothers' age	-.00	-				
3. Mothers' education	.55***	-.06	-			
4. Mother-child interactions	.35**	.25*	.15	-		
5. Child developmental quotient	.36**	-.05	.37**	.21	-	
6. Child temperament	.21	.03	.15	.13	.16	-
7. Child persistence	.28*	.05	.28*	.31*	.15	.42**

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

temperament in the prediction of child persistence (Table 3). Simple slopes analysis revealed that substantially higher levels of mother-child interactions were associated with higher levels of persistence for children with relatively difficult temperaments (-1 SD), $B = 1.22$, $t(53) = 3.29$, $p < .01$, but not for those who had relatively easy temperaments ($+1$ SD), $B = -.20$, $t(53) = -.42$, $p = .67$.

Re-Parametrized Equation

The estimate of the crossover point was .48, $SE = .22$, 95% confidence interval (CI) [.04, .91], falling more than 1 SD units above the M on mother-child interactions (Figure 1). The lower limit of the CI for the crossover point fell 0.1 SD units above the M on mother-child interactions, and the upper limit fell more than 2 SD units above the M on mother-child interactions. The CI covers values that go beyond the upper limit of the range of mother-child interactions [-1.61 , .60]. Thus, according to Widaman et al. (2012), both point and interval estimates of the crossover support a conclusion that the interaction is ordinal and therefore suggestive of the diathesis-stress model.

TABLE 3
Unstandardized Coefficients and Standard Errors of the Standard Parametrizations Equation

Parameter	Model 1	Model 2	Model 3
B_0 (intercept)	3.92 (.11)***	3.92 (.10)***	3.96 (.10)***
B_1 (home environment)	.02 (.02)	.01 (.02)	.001 (.02)
B_2 (mothers' age)	.01 (.03)	-.003 (.03)	-.02 (.03)
B_3 (mothers' education)	.04 (.03)	.04 (.03)	.04 (.03)
B_4 (child developmental quotient)	.002 (.01)	-.003 (.01)	-.002 (.01)
B_5 (mother-child interaction)	-	.45 (.25)	.51 (.24)*
B_6 (child temperament)	-	.50 (.17)**	.57 (.16)**
B_7 (interaction B_5*B_6)	-	-	-1.19 (.48)*
R^2	.11	.28	.35
Adjusted R^2	.04	.20	.27
F	1.68	3.45**	4.12**
ΔR^2	-	.17**	.08*

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

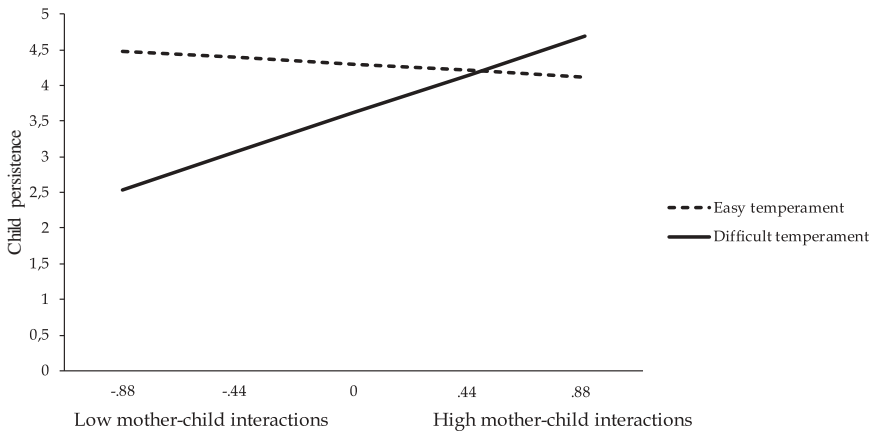


FIGURE 1

A visual representation of the interaction effect between mother-child interactions and child temperament predicting child persistence. Values in the x-axis refer to the predictor variable mean, 1 *SD*, and 2 *SD* above and below.

In summary, these findings suggest that children with the most difficult temperaments did not have higher levels of self-regulation than the children with the easiest temperaments even when they experienced the most positive parenting.

DISCUSSION

The study contrasted the diathesis-stress and differential susceptibility models in examining school-age self-regulation in terms of persistence in the classroom. Findings supported child temperament as a moderator of associations between preschool parenting, assessed through the quality of mother-child interactions, and school-age persistence. Results were consistent with the diathesis-stress model, revealing that the gap in persistence between children with easy and difficult temperaments was reduced when mothers provided more positive parenting. No evidence emerged suggesting that difficult temperament was related to better outcomes than easy temperament, even under the most positive parenting.

The pattern of the interactions between parenting and child temperament is more consistent with the diathesis-stress model than with the differential susceptibility model. Children with difficult temperaments, who had less positive parenting, had lower scores on task persistence according to their school teachers. When reared by mothers with more sensitive and stimulating parenting, those children's persistence was no worse (although not significantly better) than children with an easy temperament. These results extend the literature by demonstrating the vulnerability function of difficult temperament in associations between maternal parenting and child developmental outcomes such as social skills (e.g., Kochanska & Kim, 2013; Roisman et al., 2012) and academic skills (Roisman et al., 2012).

As recommended by Widaman and colleagues (2012), we relied on rigorous statistical procedures to differentiate between diathesis-stress and differential

susceptibility models. Furthermore, the analyses accounted, in part, for potential selection bias by including baseline characteristics of the child, mother, and family and by using different informants for the measures of individual risk, environment, and child outcomes.

How can we interpret the fact that these findings are consistent with the diathesis-stress model and not with the differential susceptibility model? Our interpretation is twofold. A first interpretation follows the suggestion of Kochanska, Kim, Barry, and Philibert (2011) and involves the socio-cognitive nature of the outcome measure. It is possible that, for children with the highest levels of persistence at school age, temperamental characteristics constrain, to a certain extent, the long-time effects of the quality of parenting during preschool age. When exposed to high-quality parenting, the persistence of children with difficult temperament was no better than their peers with easy temperament. Thus, high-quality parenting did not have the potential to significantly foster those children's persistence. To fit the differential susceptibility hypothesis, high-quality parenting would have to significantly foster the persistence of children with difficult temperament, over and above their peers with more easy temperament.

A second interpretation concerns the age of children when the predictor variables were assessed. Several researchers have argued for the idea that differential susceptibility would be more evident when temperament is assessed during infancy (Slagt et al., 2016). Although temperament is partly heritable, it is also shaped by experience over time. As children grow older, temperament reflects not only an innate and stable trait but also the effects of socialization. As such, it is possible that children with a difficult temperament in infancy are more likely to present less difficult temperament at older ages if they experience positive parenting because they learn to regulate negative reactions that are a consequence of their temperamental difficulty (Slagt et al., 2016). Additionally, a high score on difficult temperament assessed at later developmental stages is more likely to reveal an innate and stable trait, as children, for whatever reasons, over time, were not able to offset their temperamental characteristics. Thus, temperament assessed after infancy can be understood as a less accurate susceptibility marker (Slagt et al., 2016).

Age of assessment also matters in that malleability to contextual factors is higher during early years of life and decreases with age (Rabinowitz et al., 2016; Slagt et al., 2016). Therefore, preschool children may be less malleable to parenting when compared to infants, as they are less susceptible to environmental influences. Another issue regarding age also worth considering is that the younger the child, the more dependent the child is on parental support and stimulation to fulfill developmental needs. As children grow older, other extra familial contexts influence children's development and adjustment. In the case of persistence, the school context is especially relevant, as this competence is predictive of school achievement (Li et al., 2009).

In summary, this study contributes to the growing body of evidence on the interplay of individual vulnerability and environment in child development and adjustment, and shows that sensitive and stimulating parenting can buffer the risks conferred by a difficult temperament. Notwithstanding, the protective function of sensitive and stimulating parenting was not sufficient to empower children with a difficult temperament to exceed their less vulnerable peers in persistence.

This study has several strengths, including its longitudinal design, observed and reported measures, a reliable measure of mother-child interactions that was observed over three repeated sessions, and several informants for child behavior (preschool teachers

and school teachers). Having been conducted with Portuguese children, parents, and teachers, it adds cultural diversity to the literature on the diathesis-stress model.

However, some limitations deserve consideration. First and foremost, obvious constraints stem from the correlational nature of the study design, which prevents causal inference on any of the relations that were found. Second, the conclusions that were drawn are limited in scope because evidence supporting the diathesis-stress model is restricted to child persistence and to child temperament as a behavioral marker of vulnerability. Further research is needed to expand these findings to other outcome variables and other developmental domains such as teacher's report of children's social skills, found to be consistent with the differential susceptibility model in prior studies (Roisman et al., 2012). Similarly, studies focusing on specific temperamental dimensions rather than global measurements are also needed (Slagt et al., 2016). Additional limitations include the lack of generalizability of the results because this study was conducted on a Portuguese community sample and the educational level of mothers was higher than the average educational level for the Portuguese population (families from higher educational level were overrepresented). The group of children was typically developing, and mothers were mostly in the competent range as far as quality of parenting was concerned. The extent to which these findings generalize to more diverse groups that include the full range of environment and outcome variables should be examined in future studies.

IMPLICATIONS FOR PRACTICE

Our findings have direct implications for parenting interventions that align with other studies. Given that children with difficult temperaments are especially vulnerable to low-quality caregiving, parents of these children merit particular attention regarding support of positive parenting skills. Research using randomized controlled trials revealed that the effects of parenting interventions on children are not homogeneous across participants. Children with difficult temperaments seem to be more responsive to improvements in parenting because of their parents attending parenting programs (e.g., Scott & O'Connor, 2012).

Helping parents to promote their parenting skills, namely sensitivity and stimulation, seems to be particularly important for preschool-aged children in general. Globally, our results underscore the need to target parents of children with difficult temperaments in such interventions to modify their developmentally at-risk trajectories.

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