

Regular Article

Associations between early poverty exposure and adolescent well-being: The role of childhood negative emotionality

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Abstract

Using a longitudinal design (Wave 1 $n = 164$, $M_{\text{age}} = 3.57$ years, 54% female, predominantly White and French-speaking), the current study sought to answer two questions: 1) does poverty influence children's negative emotionality through heightened family-level, poverty-related stress? and 2) is negative emotionality, in turn, predictive of adolescent internalizing symptoms, externalizing behaviors, cognitive abilities, and physical health? Results confirmed an indirect pathway from family poverty to child emotionality through poverty-related stress. In addition, negative emotionality was associated with adolescent internalizing symptoms, attention difficulties, and physical health, but not externalizing symptoms, even when controlling for early poverty exposure.

Keywords: child development; emotionality; mental health; poverty; poverty-related stress

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The insidious effects of childhood poverty disrupt nearly every aspect of child development. The Adaptation to Poverty-related Stress Model posits that one of the key mechanisms through which poverty disrupts healthy development is a combination of heightened exposure to poverty-related stress and reliance on specific coping strategies to manage stressors that may contribute directly to symptomologies (Wadsworth, Raviv, Santiago, & Etter, 2011). However, a focus on coping strategy use requires that youth are able to reflect and report on the specific strategies that they invoke when managing emotions, limiting tests of this model to samples in late childhood and onward. A shift in focus towards negative emotionality as an index of early and observable behavioral manifestations of coping difficulties may allow for an extension of the Poverty-related Stress Model to younger children. The current study was designed to test whether there was an indirect association between poverty and negative emotionality through family-level poverty-related stress. We also examined the longitudinal associations between negative emotionality in early childhood and adolescent outcomes, including mental, behavioral, cognitive, and physical health outcomes. The objective of the current study was to answer two key questions: 1) does poverty influence children's early negative emotionality through exposure to heightened family-level, poverty-related stress? and 2) is negative emotionality, in turn, predictive of adolescent internalizing symptoms, externalizing behaviors, cognitive abilities, and physical health?

Strong and consistent evidence shows that exposure to poverty during childhood is negatively associated with numerous indices of wellbeing during adolescence and even adulthood. Children

who grow up in poverty tend to report higher levels of internalizing symptoms, such as anxiety, depression, and withdrawal during adolescence (Costello et al., 2010; Najman et al., 2010; Slopen et al., 2010; Wadsworth et al., 2008). They also present more externalizing behaviors in adolescence (Evans & Cassells, 2014) and emerging adulthood (Evans, 2016), including aggression, hyperactivity, and noncompliance (Loukas & Prelow, 2004; Slopen et al., 2010). Childhood poverty is also associated with deficits in cognitive abilities, such as attention difficulties (Counts et al., 2005) and lower levels of academic aptitude during adolescence (Najman et al., 2009), as well as lower levels of working memory ability in early adulthood (Evans & Schamberg, 2009). Finally, childhood poverty is predictive of adolescent and adult physical health outcomes, such as levels of allostatic load (Schulz et al., 2012), body mass index (Wells et al., 2010), and general physical health (Wen et al., 2003). It is imperative to note that the associations between childhood poverty and these outcome indices are often maintained regardless of whether individuals remain in poverty after they enter into adolescence or adulthood, signifying that childhood poverty may have disruptive impacts on the entire trajectory of an individual's development (e.g., Evans & De France, 2021; Najman et al., 2010).

The well-documented associations between childhood poverty and subsequent well-being are dissected within several theoretical frameworks that each propose specific mechanisms through which poverty status influences child development. Many of these models, including the Ecological Systems theory (Bronfenbrenner, 1992; Bronfenbrenner & Morris, 1998; Bronfenbrenner & Evans, 2000), the Family Stress Model (Conger, Ge, Elder, Lorenz, & Simons 1994), the Context of Stress model (McLoyd, 1990), and the Family Investment Model (Conger & Donnellan, 2007) center on the impacts of poverty on family-level variables, particularly increased parental stress, parental relationship quality, and overall parenting quality (Landers-Potts et al., 2015; Neppl, Senia, &

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Donnellan, 2016). Indeed, heightened exposure to stressors is endemic to life in poverty (Evans, 2004; Evans & Schamberg, 2009; McEwen & McEwen, 2017; Repetti, Taylor & Seeman, 2002), and exposure to heightened levels of poverty-related stress has been found to mediate the links between poverty status and various indices of development (Evans & De France, 2021).

Recently, however, new evidence has suggested that exposure to poverty-related stress may also impact child development through the child's inability to effectively cope with heightened levels of stress and stressors. Wadsworth and colleagues have expanded upon earlier theoretical frameworks of poverty and child development through the Adaptation to Poverty-related Stress Model (Wadsworth et al., 2011). In this model, Wadsworth and colleagues promote the previous claims that poverty directly impacts family-level stress, while also proposing that exposure to heightened levels of stressors associated with poverty overburdens a young person's regulatory capacities. In turn, youth are often unable to effectively cope with the stress they are experiencing and develop reliance on coping strategies that lead to mental health difficulties (Wadsworth et al., 2011; Wadsworth et al., 2013). Therefore, this model suggests that a youth's inability to cope with poverty-related stress may represent a more direct and causal link between poverty, stress, and youth wellbeing. Indeed, the efficacy of a child or adolescent's attempts to cope with the multitude of stressors endemic to life in poverty, as well as the specific strategies relied upon for coping, may function as key causal mechanisms within the association between poverty and child development (Evans & Kim, 2013; Wadsworth et al., 2011).

Empirical evidence provides strong support for the tenets of the Adaptation to Poverty-related Stress Model. For example, specific coping strategies, as well as general coping competence, represent indirect associations between poverty-related stress and mental health (Kim et al., 2016; Wadsworth et al., 2005) and behavior problems (Kim et al., 2016; Wadsworth et al., 2005) during adolescence. Nevertheless, it is difficult to identify exactly which strategies younger children employ during experiences of stress, and whether they are using them effectively. As young children demonstrate significantly lower levels of executive functioning and metacognition when compared to their older counterparts (Best et al., 2009; Huizinga & van der Molen, 2007; Leon-Carrion, Garcia-Orza, & Perez-Santamaria, 2004), their ability to reflect on stressful situations and accurately identify how they tend to cope with stressors may be unreliable. Even studies relying on observational methodologies or parent report of young children's coping strategies are limited as they do not have access to the various cognitive-based strategies that youth may employ, such as cognitive disengagement or reappraisal. As a result, it is difficult to extend this model to younger children. In other words, while young children may use a wide range of strategies to cope with stressors, their ability to report on which strategies they use, and how effective they perceive them to be, is likely quite limited. This limitation is important, as it prevents researchers from theoretically and empirically extending our understanding of the pathways through which poverty disrupts regulatory processes among younger children. Consistent with the main tenets of the Developmental Psychopathology model (Cicchetti, 2010), childhood poverty is not simply associated with group-level differences in health outcomes during adolescence or adulthood. Instead, poverty exposure sets children on a trajectory of mental and physical health development that is distinct from the trajectories of youth in higher income families (Evans & De France, 2021). Therefore, identifying early and observable manifestations of coping difficulties may allow

us to identify children that are most at risk for experiencing developmental disruptions as a result of their poverty exposure.

We, therefore, propose that elements of the Adaptation to Poverty-related Stress Model may be extended to younger samples by shifting focus from self-report indices of specific coping strategies or coping efficacy to early and observable manifestations of a more general failure to cope or difficulties coping. Specifically, we suggest that heightened negative emotionality, defined herein as high levels of emotional sensitivity, reactivity, and difficulty soothing during early childhood, may function as an early manifestation of difficulties coping with the stressors of family life in poverty. Second, we propose that high levels of negative emotionality represent a mechanism through which poverty and poverty-related stress influence subsequent levels of adolescent well-being. In Figure 1 we illustrate a conceptual model of these associations.

Although negative emotionality is often conceptualized as a trait, regulation and emotional reactivity/soothability are inherently intertwined and entangled from both a conceptual and empirical basis (Campos, Frankel, & Camras, 2004; Loughheed, Benson, Cole, & Ram, 2019). Indeed, regulation difficulties are often inferred or even defined by observable, behavioral indices (Beauchaine, 2015), such as emotional expression and interpersonal functioning (Gross & John, 2003). Moreover, emotional intensity, which is more likely to occur in children with high emotionality, is strongly associated with lower levels of regulatory success (Flett et al., 1996), suggesting that high emotionality is likely highly associated with lower levels of coping efficacy. Furthermore, many theorists believe that experiences, particularly interactions between children and their parents (Campos, Campos, & Barrett, 1989; Eisenberg, Cumberland, & Spinrad, 1998; Gottman et al., 1997; Kochanska, Murray, & Harlan, 2000) play a pivotal role in children's self-regulatory competencies. Indeed, levels and continuity of negative emotionality have been shown to be altered by exposure to maternal emotional responsiveness, relationship quality among parents, and maternal parenting quality (Belsky, Fish, & Isabella, 1991; Briscoe, Stack, Dickson, & Serbin, 2019). Moreover, burgeoning evidence suggests that exposure to poverty may influence a child's regulatory capacities: children who live in low-income households are more likely to demonstrate high levels of negative emotionality than children from more affluent homes (Ayoub et al., 2009; Brown & Ackerman, 2011; Hong et al., 2017; Melchior et al., 2012).

Including a focus on child negative emotionality adds considerable benefit to both the poverty and child development literatures as it encourages an assessment of whether early, and more observable, manifestations of coping difficulties function as an indirect pathway through which poverty-related stress influences subsequent child development. Following a review of the evidence linking temperament to subsequent psychopathology, Muris and Ollendick (2005) proposed that high emotionality may create significant vulnerabilities for the development of psychopathologies. Potentially due to heightened attentional biases toward threat (Helzer et al., 2009; Lengua et al., 1999; Lonigan & Vasey, 2009; Susa et al., 2014), children higher in negative emotionality are at disproportionately high risk of elevated levels of internalizing symptomologies (Eisenberg et al., 2005; Lengua, 2006; Letcher, Smart, Sanson, & Toumbourou, 2009), externalizing symptomologies (Eisenberg et al., 2009; Paulussen-Hoogbeem et al., 2007; Singh & Waldman, 2010), as well as difficulties with high order cognitive processing, such as the ability to focus and sustain attention (Healey et al., 2011; Martel, 2009; Martel & Nigg, 2006; Parker, Majeski, & Collin, 2004). Moreover, childhood emotionality is also

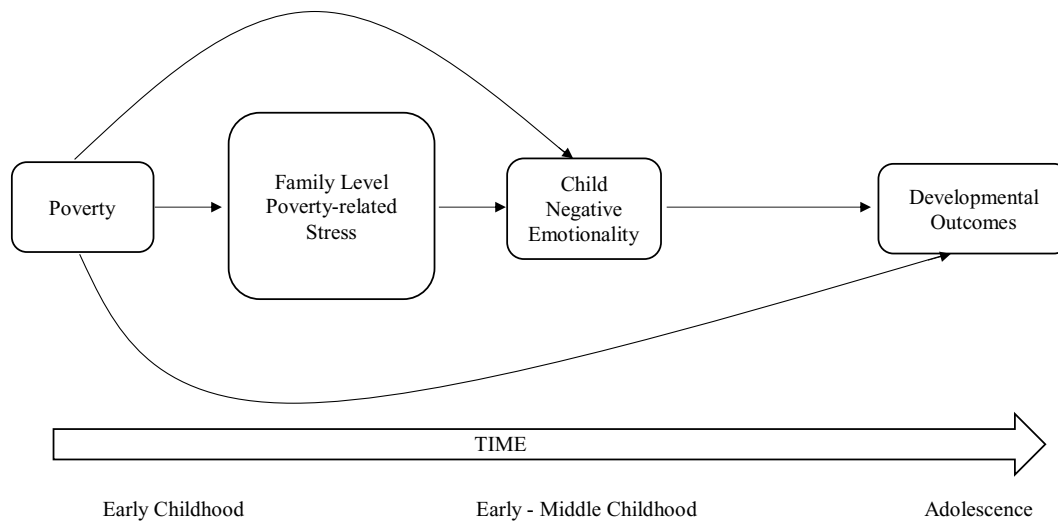


Figure 1. Conceptual model of the Adaptation to Poverty-related Stress Model to include negative emotionality during early to middle childhood as a mechanism through which poverty and poverty-related stressors influence developmental outcomes during adolescence.

strongly associated with physical health: negative emotionality is highly associated with weight gain (see Bergmeier et al., 2013 for a systematic review), and has been shown to be the most robust predictor of adult body-mass index (BMI), even when controlling for key variables related to BMI (Pulkki-Raback, Elovianio, Kivimaki, Raitakari, & Keltikangas-Jarvinen, 2005). Importantly, BMI is a well-established risk factor for mental and physical health problems in adolescents (Halfon et al., 2013) and adults (Larsson et al., 2002; Yan et al., 2004), and therefore links between early childhood negative emotionality and adolescent BMI could assist in elucidating paths between emotionality and additional health complications.

Finally, a focus on negative emotionality allows for a more neutral perspective towards specific emotion regulation or coping strategies. While it has been tempting to identify specific regulatory or coping strategies as “adaptive” or “maladaptive” (e.g., Aldao et al., 2010), these labels ignore the likelihood that the specific regulatory habits children develop are functional adaptations to their specific home environments (Wadsworth, 2015). Beyond labels of adaptiveness, the usefulness of specific strategies is largely dependent on the specific emotional situation within which it is used (De France & Hollenstein, 2021). When relying on one-time self-report surveys of coping or emotion regulation strategies, it is impossible to draw strong conclusions about whether a child or adolescent’s use of strategies was an appropriate response to specific situational demands or whether it was successful for them in the moment. Therefore, the focus on emotionality presents a detachment from *how* children and youth regulate, and in turn allows for a more direct assessment of *how well* they regulate.

The current study

The current study sought to examine whether family-level, poverty-related stress mediates the association between poverty exposure during early childhood and child negative emotionality. To this end, the current study made use of a large sample of families from lower income backgrounds that were assessed from the time their child was in early childhood until the child reached adolescence in a 3-wave longitudinal design. We included a wide range of adolescent outcomes, reflective of difficulties with mental health, behavior, cognitive development, and physical health. To develop an index of family-level stress associated with poverty during early childhood, we assessed three components of family functioning

that have shown strong associations with poverty in previous studies: parental distress, relationship quality between parents, and overall parenting quality (Jocson & McLoyd, 2015; Masarik & Conger, 2017; McLoyd, 1990; Stack, Serbin, Mantis, & Kingdon, 2015). These specific indices of family-level stress were chosen as they reflect overlapping but distinct aspects of stress in family and parent functioning that are both empirically and theoretically associated with the context of poverty.

Making use of the longitudinal nature of this data, the current study was designed to examine: 1) whether child negative emotionality was associated with poverty through family-level, poverty-related stress; and 2) if childhood negative emotionality was in turn predictive of adolescent internalizing symptoms, externalizing symptoms, attention difficulties, and physical health. Following the Adaptation to Poverty-related Stress Model, we hypothesized that poverty exposure during early childhood would be associated with higher levels of negative emotionality both directly and indirectly via family-level, poverty-related stress. In addition, we hypothesized that higher levels of negative emotionality in early childhood would in turn be associated with higher levels of internalizing symptoms, externalizing symptoms, and attention difficulties, as well as BMI in adolescence.

Methods

Participants

Participants were recruited from a large, ongoing, longitudinal study of Canadian families from disadvantaged backgrounds (Concordia Longitudinal Research Project; see Schwartzman et al. (1985) for original reporting on this sample; see also Stack et al., 2017). The original sample of participants were French-speaking students in Grades 1, 4, and 7 recruited from lower income neighborhoods in a large city in Canada in 1976–78. A subsample of 164 participants who had become parents and who had children aged 1–5 during the first phase of the current study were included in the present analyses. The children of these original participants are the focus of the current study.

At Wave 1, children ($n = 164$, 54% female) were between ages 1- and 5-years old ($M_{\text{age}} = 3.57$, $SD = 1.13$). At Wave 2 children were in early to mid-childhood (ages 6–9 years old; $n = 132$, $M_{\text{age}} = 7.02$ years, $SD = .99$), and at Wave 3 children were in early to mid-adolescence (ages 12–16; $n = 119$, $M_{\text{age}} = 13.07$ years,

SD = 1.20). Representative of the larger geographical area from which participants were recruited, participants were predominantly from White, French-speaking families. Families were largely lower income (35% report incomes below the poverty line, 73.3% report incomes within two times that of the poverty line). Parental informed consent was completed at all waves, and child informed assent was obtained at Waves 2 and 3.

Procedure

At each Wave, families were contacted by telephone to provide information about the study and invite them to participate. During these telephone calls, researchers also obtained demographic information (educational attainment, occupation, income, marital status, family structure). For Waves 1 and 2, parents completed survey packages and returned them via mail to the research laboratory. For Wave 3, collection of children's data was completed during a home visit. The procedures at each Wave of data collection were approved by the university's Human Research Ethics Committee.

Measures

Wave 1

Income to needs. Income to needs ratios were calculated as the ratio of the family's income to household needs. This ratio is an annually adjusted, per capita index of income based on the Canadian government's standardized Low Income Cut Off (LICO). Factors that influence an individual Income to Needs ratio are family income, family size, and density of the geographic location where the family lives. Compared to raw income levels, Income to Needs ratios are a more sensitive assessment of a family's income as it takes into account that smaller families living in more rural settings often do not have the same financial obligations as larger families living in more urban contexts. A family's income is compared to the LICO for a family of that size in a specific level of density, creating a ratio in which a value of 1.0 represents families with an income that is the same as the LICO, or poverty line. Higher income to needs values represent family incomes that are higher than the poverty line, such that a value of 2 represents a family income that is twice the value needed to meet the poverty line for that family, and so on. Income to needs values of 1.5 or even 2.0 are typically used as indicators of poverty given that families within these ranges often experience material hardships, such as food insecurity (Wight, Kaushal, Waldfogel, & Garfinkel, 2014). In the current sample, family income to needs values ranged from 0.35 to 5.27 (mean = 1.53, SD = 0.98). Just under 75% (73.3%) of our sample had an income to needs ratio lower than 2.0, and 35% of families had an income to needs value of 1.00 or lower. In sum, the large majority of families had incomes below the median for their geographic area and family size and were likely to experience some economic difficulties (with 35% falling below the minimum income necessary to provide basic needs). However, there was also considerable economic diversity as shown by the wide range of the income-to-needs scores within the sample.

Parenting. Parenting quality was assessed using The Parenting Scale (Arnold, O'Leary, Wolff, & Acker, 1993) at Wave 1. The Parenting Scale is a 30-item, self-report instrument designed to assess the extent to which parents demonstrated various discipline practices. Each item has two opposing statements, and participants are asked to indicate the point between the items that reflects how true the statements are for them. A sample item is "When I say my

child can't do something, I . . . a) Let my child do it anyways vs b) I stick to what I said". The score for overall Parenting was generated by summing across items, such that higher scores indicate greater levels of dysfunctional discipline practices. The internal consistency across items was strong (Cronbach's alpha = .72).

Parent relationship quality. The quality of the relationship between parents was assessed using the Dyadic Adjustment Scale (DAS; Spanier, 1976) at Wave 1. The DAS is a self-report survey comprised of 32 items assessing the degree of dyadic adjustment between the respondent and their spouse. Participants indicate how often they agree/disagree on a variety of topics on a 6-point Likert scale, ranging from 0 (always disagree) to 5 (always agree). The score for overall Parent Relationship Quality was generated by summing across all items and was reversed so that higher scores indicate higher levels of dyadic maladjustment. The internal consistency across items was strong (Cronbach's alpha = .91).

Maternal stress. The Parental Stress Index (PSI; short version, Abidin, 1995) was used at Wave 1 to assess the extent to which mothers felt various symptoms of stress related to parenting. The PSI is a self-report survey comprised of 36 items. Participants indicate how much they agree or disagree with the statements on a 5-point Likert scale, ranging from 1 to 5. A sample item is "I feel trapped by my responsibilities as a parent". The score for overall Maternal Stress was generated by summing across all items, such that higher scores indicate higher levels of perceived stress. The internal consistency across items was strong (Cronbach's alpha = .91).

Wave 2: Child's negative emotionality

Negative emotionality. Child's negative emotionality was measured at Wave 2 using the negative emotionality subscale of Buss and Plomin's Emotionality, Activity and Sociability Inventory (EAS-II, Buss & Plomin, 1984). The negative emotionality subscale consists of five items that ask mothers to report on their child's negative emotional reactivity. An example item is: "gets easily upset". Items are rated on a scale from 1, "not very typical of your child" to 5, "very typical of your child." Scores were calculated as the average across items, such that higher scores reflect more negative emotionality. Negative emotionality demonstrated strong internal consistency (Cronbach's alpha = .79).

Wave 3: Adolescent outcomes

Internalizing, externalizing, and attention difficulties. Internalizing and externalizing symptoms, as well as difficulties with attention, were assessed using subscales of the Youth Self report (YSR; Achenbach, 1991). The YSR is comprised of 94 items assessing behavioral adjustment. Each item reflects a possible symptom, and participants indicate how true the statements are for them on a 3-point Likert scale, ranging from 0 (not true) to 2 (very true/often true). Scores were calculated as the sum across items, such that higher scores reflect a greater level of symptomology within each domain. Internalizing scores reflect the composite of anxiety and depressive symptoms, while externalizing scores reflect a composite of aggression and rule breaking. The YSR subscores also align with "borderline clinical" and "clinical" ranges, indicating whether individual scores represent a borderline clinical or clinical level of symptomology. In the current sample, 9% of participants reported borderline clinical levels of Internalizing symptoms and 14% reported clinical levels. For Externalizing, 12% of participants reported borderline clinical symptom levels, while 11% reported

clinical levels. For Attention Difficulties, 5% of participants reported borderline clinical level scores, and 1% of participants reported clinical levels.

Internal consistency was strong for Internalizing ($\alpha = .85$) and Externalizing ($\alpha = .85$). However, the internal consistency for Attention Difficulties was low ($\alpha = .58$). An examination of the relation among specific items revealed that the internal consistency was higher when one item (Staring) was removed. The subscale was recalculated without this item, and internal consistency was acceptable ($\alpha = .64$).

BMI. During a home visit, children's height and weight were assessed. BMI was calculated as the weight in kilograms divided by the square of the height in meters. The commonly used threshold for severe obesity is a BMI ≥ 35 (Kelly et al., 2013). In the current study, 7.3% of participants had a BMI score within this elevated range.

Analytic plan

Prior to analyses, all study variables were checked for issues of distribution and missing data. No variables showed problematic levels of skewness or kurtosis. Moreover, Little's MCAR test revealed that data were missing completely at random, ($\chi^2 = 375.74$, $p = .60$) thus multiple imputation of missing data was included in the analyses (Little, 1988). Outliers were identified as any data point greater than 3.5 standard deviations from the variable mean and were winsorized to eliminate extreme values.

All analyses were run in MPlus (Muthen & Muthen, 1998-2018). All models were assessed for model fit by examining RMSEA ($\leq .05$), CFI ($\geq .95$), and SRMR ($\leq .05$) values. To test our first hypothesis, which centered on the indirect association between Income to Needs and Emotionality through Poverty-related Stress, we ran a factor analysis to construct a latent factor of family-level, poverty-related stress, henceforth referred to as Poverty-related Stress. To do so, a latent construct was defined as the latent combination of the three family-level stress variables (Parenting, Parent Relationship Quality, and Maternal Stress). Loadings were assessed for significance ($p < .05$) as well as meaningfulness (loadings greater than .30).

We then ran a mediation analysis within MPlus to assess the indirect association between Income to Needs and Emotionality through Poverty-related Stress. The Poverty-related Stress latent variable was regressed onto Income to Needs (Path A), Emotionality was regressed onto Poverty-related Stress (Path B), and Emotionality was regressed onto Income to Needs. The product of paths A and B was generated and included to determine the indirect effect from Income to Needs to Emotionality through Poverty-related Stress. Poverty-related Stress was also regressed onto age to partial out any systematic variance in these family-level processes that might be accounted for by the child's age.

Our second hypothesis centered on extending the model to allow Emotionality scores to predict adolescent outcomes while controlling for early family Income to Needs. To test this hypothesis, the original model was rerun with two additional paths: adolescent outcome variables were regressed onto Negative Emotionality, as well as Income to Needs values to control for their influence on adolescent outcomes. Age and gender were entered as control variables to account for any systematic variance in the outcome variables that may be attributed to differences in child age and gender. This process was repeated for each outcome variable separately.

Results

Table 1 shows the intercorrelations, means, standard deviations, and tests of gender differences for all study variables. Surprisingly, Income to Needs values did not demonstrate a significant correlation with Negative Emotionality. Nevertheless, the direct associations between Income to Needs values and family-level stressors, and the association between family-level stressors and Negative Emotionality supported a possible indirect association.

Poverty-related stress latent construct and mediation

The first model was run with only the factor analysis to generate our latent construct of Poverty-related Stress. The model fit the data well (RMSEA $< .01$, CFI $> .99$, SRMR $< .01$) and each measured variable loaded strongly onto the single factor (see Figure 2). Next, we extended our model to include the indirect effects test. See Figure 3 for the model outline and results. This model also fit the data well, RMSEA = .04, CFI = .98, SRMR = .04. Results confirmed that there was no direct association between Income to Needs and Negative Emotionality; however, the path from Income to Needs to Poverty-related Stress ($B = -.21$, $p = .03$), and the path from Poverty-related Stress to Emotionality ($B = .42$, $p < .001$) were significant. Moreover, the overall indirect effect was also significant ($b = -.34$, $p = .04$; see Figure 3). Overall, 17% ($p = .01$) of the variance in Negative Emotionality was accounted for by this model.

Associations between emotionality and adolescent outcomes

Finally, in pursuit of our second objective, to assess whether Negative Emotionality during childhood was predictive of adolescent outcomes, we extended our path model to include adolescent outcome variables. Models for Internalizing, Externalizing, and BMI fit the data well: RMSEA $< .05$, CFI $> .94$, SRMR $< .05$; however, the model for Attention Difficulties fit was poor (RMSEA = .07, CFI = .89, SRMR = .07). Following a review of the modification indices (Kaplan, 1990), the model was modified slightly to allow Attention Difficulties to covary with Poverty-related Stress. This model fit the data well (RMSEA = .05, CFI = .93, SRMR = .05). Emotionality was significantly predictive of adolescent levels of Internalizing symptoms ($B = .24$, $p = .003$), Attention difficulties ($B = .21$, $p = .03$), and BMI (.28, $p < .001$), but not Externalizing symptoms ($B = .02$, $p = .81$). See Figure 4 for full results.

Sensitivity analyses

To assess the robustness of these results, several alternative models were run. First, to determine whether an indirect effects model was truly the best modelling approach for the association between Income to Needs and Emotionality, a moderation analysis was conducted to assess whether Poverty-related Stress functioned more appropriately as a moderator. To do so, a new model was run in which Emotionality was regressed onto Income to Needs, Poverty-related Stress, and their interaction term. Emotionality was significantly associated with Poverty-related Stress ($B = .38$, $p < .01$), but was not associated with Income to Needs ($B = .02$, $p = .75$) or the interaction between Income to Needs and Poverty-related Stress ($B = -.03$, $p = .67$). Therefore, these results suggest that an indirect effects model is a more appropriate analysis through which to interpret these data.

Second, we sought to examine whether Emotionality functioned more appropriately as a moderator of the association between poverty status and adolescent outcomes. To do so, an

Table 1. Intercorrelations, means, standard deviations, and tests of gender differences for all study variables

		1	2	3	4	5	6	7	8	9
Wave 1	1. Income to Needs	–								
	2. Parenting	–.14	–							
	3. Maternal Parenting Stress	–.10	.21**	–						
	4. Parent Relationship Quality	–.17*	.25**	.51**	–					
Wave 2	5. Child Negative Emotionality	–.03	.02	.35**	.30**	–				
Wave 3	6. Internalizing	.08	–.06	.17*	.21**	.09	–			
	7. Externalizing	–.14	.20*	.19*	.27**	.07	.38**	–		
	8. Attention	–.04	.12	.33**	.16	.17	.47	.47**	–	
	9. BMI	–.22**	–.05	–.03	–.16*	.22**	.11	.24**	.07	–
Mean		1.54	153.67	68.31	106.40	13.45	4.44	10.41	5.56	26.13
Standard Deviation		0.98	17.14	16.11	16.94	3.87	3.28	7.21	2.93	6.11
Minimum Value		0.35	110	40	43	5	0	0	0	14.9
Maximum Value		5.27	200	66	108	25	13	32	13	48.4
Gender Differences (0=male, 1=female)		0.06	0.14	0.92	–1.74	1.20	–4.31**	2.14*	0.68	–0.69
Correlations with Child Age		–.03	–.01	–.05	.08	–.10	–.02	.14	–.04	–.04

Note. Test of gender differences indicates female participants report significantly higher Internalizing symptoms, and male participants report significantly higher Externalizing Symptoms and Attention Difficulties.

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

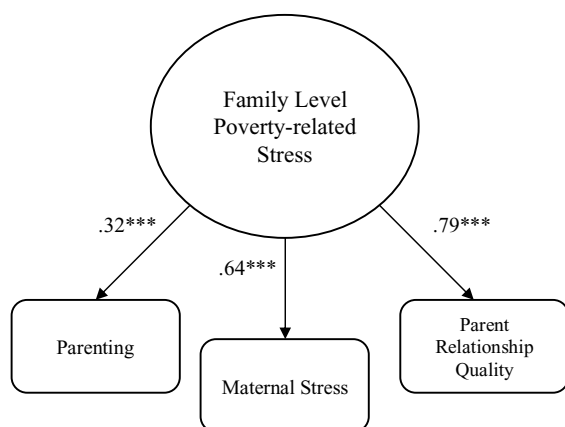


Figure 2. Factor loadings of Parenting, Maternal Stress, and Parent Relationship Quality on latent construct Poverty-related Family Stressors. Parenting and Parent Relationship Quality are reverse-scored, such that higher values represent lower parenting and relationship quality. Path values represent standardized regression betas.

Note. *** $p < .001$

interaction term was generated between Income-to-Needs and Emotionality, which was added to the model. For all outcome variables, no model fit could be achieved (RMSEA > .27, CFI < .32, SRMR > .08), suggesting that these models were not a good fit to the data. An examination of modification indices did not reveal any plausible paths that could be added to the model to achieve model fit.

Finally, we assessed whether the pattern of results was maintained when controlling for early childhood levels of symptomology. During Wave 1, parents completed the parent-report version of the CBCL, and therefore Wave 1 levels of Internalizing and

Externalizing symptoms were available¹. Therefore, for the Internalizing model, the extended path model was rerun, adding Wave 1 internalizing symptoms as a predictor to Wave 4 Internalizing symptoms. Wave 1 Internalizing was also regressed onto time 1 age and gender to control for systematic differences in these demographic factors. Fit indices were good (RMSEA = .05, CFI = .96, SRMR = .07). Results remained largely consistent: the association between Emotionality and Wave 4 Internalizing symptoms was unchanged ($B = .24$, $p = .003$). Moreover, the association between Wave 1 and Wave 4 Internalizing symptoms was not significant ($B = -.04$, $p = .67$).

This process was repeated for Externalizing symptoms. Model fit was poor (RMSEA = .12, CFI = .71, SRMR = .12). An examination of modification indices suggested an increased fit if Wave 1 externalizing was covaried with Income-to-Needs and Poverty-Related Stress. The model was therefore rerun with these changes. Model fit was good (RMSEA = .02, CFI = .99, SRMR = .04) and results showed that the nonsignificant path between Emotionality and Wave 4 Externalizing ($B = -.02$, $p = .86$) was maintained. Contrary to the results for Internalizing, Wave 4 Externalizing was significantly associated with Wave 1 Externalizing ($B = .26$, $p = .04$), suggesting a level of stability in the levels of externalizing symptoms, but not internalizing symptoms, from early childhood to adolescence within this sample.

Discussion

The current 3-wave longitudinal study represents a novel extension of the Adaptation to Poverty-related Stress Model by examining whether children's negative emotionality functions as an early manifestation of difficulties coping with the stressors of family life in poverty. Specifically, the goals of the current study were to: a) test whether income-to-needs values were associated with higher

¹Note that Wave 1 Attention Difficulties were unavailable as this subscale is not contained within the CBCL for children under 4 years of age.

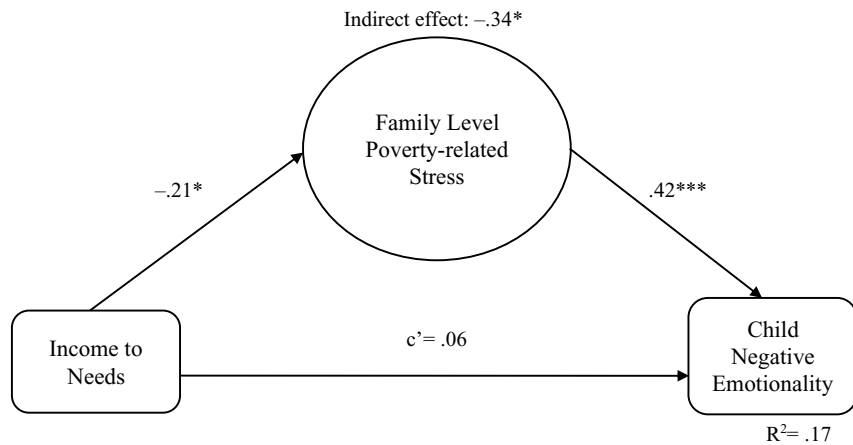


Figure 3. Mediation analysis of the indirect effect of Income to Needs on Child Negative Emotionality through Family Level Poverty-related Stressors. Path values represent standardized regression betas, with the exception of the indirect effect. Note. $***p < .001$, $*p < .05$

levels of childhood negative emotionality through family-level, poverty-related stress; and b) assess whether higher levels of childhood negative emotionality in turn created vulnerabilities for development that manifested as subsequent difficulties with mental health, behavior, attention difficulties, and physical health during adolescence. The results of the current study represent a significant contribution to our understanding of the extendibility of the Adaptation to Poverty-related Stress Model to samples of younger children, and importantly also add to our understanding of the pervasive nature of the deleterious effects of childhood poverty. A noteworthy contribution of the current study is that we add to a very small pool of studies (e.g., Boyce & Ellis, 2005) that conceptualize negative emotionality as a modifiable characteristic, rather than a relatively permanent quality of temperament, that is more likely to develop among children of low-income families in response to high, ongoing levels of family stress.

Our initial hypothesis, that family income-to-needs values would be directly associated with higher levels of child negative emotionality was not supported. These results suggest that unlike other manifestations of coping, such as specific coping strategies and self-reported coping efficacy, negative emotionality among young children may not have a consistently direct and linear association with poverty. While this finding is consistent with some previous evidence (for example, Dougherty et al. (2010) found no association between socioeconomic status and negative emotionality), it also contradicts results from numerous studies that suggest that negative emotionality may be systematically associated with family income (e.g., Ayoub et al., 2009; Hong et al., 2017; Melchior et al., 2012). While there are several possible explanations for this discrepancy, it is worth noting that the current findings may be reflective of using a Canadian sample. The majority of previous work examining poverty and emotionality has made use of American samples; the current study relied exclusively on participants residing in Canada. Due to Canada's much stronger social safety net, the depth and intensity of poverty in America is much more profound than in Canadian contexts (Osberg, 2000). Moreover, the province of Quebec, in which the current study took place, has developed some of the strongest anti-poverty measures in the country, such as the creation and expansion of affordable early learning and childcare services, expanded family income support via child benefits, and protected and enhanced parental leave (Van den Berg et al., 2017). Therefore, the strong anti-poverty measures in place in this specific context may help to buffer the association between income and negative emotionality. These

points are only speculative at this point; future studies that are able to compare the associations between poverty exposure, family stressors, and child emotionality across a variety of countries and contexts would be invaluable to our understanding of the influence of poverty on child development.

Consistent with our hypotheses, however, the results showed a strong indirect association between income-to-needs values and negative emotionality through family-level, poverty-related stress. These results suggest that poverty may have an indirect influence on negative emotionality by contributing to the level of stress, conflict, and parenting quality within a family home environment. Moreover, this pattern of results is consistent with previous assessments of the Adaptation to Poverty-related Stress Model that have demonstrated a strong indirect association between poverty and child coping through family-level stress (e.g., Wadsworth & Compas, 2002). Therefore, our results provide initial evidence that the model may be extended to younger samples through the use of observable, behavioral manifestations of coping difficulties.

Finally, our hypotheses regarding the association between childhood negative emotionality and adolescent well-being were partially supported. Consistent with previous results (Lengua & Long, 2002), childhood levels of negative emotionality were associated with higher adolescent levels of internalizing symptoms and attention difficulties, even after controlling for the effect of childhood family income. These findings contribute to a larger body of research suggesting that high levels of negative emotionality may lead to differential trajectories of stress response in children by creating biases in the encoding of, interpretation of, and responses to internal and external stress cues (Derryberry & Rothbart, 1997; Lemerise & Arsenio, 2000). These biases may create systematically over-reactive threat appraisals (Lengua, Sandler, West, Wolchik, & Curran, 1999) and over-reliance on avoidant coping (Bolger, 1990; Carver & Scheier, 1994; Lengua et al., 1999), which may increase threat perception and manifest as internalizing symptoms and difficulties creating, shifting, and maintaining attention. The current study, however, did not include measures of specific coping techniques, and therefore these results cannot directly confirm links between emotionality and subsequent use of avoidant coping.

Furthermore, results from the current study suggest that childhood levels of negative emotionality are associated with adolescent levels of BMI, controlling for early family income-to-needs values. Family income-to-needs values did maintain a significant association with adolescent BMI, however, and therefore the current study variables did not fully account for the relationship between

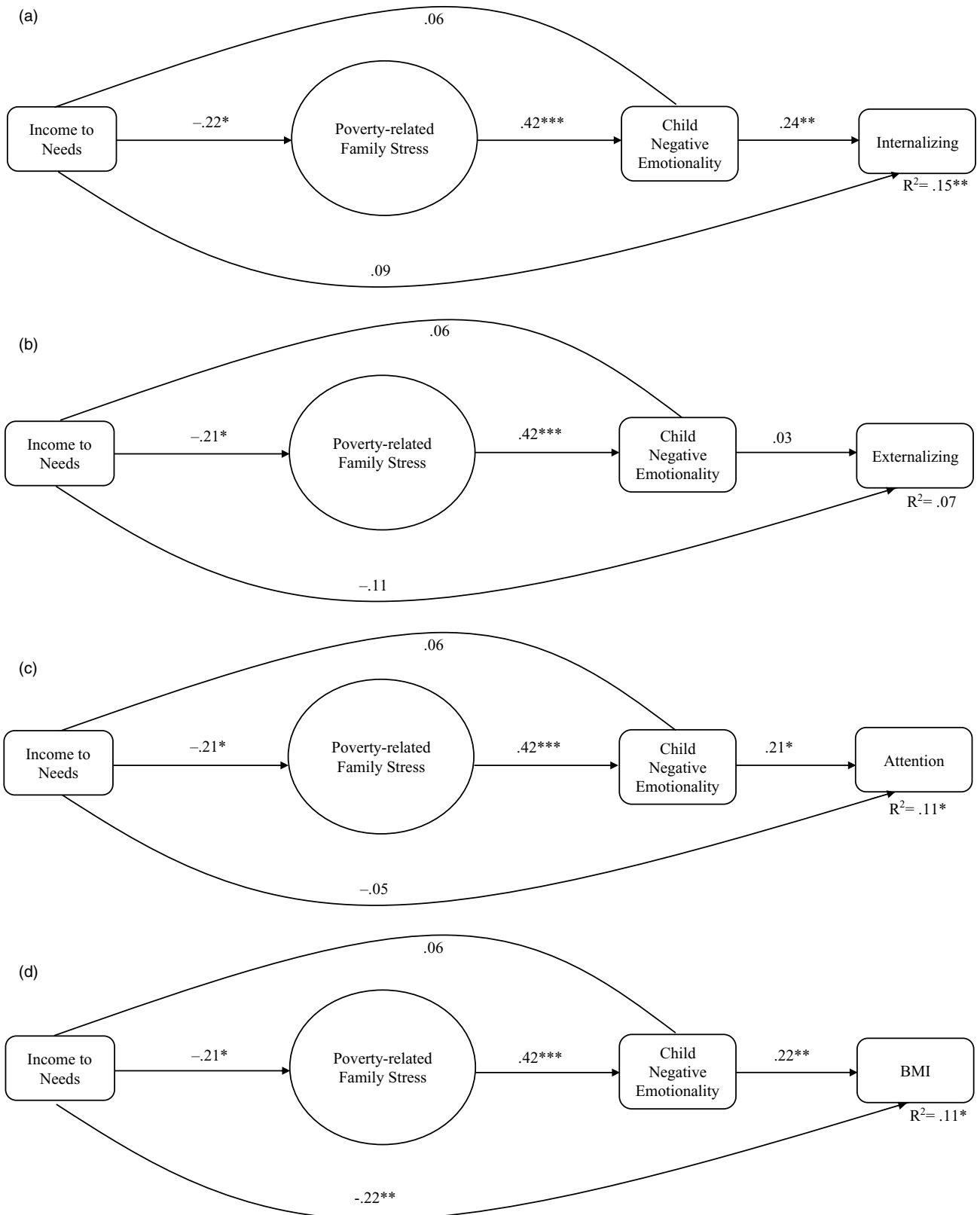


Figure 4a-4d. Path analyses assessing the association between child negative emotionality and adolescent Internalizing, Externalizing, Attention Difficulties, and BMI. Path values represent standardized regression betas. All models were run controlling for age and gender. Note. *** $p < .001$, ** $p < .01$, * $p < .05$

poverty exposure during childhood and adolescent BMI. This finding is consistent with previous research linking early childhood emotionality to adolescent weight and weight gain (Niegel, Ystrom, & Vollrath, 2007; Pulkki-Råback *et al.*, 2005; Sutin, Kerr, & Terracciano, 2017), as well as a larger literature on the association between difficulties managing emotional or stressful situations and issues with weight (Crockett *et al.*, 2015; Whiteside *et al.*, 2007; Willem *et al.*, 2019). Children high in negative emotionality are more likely to experience more intense incidents of distress (Ebstrup, Eplov, Pisinger, & Jørgensen, 2011) and therefore more difficulty regulating everyday emotional experiences (Flett *et al.*, 1996). Parents of children high in negative emotionality are more likely to use food to soothe their child (Stifter *et al.*, 2011), are more likely to feed their child an obesogenic diet (Vollrath, Tonstad, Rothbart, & Hampson, 2011), and are more likely to provide their child with more sweet drinks and food during early and mid-childhood (Vollrath *et al.*, 2012). Therefore, parents may inadvertently be encouraging regulatory habits that rely on food to regulate negative emotions.

Moreover, the current results are in line with a growing body of evidence that exposure to poverty in childhood has a wide range of physiological consequences. For example, consistent evidence suggests that poverty during childhood is associated with both concurrent levels of, and trajectories of, heightened levels of allostatic load, a cumulative index of physiological wear and tear on the body due to chronic mobilization of resources to meet changing environmental demands (Ganzel, Morris & Wethington, 2010; McEwen, 1998; Seeman & McEwen, 1996). Although biases and limitations are inherently involved when using BMI as an indicator of physical health in comparison to alternatives (e.g., Dodgen & Spence-Almaguer, 2017; Karchynskaya, Kopicakova, *et al.* 2020; Prentice & Jebb, 2001), the current study's inclusion of an adolescent physical health measure represents a significant contribution to our understanding of emotionality and child physical health development.

While these results are promising, it is also worth noting that we did not find support for an association between childhood negative emotionality and adolescent levels of externalizing symptoms. Our findings contradict previous assessments of the association between negative emotionality and externalizing symptoms (e.g., Eisenberg *et al.*, 2009; Paulussen-Hoogbeem *et al.*, 2007; Singh & Waldman, 2010). One important and possible explanatory mechanism of this finding may lie within our assumption of a main effects model linking negative emotionality and subsequent externalizing symptom levels. Instead, there may be important moderating influences on these associations. Specifically, the association between emotionality and subsequent symptomologies may be strongly moderated by various elements of the child's psychology or early environment, such as general self-regulation and effortful control (Dich, Doan, & Evans, 2015a; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Oldehinkel, Hartman, Ferdinand, Verhulst, & Ormel, 2007; Rothbart & Bates, 2006), or parenting characteristics such as maternal sensitivity and responsiveness (Belsky & Pluess, 2013; Dich, Doan, & Evans, 2015b). Furthermore, there may also be more complex feedback loops, in which family-level stressors, such as the ones explored in the current study, are in turn affected by a child's high level of negative emotionality (Serbin *et al.*, 2015). This reciprocity between child behavioral tendencies and parenting practices is evidenced in the bidirectional associations between children's irritability and parental disciplinary measures (Lengua & Kovacs, 2005), effortful control and subsequent authoritarian parenting styles (Lee, Zhou, Eisenberg, & Wang, 2013), as well as general child regulatory control and permissive parenting styles (Wittig & Rodriguez, 2019).

Limitations and future directions

The current study has numerous strengths, including a financially diverse sample of families, a longitudinal methodology spanning from early childhood into adolescence, and multi-methodological outcome variables. However, this study is also not without limitations. Like most research on social factors and health and wellbeing, the design is non-experimental and thus subject to alternative causal explanations. Moreover, it is unlikely that a single element of a child's development, such as negative emotionality, alone would be able to transmit all or even most of the variation in outcome measures, and we cannot assume that the same mechanism operates uniformly for all individuals. Future studies that are able to home in on the many possible moderating factors that may influence the association between childhood negative emotionality and subsequent wellbeing would be an asset to the field.

We also acknowledge that, in conceptualization and analysis, we describe only a unidirectional relation between family-level variables and child negative emotionality. Previous studies have emphasized that there may be important bidirectional relationships between important parenting variables, such as responsiveness and warmth, and child emotionality (Lengua & Kovacs, 2005); however, a meta-analysis showed that effect sizes for the association between child emotionality and parenting are small (Paulussen-Hoogbeem *et al.*, 2007). While the current study sought to overcome some aspects of this complex relation by making use of parent-level variables and emotionality at different time points, future studies that are able to incorporate bidirectional associations between family-level stressors and emotionality would be a valuable contribution. Furthermore, while the results for internalizing symptoms remained consistent when controlling for previous levels of internalizing, we were unable to exert this level of control over the other outcome variables. Study designs that allow for an examination of continuity or perturbations to symptomology development across childhood and adolescence would represent considerable benefits to the field.

Conclusion

Childhood poverty represents a significant, deleterious influence on children's development, effectively disrupting numerous indices of health and wellbeing across the lifespan. The Adaptation to Poverty-related Stress Model has highlighted the importance of family-level, poverty-related stress and a child's ability to cope with the stressors in their lives as key proximal processes through which poverty may disrupt healthy development. Results from the current study replicated and extended this model, as we showed that poverty is indirectly associated with heightened negative emotionality, a cluster of observable manifestations of difficulty managing emotional experiences, through family-level stress. Early negative emotionality may represent a mechanism through which to identify children who may be most affected by the negative impacts of poverty due to the association between childhood negative emotionality and adolescent levels of internalizing symptoms, attentional difficulties, and physical health challenges. Highlighting negative emotionality as a key warning sign for low-income children experiencing difficulty coping with their environment allows for early, and observable, identification of the children most in need of supports, while also providing a key avenue for potential prevention and intervention programming in the future.

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Conflicts of interest. None

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