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ORIGINAL PAPER

Preschoolers' Attentional and Behavioral Regulation: Differential Pathways through Poverty and Parenting

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Abstract

This study explored specificity in the associations between early poverty and preschoolers' behavioral and attentional regulation. In particular, there was an emphasis on delineating contextual factors (i.e., material hardship and household chaos) and parenting processes (i.e., maternal aggravation and maternal acceptance) as sequential mechanisms. The sample included 2850 families from the Future of Families and Child Wellbeing Study. Results suggested that early poverty in infancy (age one) was associated with behavioral regulation and attentional regulation in preschool years (age five). Material hardship mediated the link between early poverty and behavioral regulation, while household chaos mediated the link between early poverty and attentional regulation. Additionally, maternal aggravation mediated the association between material hardship and behavioral regulation, while maternal acceptance mediated the associations between household chaos and attentional and behavioral regulation. Findings informed targeted interventions to alleviate hardship and chaos and promote positive parenting practices to bolster children's self-regulation.

Keywords Early poverty · Material hardship · Household chaos · Parenting processes · Self-regulation

Highlights

- Early poverty in infancy was associated with preschoolers' behavioral regulation and attentional regulation.
- Material hardship mediated the link between early poverty and behavioral regulation.
- Household chaos mediated the link between early poverty and attentional regulation.
- Maternal aggravation mediated the association between material hardship and behavioral regulation.
- Maternal acceptance mediated the associations between household chaos and attentional and behavioral regulation.

Children exposed to early poverty are at risk of exhibiting lower levels of both behavioral and cognitive self-regulation, compared to their affluent peers (Evans & Rosenbaum, 2008; Lengua et al., 2015; Raver & Blair, 2020). During early childhood, self-regulation may be influenced by distinct poverty-related contextual factors, such as material hardship and household chaos, and may also be impacted by parenting processes, including both maternal aggravation and positive parenting (Andrews et al., 2021; Gee & Asim, 2018; Gershoff et al., 2007; Thomas, 2023; Vernon-Feagans et al., 2016; Yu et al., 2020). While it is clear that early poverty hinders the development of self-regulation, less is known about the specific contextual factors and parenting processes serving as mediators that may contribute to this association.

Recognizing the significance of individuals within their contexts, this study adopts a developmental systems framework (Bronfenbrenner & Morris, 1998; Lerner et al., 2006) to examine critical dynamics within households that are relevant to both poverty and children's self-regulation. In this study, we first use longitudinal data to trace the pathways from early poverty at age one to preschoolers' behavioral and attentional regulation at age five among an ethnically and economically

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diverse sample. Second, we examine material hardship and household chaos at age three as distinct mediators linking early poverty and self-regulation. Third, we simultaneously investigate specific parenting processes, including maternal acceptance and aggravation, as mediators of the associations between key contextual factors (material hardship and household chaos) and facets of self-regulation (behavioral and attentional). These sequential patterns are crucial to understanding the cascading effect of poverty-related contextual factors on children's self-regulation through distinct pathways that disrupt positive parenting and elevate parenting aggravation.

Development of Self-regulation

While diverse conceptualizations of self-regulation exist in the field, a widely accepted theoretical framework is the bi-directional psychobiological model, which encompasses both top-down processes, involving executive functions and cognitive control, and bottom-up processes, reflecting stress physiology and temperamental reactivity (Blair & Ku, 2022). Specifically, the top-down processes pertain to the intentional inhibition or regulation of attention through higher-order executive functions. These cognitive processes are derived from a neural systems approach and include attentional processes, inhibitory control, working memory, and cognitive flexibility (Diamond, 2013). In contrast, the bottom-up processes represent more automatic and unconscious reactions to stimuli and reflect variations in emotion-related reactivity (Rothbart et al., 2004). Although these two systems are interconnected (Blair, 2016), there is a possibility that they are influenced differently by environmental contextual factors (Loomis, 2021). Due to abundant research highlighting that early poverty influences the acquisition of self-regulation (Blair & Raver, 2016; Evans & Kim, 2013; Lengua et al., 2015), there has been growing research interest in dissecting self-regulation and investigating how specific facets are shaped by contextual factors. One approach to elucidate these connections is by examining the poverty-related contextual factors from material hardship and household chaos to early behavioral and attentional regulation in early childhood.

Behavioral regulation involves multiple processes, including reactivity, impulsivity, and emotional regulation (Nigg, 2017), which play a crucial role in regulating emotions and inhibiting disruptive behaviors during childhood (Willoughby et al., 2011). Originally, behavioral regulation is derived from the temperament literature, reflecting children's inherent physiological reactivity and their ability to manage arousal (Rothbart et al., 2004). In simpler terms, behavioral regulation represents a child's typical responses in emotionally laden situations across different contexts and is related to, yet distinct, from attentional self-regulation (Howard et al., 2019). The acquisition of early behavioral regulation situates children's advantage in both academics and social-emotional competence. For instance, higher levels of behavioral self-regulation are linked with higher academic achievement (McClelland & Wanless, 2012; Schmitt et al., 2014), better classroom behaviors (Garner & Waajid, 2012), and greater social-emotional competence (Korucu et al., 2022). These advantages may be particularly pronounced for girls, as there is evidence that they display higher behavioral regulatory skills than boys during childhood (Matthews et al., 2009). Additionally, behavioral regulation serves as a protective factor for an individual's long-term well-being, including higher functioning (Howard & Williams, 2018), reduced sleep problems (Bub et al., 2016), and fewer externalizing behaviors (Perry et al., 2018).

Attentional regulation reflects neurocognitive skills that allow individuals to intentionally sustain attention and ignore distractions in the environment (Posner & Rothbart, 2000). In early childhood, the rapid development of neural connections in the prefrontal cortex and the maturation of brain regions, such as the anterior attention network (Posner & Rothbart, 2009), enables preschoolers to enhance their cognitive abilities and bolster their capacity to sustain attention (Diamond, 2013). Prior research has documented that early attentional regulation is crucial in children's transition from kindergarten to a formal school setting. As such, attention regulation helps children focus on classroom activities and avoid disruption from peers, which further supports school readiness (Razza et al., 2012), academic achievement (McClelland & Cameron, 2011), and social-emotional competence (Duncan et al., 2007).

The development of self-regulation begins during infancy and progresses as a dynamic process influenced by the diverse contexts in which children interact and are embedded (Sameroff, 2010). The developmental systems framework posits that human development is intertwined with a series of interrelated and nested ecological levels, which reflect the dynamic associations between the individual and the context (Bronfenbrenner & Morris, 1998). Building upon this framework, developmental contextualism highlights plasticity and temporality in explaining how processes operating across multiple levels contribute to variations in developmental outcomes among individuals (Lerner et al., 2006). As suggested by this theory, past research has explored different contextual factors that support the development of distinct facets of self-regulation. One extensively examined macro-level context is early poverty. Indeed, early poverty can "get under the skin" (Schmidt et al., 2021) and impact self-regulation through both top-down and bottom-up processes (Evans & Kim, 2013; Raver & Blair, 2020). Thus, early poverty, as a macro-level context comprising the broader socioeconomic

structure, can shape the micro-level context including the day-to-day environments in which children reside and engage that directly impact children's self-regulation development. In this regard, research highlights two micro-level contexts, particularly household chaos and material hardship, which negatively impact cognitive self-regulation (Andrews et al., 2021) and contribute to behavioral problems (Bellair et al., 2019, 2021). Furthermore, within the family system, parents facing material hardship and chaotic environments often experience stress as a consequence of their struggles to make ends meet, making them more likely to live in unstable conditions (Hill et al., 2013). This environmental stress can manifest as compromised parenting, including heightened parental aggravation during caregiving and decreased adoption of positive parenting strategies, which, in turn, could further hinder children's self-regulation development (Duran et al., 2020).

The development of both attentional and behavioral self-regulation is embedded within and impacted by various developmental contexts, and early childhood stands out as a pivotal stage profoundly shaped by these contexts. Early childhood represents a critical period for the development of children's self-regulatory skills (McClelland et al., 2010; McClelland & Tominey, 2014). As a result of the maturation of the brain and the rapid development of the prefrontal cortex during preschool years (Diamond, 2013), children become increasingly cognitively aware of environmental contexts, rendering them potentially more susceptible to the negative effects of various contexts and parenting processes. Impoverished environments during infancy may increase contextual risks that compromise parenting and result in a shortage of resources and opportunities for enrichment as children grow, ultimately hindering their learning and the development of their self-regulatory skills over time (Evans & Kim, 2013; Raver & Blair, 2020). By examining these specific time points in early childhood (i.e., ages one, three, and five), researchers can identify specific mechanisms through which contextual factors and parenting processes impact facets of self-regulation in the context of poverty that coincide with important developmental transitions and reflect critical targets for intervention.

Poverty, Material Hardship, and Self-Regulation

Material hardship reflects a household experience of being unable to meet basic needs, including the lack of access to food, clothing, shelter, and medical care. Existing literature suggests that material hardship serves as a prominent mechanism that is interrelated but distinct from poverty (Gershoff et al., 2007; Neckerman et al., 2016; Thomas, 2022). For example, material hardship may occur independently of poverty, such that families can experience material hardship even when their household incomes above the federal poverty threshold but below 300% of the poverty threshold, typically categorized as a near-poor group. Conversely, families with incomes below the federal poverty threshold might not necessarily experience material hardship (Rodems & Shaefer, 2020). Past studies have differentiated material hardship from income poverty, indicating that it is positively associated with parenting stress and negatively linked with children's social-emotional functioning (Gershoff et al., 2007). Notably, differentiating material hardship from income poverty allows more flexible accommodations for various combinations of economic deprivation within households. Specifically, households may experience income poverty and material hardship unevenly, such that poor families are more likely to experience material hardship than non-poor families (Iceland & Bauman, 2007).

The fields that study poverty and children's self-regulation can be better aligned by considering material hardship as a distinct mechanism linking these constructs. Extant literature supports direct associations between material hardship and both children's behavioral and attentional outcomes. Notably, researchers have adopted behavioral problems as a proxy for reflecting children's lack of behavioral regulation (Sulik et al., 2015). Children experiencing higher levels of material hardship displayed elevated externalizing, internalizing behaviors, and aggression (Bellair et al. 2019; 2021; Zilanawala & Pilkauskas, 2012). Additionally, research has also examined how material hardship directly impacted children's cognitive skills, such that greater material hardship was associated with lower cognitive skills (Gershoff et al., 2007). Families facing limited access to resources may encounter challenges in providing their children with the essential educational stimulation that is crucial for cognitive and brain development (Hill et al., 2013). This deficiency in stimulation can significantly affect the development of self-regulatory capacity, particularly in shaping attention regulation skills (Palacios-Barrios & Hanson, 2019). Additional research is necessary to identify the mediating role of material hardship in the associations between early poverty and key facets of self-regulation. A comprehensive understanding of this process could inform the design of effective interventions that support families in promoting the optimal development of self-regulation in their children.

Poverty, Household Chaos, and Self-regulation

Household chaos describes a home environment characterized by a lack of structure and stability and has high levels of unpredictability in daily routines and ambient

stimulations (Bronfenbrenner & Evans, 2000). Compared to middle- and upper-income families, families in poverty are more likely to face chaotic home environments, such as crowded and noisy households, as well as unstable life routines resulting from parental irregular working hours (Evans et al., 2005; Garrett-Peters et al., 2016; Sturge-Apple et al., 2017). Poverty is a contextual risk factor impacting the development of children, and poor children may co-experience chaos within conditions of poverty at home that adversely impact their self-regulation. Unlike poverty as a general marker for multiple processes at home, household chaos could be one proximal causal mechanism that explains the association between poverty and children's self-regulation.

Disorganization and instability are two main dimensions of household chaos (Andrews et al., 2021), likely as the result of poverty, that may pose threats to the development of self-regulation in early childhood. Disorganization describes homes filled with clutter, ambient noise, crowdedness, and lack of structure (Matheny et al., 1995). Instability describes the high frequency of changes in residence and/or caregivers and is typically associated with a lack of household routines (Wachs & Evans, 2010). Both dimensions of chaotic home environments may overwhelm children with random stimulation, frequent changes, and distractions from unpredictable events (Andrews et al., 2021). Children living in chaotic home environments may lack established family routines that are crucial for behavioral regulation (Jaffee et al., 2012). Young children may withdraw from the home environment and receive fewer parental inputs and less scaffolding that promotes early self-regulatory capacity (Vernon-Feagans et al., 2016). Additionally, past research has demonstrated direct associations between household chaos and lower levels of attentional regulation in children, suggesting that children's development of attention regulation could be disrupted by chaotic inputs and distractions (Martin et al., 2012). However, no prior study has explored household chaos as a distinct pathway mediating the association between early poverty and facets of self-regulation, while simultaneously examining material hardship as another contextual factor in the longitudinal model.

Maternal Aggravation as a Process

The family stress model posits that parents facing economic hardship can experience stress, leading to reduced parental warmth and support, further contributing to children's adverse developmental outcomes (Conger & Donnellan, 2007). In this context, the impact of material hardship and household chaos on children's self-regulation may operate through maternal aggravation. Maternal aggravation describes parental stress and frustration towards parenting and caring for children (Yu & Singh, 2012). Mothers as primary caregivers experiencing material hardship, such as food insecurity, may be overwhelmed by financial challenges, resulting in higher levels of stress and worry (de Fonseca, 2014). The financial strain may heighten parental aggravation, which could further manifest in parental irritability and negative parenting behaviors (Gee & Asim, 2018). Heightened frustration may trigger the use of more aggravated parenting practices that view verbal negotiation of conflict as less necessary. As a result, children receive more negative cues from parents and experience less constructive modeling of behaviors (Suh & Luthar, 2020).

In addition, household chaos can induce stress through the demands of the need to constantly adjust to instability and establish new routines (Krabbe et al., 2017). As such, parents in chaotic environments may need to allocate more attention and time to establish new routines and reinstate order, and parents may expect more self-regulation from their children throughout this process. Conversely, lower levels of parenting aggravation resulting from better living conditions and stability may prompt parents to have more patience with their children and show more consistency in responding to children's needs (Herbell et al., 2020). Particularly, research demonstrates that parents living in more chaotic environments tend to show less positive parenting behaviors in response to children's social cues (Andeweg et al., 2022; Coldwell et al., 2006), which are less optimal for scaffolding self-regulation in young children. Given the growing recognition of the negative effects of maternal aggravation due to poverty (Gee & Asim, 2018), further research needs to explore the consecutive mediational pathways of material hardship and household chaos that influence self-regulation through maternal aggravation.

Maternal Acceptance as a Process

Positive parenting processes, particularly maternal acceptance, play a pivotal role in fostering the development of children's self-regulation. Maternal acceptance represents parents positively engaging with their children and displaying greater tolerance of children's behaviors during interaction (Eisenberg et al., 1998). Existing literature suggested that higher levels of parental acceptance were closely linked with children's self-regulatory capacity (Meyer et al., 2014). Notably, impoverished contextual environments can disrupt this positive parenting behavior. Parents with higher socioeconomic status tend to adopt warmer parenting discipline instead of harsh discipline, which in turn results in higher levels of inhibitory control among preschoolers (Xing et al., 2019). Conversely, parents facing chronic economic insecurity and material hardship

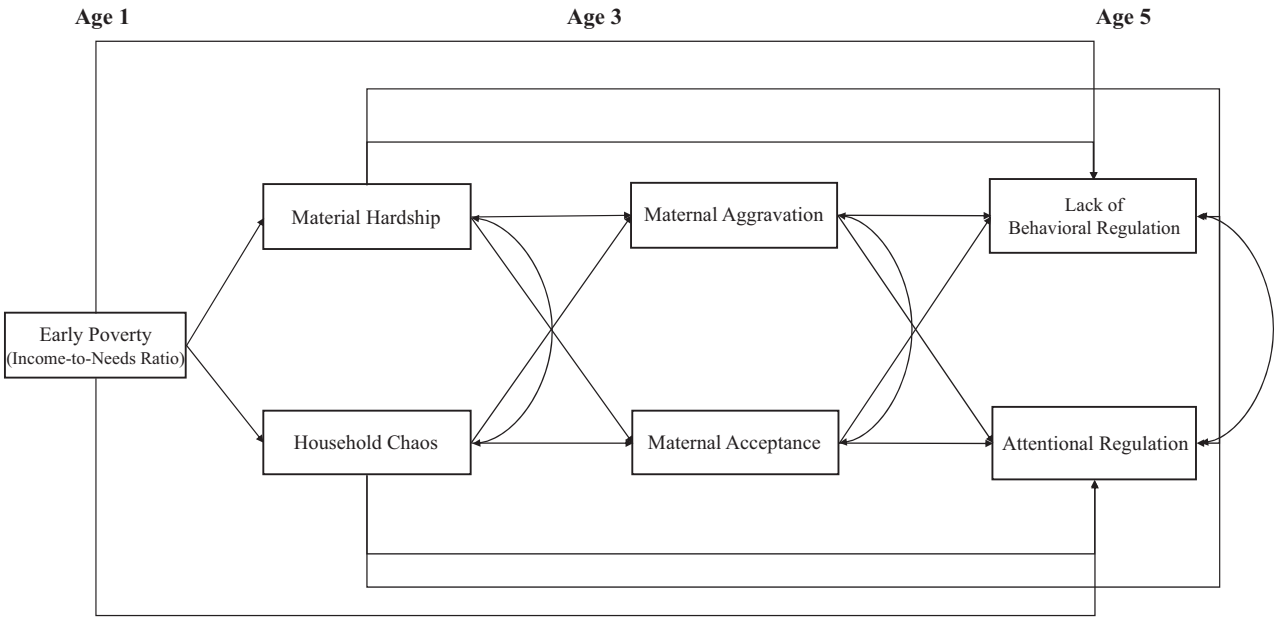

Fig. 1 Proposed Conceptual Model

tend to display harsh parenting with more aggressive behaviors toward their children (Conrad et al., 2019). Similarly, contextual risk factors like household chaos can compromise the quality of positive parenting, resulting in reduced responsiveness (Andrews et al., 2021; Martin et al., 2012) and diminished acceptance of children's behavior (Vernon-Feagans et al., 2016). Interestingly, only a few studies directly examined maternal acceptance as a mediator between the association of distinct poverty contextual factors and facets of self-regulation. For example, chaotic environments, such as household disorganization chaos over time, have been shown to disrupt parental acceptance of children, which in turn dampens children's executive function and regulatory skills (Vernon-Feagans et al., 2016). However, no prior research has investigated the indirect effect of maternal acceptance between the association of material hardship and facets of self-regulation, which needs further examination.

Current Study

The present study sought to increase our understanding of the associations between early poverty and preschoolers' facets of self-regulation by simultaneously examining the consecutive mediating roles through key contextual factors (i.e., material hardship and household chaos) and parenting processes (i.e., maternal aggravation and maternal acceptance) in a sample of socioeconomically and racially/ethnically diverse populations. To the best of our knowledge, previous studies have not incorporated both material hardship and household chaos along with maternal aggravation and maternal acceptance in the same model to examine the specificity among these linked underlying mechanisms. Our analyses also include well-documented child (i.e., child sex) and family characteristics (i.e., maternal race/ethnicity and family composition) that are relevant to these pathways as covariates in the model. Specifically, past research has found that girls had higher levels of behavioral self-regulation than boys (Kochanska et al., 2001; Matthews et al., 2009; McClelland et al., 2007). Additionally, racial/ethnic differences were documented for parenting and contextual factors, such that Black parents displayed less parental warmth than European-American and Latinx families (Kang et al., 2023). Hispanic/Latino families reported less household chaos than Black and White families (Cherry & Gerstein, 2023) and experienced higher material hardship than White families (Sosina & Saperstein, 2022). The family composition has also been associated with household chaos (Kamp Dush et al., 2013), parenting practices (Berger et al., 2008), and parental aggravation (Bronte-Tinkew et al., 2010).

We developed the following four hypotheses (see Fig. 1 for the proposed model). First, building upon existing literature (Evans & Kim, 2013; Raver & Blair, 2020), we hypothesized that higher levels of early poverty would be associated with lower levels of behavioral regulation (H1a) and attentional regulation (H1b). Second, based on developmental systems theory (Lerner et al., 2006) and prior research (Gershoff et al., 2007; Vernon-Feagans et al., 2016), we hypothesized material hardship and household chaos would serve as mediators between the

associations of early poverty and facets of self-regulation. Specifically, we expected material hardship to mediate the pathway between early poverty and behavioral regulation (H2a) and attentional regulation (H2b), while we expected household chaos to mediate the link between early poverty and behavioral regulation (H2c) and attentional regulation (H2d). Third, recognizing both material hardship (Gee & Asim, 2018) and household chaos (Dumas et al., 2005; Evans et al., 1995) as contextual factors related to poverty and heightened parental stress that are attributed to child behaviors, we hypothesized that maternal aggravation would mediate the association between material hardship and behavioral regulation (H3a) and attentional regulation (H3b), and it would mediate the association between household chaos and behavioral regulation (H3c) and attentional regulation (H3d). Fourth, extending upon existing studies(Gershoff et al., 2007; Vernon-Feagans et al., 2016), we hypothesized that maternal acceptance would mediate the association between material hardship and behavioral regulation (H4a) and attentional regulation (H4b), and it would also mediate the association between household chaos and behavioral regulation (H4c) and attentional regulation (H4d).

Table 1 Demographic Information ($N = 2850$)

Variables	Sample Mean (*SD*) or Frequency
Child sex	Boys = 1468 (51.51%)
Child's age (months) at year 1	15.08 (3.53)
Child's age (months) at year 3	35.17 (2.13)
Child's age (months) at year 5	61.11 (2.38)
Mother's age (years) at year 1	26.31 (6.01)
Poverty categories at year 1	
0–49% of poverty line	682 (25.18%)
50–99% of poverty line	500 (18.46%)
100–199% of poverty line	660 (24.37%)
200–299% of poverty line	403 (14.88%)
>300 + of poverty line	463 (17.10%)
Mother race	
White	608 (21.36%)
Black	1479 (51.97%)
Latino/a/x	679 (23.86%)
Others	80 (2.81%)
Mother's education at year 1	
Less than high school	772 (28.53%)
High school or equivalent degrees	883 (30.78%)
Some college degrees	794 (29.34%)
College or graduate and above	307 (11.35%)
Family Composition	1.12 (0.84)

Method

Participants and Procedure

Participants were drawn from the Future of Families and Child Wellbeing Study (FFCWS), a population-based longitudinal cohort study following 4898 children born between 1998 and 2000 across 20 large-size U.S. cities. The cities were purposefully selected to represent all U.S. cities with a population of 200,000 or more. By design, FFCWS oversampled the children born to unmarried mothers ($N = 3711$) compared to 1187 children born to married parents. At baseline, mothers were interviewed in the hospital within 48 hour after the child was born, and fathers were interviewed soon afterward. The initial interview was followed by telephone interviews with mothers and in-home assessments when the children were ages 1, 3, 5, 9, 15, and 22 (Reichman et al., 2001).

The current study utilized three waves of data when the focal child was ages one, three and five, including participants with valid data for either behavioral regulation or attentional regulation in year five, resulting in the final analytic sample of 2850 participants. As shown in Table 1, the analytic sample was predominantly socioeconomically disadvantaged and racially diverse. It should be noted that the final analytic sample no longer represented mid-sized U.S. cities. For example, families in the analytic sample were more likely to be Black (47.5% in the original sample vs. 51.97% in the analytic sample) and less likely to be Latino/a/x (27.3% in the original sample vs. 23.86% in the analytic sample), more likely to have some college education (25% in the original sample vs. 29.34% in the analytic sample), and more likely to below 200% of poverty line (61.26% in the original sample vs. 68.01% in the analytic sample).

Measures

Early Poverty in Year One

Early poverty was measured by the income-to-needs ratio in year one. This continuous variable reflected the mother's self-reported household annual income, which was divided by the U.S. Census Bureau's federal poverty threshold of that year and adjusted for family size. An income-to-needs ratio of 1.0 represents the family income at the federal poverty line. Households with an income-to-needs ratio less than 1.0 represented a family with income below the federal poverty line, and households with an income-to-needs ratio higher than 1.0 represented a family higher than the federal poverty line. The range for our sample was 0 to 23.7 ($M = 1.79$, $SD = 1.96$).

Material Hardship in Year Three

Mothers rated material hardship on eight dichotomized items that reflect the family's financial difficulty in meeting basic needs, such as being unable to pay rent, utilities, mortgage, or access medical care in the past 12 months. Example items included "Was there any time in the past 12 months when (you/your household) did not pay the full amount of the rent or mortgage?" and "Was there a time (you/anyone in your household) needed to see a doctor or go to the hospital but did not go?" The original item coding was *yes* (1) and *no* (2). The current study recoded the 2 as *no* (0) and created a sum composite score by adding all responses with "yes," following prior research coding approaches (Zilanawala & Pilkauskas, 2012). The higher sum scores reflected a higher level of family material hardship. The scale Omega reliability was 0.99 (McNeish, 2018).

Household Chaos in Year Three

Household chaos was measured by five dichotomized items from the Home Observation for Measurement of the Environment (Bradley & Caldwell, 1984). During in-home observation, the observer rated the chaotic levels of the home environment. Following prior research using the FFCWS dataset (Kamp Dush et al., 2013), we selected five items to reflect household chaos, including "Is the inside of the home crowded," "All visible rooms of the house/apartment noticeably cluttered," "Are all visible rooms of the house/apartment dirty or not reasonably cleaned," "Is the environment inside the home unsafe for young children," and "house/apartment overly noisy from noise in the house." Items original coding was *no* (0) and *yes* (1). A sum composite score was created by adding all responses with "yes." The higher score reflected higher levels of household chaos. The scale Omega reliability was 0.99.

Maternal Aggravation in Year Three

Maternal aggravation in parenting was measured by four items derived from Abidin's (1990) Parent Stress Inventory to represent the amount of parenting stress brought on by changes in employment, income, or other factors in the parents' lives. Following prior research using the FFCWS dataset (Ash et al., 2023), four items were included to reflect maternal aggravation, including "I often feel tired, worn out, or exhausted from raising a family," "Being a parent is harder than I thought it would be," "I feel trapped by my responsibilities as a parent," and "I find that taking care of my child(ren) is much work than pleasure." Originally, items were coded on a 4-point Likert scale as *strongly agree* (1), *somewhat agree* (2), *somewhat disagree* (3), and *strongly disagree* (4). The current study reverse-coded all four items, and the sum composite score was created in which a high value indicated a greater level of maternal aggravation in parenting. The scale Omega reliability was 0.99.

Maternal Acceptance in Year Three

Maternal acceptance was measured using five dichotomized items that are part of the Home Observation for Measurement of the Environment (Bradley & Caldwell, 1984). During the in-home visit, data collected rated maternal acceptance through observation of the mother's behaviors and interaction with children. The HOME scale has been widely used and demonstrated adequate criterion validity, internal consistency, and test-retest reliability (Bradley et al., 2001; Bradley & Caldwell, 1979; Totsika & Sylva, 2004). One example item was, "parent does not scold or criticize child during the visit." The items were coded as *not accept* (0) and *accept* (1). The current study created a sum composite score to indicate that a higher value reflects greater maternal acceptance. The scale Omega reliability was 0.89.

Behavioral Regulation in Year Five

Children's behavioral regulation was measured by the maternal report on the Child Behavior Checklist (CBCL; Achenbach, 2011). We selected 21 items from aggression, attention problems, and delinquent behavior subscales; this subset of items used to measure behavioral regulation was validated in previous studies (Liu et al., 2023; Watters & Wojciak, 2020; Zhang et al., 2023). These items were designed to encapsulate children's ability to manage their behaviors in social environments through deliberately applying different forms of attentional and cognitive adaptability and inhibitory control (McClelland & Tominey, 2014). A sum composite score was created following previous approaches (Jackson et al., 2018; Zhang et al., 2023). Mothers were asked to rate the frequency of children's behavior using a three-point Likert scale, in which *not true* (0), *somewhat or sometimes true* (1), and *very true or often true* (2). An example item was: "Child impulsive or acts without thinking." The current study reversed coding, such that higher scores represent higher levels of behavioral regulation. The scale demonstrated good reliability with Omega 0.88.

Attentional Regulation in Year Five

Children's attentional regulation was assessed by the Attention Sustained task from the Leiter International Performance Scale-Revised (Roid & Miller, 1997). For this

task, a picture booklet with a variety of different images scattered throughout and a target image at the top was presented to the children. Children were asked to cross out as many of the target images as possible in the allotted time without erroneously crossing out the non-target images. Four trials were performed, with 30 seconds for the first three trials and 60 seconds for the fourth. The performance tracked the number of correct cross-outs of target images to reflect focused attention (Razza et al., 2012). Task scores were standardized against a national norming sample with a mean of 10 ($SD = 3$); the mean of the current sample was 12.73 ($SD = 3.29$), which was higher than the national sample.

Control Variables

Several demographic variables that correlate with either contextual factors, parenting processes, or facets of self-regulation were entered into the model as control variables. Child sex was reported by mothers at baseline and was coded as *boy* (0) and *girl* (1). Mother's race was self-reported as White, Black, Latino/a/x, and Others and was dummy-coded in the analysis. Family composition was created as a ratio based on the number of adults and the number of children in the household, with higher values reflecting greater adult-to-child ratios.

Analytic Plan

Descriptive statistics of the demographic characteristics and correlation analyses were examined in R Studio 4.2. A longitudinal path analysis was conducted in Mplus 8.7 (Muthén & Muthén, 2017) to use structural equation modeling to simultaneously test the direct paths from early poverty to preschoolers' facets of self-regulation and indirect paths through the mediators of material hardship, household chaos, maternal acceptance, and maternal aggravation. Specifically, we calculated the following estimates: (1) paths from early poverty to preschoolers' behavioral regulation and attentional regulation, (2) indirect effects of early poverty on child self-regulation outcomes through material hardship and household chaos, (3) indirect effects of material hardship and household chaos on child self-regulation outcomes through maternal aggravation and maternal acceptance. Three control variables were modeled to correlate with early poverty. Child sex was controlled to predict behavioral and attentional regulation. The family composition was controlled to predict household chaos, material hardship, and parenting processes. Race/ethnicity was controlled to predict maternal acceptance and maternal aggravation. Control variables that did not contribute to significant variables were removed from the mediation model for parsimony purposes. Mediation was tested using bias-corrected bootstrapping to estimate the 95% confidence intervals (Hayes, 2009).

Several fit indices to evaluate the overall goodness of fit for each model include Comparative Fit Indices (CFI) greater than 0.90, Tucker-Lewis Index (TLI) greater than 0.90, Root Mean Squared Error of Approximation (RMSEA) less than 0.08, and Standardized Root Mean Squared Residual (SRMR) less than 0.08 indicated good model fit (Hu & Bentler, 1999). We compared the analytic sample with complete data among demographics variables, identifying that families with greater adult-to-child ratios were more likely to have missing data in attentional regulation (t (4087) $= -2.17$, $p = 0.03$). We also identified boys were more likely to have missing data in attentional regulation than girls (χ^2 (1) $= 4.79$, $p = 0.03$). Little's Missing Completely at Random (MCAR) test was not significant, suggesting that the data were missing completely at random (χ^2 (4600) $= 4455$, $p > 0.05$). Full-information Maximum Likelihood (FIML) was used to handle missing data based on the assumption of missing data at random. FIML allows the model to preserve all available data and produces less biased estimates than deleting cases or imputing the sample mean (Enders, 2022). Maximum Likelihood was used to handle skew-normal and non-normal distribution.

Results

Descriptive Statistics and Correlation

The means and standard deviations of the studied variables and the bivariate correlation matrix are presented in Table 2. The correlation analyses showed a significant association between early poverty and behavioral regulation ($r = 0.14$, $p < 0.001$) and attentional regulation ($r = 0.11$, $p < 0.001$). Material hardship was only correlated with behavioral regulation ($r = -0.16$, $p < 0.001$), while household chaos correlated with both facets of self-regulation ($r = -0.06$, $p = 0.02$ for behavioral regulation and $r = -0.10$, $p < 0.001$ for attentional regulation). Maternal aggravation only correlated with behavioral regulation ($r = -0.17$, $p < 0.001$), while maternal acceptance correlated with both facets of self-regulation ($r = 0.12$, $p < 0.001$ for behavioral regulation and $r = 0.10$, $p < 0.001$ for attentional regulation).

Path Analysis

The hypothesized model fit the data well, $\chi^2 = 45.72$, $df = 23$, $p = 0.003$, CFI = 0.97, TLI = 0.93, RMSEA = 0.02, SRMR = 0.02. The model explained 3.3% of the variance in maternal-reported material hardship, 6.9% of the variance in observer-rated household chaos, 7.2% of

Table 2 Descriptive Statistics and Bivariate Correlations of Study Variables ($N = 2850$)

		1	2	3	4	5	6	7
1	Early Poverty (Y1)	1.00						
2	Material Hardship (Y3)	-0.16^{***}	1.00					
3	Household Chaos (Y3)	-0.23^{***}	0.10^{***}	1.00				
4	Maternal Aggravation (Y3)	-0.04^{*}	0.14^{***}	0.02	1.00			
5	Maternal Acceptance (Y3)	0.12^{***}	−0.05	-0.24^{***}	−0.05	1.00		
6	Behavioral Regulation (Y5)	0.14^{***}	-0.16^{***}	-0.06^{*}	-0.17^{***}	0.12^{***}	1.00	
7	Attentional Regulation (Y5)	0.11^{***}	0.00	-0.10^{***}	−0.04	0.10^{***}	0.07^{**}	1.00
	Mean (*SD*)/%	1.79 (1.96)	0.90 (1.26)	0.78 (1.21)	5.04 (2.68)	4.50 (1.05)	33.42 (6.03)	12.73 (3.29)
	Range	0–23.7	0–7	0–5	0–5	0–12	4–42	1–19

Y1 = Year 1. Y3 = Year 3. Y5 = Year 5. Early poverty is measured by the income-to-needs ratio
$^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$

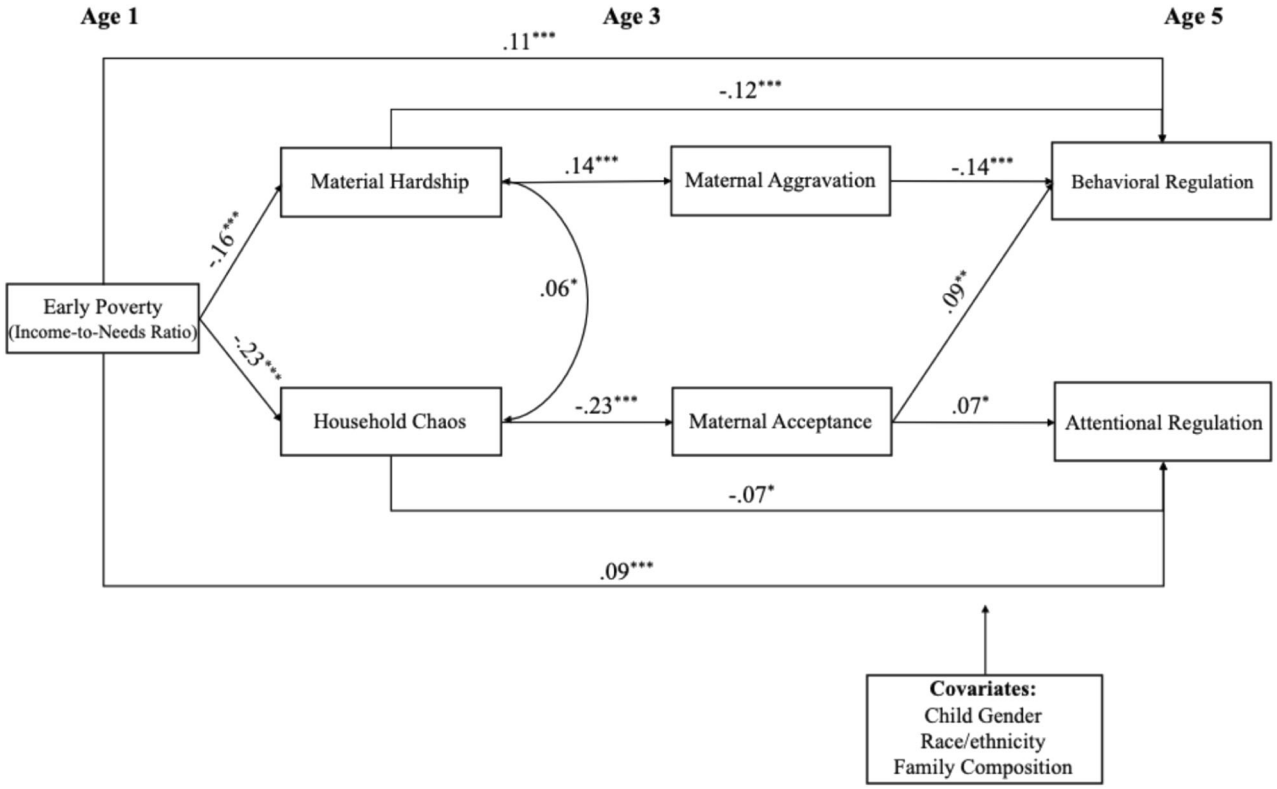

Fig. 2 Standardized Direct Effects in the Path Analysis (N = 2850). $\chi^2 = 45.72$. $df = 23$. CFI = 0.97, TLI = 0.93, RMSEA = 0.02, SRMR = 0.02. Reported standardized coefficient for direct effects. Only significant pathways from the proposed model are shown above. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$

the variance in observed-rated maternal acceptance, 2.9% of the variance in maternal-reported maternal aggravation, 7.5% of the variance in maternal reported behavioral regulation, and 5.3% of the variance in task-assessed attentional regulation. Figure 2 displays the direct effects and the indirect effects.

We detected a significant association with control variables. Regarding child sex, compared to boys, girls exhibited higher levels of behavioral regulation ($b = 0.09$, $SE = 0.02$, $p < 0.001$) and higher levels of attentional regulation ($b = 0.17$, $SE = 0.02$, $p < 0.001$). Regarding race/ethnicity, compared to White mothers, Latino/a/x mothers had lower levels of material hardship ($b = -0.05$, $SE = 0.02$, $p = 0.01$) and household chaos ($b = -0.09$, $SE = 0.03$, $p = 0.001$); no significance were detected for Black mothers regarding these two contextual factors. We discovered that compared to White mothers, Black mothers presented lower levels of maternal acceptance ($b = -0.14$,

$SE = 0.02$, $p < 0.001$). Regarding the family composition, compared to a family with fewer adult members, a family with more adult members has lower levels of material hardship ($b = -0.07$, $SE = 0.02$, $p < 0.001$), household chaos ($b = -0.09$, $SE = 0.03$, $p = 0.001$), and lower levels of maternal aggravation ($b = -0.09$, $SE = 0.02$, $p < 0.001$).

The first hypotheses were supported. Path model indicated that the lower early poverty in year one was associated with higher levels of behavioral regulation (H1a; $\beta = 0.11$, $SE = 0.02$, $p < 0.001$) and higher levels of attentional regulation (H1b; $\beta = 09$, $SE = 0.09$, $p < 0.001$) in year 5. Material hardship was negatively associated with behavioral regulation ($\beta = -0.12$, $SE = 0.02$, $p < 0.001$) but were not linked with attentional regulation in year five. Higher levels of household chaos in year three were associated with poorer attentional regulation ($\beta = -0.07$, $SE = 0.03$, $p = 0.02$) but were not linked with behavioral regulation in year five. Greater maternal aggravation in year three was inversely associated with behavioral regulation ($\beta = -0.14$, $SE = 0.02$, $p < 0.001$) but was not linked with attentional regulation in year 5. Increased maternal acceptance in year 3 predicted higher levels of behavioral regulation ($\beta = 0.09$, $SE = 0.03$, $p = 0.002$) and higher attentional regulation ($\beta = 0.08$, $SE = 0.03$, $p = 0.01$) in year five.

The second hypotheses were partially supported. Two indirect effects from early poverty in infancy to self-regulation in preschool through material hardship or household chaos emerged (Fig. 2). Specifically, the bootstrapping results showed that material hardship in year three mediated the association between early poverty and behavioral regulation (H2a; $b = 0.06$, $SE = 0.01$, 95% CI [0.04, 0.08]), but did not mediate the association between early poverty and attentional regulation (H2b). Additionally, household chaos in year three mediated the association between early poverty and attentional regulation (H2d; $b = 0.03$, $SE = 0.01$, 95% CI [0.004, 0.05]), but did not mediate the association between early poverty and behavioral regulation (H2c).

The third and fourth hypotheses were also partially supported. Three indirect effects from contextual factors to facets of self-regulation in preschool through parenting processes emerged. The bootstrapping results indicated that maternal aggravation partially mediated the association between material hardship and behavioral regulation (H3a; $b = -0.09$, $SE = 0.02$, 95% CI [−0.14, −0.06]), but did not mediate the association between material hardship and attentional regulation (H3b). Maternal aggravation did not mediate the association between household chaos and behavioral regulation (H3c) or attentional regulation (H3d). Additionally, maternal acceptance did not mediate the association between material hardship and behavioral regulation (H4a) or attentional regulation (H4b). However, maternal acceptance fully mediated the association between household chaos and behavioral regulation (H4c; $b = -0.10$, $SE = 0.04$, 95% CI [−0.17, −0.04]) and partially mediated the associations between household chaos and attentional regulation (H4d; $b = -0.04$, $SE = 0.02$, 95% CI [−0.09, −0.01]).

Discussion

This study adds to the existing literature by using longitudinal path analysis that spanned children's first five years of life to understand the underlying specificity of how early poverty is associated with preschoolers' behavioral regulation and attentional regulation through simultaneously tested mediated pathways via unique contextual factors and parenting processes. Elucidating the mechanisms through which early poverty as a macro-level context influences key micro-level contexts of the day-to-day environments, specifically both household chaos and material hardship, to impact self-regulation development is critical to delineating distinct pathways. Furthermore, it is essential to understand how the family system plays an additional role in these links through parenting processes that also affect the development of self-regulation. Gaining a clearer understanding of these collective and ordered processes could help to identify targeted interventions to bolster self-regulation with holistic interventions that intervene at multiple contextual levels.

Early Poverty Does Matter

The current study found that early poverty in infancy was linked to behavioral and attentional regulation in early childhood, above and beyond the two other indirect effects of material hardship and household chaos. These findings aligned with our first hypothesis and were consistent with established literature (Kia-Keating et al., 2018; Lengua et al., 2015; Raver et al., 2013), suggesting that children who were exposed to higher levels of early poverty exhibited lower levels of behavioral regulation and attentional regulation. These findings highlight early childhood as a sensitive and vulnerable period during which children's development can be fundamentally impacted by environmental stressors (Duncan et al., 2012; Evans & Kim, 2013). A potential explanation is that children growing up and residing in poverty contexts may confront heightened chronic stress and increased allostatic load (Blair et al., 2011), which could lead to reduced prefrontal cortex activation (Sheridan et al., 2012). During early childhood, the prefrontal cortex experiences its first developmental peak (Diamond, 2013), playing a pivotal role in initiating stimulation and honing skills for self-regulatory capacity. However, prolonged exposure to poverty could trigger neuroendocrine stress responses, resulting in compromised self-regulation

(Palacios-Barrios & Hanson, 2019). Furthermore, our findings are consistent with the experiential canalization framework, highlighting that increased stress associated with poverty could shape early self-regulation development in ways that disrupt the psychophysiological stress-related processes and the neurological system and impact behavioral and attentional regulation (Blair & Raver, 2012). While the current study did not directly measure stress-related physiology or biological markers, future studies should further delve into how early poverty may permeate physiological responses that impact self-regulatory capacity.

Mediating Mechanisms through Distinct Contextual Factors

Findings from mediation pathways partially supported our second hypothesis. Specifically, we observed that material hardship mediated the link between early poverty and children's behavioral regulation but not attentional regulation. This significant indirect pathway of poverty and behavioral regulation is consistent with prior literature, affirming that early poverty has discernible impacts on children's self-regulatory skills, particularly due to the influence of material hardship on behavioral regulation (Gershoff et al., 2007). This pathway suggests that the enduring effects of early poverty in infancy become evident through day-to-day material deprivation in year three and consequently impact self-regulation at year five. Furthermore, as poor families struggle to meet basic material needs, children may encounter unstable and unpredictable environments, such as experiencing hunger, lack of electricity or heat, or frequent relocations. Material hardship, as one form of adversity, may induce heightened stress, anxiety, and irritability in children, leading to decreased neural activation in brain regions that are closely related to optimal development of self-regulation (Blair et al., 2011; Evans & Kim, 2013; McLaughlin et al., 2014). Under stressful environments, children may respond by acting out or demonstrating a lack of behavioral regulation. Surprisingly, we did not find an indirect effect of early poverty on attentional regulation through material hardship. A potential explanation is that the nuances of attentional regulation may not be fully captured by the Leiter-R assessment task. As Petersen and Posner (2012) highlighted, attentional regulation is a multifaceted construct that includes three neural networks: alerting, orienting, and executive control. Future studies should adopt comprehensive task batteries, such as the Attentional Network Test for Interaction (ANTI; Casagrande et al., 2022), to examine which aspects of the attentional system may be sensitive to material hardship.

Moreover, our results also found that household chaos was a mediating process between early poverty and children's attentional regulation but not behavioral regulation. This significant finding for attentional regulation aligns with prior research investigating the association between household chaos and attention outcomes within poverty contexts. For example, in low-income contexts, elevated levels of household chaos were adversely related to child attention outcomes, including higher parent-reported problem attention behavior (Brown et al., 2010) and lower attentional regulation (Marsh et al., 2020). Chaotic household environments are characterized by features including noise, crowding, clutter, and lack of routines, creating an environment permeated with excessive stimulations. Children consistently exposed to such chaotic environments may feel overwhelmed, stressed, and hypervigilant to environmental stimuli. This heightened state could thwart the development of self-regulatory systems, particularly for sustained attention (Vernon-Feagans et al., 2016; Wachs & Evans, 2010). Children living in chaotic environments may need to allocate additional efforts to practicing skills to focus and maintain attention, while the chaotic nature of homes may impede younger children from developing attentional regulatory skills effectively. Excess stimulation could also potentially disrupt concentration due to the inconsistency and unpredictability of the environments, leading to greater levels of attentional problems (Martin et al., 2012) and lower levels of executive function (Andrews et al., 2021). Contrary to our hypothesis, household chaos did not mediate the association between early poverty and behavioral regulation. While it is possible that this pathway did not exist, it is more likely that this pathway was less pronounced within the current complex model that simultaneously considered parenting processes as mediators. The specificity among these pathways that include parenting is described next in more detail.

Maternal Aggravation as a Process

We further examined whether two aspects of parenting processes (i.e., maternal aggravation and maternal acceptance) mediated the associations between poverty-related contextual factors and facets of self-regulation. Partially aligned with our third hypothesis, we found that maternal aggravation mediated the association between material hardship and preschoolers' behavioral regulation. This finding is consistent with the family stress model that suggests material hardship can lead to heightened stress for parents. With this excessive stress, parents may view the parenting process as a burden and display compromised parenting strategies, which result in lower levels of behavioral regulation (Conger & Donnellan, 2007). This finding also highlights how the negative impacts of perceived stress due to material hardship may "spill over" into parent-child interactions and subsequently limit children's self-

regulation. Specifically, mothers affected by material insecurity may experience elevated psychological stress and emotional frustration, which transfer into negative emotions while parenting children, resulting in less optimal models for shaping children's behavior regulatory skills (Gee & Asim, 2018). For example, children may mimic their parents' behaviors and act out with greater problem behaviors (Suh & Luthar, 2020). In other words, children may observe and learn less optimal coping strategies as a result of their mother's parenting practices that reflect stress and aggravation.

Contrary to our expectations, maternal aggravation did not mediate the association between household chaos and either facet of self-regulation. A potential explanation is that the relationship between household chaos and maternal aggravation could be more complex than initially hypothesized. For instance, maternal aggravation primarily captured mothers' perception of overall parenting stress, while research suggested parenting stress is a specific type of stress that should be distinguished from other forms of stress (Diener & Swedin, 2020). Prior literature suggests that household chaos could induce broader psychological stress in parents (Evans et al., 1995). This stress may manifest as general mental health challenges, such as interpreting the household as a loss of control, a sense of fatigue, and anxiety, rather than directly extending to the perception of parenting as a stressful process. Future refined research approaches are needed to explore the complex dynamics between household environments, perceived parenting stress, and children's self-regulatory development.

Maternal Acceptance as a Process

Aligned with our fourth hypothesis, we found that maternal acceptance fully mediated the association between household chaos and behavioral regulation and partially mediated the association between household chaos and attentional regulation. This is consistent with literature suggesting that exposure to disorganized, chaotic households could disrupt the proximal process of positive parenting processes, which in turn results in poorer self-regulatory skills (Valiente et al., 2007; Vernon-Feagans et al., 2016). The longitudinal pathway revealed that in chaotic households, parents may express less acceptance and engage in compromised parenting strategies (Coldwell et al., 2006; Dumas et al., 2005). With the disruptions and distractions in these chaotic environments, parents may have limited ability to react to their children's cues, offer limited scaffolding to stimulate their early attention and brain development, and provide less guidance to help children regulate their behavior. Without sufficient parental support, children may react to household stimuli without purposefully processing the information due to the adaptation of long-term exposure to crowdedness and persistent noise (Andrews et al., 2021). These findings also align with the developmental systems framework (Bronfenbrenner & Morris, 1998; Lerner et al., 2006), such that the pathways demonstrate how distal factors, such as household chaos, translate into proximal factors, such as maternal acceptance, in shaping children's development. As such, our results suggest a "funnel effect," where the macro-system filters through to micro-systems and reflects a cascading effect. In particular, our study highlights how poverty influences both structural (i.e., household chaos) and processual elements (i.e., maternal acceptance), culminating in the development of self-regulation in children in early childhood (Sameroff, 2010).

Contrary to our expectations, the results did not support maternal acceptance as a mediator of the association between material hardship and either facet of self-regulation. Notably, previous research has also reported a lack of association between material hardship and positive parenting (i.e., maternal responsive parenting; Lee et al., 2021). This lack of association may be interpreted as a resilience process, suggesting that, in the current sample, maternal acceptance may function as a protective factor against the adverse effects of material hardship. Based on the resilience process model of parenting, parents may exhibit adaptability to economic hardship within the context of poverty (Park, 2023). Further research is necessary to explore the underlying process of parents' coping strategies when confronted with poverty-related stressors and child self-regulation. Moreover, the current study models maternal acceptance as the mediator in the model. Specifically, there is evidence that positive parenting may moderate the association between material hardship and children's social-emotional outcomes (Flouri et al., 2015). Thus, additional research is needed to understand how different parenting processes may mediate or moderate the links between poverty-related contextual factors and child development of self-regulation.

Limitations and Future Directions

Despite the strengths of the current study, several limitations should be noted. First, the household chaos measure included select items that may only partially represent the two main dimensions of disorganization and instability. Future research should adopt multiple informants of chaos (i.e., parents and children) combined with observational data to capture both dimensions of household chaos (Vernon-Feagans et al., 2016). It is also crucial to identify the specific types of chaotic environments (i.e., family instability, lack of routine, television exposure, crowding, and noise) children experience to better understand how each type may differentially affect facets of self-regulation.

For instance, a lack of routine has been associated primarily with delay of gratification, while exposure to television noise was linked to greater attention problems (Martin et al., 2012). Second, maternal acceptance was observed during a single in-home visit, which may not reflect a comprehensive picture of parenting across diverse contexts. Future studies should examine other dimensions of parenting, such as parental warmth, responsiveness, and sensitivity, by adopting both observation data and parent self-report. Third, parent ratings of children's behavioral regulation, such as the CBCL used here, may only reflect children's behavioral regulation in the home context. Future research could adopt more ecological adaptive measures, such as direct assessment (e.g., Head-Toes-Knees-Shoulders Revised, Gonzales et al., 2021) or observational methods across various settings, such as communities and classrooms, to capture a more holistic assessment of children's behavioral self-regulatory skills (Eberhart et al., 2023). Similarly, a more comprehensive measure of attentional regulation that incorporates observational measures along with more rigorous direct assessments, such as the attention network task (Casagrande et al., 2022), would be beneficial to unpacking attentional regulation.

Fourth, although our study measured the poverty pathways and parenting processes at year three, it is crucial to note that a causal association cannot be definitively established with these data alone. While our theory and hypotheses suggest a directional relationship between these consecutive mediators, additional research would be needed to confirm any causal links. Fifth, some of the indirect effects reported here should be interpreted with caution, considering the common method variance shared by some constructs. Specifically, shared method variance may partially explain the indirect effect of material hardship on behavioral self-regulation through maternal aggravation, given that these three constructs were measured by maternal self-report. However, another indirect effect in our model, which supported maternal acceptance as a mediator of the association between household chaos and self-regulation outcomes, was based on different informants and thus is less subject to the above-mentioned concern. For future research, it would be beneficial to replicate the indirect pathways using different informants to strengthen the reliability of those findings and address the issue of common method variance. Finally, while the current study controlled for race and ethnicity, it did not directly account for the role of cultural factors in shaping poverty pathways and parenting processes. Cultural contexts that emphasize familial support may foster warm, nurturing environments that promote children's development of self-regulation (Knight et al., 2016; Shen et al., 2018). Additionally, these larger and multigenerational households may mitigate the adverse effects of poverty by offering additional caregiving resources (e.g., financial and emotional support from grandparents), thereby improving children's self-regulation (García-Coll et al., 1996; Jiang et al., 2020; Jiang & Fung, 2022). Future research should explore how public policies that promote multigenerational living or expand access to affordable housing for larger families could help alleviate the contextual stressors that hinder children's development in low-income contexts.

Implications

The present study has several implications for theoretical and practical intervention programs that target poverty alleviation and improve positive parenting practices. Theoretically, the associations between early poverty and preschoolers' attentional and behavioral regulation are in line with the experiential canalization framework (Blair & Raver, 2012), and the observed indirect pathways are consistent with the developmental systems framework (Bronfenbrenner & Morris, 1998), emphasizing the funnel effect of contextual factors that disrupt proximal factors to shape developmental outcomes. Second, our study also demonstrated practical implications such that policymakers and local governments could provide financial support, such as cash bonuses, to bolster household income during early childhood to support the development of self-regulation. For example, evidence from the randomized control trial, Baby's First Years, indicated that unconditional cash gifts to mothers of newborns were associated with healthier brain functioning and enhanced family well-being that supported child development (Noble et al., 2021). Third, the findings highlight material hardship as a unique mediation pathway between early poverty and self-regulation, suggesting the need for targeted intervention programs to alleviate the day-to-day deprivation experienced by low-income families in the context of poverty. Expanding the coverage of existing programs, such as the Supplemental Nutrition Assistance Program, Special Supplemental Nutrition Program for Women, Infants, and Children, and Low Income Home Energy Assistance Program, could be beneficial (Rodems & Shaefer, 2020). Similarly, social programs could strengthen and expand housing benefits to reduce housing hardship among low-income families, offering housing benefits such as housing subsidies, vouchers, and accessibility to the Section 8 Program (Hardy et al., 2019). These housing-related benefits may also have important implications for household chaos and thus have the potential to simultaneously impact multiple poverty-related contextual factors that have implications for parenting and children's self-regulation.

The findings from the current study also inform the development of preventive intervention programs targeting parenting knowledge and behavior. The mediation pathway

through maternal acceptance between household chaos and attentional regulation suggests the importance of promoting positive parenting behaviors within the chaos context. For example, parental educational programs could incorporate ideas for helping parents establish family routines, including creating realistic morning, evening, and bedtime routines, which may contribute to preschoolers' development of self-regulation, as children could perceive stability, a rhythm of life, and a safe environment (Andrews et al., 2021; Martin et al., 2012). In addition, we also identified mediation through maternal aggravation, suggesting promoting healthy coping strategies and reducing negative parenting practices. For instance, early childcare centers and pediatricians could distribute informational materials or provide support groups for parents, offering strategies for self-care and supporting emotional well-being. Moreover, early childhood education programs could enhance their effectiveness by integrating parental education programs into their curriculum. For instance, an analysis of Early Head Start Research and Evaluation suggests that parents attending parenting classes in the Head Start program successfully stimulated their children's cognitive and language development (Chang et al., 2009).

Conclusion

With a national U.S. child poverty rate of 12.4% (Shrider & Creamer, 2023), it is imperative to comprehend the underlying factors and processes that may promote or suppress children's development of self-regulation. The current study contributes to the existing literature by delineating contextual factors, particularly material hardship and household chaos, and the parenting process involving maternal aggravation and maternal acceptance as sequential mechanisms underlying the associations between early poverty and facets of self-regulation. Given the ongoing economic downturn and rapid inflation in the U.S., low-income communities may experience heightened economic hardship and housing chaos, coupled with increased stress and less optimal parenting practices, which in turn negatively impact child outcomes. As these socioeconomic disparities continue to grow, there is a pressing need to bolster and widen policies and intervention programs targeting alleviating economic hardship. Our findings suggest that taking a proactive approach to address modifiable contextual factors associated with poverty could foster optimal parenting practices and reduce potential delays in child development in self-regulatory skills.

Data Availability

The scripts to reproduce all study findings are available upon request. The current manuscript uses the publicly available data from the Future of Families and Child Wellbeing Study, which can be downloaded at https://ffcws.princeton.edu/documentation.

Compliance with Ethical Standards

Conflict of Interest The authors declare no competing interests.

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