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FAMILY PROCESS

ORIGINAL ARTICLE

Understanding the link between intimate partner violence exposure and children's self-regulation: The mediating role of parenting stress and warmth

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Abstract

Intimate partner violence (IPV), affecting approximately 16.3% of U.S. households annually, has detrimental effects on children who witness it, leading to psychological distress, developmental delays, and behavioral issues. Self-regulation, a critical skill in managing attention, emotions, and behaviors essential for cognitive and social development, may be significantly impacted. The negative associations between mothers' experience of IPV and child self-regulation necessitate the examination of the underlying mechanisms, particularly during the sensitive period of early childhood. This study utilized longitudinal data from the Future of Families and Child Wellbeing Study ($N = 4338$) to investigate the mediating pathways linking mothers' experience of IPV (maternal victimization experiences) during infancy with children's self-regulation at age five. Results suggested that IPV exposure during infancy was longitudinally and negatively associated with children's behavioral and attentional regulation. This association was mediated by elevated parenting stress and decreased maternal warmth. These findings highlight the importance of programs aimed at reducing IPV and supporting mothers affected by IPV, considering their vital roles in nurturing healthy child self-regulation skills.

KEYWORDS

attentional regulation, behavioral regulation, intimate partner violence (IPV), longitudinal study, maternal warmth, parenting stress

Intimate partner violence (IPV), defined as "physical, sexual, or psychological harm by a current or former partner or spouse" (Breiding et al., 2015, p.11), is a pervasive problem that affects millions of households globally. Children who witness IPV are particularly vulnerable, experiencing profound and long-lasting negative consequences (e.g., Finkelhor et al., 2009). Specifically, children who witness IPV between their caregivers often face psychological challenges, behavioral difficulties, and developmental delays (e.g., Carpenter & Stacks, 2009; Wolfe

et al., 2003). Among the key factors in a child's cognitive and socio-emotional development is the ability to self-regulate. Self-regulation is conceptualized as a multifaceted construct, including the ability to effectively manage and control attention, emotions, and behaviors in response to environmental stimuli (Kopp, 1982). While the significant associations between maternal IPV experiences and children's development are recognized, the specific mechanisms linking IPV exposure in infancy to poor self-regulation in early childhood are still not thoroughly investigated (Zhang, Cannata, et al., 2023 for a systematic review). The literature also lacks the examination of how mothers' experiences of IPV are related to different aspects of early childhood self-regulation and the mediating roles of parenting stress and maternal warmth in these associations. Therefore, the present study aims to explore the longitudinal relationships between maternal IPV experiences and two critical aspects of children's self-regulation—attentional and behavioral regulation in early childhood—while also examine how parenting stress and maternal warmth mediate the connection between IPV exposure and children's self-regulation. A comprehensive examination of these factors will help deepen our understanding of the intricate relationships between IPV, parenting stress, maternal warmth, and self-regulation development in early childhood.

Mothers' experiences of IPV and child self-regulation

IPV affects millions of victims in America with an estimated 8.2 million children exposed to IPV between parents each year (Finkelhor et al., 2015). Self-regulation, a prerequisite to social skills and cognitive functioning, is crucial for navigating complex social situations (McClelland & Tominey, 2014). Deficits in self-regulation can lead to conduct and behavioral difficulties, especially in childhood. Early childhood is a critical period for the development of self-regulation (Perry, 2019), and this coincides with peak rates of IPV exposure, with 70%–80% of IPV incidents occurring within the first year postnatally if there was at least one reported incident of IPV during pregnancy (Charles & Perreira, 2007; Mueller & Tronick, 2019). Infants often in close proximity to their mothers (who are frequently IPV victims) are more likely to witness or indirectly affected by the violence. This exposure includes observing physical signs of abuse and sensing elevated distress levels in their mothers, which can be manifested in the child's increased stress (e.g., Breiding et al., 2015; Hamby et al., 2011). In addition, IPV disrupts the nurturing and stable home environment that is essential for young children, as mothers who experience IPV may struggle to provide consistent, sensitive care, leading to stressful and unpredictable home settings (e.g., Carpenter & Stacks, 2009; McCoy, 2013). McCoy (2013) proposed a comprehensive bioecological system model that further elaborated the links between violence exposure and child self-regulation, highlighting family environment and parenting practices as potential mediators. According to this model, violence, particularly when directed toward children's primary caregivers, can significantly impact the development of self-regulation. Specifically, children may experience a lack of caregiver support and regulation when experiencing distress due to the primary caregiver's physical and mental unavailability. Children may also experience a pervasive sense of insecurity at home, which may impede their ability to self-regulate (McCoy, 2013).

Past research has investigated the links between mothers' experience of IPV exposure and child self-regulation, primarily focusing on the impact of child emotion regulation (e.g., Cummings et al., 2009; Harding et al., 2013). These studies found that IPV-exposed children exhibited slower growth in emotional regulation compared to their non-exposed counterparts (Rigterink et al., 2010). However, child self-regulation is multidimensional, and prior studies have overlooked two critical interconnected components: behavioral self-regulation and attentional self-regulation (Blair & Ku, 2022). Behavioral self-regulation, defined as the capacity to adaptively regulate behaviors and respond to environmental stimuli (Dawes et al., 1997), is a

critical aspect of child development. Deficits in this area can lead to behavioral issues, social difficulties, and poor academic achievement (e.g., Mcclelland & Wanless, 2012). It is particularly relevant in the context of mothers' experiences of IPV, as it involves children's ability to control their reactions to potentially threatening situations. Children who witness IPV may experience chronic stress and fear, and therefore compromise their behavioral regulation (Davies & Cummings, 1994). Exposure to IPV may also be associated with changes in children's ability to focus and maintain attention. Attentional regulation describes the ability to selectively attend to relevant information, maintain attention over time, and inhibit distractions (Ruff & Rothbart, 2001). As a critical component of executive function, it lays the groundwork for higher cognitive tasks such as planning, problem-solving, and decision-making (e.g., Blair & Ku, 2022; Diamond, 2013). Children who are exposed to IPV may endure chronic stress and trauma, affecting their attentional processes (Miller-Graff & Scheid, 2023). In other words, the violence exposure and associated emotional and psychological distress may lead to focus and attention maintenance difficulties. For example, research suggested that children who were exposed to IPV exhibited heightened vigilance to potential threats, resulting in hypervigilance and distractibility (Miller-Graff & Scheid, 2023). These attentional challenges may hinder children's ability to concentrate, participate in tasks, and effectively manage their attention in various contexts.

IPV, parenting stress, and maternal warmth

Two theoretical frameworks offer distinct perspectives on the associations between mothers' IPV experiences and their parenting behaviors. The Spillover Hypothesis (Krishnakumar & Buehler, 2000) posits that stress and negative emotions from one domain of life can spill over into other domains, affecting well-being and functioning (Margolin, 2004; Margolin et al., 2010). In the context of IPV, the stress, fear, and trauma experienced by mothers may spill over into their parenting, potentially reflected in reduced maternal warmth. Specifically, the negative effects of IPV, such as physical injuries and emotional distress, can directly impact mothers' well-being and mental health, depleting their emotional resources and making positive parenting more challenging. Much empirical evidence presented the support for the Spillover Hypothesis, as demonstrated by a systematic review of 21 studies, which found modest effect sizes linking IPV experiences to compromised parenting (Chiesa et al., 2018). Recent longitudinal studies have further extended these findings, linking maternal IPV experiences to dysfunctional parenting (Prandstetter et al., 2023), harsh parenting (Grip, 2019; Rousson et al., 2023), and reduced maternal stimulation (Jeong et al., 2020). While the negative effects of IPV on parenting behaviors are well-established, the specific impact on maternal warmth has been largely overlooked.

The compartmentalization hypothesis offers an alternative perspective on the relationships between IPV experiences and maternal warmth. It suggests parents who experience IPV can separate their conflicted romantic relationship and associated negative emotions from their parenting role (e.g., Krishnakumar & Buehler, 2000). In the context of IPV, some mothers who have experienced IPV may still exhibit high warmth to compensate for the violence exposure (e.g., Letourneau et al., 2007). They create a buffer, preventing the effects of the abuse from impacting their mothering role and protecting their children from violence (Peled & Gil, 2011). Thus, in these cases, maternal warmth may not be compromised by mothers' IPV experiences. One recent study on maternal warmth amidst IPV experiences reveals two distinct parenting profiles (Grogan-Kaylor et al., 2020). Both profiles demonstrated a tendency toward more positive and less negative parenting behaviors. Specifically, one profile, encompassing approximately 85% of the mothers, is characterized by significantly higher positive parenting and markedly lower negative parenting compared to the other profile (Grogan-Kaylor et al., 2020).

With regard to perceived parenting stress, research has consistently shown a correlation between women's experiences of IPV and increased parenting stress. Parenting stress refers to the psychological and emotional strain that is associated with parenting responsibilities (Sypher et al., 2017). It encompasses challenges, demands, and pressures associated with parenting tasks, such as meeting the child's needs, managing children's behaviors, and providing a nurturing environment (Sypher et al., 2017). This stress encompasses negative emotions and strain concerning both the parent's own role (parent domain) and their interactions with their child (child domain) within the framework of parenthood (Abidin, 1992). Mothers who experience IPV often face emotional distress, fear, and feelings of helplessness (e.g., Grogan-Kaylor et al., 2020). These emotional states can be directly associated with their level of parenting stress (Peled & Gil, 2011). For example, highly stressed parents may become more irritable or impatient, leading to shorter tempers, increased frustration, and less tolerance for typical childhood behaviors. The chronic experiences of IPV and the associated stress may impede mothers' abilities to provide consistency and warmth in parenting, impacting the quality of care provided to children (Sypher et al., 2017). Empirical evidence indeed suggested that a reduction in IPV correlates with decreased parenting stress (e.g., Easterbrooks et al., 2021). Thus, it seems likely that heightened parenting stress may act as a mediator in the link between IPV and various parenting behaviors, including maternal warmth.

Maternal warmth and two aspects of self-regulation

Maternal warmth plays a crucial role in nurturing self-regulation in children. When mothers display affectionate warmth and respond promptly to their children's needs, it sends positive signals, enhancing the chances of children to form secure attachments and managing their behaviors effectively in emotionally charged situations (Calkins & Leerkes, 2004). The theory of self-regulation underscores the significance of parenting in the early development of self-regulation. It posits that through continuous interaction and socialization, mothers assist children in internalizing regulatory skills, thereby supporting their emotional and behavioral development (Kopp, 1982). Empirical studies found that lower levels of maternal warmth and sensitivity were linked with lower behavioral regulatory capacity in kindergarten years (Eiden et al., 2007). Similarly, early maternal warmth was found to be linked with better effortful control (a manifestation of behavioral regulation) and fewer externalizing behaviors (a manifestation of lack of behavioral regulation) across childhood (Eisenberg et al., 2005). However, few empirical studies have directly examined the link between maternal warmth and attentional regulation. Instead, some have investigated its relationships with children's executive function. Specifically, higher maternal warmth/sensitivity at 24 months was found to be associated with better executive function performance at 36 months (Gueron-Sela et al., 2018). Given the importance of attention regulation for later grade school success (Mcclelland & Wanless, 2012), understanding how maternal warmth is associated with attention regulation is crucial in the home context involving mothers' experiences of IPV.

Current study

The present study aimed to investigate the longitudinal mediation relationships among maternal IPV exposure, parenting stress, maternal warmth, and two aspects of self-regulation in children. Using a longitudinal design, this study sought to shed light on the potential mediating role of parenting stress and maternal warmth in the association between maternal IPV

experience and children's self-regulation. This study tested several hypotheses. First, this study hypothesized that higher maternal IPV exposure frequency in infancy is associated with lower levels of behavioral and attentional self-regulation at age five. Second, the study examined the relationship between IPV exposure and maternal warmth, with the Spillover hypothesis proposing a significant negative relationship, and the Compartmentalization hypothesis suggesting an insignificant relationship. Lastly, the third hypothesis involves a longitudinal mediation pathway that maternal experiences of IPV are associated with increased parenting stress, which is subsequently associated with maternal warmth, linking to both behavioral and attentional regulation in children over time.

In the statistical model testing these hypotheses, several factors that were found to be linked with IPV, parenting, or self-regulation were included and accounted for as control variables, such as child sex (Matthews et al., 2009), mothers' age (Moreno-Gimenez et al., 2022), number of children in the household (Hong & Liu, 2021), and poverty ratio (Lengua, 2012). IPV exposure is recognized as one type of adverse childhood experience (ACE), a factor that has been extensively studied for its impact on child development, including self-regulation (see Lund et al., 2020 for a review study). The literature has underscored the profound influence of various ACEs, including child maltreatment and factors like maternal depression, which have been shown to have direct associations with poor regulatory outcomes. To provide an understanding of IPV's unique effect, our study incorporated maltreatment and maternal depression as control variables (e.g., Renner, 2009; Zhang, Cannata, et al., 2023). Furthermore, maternal impulsivity was also included as a control variable due to its documented correlation with parenting practices and children's self-regulation, observed from the perspective of intergenerational transmission of lack of controls (Bridgett et al., 2015).

METHOD

Participants and procedure

Data were drawn from the Future of Families and Child Wellbeing Study (FFCWS), a longitudinal national representative of the birth cohort of 4898 children born in 20 big cities between 1998 and 2000 in the U.S. The current study used mother-reported data of focal children during the ages of one, three, and five. Mothers completed telephone interviews and in-home assessments (Reichman et al., 2001). About 89% of mothers from the original baseline sample were successfully interviewed by phone during the year one survey when children were at about age one (see Sample Counts and Attrition Overtime Section in FFCWS User Guide; Bendheim-Thoman Center for Research and Wellbeing & Columbia Population Research Center, 2018). For the purpose of analysis, the current sample intentionally included children who had valid values for IPV exposure in year 1. Consequently, 560 cases with missing data on the IPV measures in year 1 were excluded. The final analytic sample consisted of 4338 families. The present study applied de-identified secondary data analyses that fall under the exemption category for ethical board review and approval.

Children's age in year one ranged from 9 to 30 months ($M_{\text{childagel}} = 15.02$ months, $SD = 3.47$). Mothers' race/ethnicities were 21.08% Non-Hispanic White, 47.61% Black/African American, 27.34% Hispanic/Latina, and 3.97% Other/Mixed race. In year one, mothers' ages ranged from 15 to 48 years ($M_{\text{motherage1}} = 26.43$ years, $SD = 6.06$). Most families (67.01%) reported an income level below 200% of the federal poverty line, and 60.43% of mothers indicated high school or lower educational attainment. In terms of the sex distribution of the focal children, 52.2% were males, and 47.8% were females (Table 1).

TABLE 1 Demographic information ($N = 4338$).

Variable	Sample mean (*SD* or %)
Child sex	Boys = 2556 (52.2%)
Child's age (months) (Y1)	15.02 ($SD = 3.47$)
Child's age (months) (Y3)	35.78 ($SD = 2.58$)
Child's age (months) (Y5)	61.87 ($SD = 2.85$)
Mother's age (Y1)	26.43 ($SD = 6.06$)
Poverty status (Y3)	
0%–49% of poverty line	957 (22.62%)
50%–99% of poverty line	819 (19.36%)
100%–199% of poverty line	1059 (25.03%)
200%–299% of poverty line	573 (13.54%)
>300+ of poverty line	823 (19.45%)
Mother race (Y1)	
Non-Hispanic/White	1030 (21.08%)
Black/African American	2326 (47.61%)
Hispanic	1336 (27.34%)
Others/mixed race	194 (3.97%)
Mother's education (Y1)	
Less than high school	1340 (30.73%)
High school or equivalent	1295 (29.70%)
Some college	1222 (28.03%)
College or graduate and above	503 (11.54%)
Relationship status (Y1)	
Married	1295 (29.90%)
Cohabited	1180 (27.2%)
Single	1855 (42.59)

Note: Means and standard deviations are reported for continuous variables and percentages for categorical variables. Y1: year 1 when focal children were aged 1; Y3: year 3 when focal children were aged 3; Y5: year 1 when focal children were aged 5.

Measures

IPV experience in year 1

IPV was assessed using seven items adapted from the Conflict Tactics Scale for adults (CTS2; Straus et al., 1996, 1998). Mothers self-reported their IPV victimization experiences, reflecting how often fathers exhibited violent and abusive behaviors against them during the last month before reporting (Straus, 1979). IPV items included multiple forms of physical violence, sexual violence, emotional/psychological abuse, and financial abuse (See supplemental material for the full list of items). Responses ranged on a 3-point Likert scale: *often (1), sometimes (2), never (3)*. The study recoded the never responses into zero and created composite sum scores (ranging from 0 to 7) to represent IPV victimization experiences, with higher scores representing greater levels of IPV against mothers.

Parenting stress in year 3.

Parenting stress was measured by four items derived from Abidin's (1995) Parent Stress Inventory. An example item was "I feel trapped by my responsibilities as a parent." Responses ranged on a 4-point Likert scale: *strongly agree* (1), *somewhat agree* (2), *somewhat disagree* (3), and *strongly disagree* (4). Four items were reverse coded and summed to create a composite score, with higher values indicating greater levels of parenting stress. The scale Omega reliability was 0.68.

Maternal warmth in year 3

Maternal warmth was assessed by 5 dichotomized items, part of Home Observation for Measurement of the Environment (Bradley & Caldwell, 1977, 1979). Interviewers conducting in-home observations received training from Mathematica Policy Research, Inc. (Bendheim-Thoman Center for Research and Wellbeing & Columbia Population Research Center, 2018). Interviewers were trained and tested during the training to ensure consistent coding using training cases before being sent onto the field. After visiting the families, interviewers completed the HOME scale based on the mother's affection and accepted behaviors during interactions with children (one trained observer coded for one house). One example item is "Parent does not express overt annoyance with or hostility to the child." Items were coded as *not warm* (0) and *warmth* (1), and a sum score was created in which higher values meant greater maternal warmth. The reliability and validity of the scale have been affirmed through adequate criterion validity, internal consistency, and test–retest reliability in previous studies (e.g., Bradley & Caldwell, 1977, 1979; Totsika & Sylva, 2004). The scale Omega reliability was 0.78.

Behavioral regulation in year 5

Behavioral regulation was measured using a subset of items from the Child Behavior Checklist (CBCL; Achenbach, 2011), specifically from the impulsivity, aggression, and attention span subscales (Dawes et al., 1997). These items assess children's capacities in intentionally applying various forms of attentional, cognitive adaptability, and inhibitory control to manage their behaviors in social settings (McClelland & Tominey, 2014; Rescorla et al., 2007). The validity of these items has been established in previous studies (e.g., Deutz et al., 2018; Zhang et al., 2024). Mothers rated the frequency of children's behavior on a three-point Likert scale: *not true* (0), *somewhat or sometimes true* (1), and *very true or often true* (2). An example item was: "Child needs must be met immediately." A sum composite score was created with higher values representing greater levels of lack of behavioral regulation. Considering the directionality of scoring, the term *behavioral dysregulation* was used in the analyses and further interpretation. The scale Omega reliability was 0.88.

Attentional regulation in year 5

Children's attentional regulation in year 5 was measured by the Attention Sustained task from the Leiter International Performance Scale-Revised (Roid & Miller, 1997). Children were shown a picture with various objects and a target object. They were asked to draw a line through as many matching objects as possible without crossing out distractors within the allotted time. Four timed trials were performed, and two attention scores were calculated: focused attention (number of correct responses) and lack of impulsivity (reversed coding of incorrect

responses). Attentional regulation was determined by adjusting the total number of correct responses for the total number of errors. In the current sample, the mean was 12.41 ($SD = 3.39$) and ranging from 1 to 19, higher than the national sample. The task has high internal consistency with alpha = 0.91 (Roid & Miller, 1997).

Control variables

Several social and demographic variables that correlate with either IPV, parenting, or self-regulation were included in the model as control variables. Mothers reported child sex in baseline (0 = *boy*, 1 = *girls*). Mothers self-reported their age in years and the number of children in the household. Maternal impulsivity was initially coded on a 4-point Likert scale from *strongly agree* (1) to *strongly disagree* (4) using Dickman's impulsivity scale (Dickman, 1990). In this study, the coding was reversed so that higher values indicated greater impulsivity and a composite score was created for analysis. Maternal depression was estimated using a binary variable (0 = *not depressed*, 1 = *probably depressed*) in year 3. Poverty ratio was measured by the mother's self-reported household annual income divided by the U.S. Census Bureau's federal poverty threshold of that year and adjusted for family size. The inclusion of poverty and depression as control variables at year 3 was informed by both developmental significance and data availability specific to this time point. By year 3, more evident impacts of these factors, which are potentially linked to parenting variables at the same time point. This allows for the analysis of the distinct contributions of maternal parenting stress and maternal warmth at year 3 on subsequent levels of self-regulation in children. For child maltreatment, mothers reported the frequency of each event on a scale from 0 (never) to 6 (more than 20 times). We calculated the midpoints of the frequencies as recommended and summed the scores of the three items. These sum scores were then recoded into a dichotomous indicator: 1 for those in the top 10th percentile and 0 for those in the remaining 90th percentile, representing extreme frequencies of the behaviors.

Analytic plan

Descriptive demographic statistics and Pearson correlation analyses were used to examine the main variables in RStudio 4.2. Serial Mediation Modeling was used to examine the sequential mediating effects of IPV on various aspects of self-regulation through a series of intermediate variables using bootstrapping ($N = 1000$) in AMOS 27 (Hayes, 2009). We utilized a single-path model for both self-regulation outcomes. This decision was made considering the two aspects of self-regulation are conceptually related, so a unified model would more effectively illustrate the overarching relationships and influences across the different aspects of self-regulation. Several fit indices were used to evaluate the acceptable model fit, including Chi-square, Comparative Fit Indices (CFI) > 0.90, and Root Mean Squared Error of Approximation (RMSEA) < 0.08 (Hu & Bentler, 1999). Full-information Maximum Likelihood (FIML) estimation with the maximum likelihood (ML) estimator was used to handle nonnormality distribution and missing data. The percentage of missing data for the variables was examined first that the missing data ranged from 10% to 54%, with higher rates noted for constructs measured in later years and those measured during home observations. The results of Little's missing completely at random test showed that the missing in this sample was not completely at random (χ^2 ($df = 43$) = 88.8, $p < 0.001$), which is consistent with other studies using the FFCWS survey data and suggested that families with disadvantaged demographics and socioeconomic status were more likely to be lost to attrition (e.g., Huang et al., 2020; Juan et al., 2017). In our study, we also implemented multiple imputations in AMOS (Arbuckle, 2005) to manage missing data (Enders, 2022).

RESULTS

Descriptive and correlation analyses

Person correlation analyses (Table 2) showed that IPV exposure was positively linked with behavioral dysregulation ($r = 0.08$, $p < 0.01$) but not significantly linked with attentional regulation ($r = 0.02$, $p > 0.05$). Parenting stress was negatively associated with maternal warmth ($r = -0.06$, $p = 0.01$) and positively associated with behavioral dysregulation ($r = 0.16$, $p < 0.01$). Maternal warmth was negatively associated with behavioral dysregulation ($r = -0.12$, $p < 0.01$) and positively associated with attentional regulation ($r = 0.09$, $p < 0.01$).

Path and mediation analyses

Testing our proposed hypotheses, the path mediation model (Figure 1 and Table 3) presented a good model fit ($\chi^2 = 55.8$, $df = 11$, $p < 0.01$, CFI = 0.975, RMSEA = 0.031). Several direct effects were found. IPV exposure in year 1 significantly predicted behavioral dysregulation in year five, with higher levels of IPV exposure contributing to increased behavioral dysregulation ($\beta = 0.057$, $p < 0.01$), but not directly linked with attentional regulation ($\beta = 0.023$, $p = 0.306$; Hypothesis 1). No significant direct link between IPV and maternal warmth was observed ($\beta = -0.011$, $p = 0.631$; Hypothesis 2). Greater levels of maternal warmth were associated with lower levels of behavioral dysregulation ($\beta = -0.082$, $p < 0.01$) and higher levels of attentional regulation at age five ($\beta = 0.067$, $p = 0.018$). For testing Hypothesis 3, as presented in Figure 1, we identified significant indirect effects of parenting stress and maternal warmth as serial mediators in the relationship between IPV and behavioral dysregulation ($p = 0.002$, 95% CI [0.001, 0.003]), and the mediation effect for attentional regulation was also significant ($p = 0.002$, 95% CI [0.018, 0.153]). Furthermore, the mediation effect of parenting stress on IPV to maternal warmth was also significant ($p = 0.003$, 95% CI [−0.004, −0.001]).

Control variables

In our analysis, the roles of control variables such as child sex, mother's age, maternal depression, maternal impulsivity, child maltreatment, and poverty ratio were found to contribute to the mediation model. Specifically, child sex was a significant predictor that girls presented higher levels of both behavioral and attentional regulation at age five. The number of children was not found to be linked with behavioral or attentional regulation. Mother's age was linked inversely with attentional regulation, such that children with younger mothers presented higher levels of attentional regulation than children with older mothers. Maternal depression's effect was found to be significant on attentional regulation only that those children with depressed mothers presented lower levels of attentional regulation at age five. Maternal impulsivity was also a significant positive predictor of parenting stress and behavioral dysregulation. Lastly, the poverty ratio at age three demonstrated significant positive associations with maternal warmth and attentional regulation and was negatively associated with behavioral dysregulation at age five. This suggests that higher family income is associated with better attentional and behavioral regulation. Child maltreatment experienced at age three was also positively associated with behavioral dysregulation and negatively associated with attentional regulation at age five.

We conducted a sensitivity analysis without having control variables in the model. The path mediation model indicated a poor fit ($\chi^2 = 55.7$, $df = 2$, $p < 0.01$, CFI = 0.64, RMSEA = 0.79).

TABLE 2 Bivariate correlations among variables in path model ($N = 4338$).

		1	2	3	4	5	6	7	8	9	10	11
1	IPV (Y1)	1.00										
2	Parenting stress (Y3)	0.09***	1.00									
3	Maternal warmth (Y3)	−0.02	−0.06*	1.00								
4	Behavioral dysregulation (Y5)	0.08***	0.16***	−0.12***	1.00							
5	Attentional regulation (Y5)	0.02	−0.03	0.09**	−0.09***	1.00						
6	Maternal impulsivity (Y3)	0.12***	0.32***	−0.05*	0.18***	−0.03	1.00					
7	Child sex (Birth)	0.03*	−0.02	0.05*	−0.09***	0.17***	−0.03*	1.00				
8	Poverty ratio (Y3)	−0.06***	−0.05**	0.14***	−0.13**	0.12***	−0.14***	0.00	1.00			
9	Number of children (Y3)	0.02	0.08***	−0.02	0.04*	−0.05*	0.02	0.01	−0.20***	1.00		
10	Child maltreatment (Y3)	0.06**	0.09***	−0.16***	0.12***	−0.06*	0.07***	−0.06***	−0.04*	−0.02	1.00	
11	Maternal depression (Y3)	0.11***	0.20***	−0.07**	0.15***	−0.01	0.19***	0.01	−0.10***	0.02	0.07***	1.00
	Mean (*SD*)/%	0.76 (1.25)	4.98 (2.66)	4.51 (1.05)	8.92 (6.30)	12.41 (3.39)	6.16 (3.70)	52.12%[a]	1.96 (3.70)	2.31 (1.34)	12.41%[b]	20.72%[c]
	Range	1–7	0–12	0–5	0–40	1–19	0–18	0–1	1–18	0–10	0–1	0–1

Note: Y1: year 1 when focal children were aged 1; Y3: year 3 when focal children were aged 3; Y5: year 5 when focal children were aged 5.

[a]Frequency reported for boy.

[b]Frequency reported for have child maltreatment.

[c]Frequency reported for cases with records of maternal depression.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

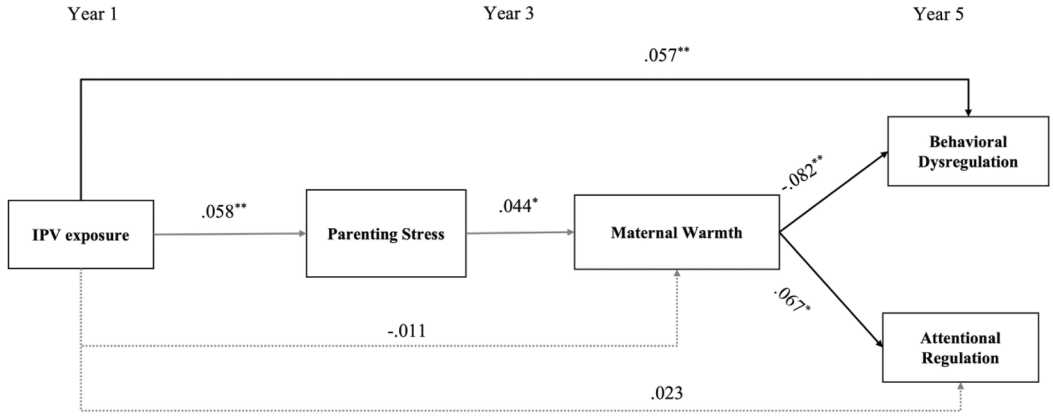

FIGURE 1 Full mediation model ($N = 4338$). $N = 4338$, $\chi^2 = 55.8$, $df = 11$, CFI = 0.975, RMSEA = 0.031. Controlled variables in the model are child sex, number of children, mother's age, maternal depression, maternal impulsivity, child maltreatment, and poverty ratio. Reported standardized coefficient. *$p < 0.05$. **$p < 0.01$.

Similar to the model with control variables included, several direct effects were found that IPV exposure at age one significantly predicted behavioral dysregulation in year five ($\beta = 0.078$, $p < 0.001$), but not directly linked with attentional regulation ($\beta = 0.023$, $p = 0.3$). No significant direct link between IPV and maternal warmth was observed ($\beta = -0.02$, $p = 0.43$). Greater levels of maternal warmth were associated with lower levels of behavioral dysregulation ($\beta = -0.18$, $p < 0.001$) and higher levels of attentional regulation at age five ($\beta = 0.088$, $p = 0.002$).

DISCUSSION

This study investigated the longitudinal mediation relationships among maternal IPV experiences, parenting stress, maternal warmth, and two aspects of self-regulation. By exploring these longitudinal relationships, this study provides insights into the impact of maternal IPV experiences on parenting dynamics and children's self-regulation during early childhood years.

The findings revealed that children exposed to IPV during infancy presented lower levels of behavioral regulation at age five, indicating that IPV exposure has a negative effect on the development of children's behavioral regulation. These findings align with previous research on IPV exposure's impact on other aspects of self-regulation, such as emotional regulation and behavioral patterns (e.g., Harding et al., 2013; Lee, 2001; Maughan & Cicchetti, 2002; Zhang, Shen, et al., 2023). However, this study extends the existing evidence by utilizing a larger sample size and assessing behavioral regulation specifically. Interestingly, our study did not find a significant direct effect of IPV exposure on attentional regulation, which could be due to several reasons. Attentional regulation is a complex concept influenced by individual factors, including cognitive abilities and executive functioning skills, which are strongly connected to how well a person can regulate their attention (Diamond, 2013). Children with weaker executive functioning skills may struggle more with regulating their attention. It should be noted that behavioral regulation and attentional regulation are distinct yet interconnected aspects of self-regulation (Blair & Ku, 2022). Their developmental trajectories may differ, leading to differentiated responses to IPV exposure. Second, the lack of a significant direct effect between IPV and attentional regulation might also be attributed to measurement limitations. The assessment tool used to measure attentional regulation was the Leiter task at one time during a home visit, which may not fully capture children's levels of attentional regulation (Razza

TABLE 3 Standardized estimates of the mediation model ($N = 4338$).

	***b* (*SE*)**
IPV (Y1) ➔ Behavioral dysregulation (Y5)	0.057 (0.095)**
IPV (Y1) ➔ Attentional regulation (Y5)	0.023 (0.06)
IPV (Y1) ➔ Parenting stress (Y3)	0.058 (0.033)**
IPV (Y1) ➔ Maternal warmth (Y3)	−0.011 (0.019)
Parenting stress (Y3) ➔ Maternal warmth (Y3)	0.044 (0.009)*
Maternal warmth (Y3) ➔Behavioral dysregulation (Y5)	−0.082 (0.151)**
Maternal warmth (Y3) ➔ Attentional regulation (Y5)	0.067 (0.091)*
Child sex ➔ Behavioral dysregulation (Y5)	−0.077 (0.234)**
Child sex ➔ Attentional regulation (Y5)	0.164 (0.149)**
# of children (Y3) ➔ Behavioral dysregulation (Y5)	0.037 (0.093)
# of children (Y3) ➔ Attentional dysregulation (Y5)	−0.025 (0.059)
Mother age (Y1) ➔ Behavioral dysregulation (Y5)	−0.036 (0.021)
Mother age (Y1) ➔ Attentional regulation (Y5)	−0.088 (0.013)**
Maternal depression (Y3) ➔ Behavioral dysregulation (Y5)	−0.009 (0.00)
Maternal depression (Y3) ➔ Attentional regulation (Y5)	0.057 (0.00)*
Maternal impulsivity (Y3) ➔ Parenting stress (Y3)	0.318 (0.011)**
Maternal impulsivity (Y3) ➔ Behavioral dysregulation (Y5)	0.146 (0.033)**
Maternal impulsivity (Y3) ➔ Attentional regulation (Y5)	−0.013 (0.021)
Maltreatment (Y3) ➔ Behavioral dysregulation (Y5)	0.084 (0.397)**
Maltreatment (Y3) ➔ Attentional regulation (Y5)	−0.045 (0.25)*
Poverty ratio (Y3) ➔ Parenting stress (Y3)	0.000 (0.016)
Poverty ratio (Y3) ➔ Maternal warmth (Y3)	0.155 (0.009)**
Poverty ratio (Y3) ➔ Behavioral dysregulation (Y5)	−0.057 (0.051)**
Poverty ratio (Y3) ➔ Attentional regulation (Y5)	0.106 (0.032)**
Model R^2 (predicting behavioral regulation)	0.078
Model R^2 (predicting attentional regulation)	0.052

Note: Y1: Year 1 when focal children were aged 1; Y3: Year 3 when focal children were aged 3; Y5: Year 5 when focal children were aged 5.

*$p < 0.05$. **$p < 0.01$.

et al., 2012). Individual performance on a single task can be influenced by a variety of factors, such as motivation, fatigue, familiarity with the test format, or even the testing environment. These variabilities may affect the variance of the scores and the power of detecting statistical significance (Rouder & Haaf, 2019).

Our findings showed that mothers' experiences of IPV were associated with increased self-reported parenting stress in mothers. IPV, as a type of family stressor, can disrupt the family system and have cascading effects on family members, including parents and children. This study's findings support McCoy's (2013) violence bioecological system model by demonstrating a link between maternal IPV experiences and higher levels of parenting stress in mothers. However, it is noteworthy that IPV experiences were not directly associated with decreased maternal warmth; this finding aligns with the compartmentalization hypothesis. Some mothers who have children exposed to violence may still exhibit warmth and compensate for the exposure through positive parenting interactions (Letourneau et al., 2007). These mothers create a buffer against the negative impact of IPV on their functioning as mothers. While we did not find a direct association between IPV and maternal

warmth, the presence of a mediation effect through parenting stress suggests that IPV has an indirect impact on maternal warmth. This presents a complexity in that some mothers can effectively separate the effects of IPV from their parenting behaviors, and the mediation by parenting stress indicates that IPV may still exert an influence, albeit indirectly, on maternal warmth. In other words, our findings demonstrate that while direct compartmentalization may occur, the indirect effects mediated by stress are still significant and impactful. Taken together, the mediation by parenting stress suggests that the influence of IPV on maternal warmth is more indirect and nuanced, and that parenting stress plays a crucial role in linking IPV to parenting outcomes. Similar findings have been reported in previous studies with Black and Hispanic mothers from communities affected by IPV, where increased parenting stress was linked to more disengaged and unresponsive parenting behaviors, as well as increased use of physical punishment (Sypher et al., 2017). These findings highlight the importance of considering parenting stress as a key mechanism through which IPV experiences associate with maternal warmth.

Lastly, our study indicates that IPV exposure during infancy has a profound, long-term effect on children's self-regulation observed at age five. This pathway is significantly mediated by increased maternal perceptions of parenting stress, as well as variations in parental warmth. Notably, parenting stress emerged as a crucial mediator in this context, highlighting its role in the connection between early IPV exposure and later self-regulatory outcomes in children (Zhang, Cannata, et al., 2023; Zhang, Shen, et al., 2023). This finding underscores the importance of addressing parenting stress in interventions aimed at mitigating the long-term effects of IPV on child regulatory outcomes.

Implications

The high prevalence of IPV exposure in the U.S. calls for urgent action from policymakers and practitioners to mitigate its adverse effects and ensure children's optimal development. The current findings highlight the long-term effects of early IPV on children's behavioral regulation, suggesting a holistic strategy that considers both children's living environment and individual-level development is necessary to implement early intervention. Particularly, the experiences of mothers play a pivotal role in shaping a child's early living environment. The impact of maternal traumatic experiences, such as IPV, and their subsequent effects on parenting stress and maternal warmth, are crucial factors that require attention. Considering the U.S. society's diverse socioeconomic, cultural, and family structures, the community's role in preventing IPV is crucial. Community-based prevention, for example, can promote family members' awareness of diverse IPV through conversations and community leader advocacy (Yoshihama et al., 2012).

Our research also identifies the role of parenting stress and maternal warmth in enhancing self-regulation, underscoring the need for tailored programs fostering parenting stress reduction and positive parenting. For instance, parenting programs and home visitors, trained to detect early signs of IPV and teach positive parenting, can be instrumental. Healthy Family New York, an in-home visiting intervention program, has successfully enhanced positive parenting and reduced child maltreatment and harsh parenting. These home visitors can also work with parents on child development and connect families with community resources (Kirkland et al., 2020). These home-visiting programs must be trauma-informed (Goddard, 2021), which means practitioners need to recognize the challenges IPV survivors face and support them in their parenting roles. Practitioners should validate mothers' experiences and avoid language that might trigger memories of feeling powerless. It is also crucial to identify resources to support these mothers rather than blaming them for perceived parenting deficits.

Lastly, the findings also highlighted the importance of intervention programs bolstering behavioral and attentional regulatory skills in children exposed to IPV. This urgently calls for social workers, clinicians, and therapists to attend to the needs of children witnessing IPV. The empirical study provided evidence that child–parent psychotherapy could effectively reduce behavioral dysregulation in children who were exposed to marital violence (Lieberman et al., 2005). Specifically, therapists could facilitate child–parent psychotherapy sessions between parents and children, utilizing play therapy to help children process trauma while simultaneously supporting the caregivers to create a secure and supportive environment and parenting skills. Preschool Kids' Club, a community-based preventive intervention designed specifically for preschool-aged children exposed to IPV has shown effective intervention to support children's regulatory skills. It is a 12-week intervention focused on reducing trauma symptoms and behavior or attentional problems while increasing self-esteem, social competence, and emotion regulation skills. Research has found it effective at reducing attention problems among preschool children exposed to IPV compared to a control group (Clark et al., 2021). Family support could also be crucial for reducing parenting stress, as evidenced by research showing the positive effects of daily intergenerational support on mothers' well-being during stressful times (e.g., Jiang et al., 2020; Jiang & Fung, 2022).

Limitations and future directions

Some limitations should be acknowledged. First, while our study adds to the existing literature by examining two critical components of self-regulation, it omitted investigating emotion regulation due to secondary data analysis constraints. Future studies could thoroughly examine the association between IPV exposure and children's multidimensional self-regulation in one comprehensive model. Also, this study suggested a potential sequential relationship between IPV, parenting stress, and maternal warmth. However, both parenting stress and maternal warmth were evaluated at age three. Therefore, temporal precedence for parenting stress prompting decreases in maternal warmth is not established, and this cross-sectional nature of the measurements limits our ability to establish a causal sequence. Additionally, due to the limitations inherent in secondary data analysis, our current research could not test the effects of paternal IPV experiences on child self-regulation. Future research endeavors should be tailored to differentiate the impacts of various IPV dynamics, including paternal experiences, on child self-regulation, offering a more comprehensive view of the IPV spectrum's influence on developmental outcomes.

CONCLUSION

This study reveals the longitudinal mediation relationships among maternal IPV experiences, parenting stress, maternal warmth, and children's self-regulation. IPV exposure at age one is significantly associated with children's behavioral regulation at age five, suggesting its negative effect on self-regulation. Parenting stress is a key mechanism linking IPV to reduced maternal warmth. While attentional regulation is not directly influenced by IPV, it may be affected by other factors mediated through parenting stress and maternal warmth. These findings emphasize the importance of addressing IPV and parenting stress to support healthy self-regulation and overall well-being in children exposed to IPV.

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DATA AVAILABILITY STATEMENT

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

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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