AMERICAN PSYCHOLOGICAL ASSOCIATION

Journal of Family Psychology

ISSN: 0893-3200

2023, Vol. 37, No. 1, 110–120
https://doi.org/10.1037/fam0001017

The Role of Strategy-Use and Parasympathetic Functioning in Maternal Emotion Regulation

Xutong Zhang[1], Lisa M. Gatzke-Kopp[1], Pamela M. Cole[2], and Nilam Ram[3, 4]
[1] Department of Human Development and Family Studies, The Pennsylvania State University
[2] Department of Psychology, The Pennsylvania State University
[3] Department of Psychology, Stanford University
[4] Department of Communication, Stanford University

Research has recognized that parental emotion regulation influences whether parents respond sensitively to their children in challenging parenting situations. However, parental emotion regulation is usually assessed using questionnaires that are not about parenting, rather than through examining parents' reaction to specific parenting situations that might evoke negative emotions. This study investigates individual differences in mothers' emotion regulation during parenting, specifically examining the relation between their subjective negative emotions and observed parenting behaviors and whether this relation is moderated by cognitive (strategies to manage negative emotions) and physiological (resting baseline and reactivity of respiratory sinus arrhythmia; RSA) processes. Data of 157 mothers' self-reported negative emotions and strategy-use, their RSA, observed maternal responsiveness, and their preschool-age children's (30–60 months, 49.7% female) challenging behaviors were collected during a Wait Task, in which mothers told children to wait before opening an appealing gift. Regression analysis indicated that, after controlling for how challenging children were, mothers' level of negative emotion was not associated with observed level of maternal responsiveness. In line with hypotheses, the association was moderated by mothers' resting RSA and the extent to which they suppressed negative emotions. However, contrary to hypotheses, the association was not moderated by use of reappraisal, distraction, or rumination, or RSA reactivity. The significant findings suggest that, although mothers' subjective experiences of negative emotions are not necessarily related to less responsive parenting behaviors, the link between maternal emotions and parenting behavior may indicate differences in how mothers engage cognitive strategies as well as their physiological regulation capacity.

Keywords: parental emotion regulation, parental responsiveness, RSA, strategy-use

Supplemental materials: https://doi.org/10.1037/fam0001017.supp

Over the preschool-age years, children typically show a decrease in negative emotions and an increase in committed behavioral compliance as they develop self-regulation skills (Cole et al., 2011; Kochanska et al., 1995). Models of the development of self-regulation in early childhood point to parent–child interaction as a critical context for such growth (Kochanska & Murray, 2000; Thompson, 2014). When young children struggle to cope with frustrating situations, parental responsiveness—attending and tailoring parenting behaviors to children's interests and needs—is thought to help children internalize behavioral rules and regulatory strategies, and in the long-term contribute to the development of children's self-regulation (Bernier et al., 2010; Wilson & Durbin, 2013). Responding sensitively to children requires parents to regulate their own negative emotions, especially when children's behaviors are demanding and hard to manage. Research has recognized that parental emotion regulation influences parenting behaviors (Hajal & Paley, 2020). However, most studies have assessed parental emotion regulation as a trait-like ability, such that individuals who report greater emotion regulation skills through questionnaires unrelated to parenting are presumed to also regulate their emotions more effectively in parenting situations. Parenting represents a uniquely challenging context, in which parents need to regulate emotions in the service of their parental role, attending to children's needs even when parents themselves experience negative

This article was published Online First July 21, 2022.
Xutong Zhang https://orcid.org/0000-0003-1661-5619
Lisa M. Gatzke-Kopp https://orcid.org/0000-0003-4470-4555
Pamela M. Cole https://orcid.org/0000-0002-0753-7009
Nilam Ram https://orcid.org/0000-0003-1671-5257
This research was supported by the National Institute of Child Health and Human Development (R01-HD076994; co-PIs: Pamela M. Cole and Nilam Ram). The article is based on the doctoral dissertation of Xutong Zhang submitted to the Pennsylvania State University. Some of the results were presented at the Society for Research in Child Development (SRCD) 2021 Virtual Biennial Meeting. The authors thank the graduate and undergraduate research assistants who contributed to the data collection and processing, as well as the families that participated in the study.

Materials and measures (except for established scales that are available through the original sources cited in text) have been included in the Supplemental Materials. Analysis codes can be accessed at https://osf.io/gx46k/?view_only=a340acdc045145dc9b5478b9177e05f8. Data are available through arrangement with the Development of Self-Regulation Dynamics Project investigators in accordance with all relevant institutional review board privacy protocols. The study design and analytic strategies were not preregistered.

Correspondence concerning this article should be addressed to Xutong Zhang, Department of Human Development and Family Studies, The Pennsylvania State University, 119 HHD Building, University Park, PA 16802, United States. Email: zhanx428@mcmaster.ca

emotions. The mechanisms facilitating or interfering with parental emotion regulation may be unique from those addressed in the general models of adult emotion regulation. In this study, we examine parental emotion regulation in the context of parenting, specifically whether the relation between parents' emotional experiences and observed parenting behaviors is moderated by cognitive (engagement of specific strategies) and physiological (parasympathetic functioning) processes that may be implicated in adult emotion regulation.

Parental Emotion Regulation in the Context of Parenting

Functional theories of emotion conceptualize emotion as a continuous process of appraising the circumstances and preparing to act to maintain or regain well-being (Frijda, 1986). From this perspective, even negative emotions evoked by child behaviors can have motivational values that provoke parents to cope with situational demands. In empirical research, parents' self-reported negative emotions, which encompass a collection of emotions that often co-occur in the challenging moments of parenting (e.g., irritation, frustration, and worry), have been associated with less positive and more negative ways of reacting to their children (e.g., lower levels of parental responsiveness, harsh parenting behaviors; Lorber & O'Leary, 2005; Martin et al., 2002; Rueger et al., 2011). However, those studies only found small- to medium-sized effects on average, with considerable heterogeneity in the association between parental emotions and parenting behaviors (Rueger et al., 2011).

The heterogeneity in the findings may reflect individual differences in parents' regulation of negative emotions, which can prevent parents from acting on prepotent tendencies that are ill-advised or detrimental for long-term goals and allow them to choose alternative actions (Dix, 1991; Teti & Cole, 2011). That is, consistent with the functionalist perspective on emotion, negative emotions may not be essentially problematic and may only lead to maladaptive parenting behaviors when they are not appropriately regulated. For instance, a recent study of the relations among mothers' subjective emotions, intentions to act, and actual behaviors during everyday occasions of parenting challenges (Hajal et al., 2019) identified a "regulated-disengaged" profile marked by relatively high levels of irritation and discouragement, self-reported intention to disengage with the situation, *and* engagement of behaviors to attend to the child. That is, in at least a quarter of the occasions measured, mothers reported experiencing negative emotions but regulated those emotions in ways that allowed them to attend to their children's needs. This finding highlights how the relation between parental emotions and parenting behaviors measured directly *in the context of parenting* can reveal information about parental emotion regulation. Building on this research and recent theoretical synthesis in defining self-regulation (e.g., Cole et al., 2019), we conceptualize parental emotion regulation as the influence of mental and/or behavioral actions on how parents experience and express emotions and, given the interest in parenting quality, especially on how emotions translate into variations in parenting behaviors. The present study examines whether cognitive and physiological processes implicated in adult emotion regulation—mothers' use of strategies when experiencing negative emotions and the engagement of their parasympathetic nervous system in regulating arousal—moderate the relation between mothers' subjective negative emotions and responsiveness to their children in a challenging parenting situation.

Parental Use of Strategies to Manage Negative Emotions

When experiencing negative emotions, individuals may engage in various *strategies* to manage these emotions. Some common strategies identified in the literature of adult emotion regulation include trying to think about an unpleasant situation in a positive way (i.e., reappraisal) or redirecting attention from the situation toward other neutral or positive contents (i.e., distraction; Efinger et al., 2019; Gross, 1998). Individuals may also ponder over their emotions in an effort to understand it (i.e., rumination) or try to inhibit emotional responses (i.e., suppression; Gross, 1998; Moberly & Watkins, 2008). In the research of adult emotion regulation, reappraisal and distraction are typically seen as adaptive strategies, as they effectively reduce both subjective and expressed negative emotions in experimental studies (Efinger et al., 2019; Webb et al., 2012). In contrast, rumination and suppression are often seen as maladaptive because, although suppression may inhibit expression, both strategies are ineffective in reducing (and may actually exacerbate) subjective negative emotions and heightened physiological arousal (Gross, 1998; Moberly & Watkins, 2008; Ray et al., 2008).

However, such "adaptiveness" is examined in individual-oriented contexts (e.g., watching an emotional film alone) and defined by individuals' internal experiences. The role of strategies in parental emotion regulation, such as whether they support or interfere with parental responsiveness when parents experience negative emotions about children's behaviors, are less clear. For instance, while reappraisal may still play a supportive role by altering negative perceptions of child behaviors and thus preventing a decrease in parental responsiveness (Kohlhoff et al., 2016; Lorber, 2012), distraction (e.g., shifting attention away from the interaction with children) may disrupt parents' awareness and understanding of children's emotion cues and impact their ability to respond sensitively (Leerkes, 2010). The functions of rumination and suppression, which are both deemed maladaptive in individual contexts, may also diverge in the context of parenting. Rumination likely compromises parental responsiveness, as ruminating parents may be entangled in their own negative feelings rather than paying attention to children's needs. In contrast, although suppression is ineffective in reducing negative feelings and may thus interfere with parental responsiveness (Le & Impett, 2016; Waters et al., 2020), some studies also found that parents who tended to suppress their negative emotions engaged in less harsh parenting behaviors when children were hard to manage (Kohlhoff et al., 2016; Lorber, 2012). The mixed findings suggest that suppressing negative emotions may have both benefits and costs in parenting. It may reflect parents' effort to not act upon irritation and frustration; however, as suppression may sustain parents' negative feelings while counteracting the functional value of emotions (e.g., motivating parents to take actions), it may compromise parents' ability to respond sensitively to their children's needs.

To summarize, the role of these strategies in parental emotion regulation has not been clearly addressed. Although a few studies linked specific strategies to parenting behaviors (e.g., reappraisal and suppression; Le & Impett, 2016; Lorber, 2012), they did not account for how emotionally provoking the parenting situation was or the degree to which parents experienced negative emotions. These factors represent the demands for regulation and can vary drastically depending on how children behave and how the interaction unfolds. Thus, the role of strategies in parental emotion regulation involves not only whether they are invoked or how

they are associated with parenting behaviors, but more importantly how they moderate the relation between parents' negative emotions and parenting behaviors.

Parasympathetic Functioning and Parental Emotion Regulation

In addition to strategies measured at the cognitive level, individuals' physiological responses, especially those reflecting parasympathetic regulation of arousal, have also been extensively examined in relation to adult emotion regulation (Balzarotti et al., 2017; Beauchaine, 2015). When activated, the parasympathetic nervous system inhibits cardiac arousal, conserving and restoring energy to maintain body functioning and support affiliative behaviors (Berntson et al., 1993; Porges, 2003). When individuals face challenges, there is typically a withdrawal of parasympathetic inhibition (resulting in an increase in cardiac arousal), which mobilizes physiological resources to support coping responses while maintaining the ability to quickly reinstate inhibition and avoid sustained or excessive arousal (Porges, 2007). Thus, both trait-like parasympathetic activity (measured as resting levels) and state-like reactivity may play unique roles in how parents respond to child-related challenges.

Parasympathetic activity is commonly measured by respiratory sinus arrhythmia (RSA), an index of heart rate variability as a function of respiration (Berntson et al., 1993). Resting RSA when no environmental challenge is present captures relatively stable individual differences in parasympathetic activity (e.g., Bornstein & Suess, 2000). Higher resting RSA (i.e., greater inhibition over cardiac arousal) has been related to activation of the prefrontal cortex that supports executive functioning (Thayer & Lane, 2009), and may thus indicate a greater capacity to self-regulate. Higher resting RSA is also theorized to support interpersonal affiliation (Porges, 2003) and has been related to more responsive parenting behaviors among mothers of young children (Joosen et al., 2013; Musser et al., 2012). Meanwhile, parents' RSA reactivity, which indicates state-like parasympathetic responses relative to resting levels, has also been studied in the context of parenting. Some studies found an association between a greater decrease in maternal RSA (i.e., RSA suppression) in challenging parenting situations and more sensitively responsive parenting behaviors (Joosen et al., 2013; Moore et al., 2009). Based on these findings, RSA suppression may facilitate parents' emotional and behavioral engagement to respond to children's needs even when they are challenged by children's behaviors. However, some studies have also indicated the value of maintaining higher levels of RSA in challenging parenting situations for parents to act supportively rather than harshly to their children (Lorber & O'Leary, 2005; Ravindran et al., 2022).

In summary of these findings, higher resting RSA likely plays a supportive role for parental emotion regulation, whereas the role of RSA reactivity is unclear. Again, although RSA measures have been associated with parenting behaviors, there is little evidence on their association with parental emotion regulation, where their implications need to be understood in conjunction with the degree to which parents experience negative emotions. For instance, a lack of RSA suppression may be adaptive when parents experience low levels of negative emotions about children's behaviors, but may reflect a tendency to disengage in the context of more negative emotions. Thus, the present study examines how resting RSA and RSA reactivity moderate the relation between maternal negative emotions and responsiveness.

The Present Study

This study examines the moderating role of maternal strategy-use and parasympathetic functioning in the relation between mothers' subjective negative emotions and maternal responsiveness. Hypotheses are tested using data collected from mothers and their preschool-aged children during a Wait Task that mimics everyday situations where mothers need to multitask (e.g., working while attending to a young child). Drawing from Kochanska's work focused on toddler and preschool years (Kochanska & Murray, 2000), we operationalize parental responsiveness as a dimension reflecting the extent to which parents' behaviors reflect attentiveness to, interest in, and acknowledgment of children's needs.

We hypothesize that the association between maternal negative emotions and maternal responsiveness is moderated by mothers' strategy-use and RSA measures. Regarding specific strategies, mothers who use reappraisal more are expected to show higher levels of responsiveness even when they experience more negative emotions. In contrast, rumination may be related to a stronger association between negative emotions and lower responsiveness. The role of distraction and suppression in parental emotion regulation is less clear, thus no specific hypotheses are set. Regarding parasympathetic regulation of arousal, given the evidence that higher resting RSA (greater engagement of parasympathetic control over arousal) may be related to greater self-regulation capacity, it is hypothesized that mothers with higher resting RSA would show higher levels of maternal responsiveness when they experience more negative emotions, reflecting the ability to cope with the parenting challenge in a child-centered way. Furthermore, as a withdrawal of parasympathetic engagement may play a supportive role for mothers to stay engaged when the situation is highly challenging, we hypothesize that mothers who show a decrease in RSA during the task (compared to resting levels) would demonstrate higher levels of responsiveness when they experience more negative emotions.

Method

Participants

This study used data drawn from the Development of Self-Regulation Dynamics Project, a cross-sectional study of age differences in young children's self-regulation. The sample size was determined based on power analyses to fulfill the main goal of the larger project (i.e., detecting associations among person-specific parameters from dynamic models and between-person differences such as child age). Families with children from 30 to 60 months of age were recruited from central Pennsylvania through a participant pool (The FIRSt Families Database), flyers, and community events (e.g., art festivals). Interested families were contacted by research assistants and screened for eligibility on (a) child age (i.e., 30–60 months), (b) no report of developmental delays or health concerns that would interfere with providing valid data (e.g., cognitive limitations, intellectual disability, and deafness); (c) the family speaks English well enough to understand study instructions; and (d) at least one caregiver is the child's legal guardian. Both parents (mother and father in most cases) were invited to participate, and the present study focused on a task completed by children and their

mothers. The final sample examined in this study included 157 children (49.7% female) between 30 and 60 months of age (M_{age} = 45.08 months, SD = 8.17 months) and their mothers (all biological mothers; M_{age} = 35.19 years, SD = 5.10 years), mostly residing in two-parent households (89.6%). The children were identified by their mothers as White (95.6%), Asian (2.6%), Black (1.3%), and Native American (0.6%). The sample had an average annual income of $89,875 ($SD$ = $50,303) with a wide range (10th and 90th percentiles of family income were $35,000 and $150,000). Most of the mothers had attained a bachelor's degree or above (78.2%), and 77.1% were working full-time or part-time at the time of the visit.

Procedure

Research assistants contacted enrolled families to collect demographic information and schedule a 4-hr laboratory visit. Before the visit, parents were asked to complete a packet of questionnaires using an online platform (Qualtrics, Provo, Utah). Upon arrival at the laboratory, the family was met by a research assistant who explained study purposes and procedures. The parent(s) then signed consent forms. Research assistants measured each family member's height and weight and applied electrodes connected to the ambulatory device that recorded physiological signals (Mindware Technologies Ltd., Westerville, Ohio). The child and the parent(s) then participated in a series of tasks, sometimes alone and sometimes in pairs (mother–child or father–child). The parent(s) completed another set of questionnaires during the visit. At the end of the visit, the parents were debriefed, the electrodes were removed, the child received the earned rewards, and the family received compensation. Study procedures were approved by the institutional review board (IRB) of the Pennsylvania State University (Project: The Development of Self-Regulation Dynamics; Study ID: STUDY00005112).

The present study used data collected from a baseline resting task, during which the mother and the child were asked to sit quietly in a room for 2 min (the baseline task occurred before any interaction task was introduced), and a mother–child Wait Task (Cole et al., 2011; Vaughn et al., 1984). At the start of the Wait Task, the child and the mother were seated at separate tables in the same room. The child was provided with a boring and broken toy, and the mother was given questionnaires to complete. The questionnaires first presented open-ended questions about wait-related situations in everyday family life, and then asked mothers to report their perception of children's emotions during the wait; at the end were two questionnaires about mothers' own emotions and strategies to manage emotions during this task (see Measures section). Mothers were instructed to review their answers and keep working if they completed the questionnaires before the task ended. The research assistant then placed a package wrapped in shiny and rustling article on the child's table and told the child there was a surprise gift inside. The mother received written instructions: "before you start working, and right after the research assistant leaves the room, tell the child to wait to open the gift until you finish your work," and was instructed to act as they normally would when they must finish some work and the child must wait. The research assistant placed a 3-min sand timer on the mother's table and left the room. This task included three sessions (3 min each); after each of the first two sessions, the research assistant entered the room, said to the parent "Oh, you need more time," and reset the timer before leaving again. At the end of the third session, the research assistant returned, and the child was allowed to open the gift.

Measures

Challenging Child Behaviors

The degree to which children's behavior would challenge a typical adult was rated second-by-second during the Wait Task, using a scale adapted from work by Lorber and O'Leary (2005). Operational definitions of negative child behaviors used for a similar task (e.g., bids for parent's attention, violation of task rules, expression of negative emotions, and disruptive behaviors) were converted from a set of binary decision rules (is a specific behavior present or not) to an ordinal rating of how challenging children's behaviors are (see Supplemental Materials). Children's behaviors were rated independent of their parents' behaviors. Using the Datavyu software (Datavyu Team, 2014), trained research assistants rated children's behaviors during the Wait Task second-by-second based on videotapes on a 5-point scale (from 0 = *not at all challenging* to 4 = *highly challenging*). Each family's video was rated independently by a research assistant, and 32 randomly selected families (20% of the sample) were double-coded to check inter-rater consistency. The intraclass correlation coefficient (ICC) across all double-coded videos was .83 (ICC 2 is selected to assess raters' absolute agreement during each second; Shrout & Fleiss, 1979). ICC was also calculated for each double-coded family, and in cases where ICC was below .70 (2 of the 32 families), the two raters discussed the discrepancies and produced consensus ratings that were included in the final data. Observational data were available for all but one family due to lost audio caused by device malfunction. For each family, the second-by-second ratings were averaged to obtain a measure indexing individual differences in how challenging the child was. Of a possible range of 0 (*no challenging behaviors exhibited*) to 4 (*highly challenging behaviors exhibited throughout the task*), scores ranged from 0 to 2.46 (M = 0.59, SD = 0.47). All but one of the participating children showed at least some challenging behaviors during the task.

Maternal Subjective Experience of Negative Emotions

Mothers completed questionnaires during the Wait Task, including one in which they reported their emotions about how the child was handling the wait. Mothers rated (on an 11-point 0 = *not at all* to 10 = *strongly* Likert scale) the extent to which they felt each of eight positive and 12 negative emotions. Scores indicating mothers' subjective experience of negative emotions during the task was calculated as the average of responses to the 12 negative emotions (i.e., impatient, annoyed, irritated, angry, nervous, tense, anxious, scared, bored, disappointed, discouraged, and sad; Cronbach's α = .88). On average, mothers reported feeling relatively low levels of negative emotions (M = 1.30, SD = 1.25; range = 0–5.33).

Maternal Strategy-Use

Mothers also rated the extent to which they used specific strategies to manage the negative emotions they reported experiencing during the Wait Task. The questionnaire consists of 16 items asking about engagement with eight types of strategies (e.g., "refocus on my work," "distract myself with good thoughts," see Table S1 in the Supplemental Materials), drawn and adapted from De France and Hollenstein (2017). Mothers rated how much they used the strategy described in each item on an 11-point Likert scale (0 = *not at all* to

10 = *very much*). The analysis here focused on the eight items measuring the extent of use of four specific strategies: reappraisal, distraction, suppression, and rumination. Scores for each strategy were calculated as the average of responses to each pair of relevant items (possible range = 0–10). For all four strategies, mothers' responses spread the full range of the scale (see Figure S1 in the Supplemental Materials and Table 1, for descriptive statistics).

Resting RSA and RSA Reactivity

Mothers' resting RSA and RSA reactivity were measured during the 2-min resting baseline and the approximately 9-min Wait Task. Detailed procedures of data cleaning and RSA calculation are provided in the Supplemental Materials. Briefly, electrocardiography (ECG) data were collected using Mindware Technologies ambulatory devices and BioLab software (Version 3.1; Mindware Technologies Ltd., Westerville, Ohio) from three disposable cardiac electrodes placed over participants' distal right collar bone, lower left rib, and lower right rib, at a sampling frequency of 500 Hz. ECG data were imported into Mindware's HRV software (Version 3.1.5; Mindware Technologies Ltd., Westerville, Ohio), which identified R peaks algorithmically and produced an inter beat interval (IBI) series. All the ECG data were visually inspected and manually cleaned by trained research assistants. Participants' respiration rate was estimated through impedance cardiography collected through four additional electrodes, which was used to ensure that respiration rate remained within the targeted frequency band for calculating RSA (0.12–0.40 Hz for adults; Berntson et al., 2007). The cleaned IBI series was then output from Mindware HRV and into R (R Core Team, 2020). The average RSA across each 30-s epoch during the baseline and the Wait Task was computed using the *RHRV* package (Martínez et al., 2017). Mothers' resting RSA and task RSA were calculated by averaging the 30-s RSA values across the baseline task and the Wait Task, respectively. RSA reactivity was then calculated by subtracting resting RSA from task RSA (see Table 1, for descriptive statistics). That is, positive RSA reactivity values represent increases in RSA, whereas negative values represent decreases in RSA from baseline to the Wait Task. A paired-sample t test showed that the mothers on average showed lower RSA during the Wait Task compared to the baseline, $t(153) = 6.85$, $p < .001$. RSA reactivity ranged from −1.94 to 1.42, suggesting individual differences in whether and how much mothers' RSA increased or decreased during the Wait Task compared to the baseline.

Maternal Responsiveness

Maternal responsiveness was measured using an ordinal rating scheme created to assess the extent to which mothers' behaviors reflected attempts to acknowledge and address the child's interests and needs, versus to dismiss or avoid attending to the child (see Supplemental Materials). Using Datavyu (Datavyu Team, 2014), trained research assistants watched the videotape of the Wait Task and rated mothers' behavior second-by-second on a 7-point scale ranging from −3 to 3. The upper half of the scale (a rating of 1, 2, or 3) was used for moments when the mother displayed attentiveness to, initiation of interaction, and/or response to the child that reflected different levels of interest in or concern about the child and/or efforts to acknowledge and support the child's interests and needs. The lower half of the scale (a rating of −1, −2, or −3) was used for moments when the mother's behavior explicitly indicated that they were disinterested in the child's states and/or did not want to interact or provide any help. The middle-point of the scale (a rating of 0) was used for moments when the mother did not show observable indicators of either attending to the child or dismissing the child (typically when the mother was simply working on questionnaires without showing any attention, speech, or behavior toward the child). Thus, higher ratings (e.g., 3) indicate higher levels of responsiveness reflected in parents' behaviors at a given moment, whereas lower ratings (e.g., −3) represent not just a lack of responsiveness, but active dismissiveness or invalidation of children's

Table 1
Descriptive Statistics and Bivariate Correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Mother age (years)	—											
2. Child age (months)	.16*	—										
3. Child gender	.05	.06	—									
4. Challenging child behaviors	−.09	−.30***	.17*	—								
5. Maternal negative emotions	.01	−.11	.07	.44***	—							
6. Reappraisal	.07	.04	.08	−.01	.20*	—						
7. Distraction	.03	−.04	.02	−.07	.10	.62***	—					
8. Suppression	−.03	−.16*	.06	.03	.30***	.46***	.43***	—				
9. Rumination	−.03	−.02	.03	.07	.28***	.25**	.29***	.29***	—			
10. Resting RSA	−.19*	.02	.07	−.07	−.07	.15	.06	−.02	.00	—		
11. RSA reactivity	−.07	−.14	−.05	.10	.02	−.06	.03	−.02	−.04	−.41***	—	
12. Maternal responsiveness	−.04	−.33***	.26**	.54***	.22**	.08	−.02	.03	.06	.09	.07	—
N	156	157	157	154	157	157	157	157	157	155	154	154
M	35.19	45.08	0.50	0.59	1.30	5.24	5.74	4.09	3.54	5.68	−0.36	0.39
SD	5.10	8.17	0.50	0.47	1.25	2.51	2.23	2.55	2.42	1.24	0.65	0.31

Note. N = sample size with available data on a given variable (total sample size = 157). Child gender was coded as 0 = female and 1 = male. Positive RSA reactivity represented an increase in RSA during the Wait Task compared to the resting baseline, whereas negative RSA reactivity represented a decrease in RSA. RSA = respiratory sinus arrhythmia.
* $p < .05$. ** $p < .01$. *** $p < .001$.

needs (e.g., "Don't bother me!"). Ratings were based on mothers' body orientation, verbalizations and vocalizations, facial expressions, and/or gestures that conveyed the level of responsiveness.

Each family's video was rated independently by a trained research assistant, and 31 randomly selected videos (20% of the sample) were double-coded. The ICC across all double-coded videos was .82. In a case-by-case check, four of the 31 double-coded videotapes had ICCs that were below .70, and consensus ratings were conducted to produce the final ratings. All mothers showed at least some behaviors toward their children that received nonzero ratings. The second-by-second ratings were averaged across the Wait Task for each mother to characterize individual differences in the overall degree of maternal responsiveness. Of a possible range from −3 to 3, the actual score ranged from −0.10 to 1.83 ($M = 0.39$, $SD = 0.31$).

Transparency and Openness

We have reported how we determined the sample size, all data exclusions, and all manipulations. The materials and measures relevant to this study (except for the established scales that are available through the sources cited in the Measures section) have also been reported in the article or included in the Supplemental Materials. Data preparation and analyses were conducted in R (Version 4.0.3; R Core Team, 2020), and analysis codes can be accessed at https://osf.io/gx46k/?view_only=a340acdc045145dc9b5478b9177e05f8. Data are available through arrangement with the Development of Self-Regulation Dynamics Project investigators following all relevant IRB privacy protocols. The study design and analytic strategies were not preregistered.

Results

Focusing on individual differences in mothers' emotions, physiology, strategies, and behaviors, hypotheses were tested using multiple linear regression models. All predictors in the models were centered around sample means; interaction terms were created using the centered variables. The rates of missing data were very low for all variables (<2%; see Table 1) and missingness was mainly due to equipment malfunction; thus, imputation was not conducted. Statistical significance was evaluated with $\alpha = .05$.

Association Between Maternal Negative Emotions and Maternal Responsiveness

Bivariate correlations (Table 1) indicated that mothers whose children were more challenging reported experiencing more negative emotions ($r = .44$, $p < .01$) and exhibited higher levels of maternal responsiveness ($r = .54$, $p < .01$), with the latter two variables also positively correlated ($r = .22$, $p < .01$). Results from a model where maternal responsiveness was regressed on mothers' negative emotions and covariates (child age, child gender, and the degree of challenging child behaviors) indicated that more challenging child behaviors were associated with higher levels of maternal responsiveness ($b = 0.29$, $SE = 0.05$, $p < .01$); however, mothers' subjective negative emotions were not uniquely associated with responsiveness ($b = -0.002$, $SE = 0.02$, $p = .91$) after controlling for the covariates. Thus, the positive bivariate correlation between negative emotions and responsiveness was explained by them both being associated with challenging child behaviors. We then proceeded to test the hypotheses regarding whether mothers' cognitive and physiological processes moderated the relation between maternal negative emotions and responsiveness.

The Moderating Role of Strategy-Use

Bivariate correlations (see Table 1) indicated that mothers' who experienced more negative emotions also used more reappraisal ($r = .20$, $p = .01$), more suppression ($r = .30$, $p < .01$), and more rumination ($r = .28$, $p < .01$), but not significantly more distraction ($r = .10$, $p = .21$). There were also significant positive correlations among the four strategies. These results suggested that when mothers experienced more negative emotions about their children's behaviors, they invoked a range of strategies to manage these emotions. However, maternal responsiveness was not correlated with the use of any strategy.

A series of regression models were then used to examine whether and how mothers' strategy-use moderated the relation between mothers' subjective negative emotions and responsiveness to their children (see Table 2). Each strategy was tested in a separate model, although post hoc analysis was conducted by entering all strategies and interaction terms into one model, which yielded consistent

Table 2

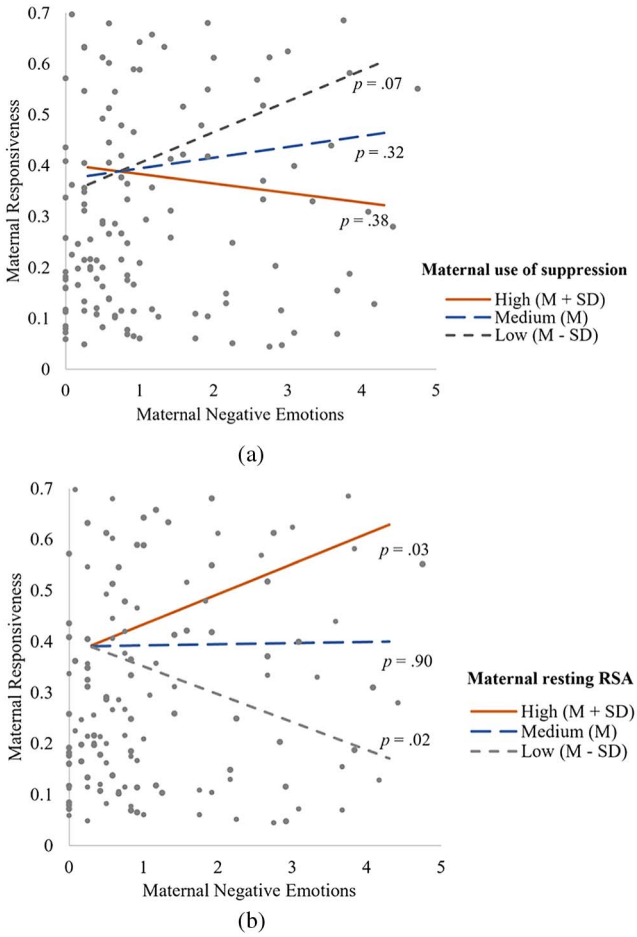
Strategies Moderating the Association Between Maternal Negative Emotions and Maternal Responsiveness

	Dependent variable: Maternal responsiveness							
	Reappraisal		Distraction		Suppression		Rumination	
Predictor	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*	*b* (*SE*)	*p*
Intercept	**0.40** (0.02)	<.01	**0.39** (0.02)	<.01	**0.40** (0.02)	<.01	**0.38** (0.02)	<.01
Child age (months)	**−0.01** (0.003)	<.01	**−0.01** (0.003)	<.01	**−0.01** (0.003)	<.01	**−0.01** (0.003)	<.01
Child gender	**0.12** (0.04)	<.01	**0.12** (0.04)	<.01	**0.12** (0.04)	<.01	**0.12** (0.04)	<.01
Challenging child behaviors	**0.30** (0.05)	<.01	**0.29** (0.05)	<.01	**0.27** (0.05)	<.01	**0.29** (0.05)	<.01
Maternal NE	−0.01 (0.02)	.58	−0.001 (0.02)	.96	0.02 (0.02)	.32	−0.004 (0.02)	.82
Strategy	0.01 (0.01)	.19	−0.001 (0.01)	.93	−0.01 (0.01)	.31	0.003 (0.01)	.69
Maternal NE × Strategy	0.005 (0.01)	.48	−0.002 (0.01)	.84	**−0.02** (0.01)	.03	0.001 (0.01)	.90
F(*df*1, *df*2)	13.95 (6, 147)		13.45 (6, 147)		14.78 (6, 147)		13.49 (6, 147)	
p	<.01		<.01		<.01		<.01	
Adjusted R^2	.34		.33		.35		.33	

Note. Child gender was coded as 0 = female and 1 = male. NE = subjective negative emotions; *SE* = standard error. All predictors were centered around sample means. Statistically significant coefficients were bolded.

Figure 1

Mothers' (a) Suppression and (b) Resting RSA Moderated the Association Between Their Subjective Negative Emotions and Responsiveness to Their Children



Note. The dots represent observed data points, and the lines represent estimated simple slopes at specific levels (sample mean and mean ± *SD*) of the moderators. RSA = respiratory sinus arrhythmia. See the online article for the color version of this figure.

findings. Results provided only partial support for the hypotheses. In line with the hypotheses, there was evidence that suppression moderated the association between mothers' negative emotions and maternal responsiveness ($b = -0.02$ for the interaction term, $p = .03$). As shown in Figure 1a, for mothers who used suppression less (1 *SD* below mean), there was a positive association between mothers' negative emotions and maternal responsiveness, although the simple slope did not reach statistical significance (simple slope coefficient = 0.06, $p = .07$). For mothers who used suppression at an average or higher level (mean or 1 *SD* above mean), their subjective negative emotions were not associated with the level of responsiveness across the task (simple slope coefficients = −0.02 to 0.02, $p > .30$). Based on the Johnson–Neyman interval, the association between maternal negative emotions and responsiveness was only statistically significant when mothers reported not using suppression at all (8% of the sample). Contrary to hypotheses, there was no evidence that the association between mothers' negative emotions and maternal responsiveness was moderated by the extent of use of reappraisal, distraction, or rumination. Overall, the results indicated that mothers who did not attempt to suppress their emotions were more likely to attend to their children in a responsive way even when they experienced negative emotions.

The Moderating Role of Resting RSA and RSA Reactivity

Bivariate correlations suggested that neither mothers' resting RSA nor RSA reactivity was associated with children's challenging behaviors, maternal negative emotion, or maternal responsiveness (Table 1). However, in the regression analysis (Table 3), the effects involving maternal resting RSA were consistent with the hypothesis. After accounting for the effects of covariates and other predictors (i.e., maternal negative emotions and RSA reactivity), a significant main effect indicated that resting RSA contributed significantly to explaining the remaining variance in maternal responsiveness; higher resting RSA was related to higher levels of responsiveness ($b = 0.05$, $p = .01$). Additionally, there was evidence that resting RSA moderated the association between mothers' subjective negative emotions and maternal responsiveness ($b = 0.05$, $p < .01$). As shown in Figure 1b, more negative emotions were associated with higher levels of responsiveness among mothers with higher resting RSA (i.e., 1 *SD* above mean; simple slope coefficient = 0.06, $p = .03$), but were associated with lower levels of responsiveness among mothers with lower resting RSA (i.e., 1 *SD* below mean; simple slope coefficient = −0.05, $p = .02$). In contrast, mothers' RSA reactivity was not associated with maternal responsiveness ($b = 0.04$, $p = .19$) and did not moderate the association between subjective negative emotions and maternal responsiveness ($b = -0.02$, $p = .58$).

As child age was correlated with challenging child behaviors and maternal responsiveness, we also conducted post hoc analysis to examine whether child age moderated the hypothesized associations. Results showed that none of the main effects or interactions

Table 3

Maternal Negative Emotions and RSA Measures Predicting Maternal Responsiveness

Predictor	Dependent variable: Maternal responsiveness	
	b (*SE*)	*p*
Intercept	**0.39** (0.02)	<.01
Child age (months)	**−0.01** (0.003)	<.01
Child gender	**0.13** (0.04)	<.01
Challenging child behaviors	**0.29** (0.05)	<.01
Maternal NE	0.002 (0.02)	.89
Resting RSA	**0.05** (0.02)	.01
Maternal NE × Resting RSA	**0.05** (0.01)	<.01
RSA reactivity	0.04 (0.03)	.19
Maternal NE × RSA reactivity	−0.02 (0.03)	.58
F(*df*1, *df*2)		13.46 (8, 144)
p		<.01
Adjusted R^2		.40

Note. Child gender was coded as 0 = female and 1 = male. RSA = respiratory sinus arrhythmia; *SE* = standard error; NE = subjective negative emotions. All predictors were centered around sample means. Statistically significant coefficients were bolded.

involving maternal emotions, strategies, and RSA measures varied by child age. Additionally, we confirmed that the main and interactive effects of mothers' strategies and RSA measures remained consistent even when removing challenging child behavior from the regression models. Overall, the results suggested that child behavior was an integral part of the context related to both maternal emotions and responsive behaviors. However, the role of suppression and resting RSA in mothers' emotion regulation revealed by the current analyses were not dependent on how challenging children were during the Wait Task.

Discussion

The current findings characterize mothers' subjective experience of negative emotions and responsiveness to their children in a challenging parenting situation, and reveal how the relation between the two may vary by specific factors implicated in adult emotion regulation. In this community sample of mothers and their preschool-age children, after controlling for how challenging children were, mothers who reported more versus less negative emotions showed comparable levels of responsiveness to their children. Thus, individual differences in the level of maternal negative emotions did not appear to support or impede responsive parenting across the sample. Rather, their relations were moderated by the extent to which mothers attempted to suppress those negative emotions and a trait-like marker of their parasympathetic activity (i.e., resting RSA). Among mothers who did not try to suppress their negative emotions and those with higher resting RSA, more subjective negative emotions were related to higher levels of maternal responsiveness. These findings are consistent with a functionalist perspective on emotion. Specifically, negative emotions may have motivational values for mothers to take action in response to the parenting challenge, and among mothers with a greater regulatory capacity, reflected in higher resting RSA (Thayer & Lane, 2009), such motivational states may be more likely to translate into child-centered parenting behaviors. Meanwhile, attempts to push down or conceal negative emotions may counteract the motivational value.

The Role of Strategy-Use in Maternal Emotion Regulation

Among previous studies with parents or non-parent adults, the use of presumably adaptive strategies (e.g., reappraisal) often had little overlap with the use of presumably maladaptive strategies (e.g., suppression; Lorber, 2012; Preece et al., 2020). However, this was not the case in the current sample, as mothers' self-report ratings of strategies were all positively correlated with one another, and more negative emotions were correlated with more use of reappraisal, suppression, and rumination. That is, the mothers tended to engage in a variety of strategies across the duration of this parenting situation.

In the research of adult emotion regulation, modifying the attention to or perception of emotionally provoking situations (i.e., distraction or appraisal) is typically seen as effective in reducing negative emotional experiences and expressive behaviors (Efinger et al., 2019; Gross, 1998). However, in the current sample, mothers' use of these two strategies did not have any main effect or moderate the association between mothers' negative emotions and maternal responsiveness. It is possible that the extent to which parents invoke a strategy does not necessarily reflect how the strategy takes effect in specific parenting situations that posit unique demands. Moreover, parents' cognitive modification processes may not always emerge to their conscious awareness, which can make it hard for them to accurately report it. To summarize, although there was evidence for the existence of regulation among the mothers in this challenging parenting situation (i.e., they reported experiencing more negative emotions but showed higher levels of responsiveness when their children were challenging), mothers' self-report of these two common strategies did not explain individual differences in their regulation.

The analyses regarding maternal suppression—a strategy that may be ineffective in reducing one's own negative feelings (Gross, 1998) but functional in interpersonal contexts (English et al., 2017), yielded findings that are consistent with two previous studies (Le & Impett, 2016; Waters et al., 2020). We found that mothers were less responsive when they experienced negative emotions but tried to suppress them. Although the intention may be to not show or act on the negative emotions toward their children, suppression likely sustains the negative feelings while dampening the functional value of those emotions in motivating parents to take action in response. Our findings add to the evidence that suppression may interfere with parents' ability to respond sensitively to their children. The other presumably maladaptive strategy, rumination, did not have a main effect in predicting maternal responsiveness or interact with mothers' negative emotions. Rumination might have enhanced mothers' negative feelings, but this conclusion could not be drawn without examining the dynamic changes in maternal emotions. Despite being related to psychosocial maladjustment in the research of adult emotion regulation (Aldao et al., 2010), we did not find evidence that rumination would be detrimental for maternal responsiveness when mothers experience negative emotions.

Collectively, although mothers likely engaged in regulation to maintain or increase their responsiveness to their children even if they experienced negative emotions, only one of the four self-reported strategies was related to individual differences in the regulation. This suggests that the effectiveness and adaptiveness of specific strategies in individual-oriented contexts may not generalize to parenting contexts. It is also possible, however, that the relatively low levels of self-reported negative emotions evoked by the Wait Task in this sample contributed to the null findings, and the effects of some strategies may manifest when parenting tasks are highly emotionally demanding.

The Role of Parasympathetic Functioning in Maternal Emotion Regulation

Higher resting RSA among adults indicates a greater capacity to regulate physiological arousal and may be related to greater cognitive resources available for regulatory attempts (Thayer & Lane, 2009). Among mothers, higher resting RSA has been associated with more sensitive parenting behaviors (Joosen et al., 2013; Musser et al., 2012). Consistent with those findings, in the current sample, higher resting RSA had a main effect in predicting higher levels of maternal responsiveness and moderated the relation between mothers' subjective negative emotions and responsiveness. Among mothers with higher resting RSA, negative emotions about how their children were handling the wait were associated with greater responsiveness, which may reflect their effort to address the

challenge in a child-centered manner. In contrast, mothers with lower resting RSA became less responsive if they experienced negative emotions, which may reflect lower regulatory capacity to support responsive parenting behaviors. It is worth noting that some individual or dyadic characteristics may influence whether resting RSA reflects a true *resting* state for some parents (e.g., parents with attention-deficit/hyperactivity disorder or those concerned about their children's behaviors even during baseline). These characteristics may jointly contribute to the individual differences in resting RSA that are associated with parents' regulatory functioning.

Meanwhile, task average RSA reactivity did not show a significant main effect, nor did it interact with mothers' subjective negative emotions in predicting maternal responsiveness. The null findings may be due to limitations of the aggregated approach. A parenting task encompasses numerous behavioral exchanges and ebbs and flows of emotions (Lorber & Slep, 2005; Scholtes et al., 2021) driven by ongoing activation and regulation processes. Thus, when mothers summarize their subjective emotional experiences across the task, or when their average RSA across the task is used to calculate RSA reactivity, the resultant measures may mask the underlying emotional dynamics and obscure their associations with parenting behaviors. A dynamic approach that examines the moment-to-moment changes in parents' subjective experience and/or parasympathetic reactivity may be necessary to further our understanding of the regulatory processes shaping parenting behaviors.

Notably, mothers' resting RSA was not correlated with the extent of use of the four strategies examined. Thus, the moderation effects of resting RSA and of suppression should be interpreted independently. This also suggests that although higher resting RSA may be associated with a greater regulatory capacity, its contribution to maternal emotion regulation is not through the engagement of those common strategies. Future research could explore other cognitive processes that may be specific to parenting (e.g., monitoring children's states, parenting-related problem-solving) through which resting RSA is related to parental emotion regulation. Mothers' RSA reactivity was not correlated with their strategies either, suggesting a lack of convergence between self-reported use of regulation-related cognitive processes and ambulatory measurement of parasympathetic engagement in the regulation of arousal.

Limitations and Future Directions

This study has several limitations to be considered in the interpretation of findings, warranting further examination in future studies. First, using aggregate measures of behavior, emotion, and physiology may mask how mothers' emotions and regulation processes unfold in real-time and vary across the task. For instance, parents may feel upset about their children's behaviors but quickly engage in a strategy that effectively helps them calm down and still respond sensitively. It is thus not clear whether (or the extent to which) our measures of maternal subjective emotions reflected activated emotional responses and/or the effects of ensuing regulatory processes. Additionally, mothers in the present study reported their emotions and strategies during the task. This was designed to best capture their experiences in the moment of the parenting situation and to avoid potential bias from retrospective interpretations (compared to rating their emotions after the task ended). However, although the order of the questionnaires was standardized and mothers were asked to review their answers until the task ended, the timing of completing these two questionnaires might vary across mothers. Therefore, for some mothers, the responses might not summarize their emotions or strategies across the entirety of the task. Second, we only measured and analyzed a limited range of strategies. In the moment of parenting, parents may engage in a wide variety of mental actions that do not necessarily fit into the categories examined here. These processes may vary across individuals, contexts, or even from moment-to-moment—nuances that may not have been measured by our questionnaire. Further understanding of how parents self-regulate can make use of more refined qualitative inquiries with open-ended interviews. Third, due to the limited variability and occurrence of specific emotions, we only examined differences in negative emotion in a broadly inclusive way. However, mothers did report more worry-related emotions (i.e., tense and anxious) relative to other negative emotions (see Figure S1 in the Supplemental Materials), which may have unique implications for how mothers regulated their emotions and responded to their children (Hajal et al., 2019). Future studies could measure parents' emotions across multiple parenting situations to better capture variability in parents' discrete emotions and how those emotions are regulated. Meanwhile, although the present study captures specific cognitive and physiological mechanisms associated with maternal emotion regulation, it is unclear how these mechanisms are associated with parenting quality in everyday life, or whether they vary across various types of parenting challenges, which are important directions for future research. Finally, our sample was relatively homogenous in terms of race/ethnicity and geography and thus may not represent patterns in families from more diverse backgrounds. Future work should examine how cultural background may influence parents' choice of strategies and/or the effectiveness of these strategies. As well, mothers in this sample only reported low levels of negative emotions and showed limited instances of low responsiveness, which may have limited our ability to detect some effects. Study of higher risk samples and more emotionally provoking situations are needed to obtain a more robust representation of strategy-use and parental emotion regulation.

In summary, this study suggests that mothers' subjective negative emotions are not deterministically associated with lower levels of maternal responsiveness. We found that some mothers manage to maintain or even increase the level of responsiveness when they experience negative emotions, potentially reflecting their regulation of negative emotions. Mothers' basal parasympathetic activity may contribute to their regulation, whereas attempts to suppress negative emotions may impede their regulation. The findings support the notion that negative emotions in challenging parenting situations are not necessarily problematic, but how parents regulate them influences parenting behaviors (Cole, 2016). In other words, parenting competence is not necessarily about not having negative feelings, but rather about managing to react in a child-centered way in those challenging moments. Preventions aiming to improve parental responsiveness can help parents be mindful of their negative feelings without trying to simply suppress them and promote child-centered ways to cope with parenting challenges.

References

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*(2), 217–237. https://doi.org/10.1016/j.cpr.2009.11.004

Balzarotti, S., Biassoni, F., Colombo, B., & Ciceri, M. R. (2017). Cardiac vagal control as a marker of emotion regulation in healthy adults: A review. *Biological Psychology*, *130*, 54–66.

Beauchaine, T. P. (2015). Respiratory sinus arrhythmia: A transdiagnostic biomarker of emotion dysregulation and psychopathology. *Current Opinion in Psychology*, *3*, 43–47. https://doi.org/10.1016/j.copsyc.2015.01.017

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, *81*(1), 326–339. https://doi.org/10.1111/j.1467-8624.2009.01397.x

Berntson, G. G., Cacioppo, J. T., & Quigley, K. S. (1993). Respiratory sinus arrhythmia: Autonomic origins, physiological mechanisms, and psychophysiological implications. *Psychophysiology*, *30*(2), 183–196. https://doi.org/10.1111/j.1469-8986.1993.tb01731.x

Berntson, G. G., Quigley, K. S., & Lozano, D. (2007). Cardiovascular psychophysiology. In J. T. Cacioppo, L. G. Tassinary, & G. G. Berntson (Eds.), *Handbook of psychophysiology* (3rd ed., pp. 182–210). Cambridge University Press. https://doi.org/10.1017/CBO9780511546396.008

Bornstein, M. H., & Suess, P. E. (2000). Child and mother cardiac vagal tone: Continuity, stability, and concordance across the first 5 years. *Developmental Psychology*, *36*(1), 54–65. https://doi.org/10.1037/0012-1649.36.1.54

Cole, P. M. (2016). The role of emotion in the development of psychopathology. In D. Cicchetti (Ed.), Developmental psychopathology: Vol. 1. *Theory and method* (3rd ed., pp. 265–324). Wiley.

Cole, P. M., Ram, N., & English, M. S. (2019). Toward a unifying model of self-regulation: A developmental approach. *Child Development Perspectives*, *13*(2), 91–96. https://doi.org/10.1111/cdep.12316

Cole, P. M., Tan, P. Z., Hall, S. E., Zhang, Y., Crnic, K. A., Blair, C. B., & Li, R. (2011). Developmental changes in anger expression and attention focus: Learning to wait. *Developmental Psychology*, *47*(4), 1078–1089. https://doi.org/10.1037/a0023813

Datavyu Team. (2014). *Datavyu: A video coding tool*. Databrary Project, New York University. http://datavyu.org

De France, K., & Hollenstein, T. (2017). Assessing emotion regulation repertoires: The regulation of emotion systems survey. *Personality and Individual Differences*, *119*(1), 204–215. https://doi.org/10.1016/j.paid.2017.07.018

Dix, T. (1991). The affective organization of parenting: Adaptive and maladaptive processes. *Psychological Bulletin*, *110*(1), 3–25. https://doi.org/10.1037/0033-2909.110.1.3

Efinger, L., Thuillard, S., & Dan-Glauser, E. S. (2019). Distraction and reappraisal efficiency on immediate negative emotional responses: Role of trait anxiety. *Anxiety, Stress, and Coping*, *32*(4), 412–427. https://doi.org/10.1080/10615806.2019.1597859

English, T., Lee, I. A., John, O. P., & Gross, J. J. (2017). Emotion regulation strategy selection in daily life: The role of social context and goals. *Motivation and Emotion*, *41*(2), 230–242. https://doi.org/10.1007/s11031-016-9597-z

Frijda, N. H. (1986). *The emotions*. Cambridge University Press.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, *74*(1), 224–237. https://doi.org/10.1037/0022-3514.74.1.224

Hajal, N. J., & Paley, B. (2020). Parental emotion and emotion regulation: A critical target of study for research and intervention to promote child emotion socialization. *Developmental Psychology*, *56*(3), 403–417. https://doi.org/10.1037/dev0000864

Hajal, N. J., Teti, D. M., Cole, P. M., & Ram, N. (2019). Maternal emotion, motivation, and regulation during real-world parenting challenges. *Journal of Family Psychology*, *33*(1), 109–120. https://doi.org/10.1037/fam0000475

Joosen, K. J., Mesman, J., Bakermans-Kranenburg, M. J., Pieper, S., Zeskind, P. S., & van IJzendoorn, M. H. (2013). Physiological reactivity to infant crying and observed maternal sensitivity. *Infancy*, *18*(3), 414–431. https://doi.org/10.1111/j.1532-7078.2012.00122.x

Kochanska, G., Aksan, N., & Koenig, A. L. (1995). A longitudinal study of the roots of preschoolers' conscience: Committed compliance and emerging internalization. *Child Development*, *66*(6), 1752–1769. https://doi.org/10.2307/1131908

Kochanska, G., & Murray, K. T. (2000). Mother–child mutually responsive orientation and conscience development: From toddler to early school age. *Child Development*, *71*(2), 417–431. https://doi.org/10.1111/1467-8624.00154

Kohlhoff, J., Hawes, D. J., Mence, M., Russell, A. M. T., Wedgwood, L., & Morgan, S. (2016). Emotion regulation strategies and parenting practices among parents of children with clinic-referred conduct problems. *Parenting: Science and Practice*, *16*(4), 302–319. https://doi.org/10.1080/15295192.2016.1184942

Le, B. M., & Impett, E. A. (2016). The costs of suppressing negative emotions and amplifying positive emotions during parental caregiving. *Personality and Social Psychology Bulletin*, *42*(3), 323–336. https://doi.org/10.1177/0146167216629122

Leerkes, E. M. (2010). Predictors of maternal sensitivity to infant distress. *Parenting: Science and Practice*, *10*(3), 219–239. https://doi.org/10.1080/15295190903290840

Lorber, M. F. (2012). The role of maternal emotion regulation in overreactive and lax discipline. *Journal of Family Psychology*, *26*(4), 642–647. https://doi.org/10.1037/a0029109

Lorber, M. F., & O'Leary, S. G. (2005). Mediated paths to over-reactive discipline: Mothers' experienced emotion, appraisals, and physiological responses. *Journal of Consulting and Clinical Psychology*, *73*(5), 972–981. https://doi.org/10.1037/0022-006X.73.5.972

Lorber, M. F., & Slep, A. M. S. (2005). Mothers' emotion dynamics and their relations with harsh and lax discipline: Microsocial time series analyses. *Journal of Clinical Child and Adolescent Psychology*, *34*(3), 559–568. https://doi.org/10.1207/s15374424jccp3403_11

Martin, S. E., Clements, M. L., & Crnic, K. A. (2002). Maternal emotions during mother–toddler interaction: Parenting in affective context. *Parenting: Science and Practice*, *2*(2), 105–126. https://doi.org/10.1207/S15327922PAR0202_02

Martínez, C. A. G., Quintana, A. O., Vila, X. A., Touriño, M. J. L., Rodríguez-Liñares, L., Presedo, J. M. R., & Penín, A. J. M. (2017). *Heart rate variability analysis with the R package RHRV*. Springer. https://doi.org/10.1007/978-3-319-65355-6

Moberly, N. J., & Watkins, E. R. (2008). Ruminative self-focus, negative life events, and negative affect. *Behaviour Research and Therapy*, *46*(9), 1034–1039. https://doi.org/10.1016/j.brat.2008.06.004

Moore, G. A., Hill-Soderlund, A. L., Propper, C. B., Calkins, S. D., Mills-Koonce, W. R., & Cox, M. J. (2009). Mother–infant vagal regulation in the face-to-face still-face paradigm is moderated by maternal sensitivity. *Child Development*, *80*(1), 209–223. https://doi.org/10.1111/j.1467-8624.2008.01255.x

Musser, E. D., Ablow, J. C., & Measelle, J. R. (2012). Predicting maternal sensitivity: The roles of postnatal depressive symptoms and parasympathetic dysregulation. *Infant Mental Health Journal*, *33*(4), 350–359. https://doi.org/10.1002/imhj.21310

Porges, S. W. (2003). The polyvagal theory: Phylogenetic contributions to social behavior. *Physiology & Behavior*, *79*(3), 503–513. https://doi.org/10.1016/S0031-9384(03)00156-2

Porges, S. W. (2007). The polyvagal perspective. *Biological Psychology*, *74*(2), 116–143. https://doi.org/10.1016/j.biopsycho.2006.06.009

Preece, D. A., Becerra, R., Robinson, K., & Gross, J. J. (2020). The Emotion Regulation Questionnaire: Psychometric properties in general community samples. *Journal of Personality Assessment*, *102*(3), 348–356. https://doi.org/10.1080/00223891.2018.1564319

Ravindran, N., McElwain, N. L., Berry, D., & Kramer, L. (2022). Dynamic fluctuations in maternal cardiac vagal tone moderate moment-to-moment associations between children's negative behavior and maternal emotional support. *Developmental Psychology*, *58*(2), 286–296. https://doi.org/10.1037/dev0001299

Ray, R. D., Wilhelm, F. H., & Gross, J. J. (2008). All in the mind's eye? Anger rumination and reappraisal. *Journal of Personality and Social Psychology*, *94*(1), 133–145. https://doi.org/10.1037/0022-3514.94.1.133

R Core Team. (2020). *R: A language and environment for statistical computing* [Computer software]. R Foundation for Statistical Computing.

Rueger, S. Y., Katz, R. L., Risser, H. J., & Lovejoy, M. C. (2011). Relations between parental affect and parenting behaviors: A meta-analytic review. *Parenting: Science and Practice*, *11*(1), 1–33. https://doi.org/10.1080/15295192.2011.539503

Scholtes, C. M., Lyons, E. R., & Skowron, E. A. (2021). Dyadic synchrony and repair processes are related to preschool children's risk exposure and self-control. *Development and Psychopathology*, *33*(3), 1072–1084. https://doi.org/10.1017/S0954579420000358

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, *86*(2), 420–428. https://doi.org/10.1037/0033-2909.86.2.420

Teti, D. M., & Cole, P. M. (2011). Parenting at risk: New perspectives, new approaches. *Journal of Family Psychology*, *25*(5), 625–634. https://doi.org/10.1037/a0025287

Thayer, J. F., & Lane, R. D. (2009). Claude Bernard and the heart-brain connection: Further elaboration of a model of neurovisceral integration. *Neuroscience and Biobehavioral Reviews*, *33*(2), 81–88. https://doi.org/10.1016/j.neubiorev.2008.08.004

Thompson, R. A. (2014). Socialization of emotion and emotion regulation in the family. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed., pp. 173–186). Guilford Press.

Vaughn, B. E., Kopp, C. B., & Krakow, J. B. (1984). The emergence and consolidation of self-control from eighteen to thirty months of age: Normative trends and individual differences. *Child Development*, *55*(3), 990–1004. https://doi.org/10.2307/1130151

Waters, S. F., Karnilowicz, H. R., West, T. V., & Mendes, W. B. (2020). Keep it to yourself? Parent emotion suppression influences physiological linkage and interaction behavior. *Journal of Family Psychology*, *34*(7), 784–793. https://doi.org/10.1037/fam0000664

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin*, *138*(4), 775–808. https://doi.org/10.1037/a0027600

Wilson, S., & Durbin, C. E. (2013). Mother–child and father–child dyadic interaction: Parental and child bids and responsiveness to each other during early childhood. *Merrill-Palmer Quarterly*, *59*(3), 249–279. https://doi.org/10.1353/mpq.2013.0018

Received September 28, 2021
Revision received June 21, 2022
Accepted June 23, 2022 ■