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BRIEF REPORT

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Parent emotion regulation socializes children's adaptive physiological regulation

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Abstract

Parenting practices play a major role in socializing children's developing regulatory abilities, but less is known about how parents' regulatory abilities relate to children's healthy functioning. This study examined whether parents' physiological and emotion regulation abilities corresponded to children's physiological and emotional responding to a structured laboratory-based disappointment task. Ninety-seven 3- to 7-year-olds (56 girls; $M = 5.79$ years) and one parent participated in a multi-method assessment of parents' and children's regulatory functioning. Direct (coaching children to use reappraisal) and indirect (resting physiology, dispositional use of reappraisal) aspects of parents' regulatory abilities were assessed. As expected, an adaptive pattern of parent regulatory abilities composed of higher resting respiratory sinus arrhythmia, use of reappraisal, and coaching reappraisal was associated with children's physiological reactivity after a disappointment indicative of more effective physiological calming in a recovery context (increased parasympathetic activation). In contrast, parents' regulatory abilities did not relate to changes in children's expressions of emotional distress.

KEYWORDS
childhood, emotion regulation, parasympathetic nervous system, parenting, reappraisal, RSA reactivity

1 | INTRODUCTION

1.1 | Parent emotion regulation socializes children's adaptive physiological regulation

Children learn about the appropriate expression and regulation of emotions, and reactions to others' emotions in part from interacting with their parents (Morris, Silk, Steinberg, Myers, & Robinson, 2007). Parents socialize children's regulatory abilities indirectly (e.g., by modeling their own emotion regulation skills) and directly (e.g., by coaching children to use emotion regulation strategies; Thompson & Meyer, 2007). Parents who validate and label their own emotions and help their children manage emotions in a constructive way tend to have children with relatively high levels of regulatory skills (Lunkenheimer, Shields, & Cortina, 2007), and parents' emotion coaching has been associated with better emotion understanding and regulation among children (Cunningham, Kliewer, & Garner, 2009). Although biological functioning is a critical factor in the development of adaptive emotional functioning (Calkins & Keane, 2004; Calkins, Graziano, & Keane, 2007), most work examining how parents' regulatory abilities influence children has focused on behavioral measures like parents' emotional expression and language (e.g., Castro, Halberstadt, Lozada, & Craig, 2015; Morris et al., 2007; Poon, Zeman, Miller-Slough, Sanders, & Crespo, 2017), or on concordant physiological patterns between parents and children (e.g., Creaven, Skowron, Hughes, Howard, & Loken, 2014; Lunkenheimer et al., 2015; Moore et al., 2009). Thus, a more comprehensive assessment of parents' regulatory abilities using both biological and behavioral indices is needed.

This study addressed two notable gaps in our understanding of children's emotional development: First, we examined how parents' regulatory abilities shape children's adaptive functioning during an emotional challenge using self-report, observational coding, and physiological assessment of parents and children. Second, we used a laboratory-based disappointment paradigm to engage children in a structured emotional challenge, which involved parent-child interaction while children were disappointed and afforded an opportunity for active emotion regulation and recovery. In this context, children's behavior and physiology can be interpreted as markers of emotion regulation efforts that are in progress, representing an important methodological contribution to this area of inquiry (Cole, Martin, & Dennis, 2004).

The autonomic nervous system (ANS) is thought to play an important role in determining the intensity and duration of emotional experiences, including how someone responds to the experience of an emotion. Individual differences in physiological activity are associated with variability in emotional experience and behavior (Porges, 2007). Porges and others suggest that the physiological basis for the ability to regulate emotion lies in the functioning of the vagus nerve. As such, functioning of the vagus nerve is related to the control of attention, emotion, and behavior. Although there are many ways to measure the activity of the vagus nerve, a common method is through respiratory sinus arrhythmia (RSA), which refers to the periodic fluctuations in heart rate that are associated with breathing. RSA is largely determined by the extent of vagal influence on the heart, making it a widely used noninvasive index of parasympathetic activity. RSA has been commonly seen as a logical index of emotion regulation, and a growing body of research suggests that individual differences in RSA are associated with regulatory behaviors (e.g., Beauchaine, 2001; Porges, 2007).

Two of the most frequently used indicators of RSA are resting RSA and RSA reactivity (El-Sheikh, 2005; Wang, Lü, & Qin, 2013). Greater parasympathetic dominance while at rest is reflected in higher RSA, and is generally associated with slower heart rate and dampening of the sympathetic nervous system's effect on the heart (Bell & Calkins, 2012). Resting RSA levels are related to an individual's capacity to adaptively respond to challenge, and higher resting RSA has been linked to better self-regulation and more adaptive outcomes (Calkins & Keane, 2004; Liew et al., 2011). Individuals who displayed higher baseline RSA showed more positive and less negative affect, less emotion dysregulation, and use of more effective emotion regulation strategies (Calkins, Propper, & Mills-Koonce, 2013).

Increases in RSA from resting levels (RSA augmentation) indicate increasing parasympathetic dominance and physiological calming, whereas decreases from resting levels (RSA suppression) indicate decreasing parasympathetic influence that enables a behavioral response. RSA suppression in response to challenge is adaptive (Calkins & Keane, 2004). For example, less RSA suppression has been associated with poor emotional regulation or extreme emotional responses (Buss, Davis, Ram, & Coccia, (2017); Buss, Goldsmith, & Davidson, 2005; El-Sheikh, Harger, & Whitson, 2001), whereas more pronounced RSA suppression during challenges relates to more positive and less negative affect, less emotion dysregulation, and more effective emotion regulation strategies (e.g., Blandon, Calkins, Keane, & O'brien, 2008; Calkins & Keane, 2004). Interpretation of adaptive patterns of physiological reactivity, however, must take context into consideration to understand whether increases or decreases in parasympathetic influence over the heart would be best (Hastings et al., 2008; Morales, Beekman, Blandon, Stifter, & Buss, 2015).

The appropriate interpretation of physiological reactivity can vary depending on the task context or task-specific demands (Sulik, Eisenberg, Spinrad, & Silva, 2015). For example, Davis, Quiñones-Camacho, and Buss (2016) showed that RSA reactivity in the form of increased parasympathetic influence was detected among 5–6 year olds while they actively implemented emotion regulation strategies, relative to children in a control group, suggesting that in the context of recovering from an emotional perturbation, RSA augmentation was the more adaptive pattern (i.e., the pattern corresponding to active regulatory attempts). Thus, RSA augmentation during emotional recovery contexts, like the laboratory-based paradigm we used in this study, would be the more adaptive physiological pattern to observe while children are regulating disappointment.

1.2 | The present study

The goal of this study was to examine whether and how parents' emotion regulation abilities directly and indirectly socialize young children's adaptive emotional and physiological responding to emotional challenges. We focused on 3- to 7-year-old children, whose emotion regulation abilities are quickly improving, but who are often unable to use complex cognitive strategies, such as reappraisal, on their own. Cognitive reappraisal involves changing one's thoughts about an emotional stimulus to alter its emotional impact (Gross & Thompson, 2007), for example by thinking about how an upsetting event is "not a big deal." Parental scaffolding or coaching of reappraisal offers children the opportunity to use a more complex and putatively adaptive strategy to manage disappointment that they might not be able to use on their own. Because parents are important socialization agents in early childhood and often help children manage their negative emotions, this is an ideal phase of development in which to study parental coaching of strategies for their children to implement.

Although many different strategies can be used to regulate emotions (e.g., Gross & Thompson, 2007), past research has identified cognitive reappraisal as a strategy that seems to be particularly adaptive (i.e., associated with better psychological health; Aldao & Nolen-Hoeksema, 2010; Davis, Levine, Lench, & Quas, 2010; Gross & John, 2003; Webb, Miles, & Sheeran, 2012). We examined parents' in-the-moment coaching of cognitive reappraisal to their disappointed child as an index of direct or explicit emotion socialization. We assessed parents' physiological regulation (resting RSA) and dispositional use of cognitive reappraisal as facets of parent regulation that might indirectly contribute to children's response to a structured disappointment task. We hypothesized that a pattern of better parental regulation across indices (higher resting RSA, more extensive use of cognitive reappraisal) and explicit parental socialization (coaching of reappraisal) would predict better physiological and behavioral adjustment in children (i.e., decreases in behavioral distress, increases in parasympathetic activation) during the active disappointment regulation context.

2 | METHODS

2.1 | Participants

Ninety-seven children between the ages of 3 and 7 (M = 5.79 years, SD = 1.25 years; 41 boys), along with one parent (84% mothers), participated in a larger study of emotional development. Families were recruited from a sociodemographically diverse area of the southwestern United States. Parents reported children's races and ethnicities as: multiracial (37%), Hispanic (27%), Caucasian (19%), African American (8%), Asian American (3%), or other (3%). Fathers' race and ethnicity was reported as Hispanic (33%), Caucasian (27%), African American (16%), multiracial (10%), Asian American (5%), or other (2%). Mothers' race/ethnicity was reported as Hispanic (36%), Caucasian (30%), multiracial (11%), African American (6%), Asian American (5%), or other (4%). Thirty-five percent of the families who chose to report annual income had a household income below $30,000; 30% reported income above $50,000. Thirteen percent of fathers did not graduate from high school, 27% were high school graduates, 16% completed a trade, technical, or vocational degree, 21% received a college Bachelor's degree, 7% received a Master's degree, and 2% obtained a Doctoral degree. About 7% of mothers did not graduate from high school, 30% were high school graduates, 20% completed a trade, technical, or vocational degree, 24% received a college Bachelor's degree, 8% received a Master's degree, and 4% obtained a Doctoral degree.

Data were partially missing for 18 participants; 13 children did not have usable physiological data (due to electrodes coming loose, technical issues with acquisition, or refusals to wear the electrodes). The other five were either missing video needed for behavioral coding, or parent self-report of reappraisal. Missing data were multiply imputed using the expectation method (EM) algorithm in SPSS. This approach is superior to listwise deletion, mean substitution, or multiple regression techniques for handling missing data (Musil, Warner, Yobas, & Jones, 2002). Ten imputations were generated and the pooled estimates were used in analyses.

2.2 | Procedure

Families visited the lab once for a 3.5 hr visit that included completion of parent self- and child-report measures, interactive tasks between the experimenter and the child, and interactive tasks between parent and child. All assessments were videotaped for later behavioral coding. Physiology was collected from children continuously throughout the visit. At the beginning of the visit, children were given a warm-up period to acclimate to the sensors and equipment before any tasks began. Physiology was additionally collected from parents for the second half of the visit.

2.2.1 | Prize rank

Children ranked six toys (a light-up ring, bouncy ball, glow-in the dark lizard, stretchy frog, parachute alien, and teething ring) in order of preference from their "most favorite" to their "least favorite" toy. Unsurprisingly, most children (73%) indicated that the teething ring was their least favorite prize. Children were assured that they would receive their favorite prize later in the visit.

2.2.2 | Disappointment task

Approximately 2.5 hr later, children were told they would be given their prize. The experimenter placed a decorated gift box in front of the child. Opening the gift revealed the child's *least* favorite toy. To ensure disappointment, the least favorite toy was intentionally damaged, rendering it unusable (e.g., the teething ring was broken in half so it could not be worn as a bracelet). We expanded on previous versions of this disappointment task (e.g., Saarni, 1984) by dividing ours into three-phases. Phase 1 began when the child saw the wrong gift. The experimenter remained with the child for 60 s, pretending to be preoccupied with paperwork. Phase 2 began when the experimenter left the testing room and children were alone with the disappointing gift for an additional 60 s. During this time, the experimenter briefed the parent on the deliberate disappointment paradigm and asked the parent to go in to the room and interact normally with their (disappointed) child. Phase 3 began when the parent entered the room to engage with their child (no experimenter present) and lasted 60 s. This third phase, the time spent interacting with the parent, is the focus of the current report. After the third phase, the experimenter re-entered the room, explained that she had made a mistake when organizing the ranked prizes, and presented the child with their favorite prize.

2.2.3 | Cardiac physiology acquisition

Physiological data (electrocardiograph; ECG) were collected during a resting baseline immediately before the disappointment task, in which children and parents sat together quietly for 3 min, and throughout the disappointment task phases. ECG was wirelessly transmitted to a nearby computer using an ambulatory impedance cardiograph (MindWare Technologies, Westerville, OH) and MindWare Wi-Fi ACQ Version 3.0.10 acquisition software. Data were collected via self-adhesive electrodes placed on participants' rib cages. The experimenter introduced the sticky, self-adhesive electrodes to the children along with colorful, attractive stickers and asked children to help "decorate" the back of the electrodes. A second experimenter entered the room and explained that children would wear the sticky sensors on their bodies so that the experimenters could listen to their hearts during the study. Stickers were secured to three disposable pre-gelled electrodes that were then placed over children's distal right collarbone, lower left rib, and lower right rib to acquire electrocardiograph (ECG) signal. Four additional electrodes were placed on children's torsos to derive impedance data (not considered in this report). The ambulatory monitor was secured in a small backpack to allow children to move freely during the tasks. Once electrodes were attached and participants acclimated to wearing the sensors, ECG recording began for resting baseline measures and task measures. Similar procedures were followed to acquire ECG from parents. For the current study, physiological data acquired during a resting baseline immediately before the disappointment task, during Phase 2, and during Phase 3 of the disappointment task were used.

2.3 | MEASURES

2.3.1 | Parents' use of reappraisal

The *Emotion Regulation Questionnaire* (Gross & John, 2003; Melka, Lancaster, Bryant, & Rodriguez, 2011) was used to assess the emotion regulation strategies parents typically used to deal with negative emotions in their own lives. The questionnaire has two subscales: *expressive suppression* (α = 0.756) and *cognitive reappraisal* (α = 0.863). There are 10 items, 6 measuring *cognitive reappraisal* and 4 items measuring *expressive suppression*. Items are scored on a 7-point scale (7 = *strongly agree*; 1 = *strongly disagree*) and averaged to create the subscale scores. Higher scores indicate greater dispositional use of the strategy. We were particularly interested in the *cognitive reappraisal* scale, because this strategy is generally viewed as an effective means of managing negative emotion (e.g., Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010; Gruber, Hay, & Gross, 2014).

2.4 | Data reduction and coding

2.4.1 | Parent coaching of reappraisal to children

Trained research assistants, supervised by the first author, coded video recordings of the parent-child interactions to determine which emotion regulation strategy parents first suggested to their disappointed children. We focused on the first strategy, because parents provided different numbers of strategy suggestions over the course of the interaction. Research assistants were trained to code parent-provided emotion regulation strategies following a previously established approach (e.g., Scrimgeour, Davis, & Buss, 2016). We coded *Cognitive Reappraisal* when parents suggested that the child think about the disappointing gift in a way that would make it less disappointing (e.g., "We can give it to your little brother;" "Isn't it still nice that you got a present?"). Inter-rater reliability for *Cognitive Reappraisal* was calculated for 50% of the files ($K = 0.82$). Disagreements between coders were discussed and resolved by the first author. Note that other strategies were also coded, including *Cognitive Distraction* (e.g., "Think about how much fun you'll have at the park later") and *Expressive Encouragement* (e.g., "It's okay to feel sad"), but only *Cognitive Reappraisal* was examined here given our hypotheses.

2.4.2 | Children's distress

Children's expressed emotional distress during the disappointment task was globally coded on a 1–5 scale (*5 = very distressed; 1 = not at all distressed*). We coded emotional distress rather than discrete negative emotional expressions (e.g., sadness, anger), because the disappointment evoked by this paradigm could have manifested as displays of anger, sadness, or both. Thus, we examined emotional distress as an index of children's global negative emotional response to the disappointment.

Raters globally assessed the duration and intensity of children's distress-related behaviors over the 60 s of each task phase. We defined distress behaviors as verbalized complaints (e.g., "It's broken; I don't want it"), facial or bodily expressions of negative emotion (e.g., frowning, pouting), as well as other less frequently exhibited expressive behaviors (e.g., crying, screaming, and throwing or destroying the gift). Distinctions between levels of distress were based on the duration and intensity of children's expressions. For example, a child who pouted for a few seconds was coded as less distressed than a child who pouted continually. Separate distress codes were assigned for the second (children alone with the wrong gift) and third (children interacted with parents) phases of the disappointment task. Inter-rater reliability was calculated for 80% of the files with a proportion agreement greater than 0.91 for distress in both phases. Disagreements between coders were discussed and resolved by the first author. A distress change score was calculated by subtracting distress while alone from distress while with the parent. Positive values indicate greater distress when with the parent, and negative values indicate less distress when with the parent.

2.4.3 | Processing and coding of cardiac physiology

The ECG data were processed off-line using a multi-pass algorithm designed to detect R-waves. Heart rate was quantified from ECG as the number of R–R intervals per minute. Respiratory sinus arrhythmia (RSA) was used as a measure of parasympathetic activity. RSA spectral power was integrated over the appropriate frequency band for respiration (the 0.15–0.80 Hz range was used for the children in our sample, and the 0.12–0.24 Hz range was used for the parents), and calculated in 30-s epochs. Each 30-s epoch was visually inspected for errors (most often these were missed R-waves or peaks misidentified as R-waves), which were manually corrected as needed. Research assistants achieved RSA values for each epoch of data within 0.1 of the master coder's (first author) values before they were considered reliable. Inter-rater reliability was calculated by double-scoring 75% of the files, and was excellent (97% agreement). Children's RSA reactivity during the recovery context of the task was calculated by subtracting children's RSA values during Phase 2 from values during Phase 3, with higher values indicating RSA augmentation when with the parent.

3 | RESULTS

Descriptives and correlations are shown in Table 1. There were no gender differences in displays of distress ($ts < -1.85$, $ps > .07$; Phase 2:

TABLE 1 Zero-order correlations between main variables

	M	SD	1	2	3	4	5	6	7
1. Child age	5.79	1.25	-	−0.06	−0.28**	0.02	0.03	−0.07	−0.06
2. Child gender	0.58	0.50	-	-	−0.13	−0.05	−0.14	−0.14	0.08
3. ERQ reappraisal	5.73	1.02	-	-	-	−0.21*	0.14	0.16	−0.04
4. Parent provision of reappraisal	0.26	0.44	-	-	-	-	−0.06	0.03	0.01
5. Parent RSA baseline	6.42	1.35	-	-	-	-	-	−0.07	0.20
6. Child change in distress	1.01	1.03	-	-	-	-	-	-	−0.24*
7. Child RSA reactivity	−0.31	0.96	-	-	-	-	-	-	-

ERQ, emotion regulation questionnaire; RSA, respiratory sinus arrhythmia.
*$p < .05$.**$p < .01$.

$M_{boys} = 1.39$, $SD_{boys} = 0.68$; $M_{girls} = 1.70$, $SD_{girls} = 0.86$; Phase 3: $M_{boys} = 2.58$, $SD_{boys} = 1.13$; $M_{girls} = 2.58$, $SD_{girls} = 1.34$). Distress levels significantly increased from Phase 2 ($M = 1.58$, $SD = 0.80$) to Phase 3 ($M = 2.58$, $SD = 1.25$); $t(90) = 9.39$, $p < .0001$. As expected, the change in children's emotional distress was negatively correlated with physiological reactivity ($r = -0.24$, $p = 0.02$), such that decreasing emotional distress when with the parent was associated with more RSA augmentation. To assess whether parents' regulatory abilities related to children's physiological and behavioral adjustment during the disappointment, we conducted separate hierarchical regressions predicting emotional distress reactivity and physiological reactivity. We entered children's age, gender, and initial levels of RSA and distress (during Phase 2, while alone) as covariates in Step 1 of each model. Gender was covaried because research suggests that parents socialize boys' and girls' emotional responding differently (Brown, Craig, & Halberstadt, 2015). In Step 2, we entered parents' resting RSA, use of cognitive reappraisal, and whether they coached cognitive reappraisal to their child. In Step 3, we entered all two-way interactions among the predictors. The three-way interaction of parents' resting RSA, use of reappraisal, and provision of reappraisal was entered in the fourth and final step of the model.

3.1 | Children's emotional distress reactivity to disappointment

No effects from this first model were significant (*b*s < 0.39, ps > 0.20), indicating that parent regulatory abilities did not relate to changes in observed child emotional distress during the disappointment task.

3.2 | Children's physiological reactivity to disappointment

Our second model examined children's physiological reactivity to disappointment. No main effects or lower-order interactions were significant (Table 2). However, we found a significant 3-way interaction among the parent regulatory indices, $b = 0.74$, $t = 2.990$, $p = 0.003$, CI [.254,1.222]; (Figure 1). The model explained 27% of the variance in physiological reactivity ($R^2 = .26$, $F(1,72) = 9.46$, $p = .003$). We probed this by plotting predictors +/ − 1SD from the mean and tested simple slopes (Aiken & West, 1991). Only one slope was significantly different from zero, $b = 0.85$, $t = 2.98$, $p = .004$, and showed that a pattern of adaptive parental regulation was associated with better physiological regulation for children (RSA augmentation when with the parent). Specifically, children showed better physiological regulation as parents' resting RSA, use of reappraisal, and provision of reappraisal increased. No other combination of parent regulatory strengths and weaknesses was associated with children's physiological reactivity, whether for parents who used reappraisal more, but did not coach reappraisal ($b = .01$, $t = 0.06$, $p = 0.95$), or parents who used reappraisal less and either did ($b = -0.18$, $t = -0.72$, $p = 0.47$) or did not ($b = 0.24$, $t = 1.27$, $p = 0.21$) coach reappraisal.

4 | DISCUSSION

The goal of this investigation was to examine whether and how parents' emotion regulation abilities directly and indirectly socialize young children's adaptive emotional and physiological responding to emotional challenges. We examined parents' physiological regulation and dispositional use of cognitive reappraisal as indirect sources of socialization, and parents' explicit coaching of reappraisal as a direct source of socialization. Consistent with hypotheses, we found that a pattern of better parental regulation (higher resting RSA, more extensive use of cognitive reappraisal) and explicit coaching of reappraisal was associated with better physiological adjustment in children (RSA augmentation while recovering from disappointment). In contrast to expectations, however, we did not find any associations between parental regulation and children's emotional functioning observed during the study.

Changes in children's observed emotional distress correlated with RSA reactivity in the recovery phase of the task, such that children whose distress decreased when they were with their parents showed greater RSA augmentation. This is consistent with reasoning that greater RSA augmentation would be indicative of more adaptive emotion regulatory responses and effective recovery (e.g., Santucci et al., 2008). RSA augmentation was an adaptive pattern of responding to the recovery phase of the structured disappointment task (e.g., Davis et al., 2016, Sulik et al., 2015). Our results extend previous

TABLE 2 Summary statistics for regression model predicting children's physiological reactivity

Model		*B*	Std. error	*t*	Sig.	Lower CI bound	Upper CI bound
1	Constant	0.486	0.773	0.628	0.530	−1.029	2.000
	Child age	−0.060	0.085	−0.708	0.479	−0.227	0.106
	Child RSA baseline	−0.026	0.080	−0.325	0.745	−0.183	0.131
	Child gender	0.288	0.222	1.297	0.195	−0.147	0.724
	Child distress	−0.280	0.138	−2.024	0.043	−0.551	−0.009
2	Constant	0.617	0.786	0.784	0.433	−0.925	2.158
	Child age	−0.074	0.088	−0.844	0.398	−0.247	0.098
	Child RSA baseline	−0.048	0.085	−0.563	0.573	−0.214	0.118
	Child gender	0.306	0.227	1.352	0.176	−0.138	0.751
	Child distress	−0.236	0.141	−1.674	0.094	−0.511	0.040
	Parent's use of reappraisal	−0.043	0.122	−0.353	0.724	−0.283	0.197
	Parent's RSA baseline	0.193	0.115	1.685	0.092	−0.031	0.418
	Parent provision of reappraisal	−0.014	0.254	−0.056	0.956	−0.513	0.485
3	Constant	0.765	0.802	0.954	0.340	−0.807	2.336
	Child age	−0.058	0.088	−0.655	0.512	−0.231	0.115
	Child RSA Baseline	−0.087	0.089	−0.973	0.330	−0.261	0.088
	Child gender	0.340	0.228	1.492	0.136	−0.107	0.787
	Child distress	−0.273	0.142	−1.914	0.056	−0.552	0.007
	Parents' use of reappraisal	0.000	0.143	0.002	0.998	−0.280	0.280
	Parents' RSA baseline	0.139	0.138	1.010	0.313	−0.131	0.410
	Parent provision of reappraisal	0.073	0.264	0.276	0.783	−0.444	0.590
	Parents’ use x Parents’ RSA	0.204	0.121	1.692	0.091	−0.032	0.441
	Parents’ provision x Parents’ RSA	0.164	0.251	0.652	0.514	−0.329	0.656
	Parents’ provision x Parents’ use	0.089	0.260	0.345	0.730	−0.419	0.598
4	(Constant)	0.304	0.766	0.398	0.691	−1.196	1.805
	Child Age	−0.004	0.085	−0.049	0.961	−0.171	0.163
	Child RSA Baseline	−0.060	0.084	−0.713	0.476	−0.226	0.105
	Child Gender	0.355	0.215	1.649	0.099	−0.067	0.777
	Child Distress	−0.265	0.136	−1.953	0.051	−0.530	0.001
	Parent use of Reappraisal	−0.009	0.135	−0.064	0.949	−0.274	0.256
	Parent RSA baseline	0.157	0.131	1.196	0.232	−0.100	0.413
	Parent provision of Reappraisal	0.142	0.247	0.574	0.566	−0.343	0.627
	Parents’ use x Parents’ RSARQ_RExDBL2P	−0.024	0.137	−0.178	0.859	−0.293	0.245
	Parents’ provision x Parents’ RSAR1XDBL2P	0.208	0.237	0.874	0.382	−0.258	0.673
	Parents’ provision x Parents’ useR1XERQ_RE	0.371	0.262	1.417	0.157	−0.142	0.885
	Parents’ provision x Parents’ RSA x Parents’ useR1XDBL2PxERQ_RE	0.738	0.247	2.990	0.003	0.254	1.222

research findings by showing that RSA augmentation corresponding to emotion regulation strategy implementation is not limited to contexts in which children are viewing emotion-eliciting film clips (e.g., Davis et al., 2016). Because we found a similar pattern of RSA augmentation while children regulated disappointment in a more naturalistic emotional challenge context, our findings provide additional evidence that the interpretation of children's RSA reactivity must carefully account for context and that the patterns of RSA reactivity and recovery that are most adaptive will depend on the parameters of the task being used. Moreover, patterns of adaptive RSA reactivity may be different for tasks in which children experience emotions without attempting to regulate them versus tasks in which children are actively regulating negative emotions.

Although we hypothesized that better parental regulation would predict both less distress when children were with their parents and greater RSA augmentation in this recovery context, we found the

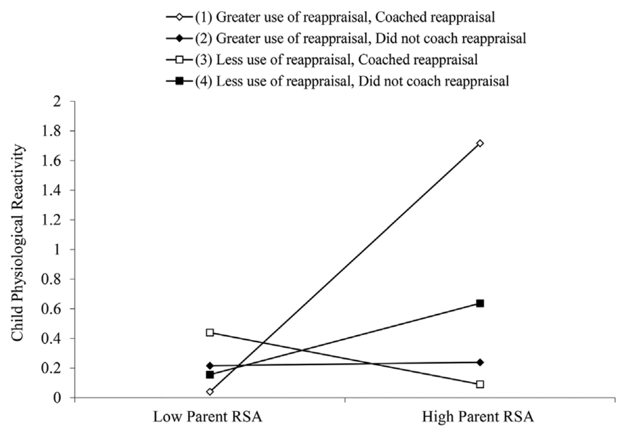

FIGURE 1 3-way interaction between parents' provision of Cognitive Reappraisal, parents' use of Cognitive Reappraisal, and parents' RSA baseline predicting children's RSA reactivity. Greater use of Cognitive Reappraisal, coached Cognitive Reappraisal: $b = 0.85$, $t = 2.98$, $p = .004$. Greater use of Cognitive Reappraisal, did not coach Cognitive Reappraisal: $b = 0.01$, $t = 0.06$, $p = 0.95$. Less use of Cognitive Reappraisal, coached Cognitive Reappraisal: $b = -0.18$, $t = -0.72$, $p = 0.47$. Less use of Cognitive Reappraisal, did not coach Cognitive Reappraisal: $b = 0.24$, $t = 1.27$, $p = 0.21$

expected association only for physiology and not for behavioral distress. Observed distress was higher during the phase of the disappointment task when children were with their parents. This was a social context with a familiar adult, and children may have increased or exaggerated their expressions of distress to elicit social support from the parent, again underscoring the importance of considering task context. It is possible that other aspects of parental socialization, such as emotion expression, are more important for understanding children's *expression* of distress during a disappointing event, whereas direct and indirect parental socialization of emotion regulation was more important for understanding children's *regulation* of disappointment.

Parents' physiological regulation, use of reappraisal, and provision of reappraisal suggestions to children predicted changes in children's physiological reactivity. Physiologically well-regulated parents who use cognitive reappraisal themselves appear to be better equipped to effectively coach reappraisal to their children, as evidenced by children's adaptive physiological responding to this combination of parental emotion regulatory facets. This is a novel finding, as many studies of parental emotion socialization have narrowly focused on behavioral measures of emotional expression and language. The behavioral approach has been fruitful, showing that young children learn how to regulate their emotions from interacting with their parents (e.g., Castro et al., 2015; Morris et al., 2007; Poon et al., 2017), and that emotion socialization happens via both indirect (by modeling emotion regulation skills) and direct (by coaching children to use emotion regulation strategies) pathways (Thompson & Meyer, 2007). However, little research has examined the combination of direct and indirect aspects of parental emotion socialization, and this is the first study we know of to relate this interplay to children's adaptive regulatory functioning. By including parents' provision of strategies, emotion regulation ability, and physiological regulation, we captured a more complete picture of parental emotion regulation. This is important, as other studies have demonstrated the impact of parental socialization practices on long-term children's adjustment (e.g., Chaplin, Cole, & Zahn-Waxler, 2005).

Future studies should assess whether parental provision (and use) of other emotion regulation strategies like distraction or suppression would also relate to children's adjustment. It will also be important for future studies to consider parent gender and how the match or mismatch between child and parent gender might influence these emotion socialization processes. And, although our inclusion of parental physiology represents an improvement over previous single-method studies, additional components of parents' physiological functioning (e.g., parents' reactivity to their child's disappointment, their own disappointment) should also be investigated in future work. Similarity between children's and parents' regulation could be due to genetic as well as experiential influences, and these biological factors should also be examined in future studies. Last, we chose to focus on the first strategy parents provided to their children, but future studies should examine the variability in parents' strategy provision (e.g., suggesting one strategy but then switching to a different one) to further probe this aspect of parental socialization.

Despite these limitations, our findings have important implications for work with parents and children in applied settings. For instance, interventions designed to teach parents how to directly socialize children's emotion regulation by providing strategy suggestions would benefit from first considering parents' own use of those strategies, as it may be important for parents to have mastered an adaptive strategy like reappraisal before they can effectively teach it to their upset child. In sum, the current study provides new and valuable insight into emotion socialization processes by specifying characteristics of parents' own emotion regulation that directly and indirectly shape children's adjustment. Findings underscore the importance of incorporating multiple levels of analyses in emotion socialization research and carefully considering context to characterize children's adaptive emotional functioning.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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