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BRIEF REPORT

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Child emotion inhibition mediates the effect of parent's adaptive cognitive emotion regulation on child frontal EEG asymmetry during reappraisal

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Abstract

Cognitive reappraisal is considered an adaptive emotion regulation strategy, but little is known regarding children's ability to effectively implement cognitive reappraisal. Some research indicates that parenting contributes to child cognitive reappraisal ability, with parent's own adaptive cognitive emotion regulation strategies playing a role. Minimal research attempts to examine how child and parenting factors work together to affect child cognitive reappraisal. We examined this association through mediation analyses to determine whether child emotion coping and emotion inhibition would mediate the relation between parent's adaptive cognitive emotion regulation and children's cognitive reappraisal implementation. Children were instructed to implement cognitive reappraisal during a sad film, while electroencephalogram (EEG) was collected. Left frontal EEG asymmetry was conceptualized as effective cognitive reappraisal implementation. Our model supported full mediation for child emotion inhibition. Parent's adaptive cognitive emotion regulation was positively associated with children's emotion inhibition, which was then positively linked to children's left frontal EEG asymmetry during cognitive reappraisal. The model with child emotion coping as a mediator was not supported. Our findings highlight the importance of examining multiple pathways that may impact children's adaptive cognitive reappraisal ability.

KEYWORDS
cognitive reappraisal, emotion inhibition, frontal EEG asymmetry, middle childhood, parenting

Parenting factors are important for the development of children's regulatory functioning, with intergenerational transmission of regulation being one way parents impact their child's regulation (Bridgett et al., 2015). The relation between parents' own emotion regulation (ER) and their child's ER may not be direct, however. Research examining parenting and child ER finds that parent's own ER strategies impact the parenting environment, which, in turn, influences the child's developing ER (Bridgett et al., 2015; Lorber, 2012; Silva et al., 2018). We define ER during childhood as the ability to enhance, inhibit, maintain, and modulate emotional experiences and expressions during emotionally eliciting situations (Calkins & Hill, 2007; J. J. Gross & Thompson, 2007).

During early childhood, children rely on behavioral strategies as a means to regulate, specifically inhibiting or suppressing their emotional responses (J.T. Gross & Cassidy, 2019). A young child's ability to inhibit negative emotions (i.e., anger and sadness) may be one facet through which more cognitive regulatory strategies begin to develop. Because inhibiting negative emotions is a behavioral strategy learned early in childhood, having the ability to inhibit emotion may become important for later developing ER strategies. For example, children's ability to understand and engage in social display rules (i.e., hiding outward displays of negative emotions from others) develops and becomes more advanced through early childhood, with fifth graders reporting using more display rules than first graders (Zeman et al., 2006). Just as the ability to engage more display rules develops, cognitive ER strategies might develop on top of more simple forms of emotion management, such as inhibition and coping.

As children mature, their ER strategies become more deliberate, incorporating more cognitive strategies to regulate emotions. More nascent forms of emotion management may be the foundation children require to develop more advance cognitive strategies. One specific strategy that children become more capable of implementing is cognitive reappraisal (CR), the ability to diminish an emotional impact of an event through cognitive reframing (J. J. Gross, 2002). Although it has been reported that children as young as 6 years of age can be instructed to engage in CR (Davis & Levine, 2013), the understanding that changing mental states can influence feelings begins to emerge around age 7 (Flavell & Green, 1999). Specifically, only 35% of 7-year-old children are able to explain that changing their thoughts about an event could change their emotions. This number increases to 60% by age 9 and 80% by age 11. Prior to age 8, children rely on behavioral strategies to diminish negative emotions (Pons et al., 2004). But by age 9, children can apply and engage in CR on their own during sad, frustrating, and fear events (Davis et al., 2010). One factor that is thought to influence child CR is parent's own CR, but research is mixed, indicating that this relation may not be direct (Bariola et al., 2011, 2012; Gunzenhauser et al., 2017; Silva et al., 2018).

One measure used to examine effective CR is through electroencephalogram (EEG) activation. Greater left hemisphere frontal EEG activation in relation to the right hemisphere (i.e., left frontal asymmetry) is indicative of positive regulatory functioning (Fox, 1991). Left frontal EEG activation is evident when adults are asked to implement CR during a task. Task frontal EEG asymmetry can be collected during a specific task and provides information about ER during a specific task. Baseline frontal EEG asymmetry, on the other hand, is collected during a resting state, in children it is typically collected while participants watch a neutral film or stare at a neutral stimulus (see Cuevas & Bell, 2022, for a review). Baseline left frontal EEG asymmetry is also more prevalent among adults who are habitual cognitive reappraisers (Choi et al., 2016). Although this research is limited, based on EEG asymmetry literature and regulation, left frontal EEG asymmetry may be an important component that allows children to effectively implement CR during emotional situations. Because we were interested in child CR, we focused on parent's adaptive cognitive ER strategies and child left FA during instructed CR, with child emotion management strategies (i.e., coping and inhibition) as mediators in this relation.

0.1 | Parental cognitive emotion regulation and children's regulation

The intergenerational transmission of self-regulation indicates that parent's own regulatory abilities affect children's regulation by way of parenting styles and the home environment (Bridgett et al., 2015). When children lack an emotionally well-regulated model, their ability to learn ER strategies diminishes (Field, 1994), making it difficult for children to develop their own ways to cope with distressing situations. On the other hand, when children have an emotionally well-regulated model, their ability to learn ER strategies is greatly enhanced (Calkins & Hill, 2007).

There has been little research specifically focused on parent's cognitive ER strategies as predictors of children's regulatory abilities. Cognitive ER strategies are thought processes that influence how an individual manages emotional information (Garnefski et al., 2007). Some research indicates that parental use of CR is associated with their children's CR when supportive parenting is high (Gunzenhauser et al., 2014). But there is other research that indicates no relation between parental CR and child CR (Bariola et al., 2012). Because we were interested in child CR during a reappraisal task, we chose to focus on adaptive parental cognitive ER strategies. Specifically, we were interested in the role of parent's adaptive cognitive ER and child CR ability during a reappraisal task, while including mediators of child emotion management as potential solutions to the mixed findings mentioned above.

0.2 | Emotion coping and emotion inhibition as mediators

A child's ability to manage their emotions and outward emotional expressions may be possible mediators that contribute to the development of more advanced forms of ER, such as CR from parent's own cognitive ER strategies. Emotion coping is one emotion management strategy that is considered an adaptive general form of ER, but coping skills may not be the only skills necessary for children to develop more advanced, cognitive ER strategies. For example, during early childhood, inhibiting negative emotions is considered a proper way of managing emotions for children (J.T. Gross & Cassidy, 2019). Inhibition is decreasing the outward expression of a felt emotion by holding an emotion inside or hiding the emotion from others (Zeman et al., 2001). When children inhibit their negative emotions, refraining from engaging in emotional outbursts, children are praised by parents and caregivers, children learn to understand the socialization processes that may be adaptive in one setting and maladaptive in another (Thompson, 1991, 2011).

Inhibition is generally considered maladaptive for children's emotional development but having a large repertoire of emotion management strategies may be adaptive. For example, more recent literature indicates that when adults are capable of engaging multiple ER strategies (i.e., affective flexibility), this is associated with their ability to engage reappraisal to downregulate negative emotions (Kobylińska & Kusev, 2019; Malooly et al., 2013). Children may be developing the ability to engage more advanced cognitive strategies through more foundational ER strategies seen during early childhood (Garnefski et al., 2007). Indeed et al. (2004) examined the suppression of emotional expression through a lab task, results indicated that when individuals were more capable of suppressing and enhancing emotional expression, this was associated with diminished distress long term in college students. Under the right circumstances, emotion inhibition may be beneficial for children's developing ER strategies.

Adaptive use of emotion coping and emotion inhibition of negative emotions by children may provide them with the foundational ability to effectively learn and engage in more advanced, cognitive strategies of ER. Although no research to date has examined the developmental factors that may contribute to CR ability, we focused on two emotion management strategies that develop during early childhood: coping and inhibition (Zeman et al., 2006). Thus, both coping with negative emotion and inhibition of negative emotion may be adaptive ER strategies during early childhood that serve as mechanisms for the development of more advanced cognitive strategies observed in middle childhood.

0.3 | Neurophysiological regulation through frontal EEG asymmetry

Frontal EEG asymmetry (FA), the increased activation of either the right or left frontal hemisphere in relation to the other hemisphere, is associated with the behavioral expression and regulation of emotions (Fox, 1991, 1994). FA is both an inherent trait temperamental factor and can also be induced during different emotion states/tasks. The approach-withdrawal motivation theory posits that increased activation of the right frontal cortical area (right FA) is associated with withdrawal-motivated behaviors, whereas increased activation of the left frontal cortical area (left FA) is associated with more approach-oriented behaviors, with left FA being indicative of more positive regulation (Fox, 1991, 1994).

Coan et al. (2006) proposed a model of FA as a core component of an individuals' capability and capacity of regulation within specific contexts. This model suggests that task FA provides a more consistent picture of individual differences during emotionally challenging tasks. By examining task FA as a measure of individual capacity, we can better understand how individual differences are being influenced by the situation. In the previous literature, task FA is used as an indicator of neurophysiological regulation during task specific measures. Infant responses to maternal separation were predicted by both baseline and task frontal EEG, with more crying behaviors being related to greater right FA after the separation (Davidson & Fox, 1989). Task-related FA during early childhood is predictive of later regulatory behaviors, such as anxiety in middle childhood (Hannesdottir et al., 2010).

A great deal of research on FA with adults has reported similar findings, with more right FA during emotion induction being associated with increasing negative emotions, such as negative affect in response to emotionally provocative films (Coan & Allen, 2003; see Coan & Allen, 2004, for review of adult research). In addition to general ER, FA has also been linked to more cognitive ER abilities. Engaging in CR while viewing negative images is linked to greater left frontal activation in adults (Choi et al., 2016).

These findings show support for the approach-withdrawal motivation theory, as well as the capability model (Coan et al., 2006; Fox, 1991), indicating the adaptability of FA as a regulatory measure in research (Kim & Bell, 2006). Due to the link between FA, general ER, and cognitive ER, we examined parent's adaptive cognitive ER strategies and child regulatory behaviors, measured using FA, and child report of coping and inhibition of negative emotion. We examined our hypotheses using two models; first, we hypothesized that parent's adaptive cognitive ER would positively predict children's FA during CR (i.e., greater parent CR would be related to child left FA), with children's coping of anger and sadness mediating this relation. Second, we hypothesized that parent's adaptive cognitive ER would positively predict children's FA during CR (i.e., greater parent CR would be related to child left FA), with children's inhibition of anger and sadness mediating this relation.

Thus, our hypotheses were that parent's adaptive cognitive ER strategies would be associated with their child's left FA, while children implemented CR during a sad film. Children's emotion management strategies, coping and inhibition, will serve as mechanisms in this relation. Mechanisms were tested in different models.

1 | METHOD

1.1 | Participants

Participants were fifty 9- to 10-year-old children (23 girls; $M = 9.74$y; $SD = 0.68$y) and their parents (45 mothers; 5 fathers). Families self-selected the parent who accompanied the child to the research lab. Participants were recruited from our department's database of volunteer families, flyers distributed in the community, and announcements posted to various university outlets (i.e., daily email, working mother, and graduate student listservs). Children were primarily non-Hispanic, Caucasian (80% White, 8% Hispanic or Latine, 6% Multi-Racial, 2% Asian, 2% Native American) and most parents had a college degree (6% High School Diploma, 6% Technical School, 32% College Degree, and 56% Graduate School). One parent did not respond to the race/ethnicity questions. Parents were compensated with a $20 gift card and children were compensated with a small gift.

1.2 | Procedures

Children and parents arrived at the research lab where they were greeted by a researcher and parent consent and child assent were collected. Parents completed questionnaires in a room adjacent to the data collection room, where they were able to see and hear their children via two-way mirror and video monitor throughout the entire visit. Visits were video recorded for later behavioral coding. The EEG cap was placed on the child. A 1-min EEG baseline was recorded, while children sat relaxed with their eyes open looking at a marker on the wall. EEG recording continued throughout the visit. After baseline, children were read the CR instructions prior to watching a sad film. After engaging in additional tasks that were not included in these analyses, children completed a questionnaire about their emotions.

1.3 | Frontal EEG asymmetry

A stretch EEG cap (Electro-Cap, Inc.; Eaton, OH; E1-series cap) with electrodes in the 10/20 system pattern was placed on the child's head. EEG recordings were collected from 26 left, right, and midline scalp sites (frontal pole [Fp1, Fp2], frontal [F3, F4, Fz, F7, F8], central [C3, C4], central frontal [FC1, FC2, FC5, FC6], temporal [T7, T8], parietal [P3, P4, Pz, P7, P8], central parietal [CP1, CP2, CP5, CP6], occipital [O1, O2]). After the cap was positioned, abrasive gel was placed and gently rubbed at each electrode site. Conductive gel was then added at each electrode site.

Electrode impedances were measured and accepted below 10 KΩ. EEG electrical activity was amplified from each lead using separate James Long Company Bioamps (James Long Company; Caroga Lake, NY). The high-pass filter was a single-pole RC filter with a 0.1 Hz cut-off (3 dB or half-power point) and 6 dB per octave roll-off. The low-pass filter was a two-pole Butterworth type with a 100 Hz cut-off (3 dB or half-power point) and 12 dB octave roll-off. Activity for each lead was displayed on a monitor of an acquisition computer. EEG signal was digitized online at 512 samples per second for each channel so that the data would not be affected by aliasing. The acquisition software Snapshot-Snapstream (HEM Data Corp., Southfield, MI) was used and the raw data were stored for later analyses.

Prior to the recording of each subject a 10 Hz, 50 μV peak-to-peak sine wave was input through each amplifier. This calibration signal was digitized for 30 s and stored for subsequent analysis. Spectral analysis of the calibration signal and computation of power at the 9–11 Hz frequency band was accomplished. These power figures were used to calibrate the power derived from the subsequent spectral analysis of the EEG. EEG data were examined and analyzed using EEG analysis software developed by the James Long Company (Caroga Lake, NY). The data were first rereferenced via software to an average reference configuration. The average reference EEG data were artifact scored for eye movements (100 μV or greater, peak-to-peak) and gross motor artifact (200 μV or greater, peak-to-peak). These artifacts scored epochs were eliminated from all subsequent analyses. The EEG data were analyzed using a discrete Fourier transform (DFT) using a Hanning window of 1-s width and 50% overlap. Power was computed for the 8–13 Hz alpha frequency band and expressed as mean square microvolts. Data were natural log (ln) transformed to normalize EEG values. FA values were created by subtracting (ln)F3 from (ln)F4 power values. Cortical activity is inversely related to alpha EEG power (Reznik & Allen, 2018); thus, positive values indicate greater relative left frontal activation compared to the right and negative values indicate greater relative right frontal activation compared to the left.

1.4 | Cognitive reappraisal task

Children watched a 5-min clip of the film *My Girl*. During the clip, a young girl learns of her friend's death who passed away due to an allergic reaction to a bee sting. She attends the funeral, becomes very upset, begins to cry, and runs out of the funeral in tears. This clip has been used to elicit sadness in children between the ages of 6–13 years in previous studies focused on CR (Davis, 2016; Davis & Levine, 2013). Prior to watching the film, children were read the following instructions:

"Now you are going to watch a clip from a movie. Watching this makes some children sad. If you feel sad, I want you to try to think about how everything that was sad for the little girl could turn out okay after all. Think about how everything could get better."

Children were then asked what it was they were going to think about while watching the film. The experimenter did not begin the film until the child repeated the instructions.

1.4.1 | Manipulation check

To ensure the sad film indeed induced sadness, we collected children's self-reported emotions prior to the start of the study, before the start of the sad film, and after the sad film concluded. Children were shown an image with faces eliciting different emotions (happy, neutral, sad, and angry; Figure S1 in the Supporting Information) and were instructed the following:

"Throughout your visit today, I am going to ask you to tell me how you are feeling. I am going to show you some faces and I am going to ask you to tell me how you feel. I will show you this, (Figure S1) and I want you to tell me if you are feeling happy, okay, sad, or angry." The ratings were coded from 1 (*happy*), 2 (*okay*), 3 (*sad*), and 4 (*angry*). "If you feel an emotion that isn't on the sheet, just try your best to pick the one that matches most closely. So, let's try for real. Go ahead and tell me how you are feeling." Following this explanation, children were then asked, "Go ahead and tell me how you are feeling" while the experimenter showed them the sheet with faces.

1.5 | Child self-report of emotion management

Children self-reported their own emotion management of anger and sadness using the *Children's Emotion Management Scale* (CEMS; Zeman et al., 2001). The CEMS is a 23-item self-report questionnaire that asks respondents to rate their emotional management when they are sad and angry from 1 (*hardly ever*), 2 (*sometimes*), *or 3* (*often*) with three subscales: inhibition, dysregulation, and coping. A composite score was created for the anger and sadness inhibition subscales, as well as the anger and sadness coping subscales. We excluded the dysregulation subscale because, unlike coping and inhibition that have some positive impact on subsequent regulation, we see dysregulation as having negative impact. Cronbach's alpha for the inhibition subscale was 0.74 and for the coping subscale it was 0.75.

1.6 | Parent self-report of cognitive emotion regulation

Parent report of their own cognition ER was collected using the *Cognitive Emotion Regulation Questionnaire* (CERQ; Garnefski & Kraaij, 2006). The CERQ measures nine cognitive coping strategies and each coping strategy subscale contains two items: self-blame, acceptance, focus on thought or rumination, positive refocusing, refocus on planning, positive reappraisal, putting into perspective, catastrophizing, and other blame. Parents rated items on a five-point Likert-type scale from 1 (*almost never*) to 5 (*almost always*). Questions are phrased to refer to stressful life events. Subscale scores were created by summing the two items in the subscale, with the minimum score being 2 and highest score being 10. Higher scores indicate greater use of the specific strategy. For the purpose of this study, two composite scores were created (Lee et al., 2019). One composite included adaptive cognitive ER (adaptive CER) strategies and the other composite score included the maladaptive cognitive ER (maladaptive CER) strategies within the questionnaire. The present analyses used the adaptive CER score. Adaptive CER was based on the following four subscales; positive reappraisal (e.g., I think I can learn something from the situation), positive refocusing (e.g., I think of something nice instead of what has happened), refocus on planning (e.g., I think about a plan of what I can do best), and putting into perspective (e.g., I tell myself that there are worse things in life). Cronbach's alpha for the adaptive CER subscale was 0.76.

1.7 | Analytic plan

PROCESS macro (V3.5; Hayes, 2022) model 4 for SPSS was used to examine two separate mediation models. Baseline FA and sex were included as covariates in both models. The indirect effect was tested using a percentile bootstrap estimation approach with 5000 samples and 95% confidence intervals (CI) for the indices; a CI that does not include zero indicates statistical significance of the parameter.

2 | RESULTS

Correlations between the variables of interest are provided in Table 1. We first examined whether children self-reported more negative emotion, particularly sadness, after they watched the sad film. We conducted a paired samples *t*-test comparing emotion ratings pre- and post sad film. Our results revealed that children indeed self-reported feeling less happy after the sad film; $t\,(48) = -11.42$, $p < .001$ (Table S1 in the Supporting Information).

TABLE 1 . Descriptive statistics and bivariate correlations among variables

	1	2	3	4	5
1. CEMS Inhibition	1				
2. CEMS Coping	0.48**	1			
3. Parent aCER	0.40**	0.17	1		
4. Baseline FA	0.07	0.02	0.23**	1	
5. Sad Film FA	0.31*	0.07	0.38**	−00.77***	1
6. Child Sex	−0.11	−0.04	0.00	−0.30*	−0.32*
Means	7.27	9.38	6.70	0.001	0.03
SD	1.59	1.82	1.24	0.25	0.20

Note: aCER, adaptive cognitive emotion regulation; CEMS, Child Emotion Management Scale; FA , frontal asymmetry. ***$p < .001$; **$p < .01$; *$p < .05$.

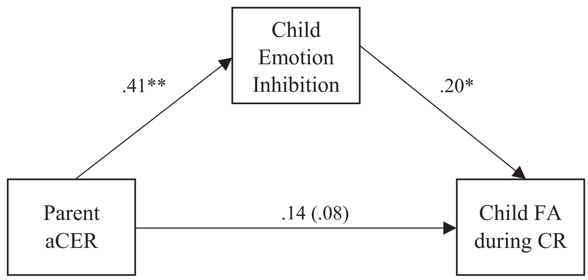

FIGURE 1 Relation between parent's adaptive cognitive emotion regulation and child frontal asymmetry during cognitive reappraisal being mediated by child inhibition. Note: aCER , adaptive cognitive emotion regulation; FA, frontal asymmetry; CR, cognitive reappraisal. **$p < .01$; *$p < .05$

Our first model with child coping with negative emotions as the mediator of the association between parental adaptive CER and child FA during CR was not significant. After controlling for baseline FA and child sex, regression analysis revealed that parental adaptive CER was associated with child left FA during the sad film ($p = .02$). Parental adaptive CER was not associated with child coping ($p = .24$); however, nor was child coping associated with FA during the sad film ($p = .86$). These findings were not expected. Although no previous research has examined the development of CR, we hypothesized that coping would be significantly associated with subsequent CR due to coping being adaptive.

Our second model with child inhibition of negative emotions as the mediator of the association between parental adaptive CER and child FA during CR was significant (see Figure 1). We controlled for sex ($p = .17$) and baseline FA ($p < .001$) in the first step of our regression equation; because sex was not significant, it was removed from the analyses. Results indicated that parent's adaptive CER was a significant predictor of child emotion inhibition ($B = 0.52$, SE $= 0.18$, $p < .01$) and that child emotion inhibition predicted child FA during CR ($B = 0.03$, SE = 0.01, $p < .05$) when controlling for baseline FA. These results support the mediational hypothesis. Parent's adaptive CER was no longer a significant predictor of children's FA during CR after controlling for the mediator, child inhibition ($B = 0.02$, SE = 0.02, ns) consistent with full mediation. Approximately 68% of the variance in child FA during CR was accounted for by the predictors ($R^2 = 0.68$). These results indicated that the indirect coefficient was significant ($B = 0.01$, SE = 0.04, 95% CI [0.002, 0.033]). Child inhibition of anger and sadness mediated the relation between parent's adaptive CER and child FA during CR.

3 | DISCUSSION

Our results indicate that parent's own use of adaptive CER strategies can impact their children's neurophysiological regulation (i.e., FA) through other mechanisms. When parents engage in more adaptive CER strategies, their children report higher inhibition of both sadness and anger emotions, which positively predicts greater left FA while engaging in CR (conceptualized as effective CR; Choi et al., 2016). A child's ability to inhibit emotions at such an early age has been considered an adaptive way of regulating emotions (J. T. Gross & Cassidy, 2019). These results indicate that when parents use more adaptive cognitive strategies to regulate their own emotions, although cognitive in nature, they are providing their children with the capability to implement more adaptive ER strategies themselves. Our findings also indicate that the mechanism through which this occurs is through children's inhibition of negative emotions, a simpler ER ability. We did not find the association to be present for children's coping with negative emotions, which was surprising due to previous research indicating coping as being more adaptive ER (Zeman et al., 2001). Previous research with parents indicates that when parents report using more CR, their children show greater physiological regulation during a distressing task (Shih et al., 2018). Future research should continue to examine the direct and indirect associations between parent's adaptive CER strategies and the impact they have on children's ER abilities.

Although our analyses did not show a significant relation with children's coping, it is important to note that coping and inhibition were highly correlated within our sample of children (see Table 1). Therefore, our findings can only be interpreted in light of children who also indicate high levels of coping management. Based on our findings, one possible explanation is that children with a more diverse repertoire of emotion management strategies may be capable of developing more advanced cognitive ER strategies. Literature focused on affective flexibility, or shifting between ER strategies, indicates that individuals tend to have a wider range of strategies and do not rely on one specific strategy (Aldao & Nolen-Hoeksema, 2013). The flexibility to choose between multiple strategies in an environment that constantly changes has adaptive consequences for mental health (Aldao et al., 2015).

Research indicates that when adults are asked to engage CR, they show greater left FA during the task (Choi et al., 2016). Based on our findings, left FA during CR is seen among children whose parents engage adaptive CER strategies and when the children are more capable of inhibiting anger and sadness. Left FA can serve as a protective factor for more maladaptive outcomes. For example, among preschool children, those with greater right FA and who were sociable displayed greater externalizing problems than did sociable children with left FA. In comparison, shy children with greater right FA displayed more internalizing than shy children with greater left FA (Fox et al., 1996). Parents who engage more adaptive CER strategies and who are able to instruct their children to also use adaptive CER, like CR, can indirectly help their children develop more adaptive neurophysiological regulation. Further, parents who engage more adaptive ER strategies consequently help their own children develop adaptive ER through the intergenerational transmission of self-regulation (Bridgett et al., 2015).

A limitation of our study is that we did not collect children's own adaptive CER and future research should examine the link between parent's and children's adaptive CER. Another limitation is that we only examined children's CR and did not ask children to engage in additional ER strategies while viewing the sad film. Future research can continue to examine whether differences in parental ER strategies, both adaptive and maladaptive, may differentially contribute to child ER strategies. Our sample was also limited, with a majority of parents being highly educated, which leads the generalizability of our findings to be constrained to highly educated parents. Examining whether parent's adaptive CER also contributes to children's implementation of CR in more diverse samples will allow for a greater understanding of potential parenting interventions to assist children in developing their own ER strategies among diverse families (Pat-Horenczyk et al., 2015). An additional limitation of the current study is that empathic reactions to others are also correlated with frontal EEG. Specifically, individuals with more empathic concern and sadness show greater right frontal EEG asymmetry at baseline levels (Tullet et al., 2012). Thus, our frontal EEG asymmetry measure could potentially reflect empathy induced by the task in addition to or instead of ER. Finally, we did not collect information about children's emotion management of positive emotions or their ER flexibility. Future research should continue to examine affective flexibility in childhood to determine its adaptiveness throughout the adolescent years.

Although parental cognitive ER strategies may not be outward forms of ER, children are still impacted by their parent's ability to effectively regulate themselves, whether that is through cognitive ER or through behavioral ER (Bariola et al., 2011). When parents are adaptive regulators of their own emotions, their children are subsequently impacted (Morris et al., 2007, 2011; Rogers et al., 2016). Our findings extend previous research, by examining child FA during emotion elicitation, we find that parental adaptive CER impacts child neurophysiological regulation through child emotion inhibition of negative emotions.

CONFLICT OF INTEREST DISCLOSURE

The authors have no conflicts to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request. cd_value_code=text

ETHICS APPROVAL STATEMENT

This study was approved by the Virginia Tech Institutional Review Board (#17-699).

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SUPPORTING INFORMATION

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

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