Late Childhood Predictors of Adolescent Cognitive Reappraisal: Impacts on Adolescent Depressive Symptoms

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ABSTRACT

In adolescence, the use of cognitive reappraisal (CR) is adaptive for general emotion regulation and for decreasing symptoms of depression. Still, with all of the literature indicating the usefulness of CR, minimal research attempts to understand the childhood processes contributing to CR in adolescence. My dissertation study examined individual factors of executive function and frontal EEG asymmetry during late childhood, and environmental factors of parenting in adolescence, as predictors of adolescent CR and depressive symptoms. Data were from 123 participants in late childhood (age 10) and adolescence (age 14.5). During the late childhood visit, executive function and frontal EEG asymmetry were assessed. The adolescent visit included questionnaires for maternal CR, maternal supportive and unsupportive responses to adolescent's negative emotions, adolescent CR and depressive symptoms. Results indicated that maternal unsupportive reactions moderated the association between maternal CR and adolescent CR, such that higher unsupportive reactions were associated with higher adolescent CR when mothers reported higher CR. Higher CR in turn was associated with lower depressive symptoms. Regarding individual factors, frontal EEG asymmetry moderated the association between inhibitory control during late childhood and adolescent CR, such that better inhibitory control during late childhood was associated with higher CR when children had right frontal asymmetry. Higher CR was associated with lower depressive symptoms in adolescence. The results suggest the potential for targeting inhibitory control and parenting as two mechanisms for improving CR among adolescents to diminish depressive symptoms.

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GENERAL AUDIENCE ABSTRACT

Changing the way one thinks of an emotional event is considered highly adaptive, this strategy is referred to as cognitive reappraisal (CR). 123 participants during late childhood and adolescence and their mothers participated in this study. During the late childhood visit, children completed executive function tasks and electrical brain activity was collected during rest. For the adolescent visit, mothers completed questionnaires regarding their emotion regulation strategies and parenting styles, adolescents completed questionnaires regarding their own emotion regulation strategies and depressive symptoms. Results indicated that when mothers indicated more CR and higher unsupportive reactions this was associated with higher adolescent CR. Higher CR in turn was associated with lower depressive symptoms. Late childhood electrical brain activity and a child's ability to inhibit prepotent responses (inhibitory control) were associated with higher adolescent CR. Higher CR was associated with lower depressive symptoms in adolescence. The results suggest the potential for targeting inhibitory control and parenting as two mechanisms for improving CR among adolescents to diminish depressive symptoms.

DEDICATION

I would like to dedicate this dissertation to my wonderful daughter Jade, although this has been rough, you are worth every late night that I have spent working on this dissertation. To my husband Jorge, thank you for moving out here and believing in me, your support means the world to me. A mi madre, te quiero mucho. Tu me enseñaste que nada en este mundo es facil, y cuando queremos algo tenemos que trabajar duro y nunca darnos por vencidos.

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Introduction

Depressive symptoms among adolescents have been increasing over the last few decades, with research indicating worrisome increases among adolescents born between 1990 and 2000 (Keyes et al., 2019). The growing trend in adolescent depressive symptoms indicates the importance for understanding specific factors that may mitigate these effects. Previous research indicates that adolescent emotion regulation (ER) strategies are important for minimizing adolescent depression (Aldao et al., 2010; Kudinova et al., 2018; Shapero et al., 2019). One ER strategy that has received widespread attention in the literature, especially with adults, is cognitive reappraisal (CR), which involves changes to thoughts about an emotional event by using positive reframing to alter the emotional experience and change the emotional impact (Lazarus & Alfert, 1964).

Although CR is regarded as an adaptive ER strategy (i.e., it is used in cognitive behavior therapy; Aldao et al., 2010), there is little research that integrates potential underlying mechanisms contributing to the effective use and application of CR by adults in real world situations. There is even less research on the application of CR by adolescents, but the minimal research there is suggests that executive functions, frontal EEG asymmetry, and parenting serve as important factors for the development of CR (Choi et al., 2016; Gunzenhauser et al., 2014; Kelley & Hughes, 2019; Lantrip et al., 2016; Papousek et al., 2017). Therefore, my dissertation study incorporated individual and environmental factors in predicting CR ability in adolescence and subsequent depressive symptoms. The results of my study have the potential to provide an understanding of interventions that can be incorporated during middle and late childhood to enhance CR ability and diminish the potential for depressive symptoms in adolescence.

Development of Cognitive Reappraisal

As children mature, so does their ER, with children adapting their ER to become more strategic by incorporating greater cognitive control abilities (Pons et al., 2004). Strategies relying on greater cognitive control abilities include antecedent and response-focused strategies associated with Gross' process model of emotion regulation (J. J. Gross, 1998a). Antecedent focused strategies are those that attempt to modify the emotional input by engaging in cognitive reframing, inclusive of CR, which are believed to be more adaptive to individual functioning (J. J. Gross, 1998b; McRae, 2016; Ochsner et al., 2004). Response-focused strategies attempt to modify the behavioral responses following an emotion, such as suppression, and have been

considered maladaptive (J. J. Gross, 1998b). The process model focuses on four broad processes (i.e., situation selection and modification, attentional deployment, cognitive change, response modulation) that occur within the emotion generation and regulation process. The process model was recently expanded to become the extended process model (EPM) of ER (J. J. Gross, 2015b). The focus of the EPM is on the valuation systems that help individuals identify which ER strategies to implement and the components that make certain ER strategies more adaptive. My dissertation study attempted to apply a developmental lens to both models by incorporating factors which may be important for situation selection and modification, attentional deployment, cognitive change, and response modulation. After reviewing the literature on the development of CR, I turn to three childhood and adolescent situation (frontal EEG asymmetry and parenting) and attention (executive function) processes that may impact adolescent CR.

During childhood, CR begins its foundational development as the understanding that thoughts can change emotions, which emerges around age 5 (Pons et al., 2004; Sala et al., 2014). This emerging ability does not necessarily indicate that children are using CR at this age. For example, in a study asking children to report on ER strategies used to alleviate negative emotions, only 50% of 5- to 6-year-old children provided cognitive strategies, such as thinking of something different, to alleviate negative emotions (Davis et al., 2010). The children reported cognitive strategies more often to alleviate sadness and fear than anger. Six-year-old children report relying more on behavioral distraction, rather than cognitive distraction, to regulate emotions when compared to 7-year-olds (Altshuler & Ruble, 1989; Harris et al., 1981). When 5- to 6-year-olds do provide CR as an ER strategy, nonverbal intelligence (i.e., fluid reasoning, visualization, appraisal of visuospatial memory, and attention) emerges as a significant predictor, but emotional intelligence does not (Sala et al., 2014). Additionally, children's verbal ability is not correlated with children's CR deployment, but cognitive ability is (Sala et al., 2014). This indicates that developing cognitive abilities during these early years may be providing children with the necessary tools to begin employing CR as an ER strategy.

Some common tasks used to examine CR in childhood are instruction to decrease emotions, asking children to provide ER strategies for different scenarios, and parent reports (Davis & Levine, 2013; López-Pérez et al., 2016, 2017; Ochsner et al., 2004; Parsafar & Davis, 2019). Children between 8 and 10 years of age are capable of describing strategies to change their mental states in order to regulate their emotions (Altshuler & Ruble, 1989; McCoy &

Masters, 1985). One way to examine whether children actually are implementing CR, rather than simply describing strategies, is through the brain electrical measure called late positive potential (LPP), which provides information regarding the emotional intensity of a stimulus. If effectively applied, CR should reduce the LPP after exposure to emotional stimuli. In a study of 5- to 7-year-old children examining effective CR after instruction, researchers found that the LPP was not reduced after viewing negative stimuli (DeCicco et al., 2012). This indicates that at 5 to 7 years, children may not be effective in using CR to reduce emotional experience. Although children in this age group are able to list cognitive strategies as means through which emotions can be regulated, they may not be adequately implementing these strategies to assist in their ER. In these same children two years later (i.e., 7 to 9 years of age), the older children had greater LPP reductions after CR (DeCicco et al., 2014). By age 9, more than half of children are able to apply, engage, and report on CR (Davis et al., 2010; Gullone et al., 2010; Pons et al., 2004; Stansbury & Sigman, 2000).

An fMRI study comparing brain activation during instructed reappraisal saw linear increases in the ventral-lateral prefrontal cortex with the following age groups: 10 to 13, 14 to 17, and 18 to 22 (McRae, Gross, et al., 2012). This suggests that reappraisal ability increases with age, as observed through brain activation of the appropriate brain regions. In 9- to 15-year-olds, reliance on CR was fairly stable over time, but there was a decrease in CR, with children reporting more use than young adolescents (Gullone et al., 2010).

In another study of 6- to 13-year-olds, children watched a sad film and were placed into one of four conditions: reappraising the importance, reappraising the outcome, rumination, or a control condition. Children then watched an informative film clip, which was used to measure memory. Both reappraisal conditions were more effective than rumination and control conditions for decreasing sadness and for enhancing memory of the informative film, with no age differences reported (Davis & Levine, 2013). This study indicates that engaging in instructed reappraisal can occur at a young age and that it is effective for increasing memory and reducing negative emotions. In these same 6- to 13-year-old children, Davis (2016) found that both reappraisal and waiting for a researcher to return after briefly stepping away resulted in decreasing sadness. Davis (2016) suggested that children implemented their own ER strategy that have assisted them in the past during the waiting condition.

Adolescents are capable of reporting which strategies they have used to deal with a

stressful situation. In high school students, self-reported CR after an exit exam was related to affective experience and memory weeks later when recalling the exit exams. Specifically, when students reported using more CR, they overestimated having more positive emotions and less negative emotions when recalling their exam experience (Levine et al., 2012). Similarly, CR also offsets the association between depressive symptoms and emotional responses to stress in adolescents (Shapero et al., 2019).

Although CR ability begins to emerge by early school age, it seems that the capability to effectively use this strategy does not occur until much later, potentially late childhood and definitely by early adolescence. Before this, children are regulating their emotions, but they are doing so through different mechanisms, such as those that depend on more behavioral processes (J. T. Gross & Cassidy, 2019). With development, these behavioral regulation strategies become linked to more cognitive forms of ER. For example, in a study of 9- to 12-year-old children, Zalewski and colleagues (2011) reported that children's ER style during frustrating and anxiety-provoking tasks were related to cognitive restructuring ability (i.e., rethinking the situation in a more positive way). Thus, the ability to engage adaptive reappraisal may be a continuum from early regulatory abilities that begin to incorporate cognitive components. In order to consider CR as a developmental trait, it is important to understand specific individual and environmental factors that might influence the adaptive development of CR. As such, I focused on specific environmental and individual difference factors.

Executive Function and Cognitive Reappraisal

An important aspect of child development that may be influencing the process of attentional deployment in Gross's model (J. J. Gross, 1998a) is children's developing executive functioning. Attentional deployment plays an important role in ER as seen in its role in the EPM of ER. Attention is also important for the development of executive functions (EF; Cuevas & Bell, 2014). Adulthood literature indicates the importance of EF for effective CR use (see Schmeichel & Tang, 2014, for a comprehensive review), which leads to the question of why this association has not been examined more thoroughly during childhood and adolescence. The emergence of EF and CR capacity seem to develop on a very similar trajectory. During the time that CR ability begins to emerge, there are dramatic changes occurring in children's EF. For example, children are capable of engaging in multiple EFs (i.e., working memory, inhibitory control, cognitive flexibility) at the age of 5 and 6, with development in ER also being prominent

at this time (Best et al., 2009; Calkins & Marcovitch, 2010). The timeline of development may be different, however. One study reported that EF ability preceded CR for 9- to 12-year-old children (Andrés et al., 2016). Although research linking EF and CR in childhood and adolescence is sparse, adulthood literature provides support for the argument that EF ability may be important for effective CR.

The ability or inability to effectively engage adequate EF resources is linked to ER strategies. In adulthood, working memory has been found to be correlated with CR (Hendricks & Buchanan, 2016; McRae, Jacobs, et al., 2012; Opitz et al., 2014; Schmeichel et al., 2008; Schmeichel & Tang, 2014). In adolescents, those who indicate greater reliance on emotion suppression, rather than CR, report more difficulties with working memory (Lantrip et al., 2016). Cognitive flexibility also shows associations with CR. McRae, Jacobs, and colleagues (2012) reported individuals who were more capable of engaging in the CR task also were more accurate in the shifting task

In childhood, inhibitory control plays an important role for ER ability (Carlson & Wang, 2007; J. T. Gross & Cassidy, 2019). In both younger and older adults, inhibitory control task performance predicts preference for reappraisal over distraction during an affective task (Scheibe et al., 2015). Inhibitory control training is associated with participants using more CR (Cohen & Mor, 2018). Specifically, participants in the inhibitory control training condition were found to be more effective at CR implementation, with greater reductions in sadness after CR, relative to participants in the control condition.

Thus, the process of attentional deployment may be influenced by greater EF in multiple domains influencing an individual's ability to effectively implement CR. Based on my review of the EF and CR literature in adulthood, my hypotheses focused on EF as a moderator. The moderator rationale appears in the section "Cognitive Reappraisal and Adolescent Depressive Symptoms."

Frontal Asymmetry and Cognitive Reappraisal

An individual differences factor that may influence the process of situation selection in Gross's model (J. J. Gross, 1998a) is frontal EEG asymmetry. Frontal EEG asymmetry (FA) is the increased activation of either the right or left frontal hemisphere in relation to the other hemisphere and is associated with the behavioral expression and regulation of emotions (Fox, 1991, 1994; Fox et al., 1996). The approach/withdrawal model of resting state EEG proposes that

greater left FA is associated with more approach behavioral responses and positive affect, whereas greater right FA is associated with more withdrawal behavioral responses and negative affect (Fox, 1991, 1994). Gross' process model of ER indicates situation selection and modification as the first ER process (J. J. Gross, 1998a, 2015a), potentially conceptualizing the FA associated with ER as foundational for CR. Other literature conceptualizes FA as an individual characteristic that may be affecting situation selection and situation modification with consequential effects on subsequent ER processes. This literature sees FA as a potential moderator of the ER/CR process, I examined FA as a predictor of CR and EF as a moderator in this relation.

Previous research examining neural correlates of CR in adults has focused widely on brain activation using fMRI and ERP methodologies while individuals view negative images (IAPS; Lang et al., 2008; Ochsner et al., 2012). Although this information has been critical in the understanding of brain correlates of CR, little is known regarding the underlying neurological mechanisms which may lead individuals to effectively engage in CR over other, less effective, ER strategies. EEG is one methodology that can be used to address this question. EEG FA provides information on individuals' trait and state neurological correlates in emotion focused contexts. In addition, greater right FA during baseline or resting state is linked with depression in adults and their children (e.g., Thibodeau et al., 2006).

Research that has examined the link between FA and CR in adults indicates that left FA is greater among habitual cognitive reappraisers, but only in males. When individuals were instructed to engage in CR, they displayed greater left FA regardless of sex (Choi et al., 2016). In a study of adults ages 18 to 35, those who had a higher capacity for generating CR displayed greater left FA during the CR generation task (Papousek et al., 2017). This was also indicated in a sample of university students. Students were exposed to a stressful speech task and placed into different conditions. The CR and irrelevant writing groups had lower stress levels than the non-writing group, but individuals in the CR writing group had more right FA (lower FA scores) during the task than individuals in the irrelevant writing group. However, after re-exposure to stress, the CR writing condition displayed more left FA asymmetry (higher FA scores) than the irrelevant writing condition (F. Wang et al., 2015). It is possible that the intervention provided students with the capacity to effectively regulate themselves (through left FA) after re-exposure to stress. Among another group of university students, left FA and right FA were related to

greater habitual CR depending on the specific area of frontal lobe under investigation (Y. Wang et al., 2018). Thus, the findings related to FA and CR are varied.

These findings may suggest that left FA for some individuals is associated with the tendency to engage CR more effectively, with another factor (possibly EF, as noted below) potentially moderating the relation between FA and CR. Due to the association between right FA and depressive symptoms, with positive factors moderating this link, and given the mixed findings in the literature, I focused on the positive factor of EF. Thus, I hypothesized right FA as being associated to CR when EF during late childhood was higher.

Parenting and Cognitive Reappraisal

When considering the development of ER strategies in children and adolescents, it is imperative to consider the role of parents. The parenting environment can influence many components of ER development in childhood and adolescents. Thus, parenting is important for individual differences in the process of situation selection and situation modification (Diaz & Eisenberg, 2015). Specifically, parents may be providing their children and adolescence with the tools necessary for them to learn more effective ways to select and modify the situation to engage adaptive ER strategies, such as CR.

There is research to suggest that mothers' use of CR positively affects their adolescent's use of CR, but findings are mixed, with other parenting factors moderating this relation. For example, Silva and colleagues (2018) found that the relationship quality between mothers and their adolescents moderated the association between maternal CR use and adolescent CR use. Adolescent reports of a lower quality relationship with mother predicted greater CR use among those adolescents when mothers also reported using CR. This was a small pilot study, indicating that more research is needed to further understand the most adaptive ways adolescents can learn CR. Among much younger children, parents' supportive reactions to their children's negative emotions along with their CR seem to be much more important for children's developing CR ability (Gunzenhauser et al., 2014).

Research not examining child CR finds that maternal CR is associated with more general forms of ER ability. One study examining ER and emotion lability in childhood found that maternal CR and supportive reactions to children's negative emotions were linked to lower lability scores among 8- to 9-year-olds, with lability being defined as reactivity and difficulty recovering from emotionally eliciting situations (Rogers et al., 2016). Although maternal CR and

support were not linked to children's ER in that study, the relation to other emotional components of children's behaviors indicate that maternal CR use and support are still important for children's ability to develop more adaptive methods of regulating through reactivity and recovery. Tan & Smith (2018) also found that maternal CR was associated with children's emotion regulation, with maternal CR being linked to positive expressivity, which then predicted more adaptive ER among 8- to 9-year-olds.

It is important to note that maternal CR may not be directly linked to child and adolescent ER and CR use, but rather there may be multiple pathways that include influences from the parenting environment (Bridgett et al., 2015). Mothers who engage CR in global settings also show decreased disciplinary parenting practices and through their expression of negative emotions (Lorber, 2012). When parents report low levels of depression, their use of CR is linked to greater praise of their toddler children (Kohlhoff et al., 2016). These findings indicate that the relation between parental CR use and child and adolescent CR is not very straightforward. Parent CR impacts child emotion, adolescent CR, and it can have an effect on the parenting environment or be impacted by the parenting environment. In addition to mother's own emotion regulation abilities, the way in which parents socialize their child's and adolescent's emotions impact emotion regulation and psychopathology outcomes (Brand & Klimes-Dougan, 2010; Klimes-Dougan & Zeman, 2007; Schwartz et al., 2012). The way that parents respond to their adolescent's emotional displays are impacting how those adolescent's learn to regulate those emotions, which then impacts differences in the development of depressive symptoms (Schwartz et al., 2012).

As adolescents become more competent in their emotion regulation abilities, parents' own emotion socialization practices begin to shift, engaging less supportive and more unsupportive reactions (Brand & Klimes-Dougan, 2010). Research examining parental socialization practices indicates the importance of examining both positive and negative emotion socialization (Miller-Slough et al., 2018; Poon et al., 2017). Parents' ability to engage both supportive and unsupportive practices seem to be the most optimal for diminishing children's internalizing symptoms. When examining emotion coaching and dismissing behaviors, the interaction between emotion coaching and emotion dismissing served as a protective factor for emotion dismissing behaviors of parents (Lunkenheimer et al., 2007). Considering both positive and negative parenting practices can better inform the role that parents are playing in child and

adolescent development of emotion regulation skills and strategies. In order to do this, I examined the association between maternal CR and adolescent CR, but also included both supportive and unsupportive reactions as moderators in this relationship.

Maternal Emotion Regulation and Adolescent Depressive Symptoms

When mothers display more negativity and less positivity during interactions with their adolescents, those adolescents have more dysregulated ER. When adolescent's engage more maladaptive ER strategies, this in turn is associated with a greater number of depressive symptoms (Yap et al., 2010). When mothers report minimizing their adolescent's positive affect, this is linked to more depressive symptoms through more maladaptive forms of ER (Yap et al., 2008). Maternal depression is also associated to differences in children's internalizing and adolescent depression; this link may be due to mother's and children's ER difficulties (Monti & Rudolph, 2017; Silk et al., 2006). Based on previous research, I hypothesized that maternal difficulties with ER, specifically CR, will influence adolescent's CR difficulties and subsequent depressive symptoms.

Cognitive Reappraisal and Adolescent Depressive Symptoms

The EPM of ER considers valuation systems (first level and second level), with the second level being able to modify the first through situation selection and modification, attentional deployment, cognitive change, and response modulation. These are thought to be important for an individual's decision to use a specific strategy to regulate emotion. The strategy that was of focus in my study is CR. Considering the use of CR as a trait ER strategy allows examination of specific factors which may influence whether an adolescent decides to engage CR as their ER strategy of choice. In order to understand the response modulation aspect of the model, I have included depressive symptoms as an indicator of whether adolescents are effective when using CR.

My study focused on two models that predict adolescent depressive symptoms. Less adaptive use of CR is linked to greater clinical levels of anxiety and depression in adolescence (Dryman & Heimberg, 2018; Young et al., 2019). CR helps to decrease the relation between depressive symptoms and stress among adolescents who report engaging CR (Shapero et al., 2019). Much more research has examined links between CR and depression in adults. For example, those who are less capable of inhibiting negative emotions report using CR less than individuals who are more capable of inhibiting negative emotion; less use of CR is consequently

linked to more depression (Joormann & Gotlib, 2010). Adults who perform worse on a task of executive control indicate lower levels of CR, with higher executive control linked to lower depressive symptoms (Quinn & Joormann, 2020).

Although no other studies have attempted to examine whether EF serves as a moderator in the relation between adolescent CR and depressive symptoms, my study examined this association. Based on the research in adulthood that reports EF being a positive predictor of CR, as well as the findings that indicate that not all individuals who report using CR are doing so effectively, my study took into account these findings. By doing so, I was able to examine whether CR associations with lower depressive symptoms are reported only among those adolescents with higher EF during late childhood. Similarly, no other studies have attempted to examine whether EF serves as a moderator in the relation between FA and adolescent CR and between adolescent CR and depressive symptoms.

Based on the literature linking FA with depression (e.g., Allen & Reznik, 2015; Thibodeau et al., 2006), my study examined whether CR links with lower depressive symptoms are reported only among those adolescents with left FA during late childhood. FA is linked to both emotional responses and depressive symptoms, with individuals who underwent neurofeedback training to change FA showing subsequent changes in their mood (Allen & Reznik, 2015). FA has also received recent attention as being a predictor, moderator, and mediator of emotion. However, based on links between FA and CR in the adult literature, and between FA and depression, I included FA as a predictor.

My second model involves maternal use of CR and the parenting environment in a model of adolescent CR and depressive symptoms. The relation among maternal use of CR and their parenting practices can affect children beyond their own ER and CR use. For example, deficits of CR among mothers with anxiety is linked to greater anxiety disorders in children aged 10 to 17-years-old (Wald et al., 2018). Children of parents who are diagnosed with Major Depressive Disorder (MDD) show lower levels of depression when those children (ages 7-11) report engaging CR (Kudinova et al., 2018). The family environment, defined here as parent CR and parenting behaviors being displayed in the home, can serve as foundations for children's learning of more adaptive ER strategies themselves, such as reappraisal. Adolescent use of CR can consequently serve to diminish depressive symptoms among adolescents (Palmer et al., 2019; Yap et al., 2007). Among college students, those who report greater parental support engage

more active coping strategies (such as reappraisal), which in turn affects well-being and lowers the levels of depression and anxiety symptoms (Holahan et al., 1995). Adolescents who learn to use CR through parent's own use of these same strategies, and through parental practices, especially those focused on emotion, may be able to use these CR strategies in order to diminish their own depressive symptoms. My study examined adolescent CR as a mediator between maternal CR and adolescent depressive symptoms, while examining the role of parenting practices focused on emotion as a moderator in the relation between parent CR and adolescent CR.

Current Study Hypotheses

Based on the previous literature review, I tested the following hypotheses:

1) Adolescent CR mediates the relation of late childhood FA to adolescent depressive symptoms when late childhood EF is high. Specifically, children with right FA who also have higher EF will self-report higher levels CR during adolescence. Similarly, adolescents who self-report lower levels of CR during adolescence who also had higher EF during late childhood will self-report fewer depressive symptoms during adolescence. The hypothesized moderated mediational model, with the moderating effect of EF on the link between FA and CR and also between CR and depressive symptoms (Model 1), is shown in Figure 1.

2) Adolescent CR mediates the relation of maternal CR (from late childhood) to adolescent depressive symptoms when maternal unsupportive parenting is high. Specifically, maternal CR will predict higher adolescent CR only for adolescents whose mothers report higher levels of unsupportive parenting. In turn, higher adolescent CR will predict fewer adolescent depressive symptoms. The hypothesized moderated mediational model (Model 2) is shown in Figure 2.

2a) When substituting maternal supportive parenting in the previous hypothesis, the model will be different. Specifically, for those mothers who report higher levels of supportive parenting, there will be no effect of maternal CR on adolescent CR, but higher adolescent CR will predict fewer adolescent depressive symptoms.

Method

Participants

Participants were two cohorts of a longitudinal study examining the integration of emotion and cognition across infancy and childhood. Participants were recruited during infancy using flyers, word of mouth, and mailing lists. The two cohorts represent half of the original sample, with the third cohort seen at a university research lab in another state.

In late childhood (age 9-10 years), cohort 1 visited the research lab during 2013 (n = 81) and cohort 2 visited the lab in 2016 (n = 80). In late childhood, 31 questionnaires were completed and mailed for cohort 1 (n = 11) and cohort 2 (n = 20) for families who were unable to visit the research lab. Thus, the late childhood sample consisted of 192 children (range 9 – 12 years; *M* = 9.92, *SD* = .74) and their mothers. The sample was 85% White, 4% Hispanic, 9% Multi-racial/other, 1.5% Asian, and .5% Black. Only participants who contributed data during the late childhood visit were recruited for the adolescent visit. Specifically, past participants in this longitudinal study who did not contribute data for the late childhood visit were not contacted regarding the adolescent visit.

The adolescent visit consisted of 78 in-lab participants and 45 questionnaire-only participants, for a total of 123 adolescents (51% girls) and their mothers. Due to COVID-19, in-lab visits for tasks and questionnaires (mid-August 2019 through mid-March 2020) were halted and data collection resumed online (late August through early October 2020) with questionnaires. There were 79 dyads who completed data pre-COVID-19 with 78 in-lab and one questionnaire-only family. During COVID-19, 44 questionnaire-only participants provided data. Adolescent age range (range 12 – 18 years; *M* = 14.64, *SD* =1.94) at the time of participation was wide due to the mean 3-year age difference between cohorts 1 and 2. Thus, the adolescent visit consisted of cohort 1 (n = 57; range 15 – 18 years; *M* = 16.6, SD = .72) and cohort 2 (n = 66; range 12 – 14.5 years; *M* = 12.95, *SD* = .63). For the combined adolescent participants, 88% identified as White/Caucasian, 6% Multi-racial/other, 5% Hispanic, and 1% Asian. Mothers were highly educated (85% had a college degree or advanced degree).

Analyses were conducted using general linear model (GLM) to examine whether differences in gender, and maternal education differed between those in late childhood who did and did not contribute data for the adolescent visit. No significant differences emerged (all *p*s > .11).

Procedures

Participants visited the research lab during late childhood and during adolescence. For both visits, participants entered the research lab with their parent, parents provided their written consent, and children/adolescents provided their written assent prior to starting the study. For both visits, mothers observed from an adjacent room while completing questionnaires.

During the late childhood visit, children were compensated with a $20 gift card and mothers were compensated with a $75 gift card for in-lab visits. Families who only completed questionnaires received two $20 gift cards, one for the child and one for the parent. During the adolescent visit, in-lab participants were compensated $50 cash for the adolescent and $50 cash for the mother. For the questionnaire only families, both the adolescent and the mother received a $20 gift card.

Measures Collected During Late Childhood

Frontal EEG asymmetry. Baseline EEG was collected during 60 seconds eyes-open**.** Children were capped using a stretch cap (Electro-Cap, Inc.; Eaton, OH; E1-series cap) with electrodes in a modified 10/20 system pattern. 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 10Ω. EEG electrical activity was amplified from each lead using separate James Long Company Bioamps and bandpassed from .1 to 100 Hz. Activity for each lead was displayed on a monitor of an acquisition computer. EEG signal was digitized on-line 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 was stored for later analyses.

EEG data was examined and analyzed using EEG Analysis software developed by the James Long Company (Caroga Lake, NY). The data were re-referenced via software to an average reference configuration. The average reference EEG data were artifact scored for eye movements and gross motor artifact. These artifacts scored epochs were eliminated from all subsequent analyses. The EEG data was analyzed using a discrete Fourier Transform (*DF*T)

using a Hanning window of 1-second width and 50% overlap. Power was computed for the 8-10 Hz frequency band. For children this age, alpha likely corresponds to 8-10 Hz; this frequency band has been used by others publishing FA research with children in late childhood (Forbes et al., 2008; Vuga et al., 2008). Data were log (ln) transformed to normalize EEG values. FA values were created by subtracting ln EEG power in the left hemisphere from ln EEG power in the right hemisphere. Positive values indicate greater relative left frontal activation compared to the right (i.e., left FA) and negative values indicate greater relative right frontal activation compared to the left (i.e., right FA). Mean scores were created for left (F3 and F7) and right (F4 and F8) frontal electrode sites; then left EEG power value was subtracted from right EEG power value to create the variable used for FA analyses.

Executive Function

EF was assessed with a battery of lab tasks and via parent questionnaire and included assessments of working memory, cognitive flexibility, and inhibitory control. Analyses were conducted to create a general EF variable from the following data.

Backward digit span task. For this working memory task, the experimenter read a series of random single-digit numbers to participants. Children were asked to repeat out loud the numbers in reverse order, with practice trial of two sets of two digits. After children passed the practice trial, the test trials were collected. Test trials included two different three-digit sequences, increasing one single-digit for both trials in the sequence until participants failed to correctly repeat the digits in both trials of the sequence. The variable of interest was the last correct trial as an indicator of backward digit span score.

Wisconsin Card Sorting Test (WCST; Heaton & PAR Staff, 2003). The WCST is a task that assesses cognitive flexibility. For this computerized task, children were instructed to match a card of 64 total cards to one of four key cards. Images on the cards varied from shape, color, and quantity, children were asked to sort the cards according to one of three rules (e.g., by shape, by color, or by number) that they had to determine based on feedback from the computer. The sorting rules changed several times throughout the task, with computer feedback informing children of their errors. The age-standardized percentile score associated with conceptual level was the measure of interest.

Number Stroop (Ruffman et al., 2001). The number Stroop is an age-appropriate Stroop task that assess inhibitory control. Three conditions were administered. During the letter or

control condition, trials consisted of a string of letters on the computer screen. Children were instructed to count the number of letters as quickly and accurately as possible and press the corresponding keyboard number. For the incongruent condition, children were presented with a series of numbers and asked to select the number that corresponded with the total number of items on the screen (e.g., 5555 would be 4). In the mixed condition, children were presented with either strings of letters or strings of numbers and asked to count the items in the string. The measure of interest was reaction time in the mixed condition, thus higher levels are indicative of worse IC.

Behavior Rating Inventory of Executive Function (BRIEF; Gioia et al., 2000). The parent report version of the BRIEF is an 86-item questionnaire which measures EF in everyday situations and is standardized for ages 5 to 18. Parents were asked to rate their child's behaviors on a Likert scale from 1 (*occur never*), 2 (*sometimes*), or 3 (*often*). The BRIEF is comprised of eight scales, with lower scores indicating more optimal EF. The standardized T-score of the working memory scale (e.g., "Hold information in mind for the purpose of completing a task; stay with, or stick to, an activity") was used as an indicator of working memory (Cronbach's alpha = .92 in this sample). The standardized T-score of the shift scale (e.g., "Solve problems flexibly") was used as an indicator of cognitive flexibility (Cronbach's alpha = .81). The standardized T-score of the inhibit scale (e.g., "Control impulses, appropriately stop own behavior at the proper time") was used as an indicator of inhibitory control (Cronbach's alpha = .91). Because lower scores indicate more optimal EF, EF scale scores were multiplied by -1 so that all EF variables were in the same direction.

Measures Collected During Adolescence

Adolescent cognitive reappraisal. Adolescents were asked to complete the Emotion Regulation Questionnaire (ERQ; J. J. Gross & John, 2003). The ERQ is a 10-item self-report questionnaire that asks respondents to rate their use of different emotion regulation strategies from 1 (*strongly disagree*) to 7 (*strongly agree*) with two subscales, cognitive reappraisal (CR) and expressive suppression. The CR subscale was used for my study. Cronbach's alpha for the CR subscale was .75.

Adolescent depressive symptoms. Adolescents self-reported depressive symptoms on the Revised Children's Anxiety and Depression Scale (RCADS). The questionnaire consists of 47 items, asking participants to rate how often certain things happen to them from 1 (*never*) to 4

(*always*). The RCADS consists of the following subscales: separation anxiety disorder, social phobia, generalized anxiety disorder, panic disorder, obsessive compulsive disorder, and low mood (major depressive disorder). I used the low mood subscale raw score. The Cronbach's alpha was .96.

***Maternal cognitive reappraisal*.** Mothers were asked to complete the Emotion Regulation Questionnaire (ERQ; J. J. Gross & John, 2003) for themselves. Cronbach's alpha for the CR subscale was .88.

***Maternal supportive and unsupportive reactions of negative emotions*.** The Coping with Children's Negative Emotions (CCNES modified for adolescents; see Appendix A; Fabes et al., 2002; Shortt et al., 2016) questionnaire was used to assess supportive and unsupportive parenting practices. The CCNES is a 16-item questionnaire which asks mothers to respond to questions addressing their reactions to their adolescent's negative emotions, specifically sad and angry affective states, on a Likert scale from 1 (*very unlikely*) to 7 (*very likely*). The scales included supportive (problem-focused reactions, emotion-focused reactions, expressive encouragement) and unsupportive (punitive reactions, minimizations reactions, and distress reactions). Both scales were used in the analyses. Cronbach's alpha for the unsupportive scale was .91. Cronbach's alpha for the supportive scale was .94.

Analysis Plan

Analyses were conducted using MPlus version 8.3 (Muthén & Muthén, 2018) with maximum likelihood estimation method. Missing data was handled using full information maximum likelihood estimation (FIML). Fit indices of root mean square error of approximation (RMSEA; McDonald & Ho, 2002), confirmatory fit index (CFI), standardized root mean square residual (SRMR), chi square (χ^2) were used to determine the fit of the model to the data for each hypothesis. The following cut offs were used; RMSEA < .08, SRMR < .08, CFI ≥ .95 (Hu & Bentler, 1999). The following analyses follow codes developed by Stride and colleagues (2015) to examine moderation, mediation, and moderated mediation analyses. Moderated mediation analysis was examined using 10000 bootstrap samples and 95% confidence intervals. All predictor and moderator variables were centered in order to minimize multicollinearity of the interaction variables.

Power Analysis

Power analyses were conducted separately for each of the proposed models. For

hypothesis 1, a-priori sample size calculator for structural equation models was used (Soper, 2021b). For a model with 6 observed variables and 1 latent variable, the minimum sample size needed to detect an effect size of .1 would be n = 87 with $1 - \beta = .80$, $\alpha = .05$. Hypothesis 2 used 10000 bootstrapping method. I conducted a-priori sample size calculator for multiple regression (Soper, 2021a). For a moderated mediation model with 4 predictors, the minimum sample size needed to detect an effect size of $f^2 = .15$ would be n = 84 with $1 - \beta = .80$, $\alpha = .05$.

Results

Outliers were handled through Winsorization, such that values 3 SD above or below the mean were replaced by the next closest value. This technique was applied to one outlier for FA. Descriptive statistics for all variables of interest at each visit are shown in Table 1. The data for the late childhood visit represent children who also participated in the adolescent visit, not the data for the entire late childhood sample. Correlations among the variables of interest are reported separately for Model 1 (see Table 2) and Model 2 (see Table 3).

To determine whether differences in questionnaire responses were evident due to COVID-19, *t*-tests were conducted with a pre- and during-COVID-19 grouping variable for the questionnaire responses. Results revealed significant differences only for maternal self-report CR ($p < .01$). Covid-19 was included as a covariate for analyses including maternal CR. Pre- and during-Covid-19 means on all questionnaires are presented in Table 4.

Gender and cohort differences in adolescent CR and adolescent depressive symptoms were examined (see Table 5). *T*-tests revealed that adolescent depressive symptoms were significantly different when cohort was considered ($p < .05$), but not sex ($p = .24$). Therefore, age was included as a covariate for all analyses.

Hypothesis 1 (Model 1)

I hypothesized that adolescent CR mediates the relation of late childhood FA to adolescent depressive symptoms when later childhood EF is high. Specifically, children with right FA who also have higher EF will self-report higher levels CR during adolescence. Similarly, adolescents who self-report lower levels of CR during adolescence who also had higher EF during late childhood will self-report fewer depressive symptoms during adolescence. The hypothesized moderated mediational model, with the moderating effect of EF on the link between FA and CR and also between CR and depressive symptoms is shown in Figure 1.

EF measurement model. To begin, a measurement model was analyzed for. The EF factor included six indicator variables, three questionnaire variables and three task variables. A one factor measurement model indicated a bad fit, $\chi^2 = 35.80$, $df = 9$, $p < .001$, RMSEA = .16, CFI = .82, SRMR = .08. Modification indices indicated adding a correlation between BRIEF shift and BRIEF inhibit. Once this was included the model did not fit the data ($\chi^2 = 23.24$, $df = 8$, $p = .003$, RMSEA = .13, CFI = .90, SRMR = .08). The BRIEF working memory variable had a negative residual variance, so I fixed BRIEF working memory to 0, but the data did not fit the

model (χ^2 = 23.95, *df* = 9, *p* = .004, RMSEA = .12, CFI = .90, SRMR = .08). Modification indices indicated including a correlation between the BRIEF shift (i.e., cognitive flexibility) and the backward digit span working memory task. Once this correlation was included, model fit improved (χ^2 = 14.06, *df* = 8, *p* = .08, RMSEA = .08, CFI = .96, SRMR = .07). I decided to move forward with the measurement model. Kenny and colleagues suggested when sample size is small and degrees of freedom are small, RMSEA can result in a poor fitting model (Kenny et al., 2015).

Within the model, WCST cognitive flexibility was not a significant indicator (*p* = .31); therefore, this path was trimmed from the model. The resulting model did not fit the data (χ^2 = 11.09, *df* = 4, *p* = .03, RMSEA = .12, CFI = .95, SRMR = .07). Modification indices indicated adding a correlation between number Stroop inhibitory control task and backward digit working memory task. Once this correlation was included the resulting model fit was good (χ^2 = 6.96, *df* = 3, *p* = .07, RMSEA = .10, CFI = .97, SRMR = .06).

As shown in Table 6, the factor loadings for EF were of moderate strength, b = 1.00 (β = .57, SE = .06, *p* < .001) for inhibit on the BRIEF, b = 2.11 (β = 1.00, SE = .00, *p* < .001) for working memory on the BRIEF, and, b = .88 (β = .54, SE = .07, *p* < .001) for shift (i.e., cognitive flexibility) on the BRIEF. For tasks, backward digit working memory task was significant, b = .004 (β = .25, SE = .09, *p* = .005). Inhibitory control number Stroop was also significant, b = 33.46 (β = .35, SE = .09, *p* < .001).

Thus, a factor score was created for EF and the model for Hypothesis 1 was analyzed using the factor scores. Model fit statistics indicated model fit was appropriate (χ^2 = 4.22, *df* = 7, *p* = .75, RMSEA = .00, CFI = 1.00, SRMR = .03). See Figure 3 for a summary of model fitting results.

Hypothesis 1 main effects. After controlling for age, b = .63 (β = .21, *SE* = .08, *p* = .01), late childhood FA was not a significant predictor of adolescent CR, b = .38 (β = .05, *SE* = .10, *p* = .60) or adolescent depressive symptoms, b = -5.08 (β = .05, *SE* = .10, *p* = .60). EF was not a significant predictor of adolescent CR, b = .02 (β = .12, *SE* = .10, *p* = .18) or adolescent depressive symptoms, b = .06 (β = .07, *SE* = .08, *p* = .43). Higher adolescent CR was associated with lower adolescent depressive symptoms, b = -1.65 (β = -.29, *SE* = .08, *p* < .001).

Hypothesis 1 interaction effects. The interaction between late childhood EF and FA did not predict adolescent CR, b = -.03 (β = -.02, *SE* = .10, *p* = .84). The interaction between EF and

FA was not a significant predictor of adolescent depressive symptoms, b = .08 (β = .38, *SE* = .38, *p* = .32). No other paths emerged as significant.

Hypothesis 2 (Model 2)

I hypothesized that maternal unsupportive parenting during adolescence would moderate the association between maternal self-report CR and adolescent self-report CR; in turn, higher adolescent CR will be associated with fewer adolescent depressive symptoms (see Figure 2). Specifically, maternal CR will predict higher adolescent CR only for adolescents whose mothers who report higher levels of unsupportive parenting (Silva et al., 2018).

A moderated mediation model was fit to test whether maternal CR was linked to adolescent depressive symptoms through adolescent CR, with maternal unsupportive reactions moderating the relation between maternal CR and adolescent CR.

After controlling for age and Covid-19, model fit was poor (χ2 = 23.16, *df* = 12, *p* = .03; CFI = .77; RMSEA = .09; SRMR = .08). Modification indices indicated adding a correlation between maternal CR and the interaction between maternal CR and unsupportive reactions. Once this correlation was included, model fit was good (χ2 = 8.55, *df* = 11, *p* = .66; CFI = 1.00; RMSEA = .00; SRMR = .04). Once modification indices were included, the hypothesized model with maternal unsupportive reactions was supported. See Figure 4 for a summary of model fitting results.

Hypothesis 2 main effects. Main effects for maternal CR, unsupportive reactions, and adolescent CR were estimated (i.e. maternal CR → adolescent CR, unsupportive reactions → adolescent CR, adolescent CR → adolescent depressive symptoms). As shown in Table 7 and Figure 4, results indicated higher maternal CR was associated with lower adolescent CR. Higher levels of maternal unsupportive reactions were associated with lower levels of adolescent CR. Higher levels of adolescent CR were associated with lower levels of adolescent depressive symptoms.

Hypothesis 2 interaction effects. The results indicated that maternal unsupportive reactions moderated the relation between maternal CR and adolescent CR, b = .54 (β = .29, *SE* = .09, *p* < .001; see Table 7 and Figure 4).

To further examine the moderation effect of maternal unsupportive reactions on the relation between maternal CR and adolescent CR, simple slopes analyses were conducted to examine the effect of maternal CR at varying levels of unsupportive reactions: low unsupportive

reactions (1 SD below the mean) and high unsupportive reactions (1 SD above the mean).

The overall moderated mediation model was significant, supported with the index of moderated mediation, b = -.85, *SE* = .45, 95% CI [-1.92, -0.16]. The conditional indirect effect was strongest when mothers displayed higher levels of unsupportive reactions (b = -1.21, *SE* = .66, 95% CI [-2.73, -.23]) and weakest when mothers displayed lower levels of unsupportive reactions (b = 0.50, *SE* = .32, 95% CI [-.03, 1.24]). Higher maternal CR was associated with higher levels of adolescent CR when maternal unsupportive reactions were high. When mothers indicated lower levels of CR and higher levels of unsupportive reactions, adolescents indicated lower levels of CR and lower levels of depressive symptoms (see Figure 5).

Hypothesis 2a

Maternal supportive parenting during adolescence will not moderate the association between maternal self-report CR and adolescent self-report CR. For those mothers who report higher levels of supportive parenting, there will be no effect of maternal CR on adolescent CR (Gunzenhauser et al., 2014), but higher adolescent CR will predict fewer adolescent depressive symptoms (see Figure 2).

A moderated mediation model was fit to test whether maternal CR predicted adolescent depressive symptoms through adolescent CR, with maternal supportive reactions moderating the relation between maternal CR and adolescent CR. After controlling for age and Covid-19, model fit was poor ($\chi 2$ = 20.84, *df*=12, *p* = .05; CFI = .73; RMSEA = .08; SRMR = .73). Modification indices indicated adding a correlation between maternal CR and the interaction between maternal CR and supportive reactions. Once this correlation was included, the data did not fit the model ($\chi 2$ = 19.72, *df*=11, *p* = .05; CFI = .74; RMSEA = .08; SRMR = .08). Additional modification indices indicated including a correlation between maternal CR and maternal supportive reactions, once this correlation was included, model fit was good ($\chi 2$ = 6.28, *df*=10, *p* = .79; CFI = 1.00; RMSEA < .001; SRMR = .04). See Figure 6 for a summary of model fitting results.

Hypothesis 2a main effects and interaction effects. In the main effects model (see Figure 6), main effects for maternal CR, supportive reactions, and adolescent CR were estimated (i.e. maternal CR → adolescent CR, supportive reactions → adolescent CR, adolescent CR → adolescent depressive symptoms). Within the model, three paths emerged as significant. The effect of age on adolescent depressive symptoms was significant, b = .59 (β = .20, *SE* = .08, *p* = .009), indicating that older adolescents reported higher depressive symptoms. The effect of

adolescent CR on adolescent depressive symptoms was significant, b = -1.58 (β = -.28, *SE* = .09, $p < .001$), indicating that higher CR was associated with lower depressive symptoms. The effect of COVID-19 on maternal CR was significant, b = -.44 (β = -.24, *SE* = .08, p =.003), indicating mothers used lower CR after COVID-19. All other paths within the model were nonsignificant, including all interaction effects. Specifically, supportive reactions did not moderate the association between maternal CR and adolescent CR. After controlling for age, supportive reactions were not a significant moderator in the relation between maternal CR and adolescent CR for predicting adolescent depressive symptoms, supporting the null hypothesis.

Post Hoc Analyses

Adulthood research indicates that specific EF components separately predict CR (McRae, Jacobs, et al., 2012; Schmeichel & Tang, 2014; Tabibnia et al., 2011). Results from the hypothesized model examining EF as a moderator did not indicate a link between EF and CR. Due to the null results, late childhood EF was examined through behavioral tasks for predicting CR and depressive symptoms during adolescence. Because the late childhood tasks were collected prior to the adolescent visit, late childhood inhibitory control (number Stroop), working memory (backward digit span test), and cognitive flexibility (WCST) were examined as predictors of CR and depressive symptoms. Additionally, based on Reznik & Allen's (2018) review, FA as a moderator of emotion may be the best approach to examining the relation between FA and emotion-focused outcomes.

Three models were examined by separating EF into individual components of working memory, cognitive flexibility, and inhibitory control (see Figure 7). I chose to focus on the EF behavioral tasks because previous research examining EF and CR examines this association using task behavioral data (Andrés et al., 2016; McRae, Jacobs, et al., 2012; Tabibnia et al., 2011).

Cognitive Flexibility

The model with cognitive flexibility (WCST) demonstrated a poor fit ($\chi 2$ = 14.80, *df*=6, p = .02; CFI = .23; RMSEA = .11; SRMR = .08). I did not interpret the model.

Working Memory

The model with working memory (backward digit span test) demonstrated a good fit ($\chi 2$ = 6.38, *df*=6, p = .38; CFI = .98; RMSEA = .02; SRMR = .05).

Post hoc working memory main effects. Main effects for late childhood working

memory, late childhood FA, and adolescent CR were estimated (i.e. late childhood working memory → adolescent CR, late childhood FA → adolescent CR, late childhood inhibitory control → adolescent depressive symptoms, adolescent CR → adolescent depressive symptoms; see Figure 8).

Within the model, three paths emerged as significant. The effect of age on adolescent depressive symptoms was significant, b = .60 (β = .21, *SE* = .08, *p* = .01), older adolescents reported more depressive symptoms. The effect of adolescent CR on adolescent depressive symptoms was significant, b = -1.69 (β = -.30, *SE* = .09, *p* < .001), lower adolescent CR was associated with higher depressive symptoms.

Post hoc working memory interaction effects. The interaction between working memory and FA was significant, b = -21.09 (β = -.24, *SE* = .11, *p* = .04). To further examine the moderation effect of late childhood FA on the relation between late childhood working memory and adolescent CR, simple slopes analyses were conducted to examine the effect of late childhood working memory on adolescent CR for both left and right FA: right FA (1 SD below the mean) and left FA (1 SD above the mean).

The overall moderated mediation model was not significant, b = 35.71, *SE* = 21.59, 95% CI [-.19, 88.86]. The conditional indirect effect was strongest when children displayed right FA during late childhood (B = -36.52, *SE* = 21.49, 95% CI [1.64, 30.15]) and weakest when children displayed left FA during late childhood (B = 34.91, *SE* = 21.86, 95% CI [-25.18, .26]). When children had worse working memory during late childhood and right FA, they reported lower CR, when they had better working memory and right FA, adolescent's reported higher CR (see Figure 9). All other paths within the model were not significant.

Inhibitory control

I first analyzed the final model with the number Stroop task (inhibitory control), but the model did not converge due to variance of the number Stroop task being too high. I log transformed the number Stroop task to minimize variance. The final model with inhibitory control (number Stroop task) was analyzed and demonstrated good fit (i.e., $\chi 2$ = 4.73, *df*= 6, *p* = .58; CFI = 1.00; RMSEA = .00; SRMR = .04).

Post hoc inhibitory control main effects. The post hoc model was examined with late childhood inhibitory control predicting adolescent CR and adolescent depressive symptoms, with late childhood FA as a moderator. Main effects for late childhood inhibitory control, late

childhood FA, and adolescent CR were estimated (i.e. late childhood inhibitory control → adolescent CR, late childhood FA → adolescent CR, late childhood inhibitory control → adolescent depressive symptoms, adolescent CR → adolescent depressive symptoms; see Figure 10).

As shown in Table 8 and summarized in Figure 10, results indicated that worse late childhood inhibitory control (slower reaction time) was associated with lower adolescent CR. Higher levels of adolescent CR were associated with lower levels of adolescent depressive symptoms. Older adolescents reported higher depressive symptoms.

Post hoc inhibitory control interaction effects. The results indicated that FA moderated the relation between inhibitory control and adolescent CR, b = 6.07 (β = .19, *SE* = .09, *p* = .038; see Table 8 and Figure 11). To further examine the moderation effect of late childhood FA on the relation between late childhood inhibitory control and adolescent CR, simple slopes analyses were conducted to examine the effect of late childhood inhibitory control on adolescent CR for both left and right FA: right FA (1 SD below the mean) and left FA (1 SD above the mean).

The overall moderated mediation model was significant, supported with the index of moderated mediation, b = -10.47, *SE* = 6.67, 95% CI [-27.49, -.80]. The conditional indirect effect was strongest when children displayed right FA during late childhood (B = 11.98, *SE* = 7.13, 95% CI [1.64, 30.15]) and weakest when children displayed left FA during late childhood (B = -8.96, *SE* = 6.30, 95% CI [-25.18, .26]). When children had worse inhibitory control (i.e., slower reaction time) during late childhood and right FA, they reported lower CR, when they had better inhibitory control (i.e. faster reaction time) and right FA, adolescent's reported higher CR (see Figure 11). A mediation effect of late childhood inhibitory control on adolescent depressive symptoms via adolescent CR was significant when children displayed right FA, such that worse inhibitory control is linked to lower adolescent CR, and lower adolescent CR is associated with high adolescent depressive symptoms.

Discussion

Depressive symptoms begin to rise after puberty. Suicide among adolescents is the second leading cause of death, with those adolescents being reported as having depressive disorder at the time of death (Thapar et al., 2012). One mechanism that may help to decrease depressive symptoms among adolescents is through ER strategies, specifically CR. The results of my study indicate that CR is adaptive for diminishing adolescent's depressive symptoms, but the mechanism through which CR develops can take many different forms, including both individual (EF, FA) and environmental (parenting environment) factors.

I discuss the results of each hypothesized model, as well as my post hoc analyses and results, in turn. First, a word about sex and age effects. In my study, sex differences on adolescent depressive symptoms were not significant. This was an interesting finding considering previous research which indicates that females are at an increased risk of depression. However, once early adolescent challenges are considered, the effect of sex is no longer significant (Petersen et al., 1991). Since our age range was wide, this may be why the effect of age on depressive symptoms was significant and the effect of sex was not.

Hypothesis 1

The hypothesized model with late childhood EF was not supported; specifically, late childhood EF did not moderate the association between late childhood FA and adolescent CR. EF was also not a significant moderator in the relation between adolescent CR and adolescent depressive symptoms. Adolescent CR did predict adolescent depressive symptoms. I used both parent-report questionnaire and child behavioral tasks to create one latent variable since I only had two indicators for each EF variable. Due to issues relating to power, this was the only way that I was able to handle the EF latent variable. Research examining EF and CR, however, has focused specifically on the different manifest variables of EF, specifically behavioral EF tasks, rather than creating a latent EF variable or composite score. Thus, focusing on a latent variable of EF may not have been the most adequate way for examining CR in hypothesis 1 (Andrés et al., 2016; McRae, Jacobs, et al., 2012; Tabibnia et al., 2011). Focusing on the manifest variables of EF may be the most informative for understanding the relations between inhibitory control, working memory, cognitive flexibility, and CR ability.

FA was also not directly linked to CR or depressive symptoms. This may be why FA is not always associated with CR, with different FA scalp locations being differentially linked to

CR (Choi et al., 2016; Papousek et al., 2017; Y. Wang et al., 2018). It may be that FA is a moderator or mediator of CR ability, rather than a predictor (Reznik & Allen, 2018). Further, the association between FA and depressive symptoms was not significant. This was not expected, though it may be because the link between depressive symptoms and FA is not as robust as the association between clinical depression and FA (Allen et al., 2004). It may also be that resting FA may not be directly linked to depressive symptoms, but rather the association for children and adolescents may be heightened during emotion elicitation; thus task-related FA may be a better predictor of depressive symptoms for adolescent participants (Feng et al., 2012; Forbes et al., 2008).

Another possible issue may be that the model was not appropriate for examining the relations among the constructs. It may be that FA, EF, CR, and depressive symptoms are related, but my original model is not an adequate depiction of how the constructs are influencing one another. My post hoc analysis attempted to take this into account by examining the relations among these constructs with some adjustments. No other research has examined in one model all the associations among FA, EF, CR, and depressive symptoms. Much adulthood literature, however, reports correlations when examining FA, CR, and EF in various combinations (Hendricks & Buchanan, 2016; McRae, Jacobs, et al., 2012; Opitz et al., 2014; Schmeichel & Tang, 2014; Tabibnia et al., 2011).

Hypothesis 2

I hypothesized that maternal unsupportive reactions to adolescent's negative emotions would moderate the association between maternal CR and adolescent CR; and that adolescent CR would then be linked to lower depressive symptoms. When COVID-19 group was included in the model, model fit was bad. After including a correlation between maternal CR and unsupportive reactions, model fit improved. Mothers reported lower levels of CR during COVID-19. This decrease was not a significant indicator of differences in adolescent CR. It may be that at this point in adolescent development, maternal CR is no longer an important contributing factor for CR development, with adolescent CR already established for diminishing depressive symptoms.

Once model fit was improved, the results indicated the index of moderated mediation was significant. Specifically, when mothers reported higher levels of unsupportive reactions and mothers had high levels of CR, those adolescents reported higher CR. When mothers reported

lower levels of maternal CR and higher unsupportive reactions, those adolescents indicated lower CR use. Silva and colleagues (2018) found the association among lower parent-adolescent relationship quality, though this was a small pilot study. Based on the correlations of the subscales within the CCNES, minimizing and adolescent CR was the only significant correlation. It may be that the unsupportive effect is being driven by mothers minimizing their adolescent's negative emotions. Since CR includes parental attempts to minimize negative emotions; it may be that parents are teaching their adolescents CR through minimizing, this requires further examination. Future research should continue to examine this relation by separating the CCNES into its subscales.

I also hypothesized that higher levels of adolescent CR would be linked to lower adolescent depressive symptoms. The results indicate that CR ability during adolescence can serve as a protective factor for the development of depressive symptoms. Due to the increase of depressive symptoms during the adolescent period (Keyes et al., 2019), my study can help to inform ways that parents can help to decrease their adolescent's depressive symptoms. Higher levels of unsupportive reactions were linked to higher adolescent CR when mothers reported using more CR themselves, but if mothers self-reported low levels of CR and high unsupportive reactions, this combination of parenting was detrimental to adolescent CR use and subsequent depressive symptoms. Although the current study does not include maternal CR during the childhood period, these results signify the importance of maternal CR for adolescent's development of CR.

The effect of unsupportive reactions needs further consideration. Previous research shows that children require more supportive environments (Gunzenhauser et al., 2014), whereas during adolescence lower relationship quality between mothers and adolescents is linked to greater adolescent CR use when mothers also use CR (Silva et al., 2018). The effect of negative parent-adolescent relationship quality was based on a small pilot study, indicating this requires further study. The direct link between maternal CR and adolescent CR was not significant, indicating that maternal CR is only linked to differences in adolescent CR under specific conditions. Future research should consider the developmental period; adolescence may require different levels of supportive and unsupportive reactions. Maternal CR was correlated with supportive reactions; if mothers are using more CR then they are also engaging in more supportive responses. It may be that when mothers are engaging both supportive and unsupportive reactions this may be the most

adaptive parenting practice to assist in their adolescent's development of CR and subsequently diminishing depressive symptoms (McNeil & Zeman, 2021; Miller-Slough et al., 2018).

Children's development of CR may be more reliant upon parenting practices, but as children mature, and with the changes that occur in the adolescent-parent relationship (Branje, 2018; Hadiwijaya et al., 2017) such as increasing conflict, adolescents may require the autonomy to make their own decisions regarding ER strategies. The nonsignificant relation between maternal CR and adolescent CR has previously been reported by Bariola and colleagues (2012); additional analyses were not reported regarding potential moderators. Another study examining child CR ability found that parental care and child temperamental approach were associated with higher levels of CR (Jaffe et al., 2010). Based on the findings in my study, additional variables need to be considered when examining the relations between maternal CR ability and those of their children and adolescents.

My results indicate that the intergenerational transmission of ER abilities, specifically CR, occur through parenting behaviors like unsupportive reactions to negative emotions (Bridgett et al., 2015). Although I did not examine the minimizing subscale alone, it may be that during the adolescent period mothers' minimizing is most adaptive when they also engage more supportive reactions (Poon et al., 2017). The ER strategies of mothers are not directly impacting their adolescent's ER abilities, but rather are doing so under certain conditions (Bariola et al., 2011). When mothers indicate being unsupportive of their adolescent's negative emotions, but also indicate using CR habitually, these adolescents report higher CR and lower depressive symptoms. Mothers' own use of CR may not be easily visible by the adolescent, but because these mothers themselves are engaging CR, they may be most capable of teaching their adolescents CR through differences in parenting practices.

Hypothesis 2a

It is difficult to hypothesize the null, due to the many replications that are necessary to confirm the null. By examining supportive reactions, the role of parenting in the development of adolescent CR ability becomes more clear. Although the findings seem to indicate that supportive parenting is not playing a role in the development of adolescent CR and subsequent depressive symptoms, higher maternal CR is correlated with higher supportive reactions. The supportive reactions that mothers with high CR are engaging in may not be directly associated with helping adolescents learn effective CR. It may be that for adolescent CR, emotion focused,

problem focused, and expressive encouragement reactions are not effective for teaching adolescents CR specifically, but may be more important for general emotion regulation (Diaz & Eisenberg, 2015).

Due to the changing nature of the adolescent-parent relationship, with increasing conflict becoming more prevalent, the developmental period needs to be considered when examining parenting practices. Additionally, how adolescents perceive parenting practices may impact how adolescents respond to their parents, as well as the impact those practices have on CR and depressive symptoms (Hale et al., 2006; Padilla-Walker, 2008). Based on the individual items in the CCNES (see Appendix A), supportive reactions may be important for teaching adolescents other emotion regulation strategies, such as those that are problem focused or emotion focused, strategies that although are important, in my analyses are not significant because of the focus on one specific emotion regulation strategy, CR.

Post Hoc Analysis

My post hoc analyses expanded upon hypothesis 1, but focused on examining late childhood FA as a moderator in the relation between several behavioral EF tasks during late childhood (i.e., working memory, inhibitory control, and cognitive flexibility) and adolescent CR. Examining EF behavioral tasks and CR is the approach that previous researchers have taken when examining the relation between these constructs, which is what I did with my post hoc analyses (e.g., Andrés et al., 2016; McRae, Jacobs, et al., 2012; Tabibnia et al., 2011). Post hoc results revealed that only inhibitory control was a significant predictor of CR. This association was only significant when children displayed right FA during late childhood; specifically, better inhibitory control (faster reaction time) predicted higher adolescent CR. When children had worse inhibitory control (slower reaction time) and right FA during late childhood, they self-reported lower CR as adolescents. Lower CR was then linked to a higher number of depressive symptoms in adolescence.

My findings support the approach of examining EF separately, since inhibitory control was the only significant predictor of CR ability. When looking to the adulthood research, a similar approach is taken to examine EF and CR. By examining EF variables separately, previous adulthood research indicates differences regarding the specific EF variables that are linked to CR ability (McRae, Jacobs, et al., 2012; Tabibnia et al., 2011). In my analyses, only the model examining inhibitory control was significant; models with working memory and cognitive

flexibility were not significant. Adolescents' habitual CR was the measure of interest in my study. It is possible that had I measured task-specific CR, I will have seen differences regarding direct links of working memory and cognitive flexibility tasks associated with task CR. Asking an adolescent to learn a new strategy and implement it during emotion elicitation may require other EF, in addition to inhibitory control.

The model examining working memory indicated that only the interaction between working memory and FA during late childhood was a significant predictor of adolescent CR. Working memory alone was not significant in predicting adolescent CR. Although the interaction was significant, the index of moderated mediation was not significant, indicating that the moderated mediation model was not significant in predicting adolescent depression symptoms. This model supports previous research findings linking differences in working memory with CR ability. Based on my post hoc analysis with working memory, FA moderates the association, which may be why previous findings do not consistently find a significant association between different EF factors and CR (Schmeichel & Tang, 2014).

Among adults, depression is linked to deficits in working memory, inhibitory control, and cognitive flexibility, but these associations are not well understood during adolescence (Fossati et al., 2002; Vilgis et al., 2015). Childhood and adolescent research indicates that symptoms of depression are associated with slower reaction times on inhibitory control tasks (Cataldo et al., 2005; Vilgis et al., 2015). This association is also visible in children and adolescents with deficits in working memory and cognitive flexibility (Vilgis et al., 2015). My data show that only inhibitory control is a significant contributor to adolescent depressive symptoms when CR is also considered in the analyses. Thus, inhibitory control emerged as the only significant predictor of both adolescent CR and depressive symptoms. Furthermore, the indirect effect of inhibitory control on depressive symptoms through CR indicates that adolescents who are more effective inhibitors are better capable of engaging CR, which then diminishes their symptoms of depression. The inhibitory control to CR link was moderated by right FA. Based on previous literature indicating right FA as being associated to more depressive symptoms, our findings indicate this association requires a consideration of other factors (Thibodeau et al., 2006) or a more complex model of adolescent FA and depression. My data show that adolescents with right FA and greater inhibitory control (faster RT) are more capable of engaging CR, which is then associated with lower depressive symptoms.

Limitations, Future Directions, and Contributions

The sample demographics of my study are limited to primarily white and educated parents, which was one limitation. Although the findings can help to develop early interventions for parenting and inhibitory control, based on the sample demographics, unsupportive parenting may only be positive for the development of CR when mothers are highly educated. However, among the sample in Silva and colleagues (2018), only 50% of the families in the sample completed college and the association between relationship quality and adolescent CR development was significant. Future research could continue to examine the association between parenting and adolescent CR development among more diverse families with respect to race, ethnicity, and parent education level.

I did not collect adolescent's perceptions of their mother's unsupportive reactions. Future research could examine whether the link between maternal CR and adolescent CR differs based on adolescent's perceptions and how those perceptions impact adolescent depressive symptoms. I did not examine the quality of the parent-adolescent relationship. Examining quality of the relationship may provide additional avenues through which interventions can be implemented in order to increase adolescent CR. Future research could examine supportive and unsupportive reactions as well as the quality of the parent-adolescent relationship in order to further understand how parenting impacts adolescent CR development.

The model with FA and inhibitory control was informative for understanding adolescent habitual CR development. Future research could also examine CR ability during emotional situations to determine whether EF contributions emerge when considering CR during an emotional event.

Overall, my findings have the potential to inform future interventions that can be targeted toward parenting and individuals during late childhood, as well as during early childhood. Inhibitory control development is important for ER from early childhood. Targeting inhibitory control as a potential foundation through which adaptive CR ability begins to develop could help to diminish the association between right FA and depression in adolescence (Blair & Diamond, 2008; Carlson & Wang, 2007). Additionally, interventions targeting parenting CR ability may help provide young children with a model to learn effective CR.

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

Allen, J. J. B., & Reznik, S. J. (2015). Frontal EEG asymmetry as a promising marker of depression vulnerability: Summary and methodological considerations. *Current Opinion in Psychology*, *4*(1), 93–97. https://doi.org/10.1016/j.copsyc.2014.12.017

Allen, J. J. B., Urry, H. L., Hitt, S. K., & Coan, J. A. (2004). The stability of resting frontal electroencephalographic asymmetry in depression. *Psychophysiology*, *41*(2), 269–280. https://doi.org/10.1111/j.1469-8986.2003.00149.x

Altshuler, J. L., & Ruble, D. N. (1989). Developmental changes in children's awareness of strategies for coping with uncontrollable stress. *Child Development*, *60*(6), 1337–1349. https://doi.org/10.1111/j.1467-8624.1989.tb04007.x

Andrés, M. L., Castañeiras, C., Stelzer, F., Canet, L., & Introzzi, I. (2016). Executive functions and Cognitive Reappraisal ability: the relationship in children. *Psicología Desde El Caribe*, *33*(2), 55–82. https://doi.org/10.14482/psdc.33.2.7278

Bariola, E., Gullone, E., & Hughes, E. K. (2011). Child and adolescent emotion regulation: The role of parental emotion regulation and expression. *Clinical Child and Family Psychology Review*, *14*(2), 198–212. https://doi.org/10.1007/s10567-011-0092-5

Bariola, E., Hughes, E. K., & Gullone, E. (2012). Relationships between parent and child emotion regulation strategy use: A brief report. *Journal of Child and Family Studies*, *21*(3), 443–448. https://doi.org/10.1007/s10826-011-9497-5

Best, J. R., Miller, P. H., & Jones, L. L. (2009). Executive functions after age 5: Changes and correlates. *Developmental Review*, *29*(3), 180–200. https://doi.org/10.1016/j.dr.2009.05.002

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology*, *20*(3), 899–911. https://doi.org/10.1017/S0954579408000436

Brand, A. E., & Klimes-Dugan, B. (2010). Emotion socialization in adolescence: The roles of mothers and fathers. In A. Kennedy Root & S. Denham (Eds.), *The role of gender in the socialization of emotion: Key concepts and critical issues. New Directions for Child and Ado-lescent Development, 128,* 85–100. San Francisco: Jossey-Bass.

Branje, S. (2018). Development of parent–adolescent relationships: conflict interactions as a mechanism of change. *Child Development Perspectives*, *12*(3), 171–176. https://doi.org/10.1111/cdep.12278

Bridgett, D. J., Burt, N. M., Edwards, E. S., & Deater-Deckard, K. (2015). Intergenerational transmission of self-regulation: A multidisciplinary review and integrative conceptual framework. *Psychological Bulletin*, *141*(3), 602–654. https://doi.org/10.1037/a0038662

Calkins, S. D., & Marcovitch, S. (2010). Emotion regulation and executive functioning in early development: Integrated mechanisms of control supporting adaptive functioning. In S. D. Calkins & M. A. Bell (Eds.), *Child Development at the Intersection of Emotion and Cognition.* (pp. 37–57). American Psychological Association. https://doi.org/10.1037/12059-003

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development*, *22*(4), 489–510. https://doi.org/10.1016/j.cogdev.2007.08.002

Cataldo, M. G., Nobile, M., Lorusso, M. L., Battaglia, M., & Molteni, M. (2005). Impulsivity in depressed children and adolescents: A comparison between behavioral and neuropsychological data. *Psychiatry Research*, *136*(2–3), 123–133. https://doi.org/10.1016/j.psychres.2004.12.012

Choi, D., Sekiya, T., Minote, N., & Watanuki, S. (2016). Relative left frontal activity in reappraisal and suppression of negative emotion: Evidence from frontal alpha asymmetry (FAA). *International Journal of Psychophysiology*, *109*, 37–44. https://doi.org/10.1016/j.ijpsycho.2016.09.018

Cohen, N., & Mor, N. (2018). Enhancing reappraisal by linking cognitive control and emotion. *Clinical Psychological Science*, *6*(1), 155–163. https://doi.org/10.1177/2167702617731379

Cuevas, K., & Bell, M. A. (2014). Infant attention and early childhood executive function. *Child Development*, *85*(2), 397–404. https://doi.org/10.1111/cdev.12126

Davis, E. L. (2016). An age-related mechanism of emotion regulation: Regulating sadness promotes children's learning by broadening information processing. *Child Development*, *87*(5), 1617–1626. https://doi.org/10.1111/cdev.12552

Davis, E. L., & Levine, L. J. (2013). Emotion regulation strategies that promote learning: Reappraisal enhances children's memory for educational information. *Child Development*,

84(1), 361–374. https://doi.org/10.1111/j.1467-8624.2012.01836.x

Davis, E. L., Levine, L. J., Lench, H. C., & Quas, J. A. (2010). Metacognitive emotion regulation: Children's awareness that changing thoughts and goals can alleviate negative emotions. *Emotion*, *10*(4), 498–510. https://doi.org/10.1037/a0018428

DeCicco, J. M., O'Toole, L. J., & Dennis, T. A. (2014). Cognitive reappraisal in children: an ERP study using the late positive potential. *Developmental Neuropsychology*, *39*(7), 497–515. https://doi.org/10.1080/87565641.2014.959171.Cognitive

DeCicco, J. M., Solomon, B., & Dennis, T. A. (2012). Neural correlates of cognitive reappraisal in children: An ERP study. *Developmental Cognitive Neuroscience*, *2*(1), 70–80. https://doi.org/10.1016/j.dcn.2011.05.009

Diaz, A., & Eisenberg, N. (2015). The process of emotion regulation is different from individual differences in emotion regulation: Conceptual arguments and a focus on individual differences. *Psychological Inquiry*, *26*(1), 37–47. https://doi.org/10.1080/1047840X.2015.959094

Dryman, M. T., & Heimberg, R. G. (2018). Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. *Clinical Psychology Review*, *65*, 17–42. https://doi.org/10.1016/j.cpr.2018.07.004

Feng, X., Forbes, E. E., Kovacs, M., George, C. J., Lopez-Duran, N. L., Fox, N. A., & Cohn, J. F. (2012). Children's depressive symptoms in relation to EEG frontal asymmetry and maternal depression. *Journal of Abnormal Child Psychology*, *40*(2), 265–276. https://doi.org/10.1007/s10802-011-9564-9

Forbes, E. E., Shaw, D. S., Silk, J. S., Feng, X., Cohn, J. F., Fox, N. A., & Kovacs, M. (2008). Children's affect expression and frontal EEG asymmetry: Transactional associations with mothers' depressive symptoms. *Journal of Abnormal Child Psychology*, *36*(2), 207–221. https://doi.org/10.1007/s10802-007-9171-y

Fossati, P., Ergis, A. M., & Allilaire, J. F. (2002). Executive functioning in unipolar depression: A review. *L'encéphale*, *28*(2), 97-107.

Fox, N. A. (1991). If it's not left, it's right: Electroencephalograph asymmetry and the development of emotion. *American Psychologist*, *46*(8), 863–872. https://doi.org/10.1037/0003-066X.46.8.863

Fox, N. A. (1994). Dynamic cerebral processes underlying emotion regulation. *Monographs of*

the Society for Research in Child Development, *59*(2–3), 152–166. https://doi.org/10.1111/j.1540-5834.1994.tb01282.x

Fox, N. A., Schmidt, L. A., Calkins, S. D., Rubin, K. H., & Coplan, R. J. (1996). The role of frontal activation in the regulation and dysregulation of social behavior during the preschool years. *Development and Psychopathology*, *8*(April 1995), 89–102. https://doi.org/10.1017/S0954579400006982

Gross, J. J. (1998a). 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

Gross, J. J. (1998b). The emerging field of emotion regulation : An integrative review. *Review of General Psychology*, *2*(5), 271–299. https://doi.org/10.1037/1089-2680.2.3.271

Gross, J. J. (2015a). Emotion regulation: Current status and future prospects. *Psychological Inquiry*, *26*(1), 1–26. https://doi.org/10.1080/1047840X.2014.940781

Gross, J. J. (2015b). The extended process model of emotion regulation: Elaborations, applications, and future directions. *Psychological Inquiry*, *26*(1), 130–137. https://doi.org/10.1080/1047840X.2015.989751

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*(2), 348–362. https://doi.org/10.1037/0022-3514.85.2.348

Gross, J. T., & Cassidy, J. (2019). Expressive suppression of negative emotions in children and adolescents: Theory, data, and a guide for future research. *Developmental Psychology*, *55*(9), 1938–1950. https://doi.org/10.1037/dev0000722

Gullone, E., Hughes, E. K., King, N. J., & Tonge, B. (2010). The normative development of emotion regulation strategy use in children and adolescents: A 2-year follow-up study. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *51*(5), 567–574. https://doi.org/10.1111/j.1469-7610.2009.02183.x

Gunzenhauser, C., Fäsche, A., Friedlmeier, W., & Suchodoletz, A. von. (2014). Face it or hide it: Parental socialization of reappraisal and response suppression. *Frontiers in Psychology*, *4*. https://doi.org/10.3389/fpsyg.2013.00992

Hadiwijaya, H., Klimstra, T. A., Vermunt, J. K., Branje, S. J. T., & Meeus, W. H. J. (2017). On the development of harmony, turbulence, and independence in parent–adolescent

relationships: A five-wave longitudinal study. *Journal of Youth and Adolescence*, *46*(8), 1772–1788. https://doi.org/10.1007/s10964-016-0627-7

Hale, W. W., Engels, R., & Meeus, W. (2006). Adolescent's perceptions of parenting behaviours and its relationship to adolescent Generalized Anxiety Disorder symptoms. *Journal of Adolescence*, *29*(3), 407–417. https://doi.org/10.1016/j.adolescence.2005.08.002

Harris, P. L., Olthof, T., & Terwogt, M. M. (1981). Children's knowledge of emotion. *Journal of Child Psychology and Psychiatry*, *22*(3), 247–261. https://doi.org/10.1111/j.1469-7610.1981.tb00550.x

Hendricks, M. A., & Buchanan, T. W. (2016). Individual differences in cognitive control processes and their relationship to emotion regulation. *Cognition and Emotion*, *30*(5), 912–924. https://doi.org/10.1080/02699931.2015.1032893

Holahan, C. J., Valentiner, D. P., & Moos, R. H. (1995). Parental support, coping strategies, and psychological adjustment: An integrative model with late adolescents. *Journal of Youth and Adolescence*, *24*(6), 633–648. https://doi.org/10.1007/BF01536948

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Jaffe, M., Gullone, E., & Hughes, E. K. (2010). The roles of temperamental dispositions and perceived parenting behaviours in the use of two emotion regulation strategies in late childhood. *Journal of Applied Developmental Psychology*, *31*(1), 47–59. https://doi.org/10.1016/j.appdev.2009.07.008

Joormann, J., & Gotlib, I. H. (2010). Emotion regulation in depression: Relation to cognitive inhibition. *Cognition and Emotion*, *24*(2), 281–298. https://doi.org/10.1080/02699930903407948

Kelley, N. J., & Hughes, M. L. (2019). Resting frontal EEG asymmetry and emotion regulation in older adults: The midlife in the United States (MIDUS) Study. *Psychology and Aging*, *34*(3), 341–347. https://doi.org/10.1037/pag0000344

Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2015). The Performance of RMSEA in models with small degrees of freedom. *Sociological Methods and Research*, *44*(3), 486–507. https://doi.org/10.1177/0049124114543236

Keyes, K. M., Gary, D., O'Malley, P. M., Hamilton, A., & Schulenberg, J. (2019). Recent

increases in depressive symptoms among US adolescents: Trends from 1991 to 2018. *Social Psychiatry and Psychiatric Epidemiology*, *54*(8), 987–996. https://doi.org/10.1007/s00127-019-01697-8

Klimes-Dougan, B., & Zeman, J. (2007). Introduction to the special issue of social development: Emotion socialization in childhood and adolescence. *Social Development*, *16*(2), 203–209. https://doi.org/10.1111/j.1467-9507.2007.00380.x

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*, *16*(4), 302–319. https://doi.org/10.1080/15295192.2016.1184942

Kudinova, A. Y., James, K., & Gibb, B. E. (2018). Cognitive reappraisal and depression in children with a parent history of depression. *Journal of Abnormal Child Psychology*, *46*(4), 849–856. https://doi.org/10.1007/s10802-017-0333-2

Lantrip, C., Isquith, P. K., Koven, N. S., Welsh, K., & Roth, R. M. (2016). Executive function and emotion regulation strategy use in adolescents. *Applied Neuropsychology: Child*, *5*(1), 50–55. https://doi.org/10.1080/21622965.2014.960567

Lazarus, R. S., & Alfert, E. (1964). Short-circuiting of threat by experimentally altering cognitive appraisal. *Journal of Abnormal and Social Psychology*, *69*(2), 195–205. https://doi.org/10.1037/h0044635

Levine, L. J., Schmidt, S., Kang, H. S., & Tinti, C. (2012). Remembering the silver lining: Reappraisal and positive bias in memory for emotion. *Cognition and Emotion*, *26*(5), 871–884. https://doi.org/10.1080/02699931.2011.625403

López-Pérez, B., Gummerum, M., Wilson, E., & Dellaria, G. (2017). Studying children's intrapersonal emotion regulation strategies from the process model of emotion regulation. *Journal of Genetic Psychology*, *178*(2), 73–88. https://doi.org/10.1080/00221325.2016.1230085

López-Pérez, B., Wilson, E. L., Dellaria, G., & Gummerum, M. (2016). Developmental differences in children's interpersonal emotion regulation. *Motivation and Emotion*, *40*(5), 767–780. https://doi.org/10.1007/s11031-016-9569-3

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

Lunkenheimer, E. S., Shields, S. A., & Cortina, K. S. (2007). Parental emotion coaching and dismissing in family interaction. *Social Development*, *16*(2), 232–248. https://doi.org/10.1111/j.1467-9507.2007.00382.x

McCoy, C. L., & Masters, J. C. (1985). The development of children's strategies for the social control of emotion. *Child Development*, *56*(5), 1214–1222. https://doi.org/10.1111/j.1467-8624.1985.tb00190.x

McDonald, R. P., & Ho, M. H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods*, *7*(1), 64–82. https://doi.org/10.1037/1082-989X.7.1.64

McNeil, D., & Zeman, J. (2021). Adolescents' reluctance to express emotions: Relations to parent emotion socialization. *Journal of Child and Family Studies*, *30*(1), 107–120. https://doi.org/10.1007/s10826-020-01861-8

McRae, K. (2016). Cognitive emotion regulation: A review of theory and scientific findings. *Current Opinion in Behavioral Sciences*, *10*, 119–124. https://doi.org/10.1016/j.cobeha.2016.06.004

McRae, K., Gross, J. J., Weber, J., Robertson, E. R., Sokol-Hessner, P., Ray, R. D., Gabrieli, J. D. E., & Ochsner, K. N. (2012). The development of emotion regulation: an fMRI study of cognitive reappraisal in children, adolescents and young adults. *Social Cognitive and Affective Neuroscience*, *7*(1), 11–22. https://doi.org/10.1093/scan/nsr093

McRae, K., Jacobs, S. E., Ray, R. D., John, O. P., & Gross, J. J. (2012). Individual differences in reappraisal ability: Links to reappraisal frequency, well-being, and cognitive control. *Journal of Research in Personality*, *46*(1), 2–7. https://doi.org/10.1016/j.jrp.2011.10.003

Miller-Slough, R. L., Dunsmore, J. C., Zeman, J. L., Sanders, W. M., & Poon, J. A. (2018). Maternal and paternal reactions to child sadness predict children's psychosocial outcomes: A family-centered approach. *Social Development*, *27*(3), 495–509. https://doi.org/10.1111/sode.12244

Monti, J. D., & Rudolph, K. D. (2017). Maternal depression and trajectories of adolescent depression: The role of stress responses in youth risk and resilience. *Development and Psychopathology*, *29*(4), 1413–1429. https://doi.org/10.1017/S0954579417000359

Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D. E., & Gross, J. J. (2004). For better or for worse: Neural systems supporting the cognitive down- and up-regulation of negative emotion. *NeuroImage*, *23*(2), 483–499.

https://doi.org/10.1016/j.neuroimage.2004.06.030

Ochsner, K. N., Silvers, J. A., & Buhle, J. T. (2012). Functional imaging studies of emotion regulation: a synthetic review and evolving model of the cognitive control of emotion. *Annals of the New York Academy of Sciences*, *1251*(1), E1–E24. https://doi.org/10.1111/j.1749-6632.2012.06751.x

Opitz, P. C., Lee, I. A., Gross, J. J., & Urry, H. L. (2014). Fluid cognitive ability is a resource for successful emotion regulation in older and younger adults. *Frontiers in Psychology*, *5*(JUN), 1–13. https://doi.org/10.3389/fpsyg.2014.00609

Padilla-Walker, L. M. (2008). "My mom makes me so angry!" Adolescent perceptions of mother-child interactions as correlates of adolescent emotions. *Social Development*, *17*(2), 306–325. https://doi.org/10.1111/j.1467-9507.2007.00426.x

Palmer, A. R., Lakhan-Pal, S., & Cicchetti, D. (2019). Emotional development and depression. In V. LoBue, K. Pérez-Edgar, & K. A. Buss (Eds.), *Handbook of Emotional Development* (pp. 695–748). Springer International Publishing. https://doi.org/10.1007/978-3-030-17332-6_26

Papousek, I., Weiss, E. M., Perchtold, C. M., Weber, H., de Assunção, V. L., Schulter, G., Lackner, H. K., & Fink, A. (2017). The capacity for generating cognitive reappraisals is reflected in asymmetric activation of frontal brain regions. *Brain Imaging and Behavior*, *11*(2), 577–590. https://doi.org/10.1007/s11682-016-9537-2

Parsafar, P., & Davis, E. L. (2019). Divergent effects of instructed and reported emotion regulation strategies on children's memory for emotional information. *Cognition and Emotion*, *33*(8), 1726–1735. https://doi.org/10.1080/02699931.2019.1598937

Petersen, A. C., Sarigiani, P. A., & Kennedy, R. E. (1991). Adolescent depression: Why more girls? *Journal of Youth and Adolescence*, *20*(2), 247–271. https://doi.org/10.1007/BF01537611

Pons, F., Harris, P. L., & de Rosnay, M. (2004). Emotion comprehension between 3 and 11 years: Developmental periods and hierarchical organization. *European Journal of Developmental Psychology*, *1*(2), 127–152. https://doi.org/10.1080/17405620344000022

Poon, J., Zeman, J., Miller-Slough, R., Sanders, W., & Crespo, L. (2017). "Good enough" parental responsiveness to Children's sadness: Links to psychosocial functioning. *Journal of Applied Developmental Psychology*, *48*, 69–78.

https://doi.org/10.1016/j.appdev.2016.11.005

Quinn, M. E., & Joormann, J. (2020). Executive control under stress: Relation to reappraisal ability and depressive symptoms. *Behaviour Research and Therapy*, *131*(April), 103634. https://doi.org/10.1016/j.brat.2020.103634

Reznik, S. J., & Allen, J. J. B. (2018). Frontal asymmetry as a mediator and moderator of emotion: An updated review. *Psychophysiology*, *55*(1). https://doi.org/10.1111/psyp.12965

Rogers, M. L., Halberstadt, A. G., Castro, V. L., Maccormack, J. K., & Garrett-Peters, P. (2016). Maternal emotion socialization differentially predicts third-grade children's emotion regulation and lability. *Emotion*, *16*(2), 280–291. https://doi.org/10.1037/emo0000142

Ruffman, T., Rustin, C., Garnham, W., & Parkin, A. J. (2001). Source monitoring and false memories in children: Relation to certainty and executive functioning. *Journal of Experimental Child Psychology*, *80*(2), 95–111. https://doi.org/10.1006/jecp.2001.2632

Sala, M. N., Pons, F., & Molina, P. (2014). Emotion regulation strategies in preschool children. *British Journal of Developmental Psychology*, *32*(4), 440–453. https://doi.org/10.1111/bjdp.12055

Scheibe, S., Sheppes, G., & Staudinger, U. M. (2015). Supplemental material for distract or reappraise? Age-related differences in emotion-regulation choice. *Emotion*, *15*(6), 677–681. https://doi.org/10.1037/a0039246.supp

Schmeichel, B. J., & Tang, D. (2014). The relationship between individual differences in executive functioning and emotion regulation: A comprehensive review. In J. P. Forgas & E. Harmon-Jones (Eds.), *The Control Within: Motivation and its regulation* (pp. 133–151). Psychology Press.

Schmeichel, B. J., & Tang, D. (2015). Individual differences in executive functioning and their relationship to emotional processes and responses. *Current Directions in Psychological Science*, *24*(2), 93–98. https://doi.org/10.1177/0963721414555178

Schmeichel, B. J., Volokhov, R. N., & Demaree, H. A. (2008). Working memory capacity and the self-regulation of emotional expression and experience. *Journal of Personality and Social Psychology*, *95*(6), 1526–1540. https://doi.org/10.1037/a0013345

Schwartz, O. S., Sheeber, L. B., Dudgeon, P., & Allen, N. B. (2012). Emotion socialization within the family environment and adolescent depression. *Clinical Psychology Review*, *32*(6), 447–453. https://doi.org/10.1016/j.cpr.2012.05.002

Shapero, B. G., Stange, J. P., McArthur, B. A., Abramson, L. Y., & Alloy, L. B. (2019). Cognitive reappraisal attenuates the association between depressive symptoms and emotional response to stress during adolescence. *Cognition and Emotion*, *33*(3), 524–535. https://doi.org/10.1080/02699931.2018.1462148

Shortt, J. W., Katz, L. F., Allen, N. B., Leve, C., Davis, B., & Sheeber, L. B. (2016). Emotion socialization in the context of risk and psychopathology: Mother and father socialization of anger and sadness in adolescents with depressive disorder. *Social Development*, *25*(1), 27–46. https://doi.org/10.1111/sode.12138

Silk, J. S., Shaw, D. S., Forbes, E. E., Lane, T. L., & Kovacs, M. (2006). Maternal depression and child internalizing: The moderating role of child emotion regulation. *Journal of Clinical Child and Adolescent Psychology*, *35*(1), 116–126. https://doi.org/10.1207/s15374424jccp3501_10

Silva, E., Freire, T., & Faria, S. (2018). The emotion regulation strategies of adolescents and their parents: An experience sampling study. *Journal of Child and Family Studies*, *27*(6), 1774–1785. https://doi.org/10.1007/s10826-018-1015-6

Soper, D.S. (2021a). A-priori sample size calculator for multiple regression [Software]. Available from https://www.danielsoper.com/statcalc

Soper, D.S. (2021b). A-priori sample size calculator for structural equation models [Software]. Available from https://www.danielsoper.com/statcalc

Stansbury, K., & Sigman, M. (2000). Responses of preschoolers in two frustrating episodes: Emergence of complex strategies for emotion regulation. *Journal of Genetic Psychology*, *161*(2), 182–202. https://doi.org/10.1080/00221320009596705

Tabibnia, G., Monterosso, J. R., Baicy, K., Aron, A. R., Poldrack, R. A., Chakrapani, S., Lee, B., & London, E. D. (2011). Different forms of self-control share a neurocognitive substrate. *Journal of Neuroscience*, *31*(13), 4805–4810. https://doi.org/10.1523/JNEUROSCI.2859-10.2011

Tan, L., & Smith, C. L. (2018). Intergenerational transmission of maternal emotion regulation to child emotion regulation: Moderated mediation of maternal positive and negative emotion. *Emotion*. https://doi.org/10.1037/emo0000523

Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet*, *379*(9820), 1056–1067. https://doi.org/10.1016/S0140-6736(11)60871-4

Thibodeau, R., Jorgensen, R. S., & Kim, S. (2006). Depression, anxiety, and resting frontal EEG asymmetry: A meta-analytic review. *Journal of Abnormal Psychology*, *115*(4), 715–729. https://doi.org/10.1037/0021-843X.115.4.715

Vilgis, V., Silk, T. J., & Vance, A. (2015). Executive function and attention in children and adolescents with depressive disorders: a systematic review. *European Child and Adolescent Psychiatry*, *24*(4), 365–384. https://doi.org/10.1007/s00787-015-0675-7

Vuga, M., Fox, N. A., Cohn, J. F., Kovacs, M., & George, C. J. (2008). Long-term stability of electroencephalographic asymmetry and power in 3 to 9 year-old children. *International Journal of Psychophysiology*, *67*(1), 70–77. https://doi.org/10.1016/j.ijpsycho.2007.10.007

Wald, N., Carthy, T., Shenaar-Golan, V., Tadmor-Zisman, Y., & Ziskind, M. (2018). Influence of maternal negative emotion reactivity and cognitive reappraisal on child anxiety disorder. *Depression and Anxiety*, *35*(4), 353–359. https://doi.org/10.1002/da.22745

Wang, F., Wang, C., Yin, Q., Wang, K., Li, D., Mao, M., Zhu, C., & Huang, Y. (2015). Reappraisal writing relieves social anxiety and may be accompanied by changes in frontal alpha asymmetry. *Frontiers in Psychology*, *6*(OCT), 1–11. https://doi.org/10.3389/fpsyg.2015.01604

Wang, Y., Lu, J., Gu, C., & Hu, B. (2018). Mapping the frontal alpha asymmetry indicators of habitual emotion regulation: A data-driven approach. *NeuroReport*, *29*(15), 1288–1292. https://doi.org/10.1097/WNR.0000000000001109

Yap, M. B. H., Allen, N. B., & Ladouceur, C. D. (2008). Maternal socialization of positive affect: The impact of invalidation on adolescent emotion regulation and depressive symptomatology. *Child Development*, *79*(5), 1415–1431. https://doi.org/10.1111/j.1467-8624.2008.01196.x

Yap, M. B. H., Allen, N. B., & Sheeber, L. B. (2007). Using an emotion regulation framework to understand the role of temperament and family processes in risk for adolescent depressive disorders. *Clinical Child and Family Psychology Review*, *10*(2), 180–196. https://doi.org/10.1007/s10567-006-0014-0

Yap, M. B. H., Schwartz, O. S., Byrne, M. L., Simmons, J. G., & Allen, N. B. (2010). Maternal positive and negative interaction behaviors and early adolescents' depressive symptoms: Adolescent emotion regulation as a mediator. *Journal of Research on Adolescence*, *20*(4), 1014–1043. https://doi.org/10.1111/j.1532-7795.2010.00665.x

Young, K., Sandman, C., & Craske, M. (2019). Positive and negative emotion regulation in adolescence: Links to anxiety and depression. *Brain Sciences*, *9*(4), 76. https://doi.org/10.3390/brainsci9040076

Zalewski, M., Lengua, L. J., Wilson, A. C., Trancik, A., & Bazinet, A. (2011). Associations of coping and appraisal styles with emotion regulation during preadolescence. *Journal of Experimental Child Psychology*, *110*(2), 141–158. https://doi.org/10.1016/j.jecp.2011.03.001

Tables

Table 1

Descriptive statistics of measures

	Variables	N	Mean	SD	Range	Skewness	Kurtosis
	Mean FA	111	-.03	.14	-.55 – .37	-.35	2.07
	Inhibitory Control Number Stroop Task	110	2234.92	570.46	1234.18 – 4074.92	.60	-.01
	Backward Digit Working Memory Span Test	113	-.66	.09	.-44 – -.83	.42	-.59
Time 1	WCST Cognitive Flexibility	109	-55.71	35.73	-2 – -99	.21	-1.61
	BRIEF Inhibit	120	49.74	10.36	37 – 78	.92	.08
	BRIEF Shift	120	49.97	9.48	36 – 84	1.01	1.06
	BRIEF Working Memory	120	54.16	12.46	36 – 83	.39	-.74
	Adolescent Cognitive Reappraisal	121	4.53	1.01	1.83 – 7	-.11	.25
	Adolescent Depressive Symptoms	121	17.74	5.72	10 – 39	.93	1.06
Time 2	Maternal Cognitive Reappraisal	119	5.49	.87	3.17 – 7	-.37	.20
	Maternal Supportive Reactions	123	5.56	.70	2.17 – 6.96	-.88	3.32
	Maternal Unsupportive Reactions	123	2.79	.68	1.56 – 4.46	.28	-.64

Note: Time 1 = late childhood; Time 2 = adolescence; FA = frontal EEG asymmetry; WCST = Wisconsin card sorting test, BRIEF = Behavior Rating Inventory of Executive Function.

Table 2

Correlations Among Variables in Model 1

	1	2	3	4	5	6	7	8	9
1. Mean Frontal Asymmetry	1.00								
2. Adolescent Cognitive Reappraisal	.07	1.00							
3. Adolescent Depressive Symptoms	-.16	-.29**	1.00						
4. Inhibitory Control Number Stroop Test	.05	-.23*	.02	1.00					
5. Working Memory Backward Digit Span Test	-.03	-.09	-.02	.31***	1.00				
6. Cognitive Flexibility WCST	.11	-.05	-.12	.12	.06	1.00			
7. BRIEF Inhibit	-.02	-.01	.08	.09	.23*	.09	1.00		
8. BRIEF Shift	-.05	.08	-.01	.02	-.03	.13	.61***	1.00	
9. BRIEF Working Memory	.05	.12	.02	.34***	.25**	.09	.57***	.55***	1.00

Note: $p < .05$* $p < .01$** $p < .001$***; Note: WCST = Wisconsin card sorting test; BRIEF = Behavior Rating Inventory of Executive Function.

Table 3

Correlations Among Variables in Model 2

	1	2	3	4	5	6	7	8	9	4	5
1. Adolescent Cognitive Reappraisal	1.00										
2. Adolescent Depressive Symptoms	-.29**	1.00									
3. Maternal Cognitive Reappraisal	.10	-.18	1.00								
4. CCNES Minimizing	.22*	.09	.14	1.00							
5. CCNES Punitive Reactions	.18	.09	.09	.76***	1.00						
6. CCNES Distress Reactions	.11	.05	-.15	.36***	.28**	1.00					
7. CCNES Expressive Encouragement	-.16	.04	.32***	-.09	-.22*	-.23**	1.00				
8. CCNES Problem Focused	.09	-.16	.28**	.13	.000	-.15	.43***	1.00			
9. CCNES Emotion Focused	.05	-.002	.16	.41***	.11	.09	.34***	.64***	1.00		
4. Maternal Supportive Reactions	-.02	-.04	.31**	.20*	-.04	-.11	.74***	.83***	.84***	1.00	
5. Maternal Unsupportive Reactions	.22*	.10	.07	.92***	.89***	.58***	-.20*	.02	.27**	.05	1.00

Note: $p < .05$* $p < .01$** $p < .001$***

Table 4

Questionnaire Response Means Collected Pre and During COVID-19

	Covid-19	N	Mean	SD	t-test
Maternal Cognitive Reappraisal	Pre COVID-19	75	5.65	.87	$t(117) = 2.68$, $p = .008$
	During COVID -19	44	5.22	.82	
Maternal Supportive	Pre COVID -19	79	5.57	.61	$t(121) = -.07$, $p = .94$
	During COVID -19	44	5.58	.89	
Maternal Unsupportive	Pre COVID -19	79	2.80	.70	$t(121) = .24$, $p = .81$
	During COVID -19	44	2.77	.65	
Adolescent Cognitive Reappraisal	Pre COVID -19	78	4.57	1.02	$t(119) = .59$, $p = .56$
	During COVID -19	43	4.46	1.00	
Adolescent Depressive Symptoms	Pre COVID -19	78	17.25	5.97	$t(119) = -1.27$, $p = .21$
	During COVID -19	43	18.63	5.18	

Table 5

Sex and Cohort Differences on Cognitive Reappraisal and Depressive Symptoms

		N	Mean	SD	t-test
Adolescent Cognitive Reappraisal	Female	59	4.50	.98	$t(119) = -.29$, $p = .77$
	Male	62	4.56	1.05	
Adolescent Cognitive Reappraisal	Cohort 1	55	4.53	1.00	$t(119) = -.003$, $p = .99$
	Cohort 2	66	4.53	1.02	
Adolescent Depressive Symptoms	Female	59	17.11	4.44	$t(119) = -1.18$, $p = .24$
	Male	62	18.34	6.70	
Adolescent Depressive Symptoms	Cohort 1	55	19.02	5.64	$t(119) = 2.28$, $p = .02$
	Cohort 2	66	16.67	5.61	

Table 6

Factor Loadings of EF during Late Childhood

Variables	Estimate	*SE*	*p*
BRIEF-Inhibit	0.57	.06	.00
BRIEF-Shift	0.54	.07	.00
BRIEF-Working Memory	1.00	.00	.00
Working Memory Backward Digit Span Test	0.25	.09	.01
Inhibitory Control Number Stroop Test	0.35	.09	.00

Note: BRIEF = Behavior Rating Inventory of Executive Function. Standardized estimates are reported.

Table 7

Parameter estimates for Hypothesis 2 (Model 2) for the associations among maternal cognitive reappraisal, adolescent cognitive reappraisal, adolescent depressive symptoms moderated by maternal unsupportive reactions.

	B	*SE*	*p*	*b**
Hypothesis 2 – Model 2				
Main Effects				
Age → Adolescent Depressive Symptoms	.60	.24	< .05	0.20
Maternal Cognitive Reappraisal → Adolescent Cognitive Reappraisal	.23	.12	< .05	0.19
Maternal Unsupportive Reactions → Adolescent Cognitive Reappraisal	.30	.13	< .05	0.20
Adolescent Cognitive Reappraisal → Adolescent Depressive Symptoms	-1.58	.53	< .01	-0.28
Maternal Cognitive Reappraisal → Adolescent Depressive Symptoms	-.98	.61	.11	-0.15
COVID-19 → Maternal Cognitive Reappraisal	-.38	.15	< .01	-0.21
Interaction Effects				
Maternal Cognitive Reappraisal × Maternal Unsupportive Reactions → Adolescent CR	.54	.19	< .01	0.29

Note: CR = cognitive reappraisal.

Table 8

Parameter estimates for the post hoc model for associations among late childhood inhibitory control, adolescent cognitive reappraisal, adolescent depressive symptoms moderated by late childhood frontal EEG asymmetry.

	B	*SE*	*p*	*b**
Post hoc Model				
Main Effects				
Age → Adolescent Depressive Symptoms	.60	.26	< .05	0.20
Late Childhood Inhibitory Control → Adolescent Cognitive Reappraisal	-.91	.37	< .05	-0.23
Late Childhood Frontal EEG Asymmetry → Adolescent Cognitive Reappraisal	.37	.69	.59	0.05
Adolescent Cognitive Reappraisal → Adolescent Depressive Symptoms	-1.72	.56	< .01	-0.30
Late Childhood Inhibitory Control → Adolescent Depressive Symptoms	-0.90	2.33	.70	-0.04
Interaction Effects				
Late Childhood Inhibitory Control × Late Childhood FA → Adolescent CR	6.07	2.91	< .05	.19

Note: FA = frontal EEG asymmetry; CR = cognitive reappraisal.

Figures

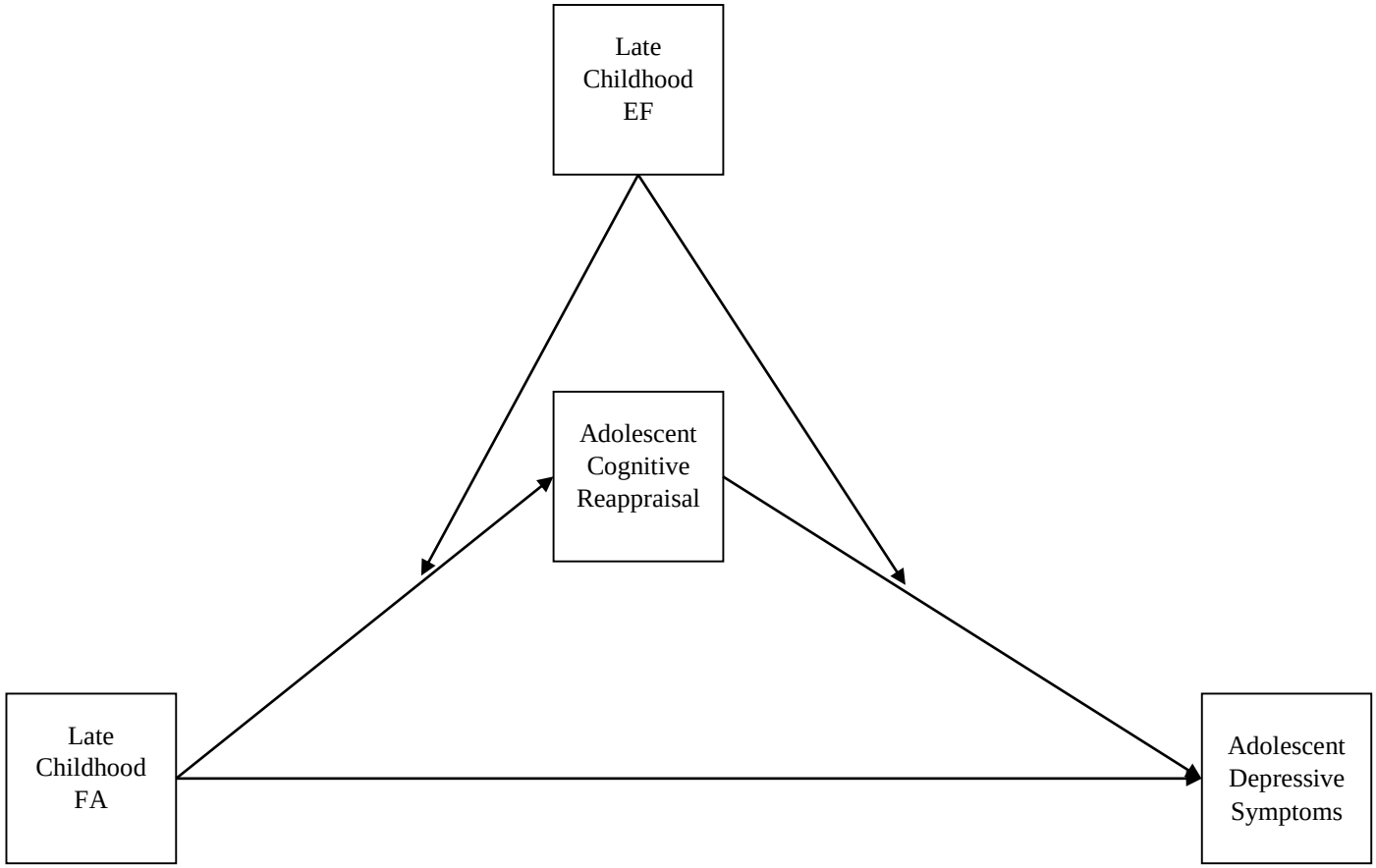

Figure 1. Hypothesis 1 - moderated mediation model with late childhood frontal asymmetry and adolescent cognitive reappraisal predicting adolescent depressive symptoms, as moderated by late childhood executive function. FA = frontal EEG asymmetry; EF = executive function.

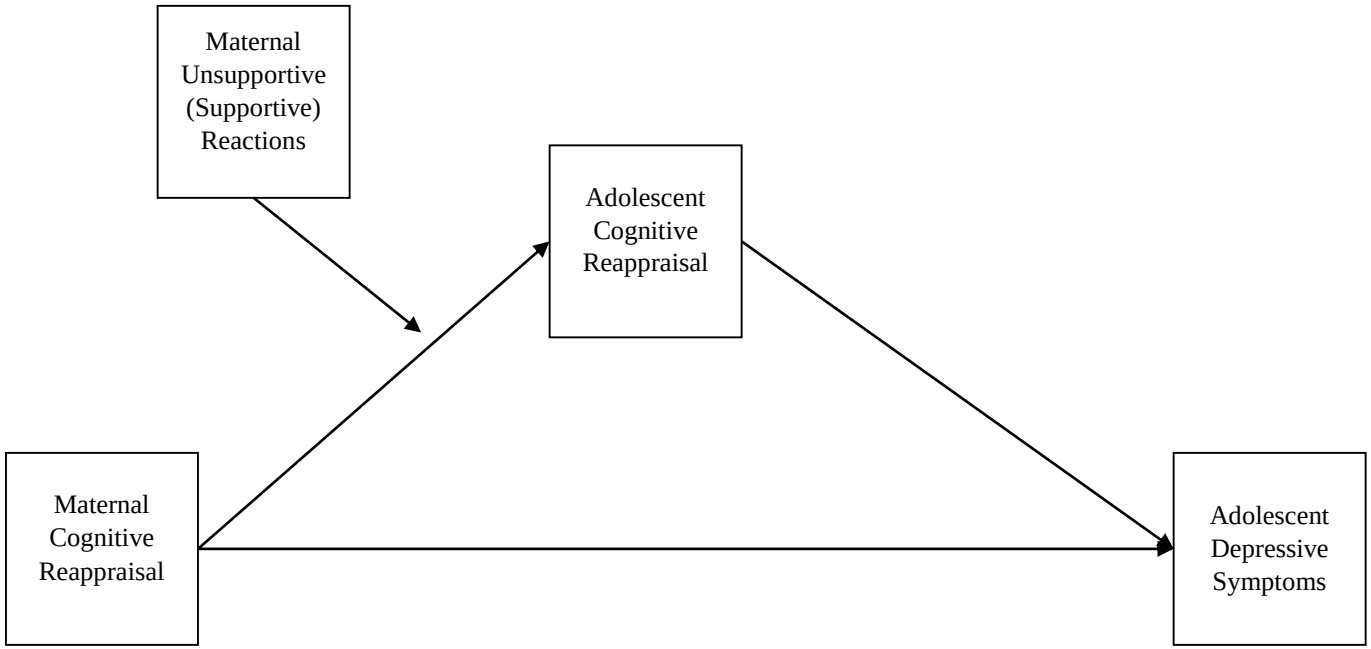

Figure 2. Hypothesis 2 - moderated mediation model predicting adolescent depressive symptoms. Maternal unsupportive reactions moderate the relation between maternal cognitive reappraisal and adolescent cognitive reappraisal (CR). Hypothesis 2a - for those mothers who report higher levels of supportive parenting, there will be no effect of maternal on adolescent CR, but higher adolescent CR will predict fewer adolescent depressive symptoms.

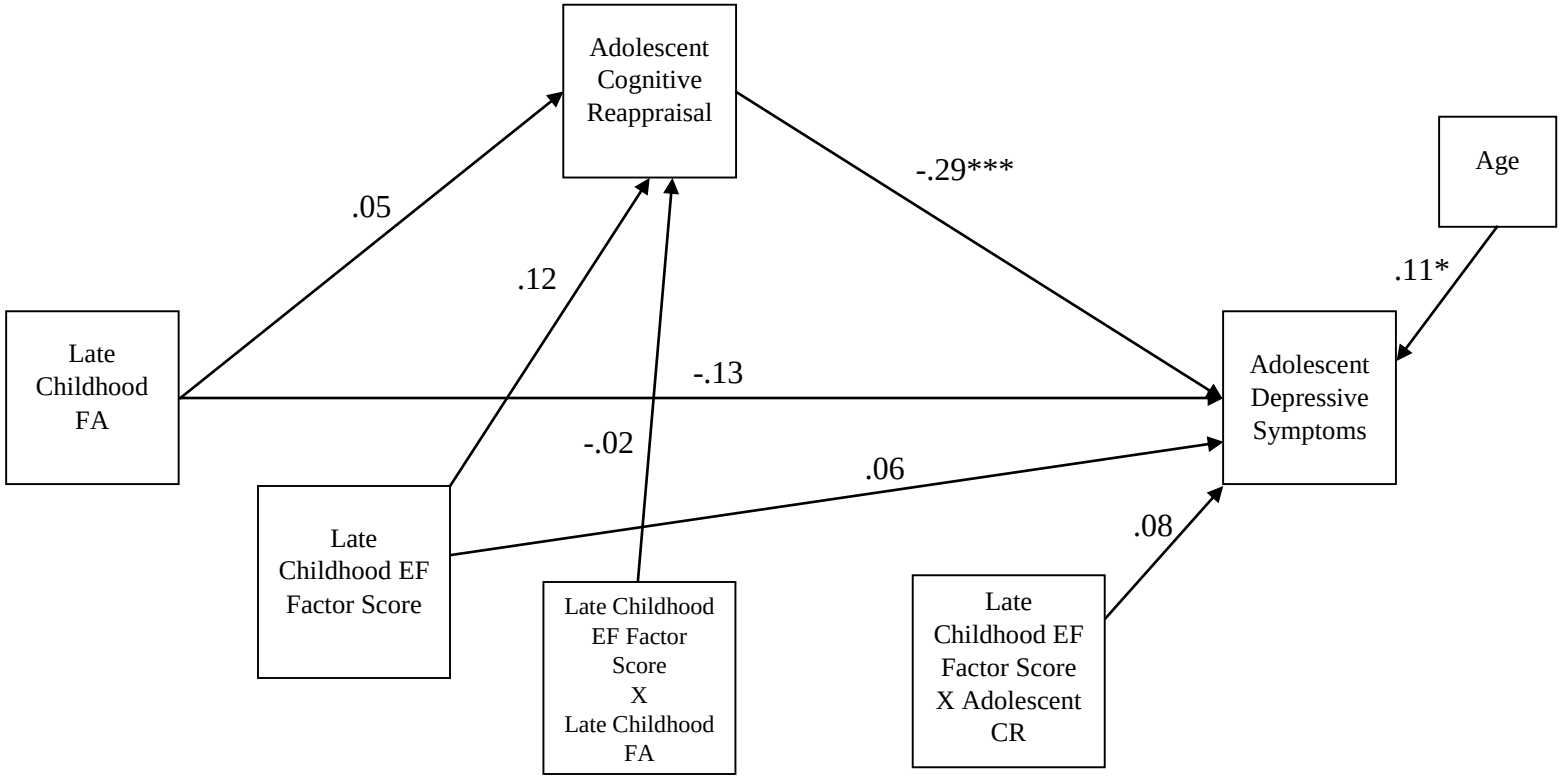

Figure 3. Summarized model fitting results of associations among late childhood FA, adolescent cognitive reappraisal, and adolescent depressive symptoms moderated by late childhood EF. Standardized estimates are presented. FA = frontal EEG asymmetry; EF = executive function. ***p < .001, *p < .05.

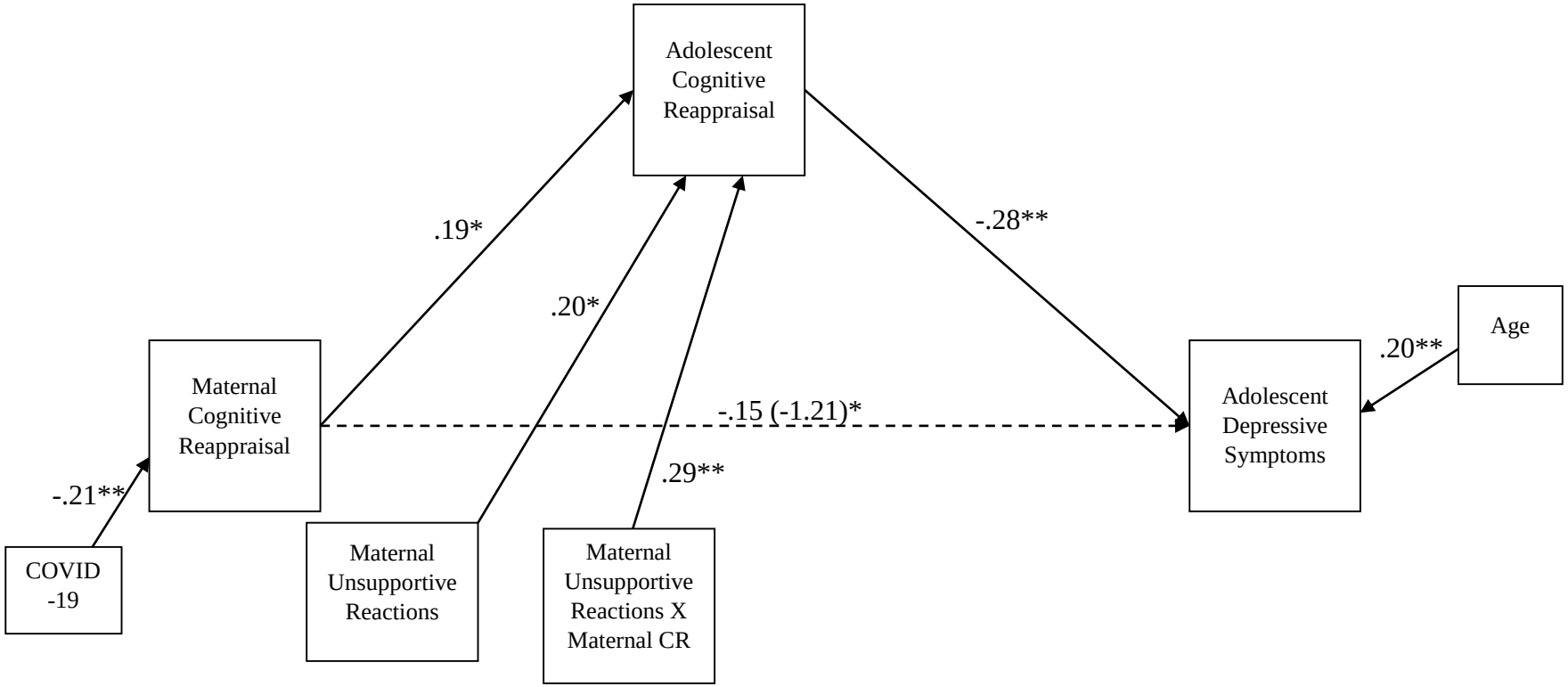

Figure 4. Summarized model fitting results of associations among maternal cognitive reappraisal, adolescent cognitive reappraisal, and adolescent depressive symptoms moderated by maternal unsupportive reactions. Parentheses indicate the indirect effect estimate of maternal cognitive reappraisal on adolescent depressive symptoms. Standardized estimates are presented. CR = cognitive reappraisal. **p < .01, *p < .05.

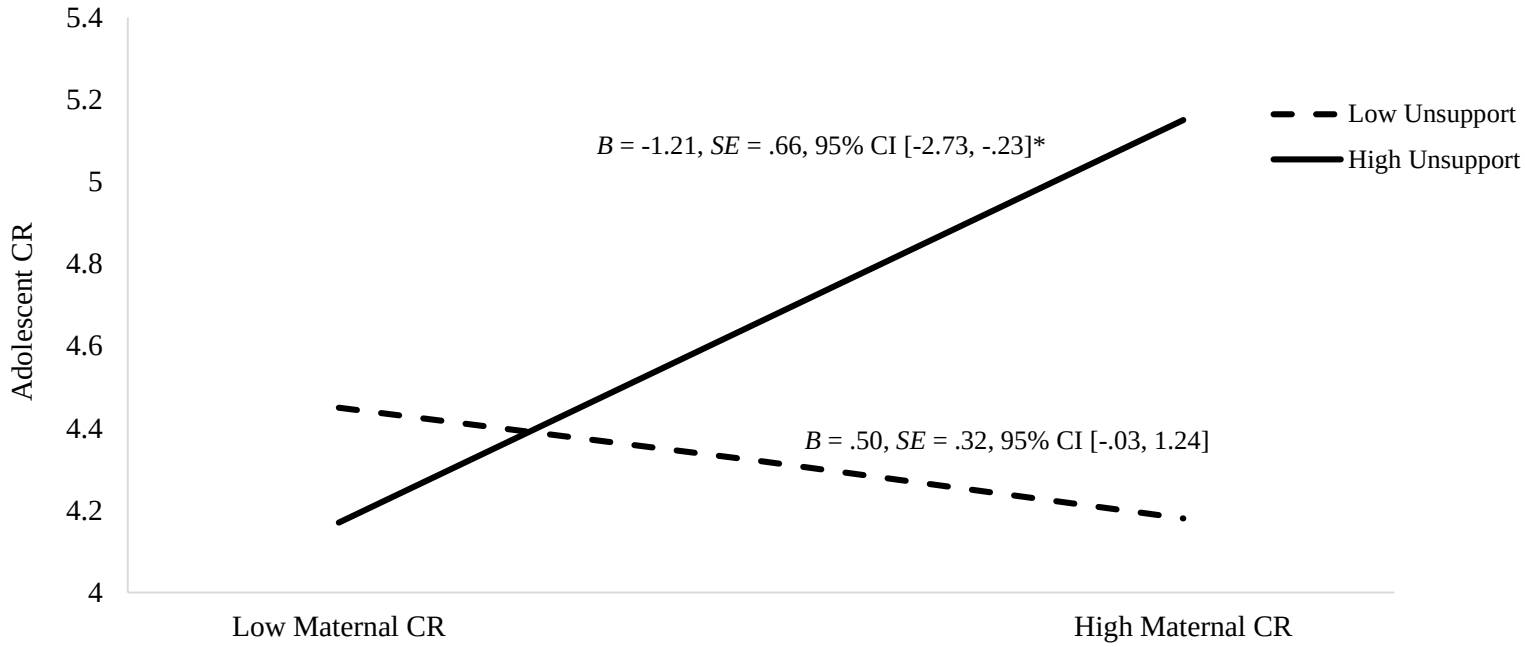

Figure 5. Simple slope analyses comparing the relation between maternal CR (cognitive appraisal) and adolescent CR for mothers who report low and high unsupportive reactions.

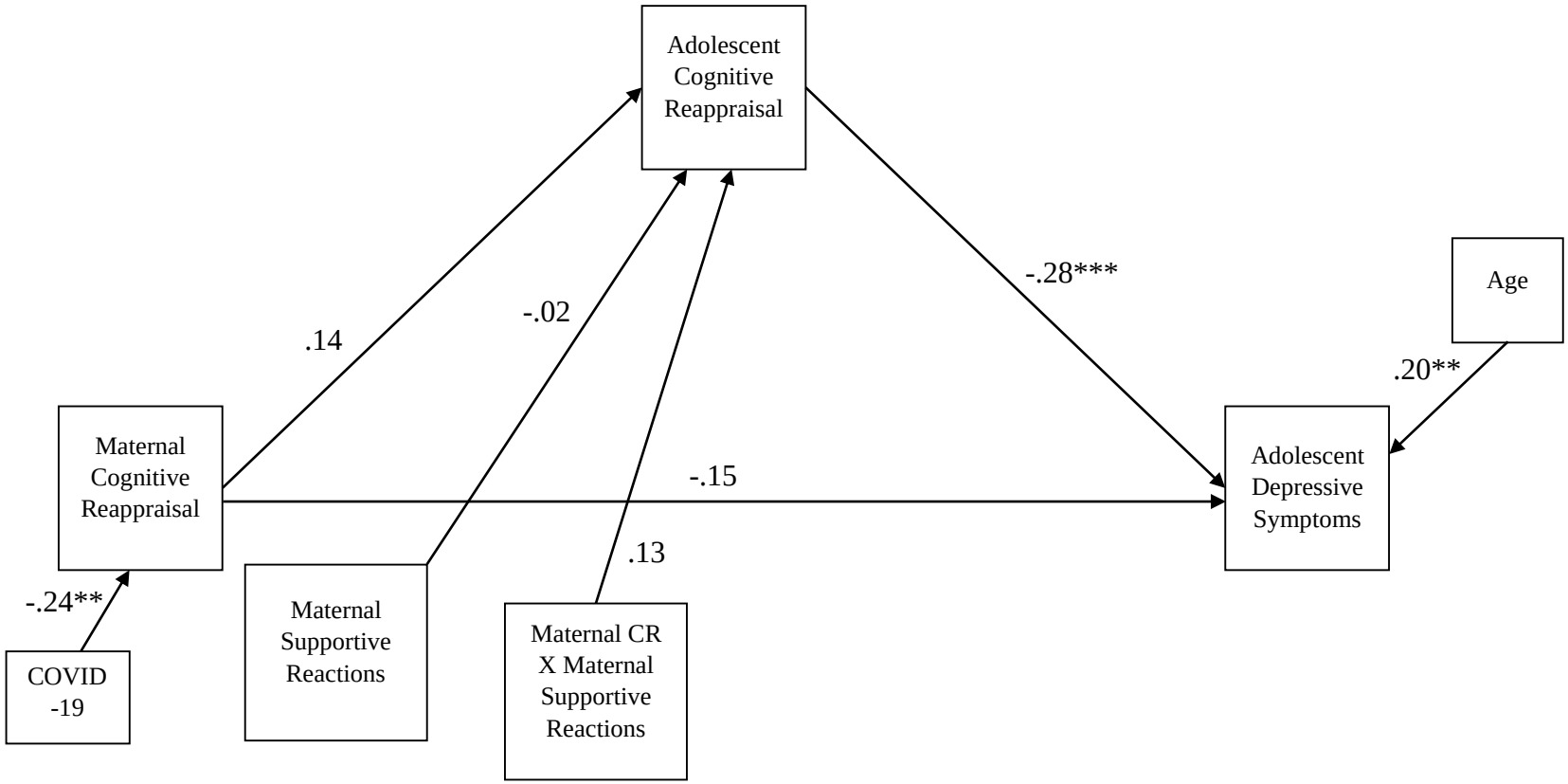

Figure 6. Summarized model fitting results of associations among maternal cognitive reappraisal, adolescent cognitive reappraisal, and adolescent depressive symptoms moderated by maternal supportive reactions. Standardized estimates are presented. CR = cognitive reappraisal. ***p < .001, **p < .01.

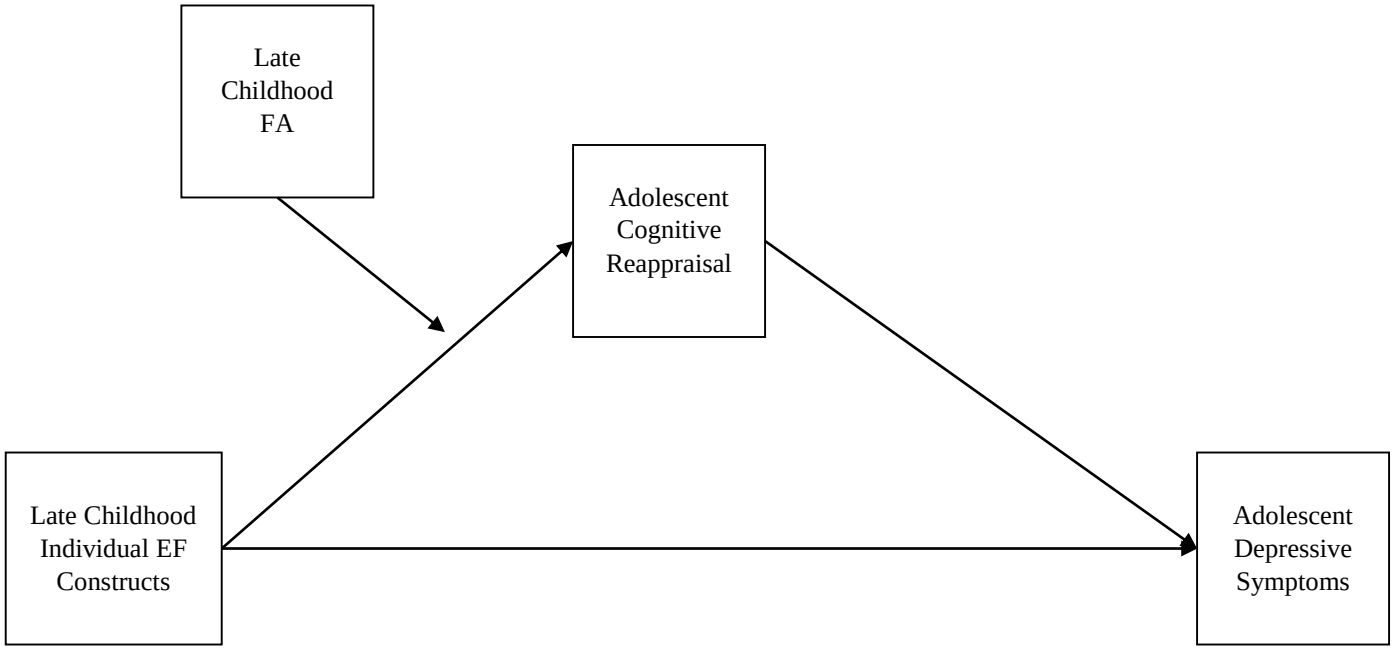

Figure 7. Post hoc moderated mediation model predicting adolescent depressive symptoms. Late childhood FA (frontal EEG asymmetry) moderates the relation between late childhood individual EF constructs (working memory, inhibitory control, cognitive flexibility) and adolescent cognitive reappraisal.

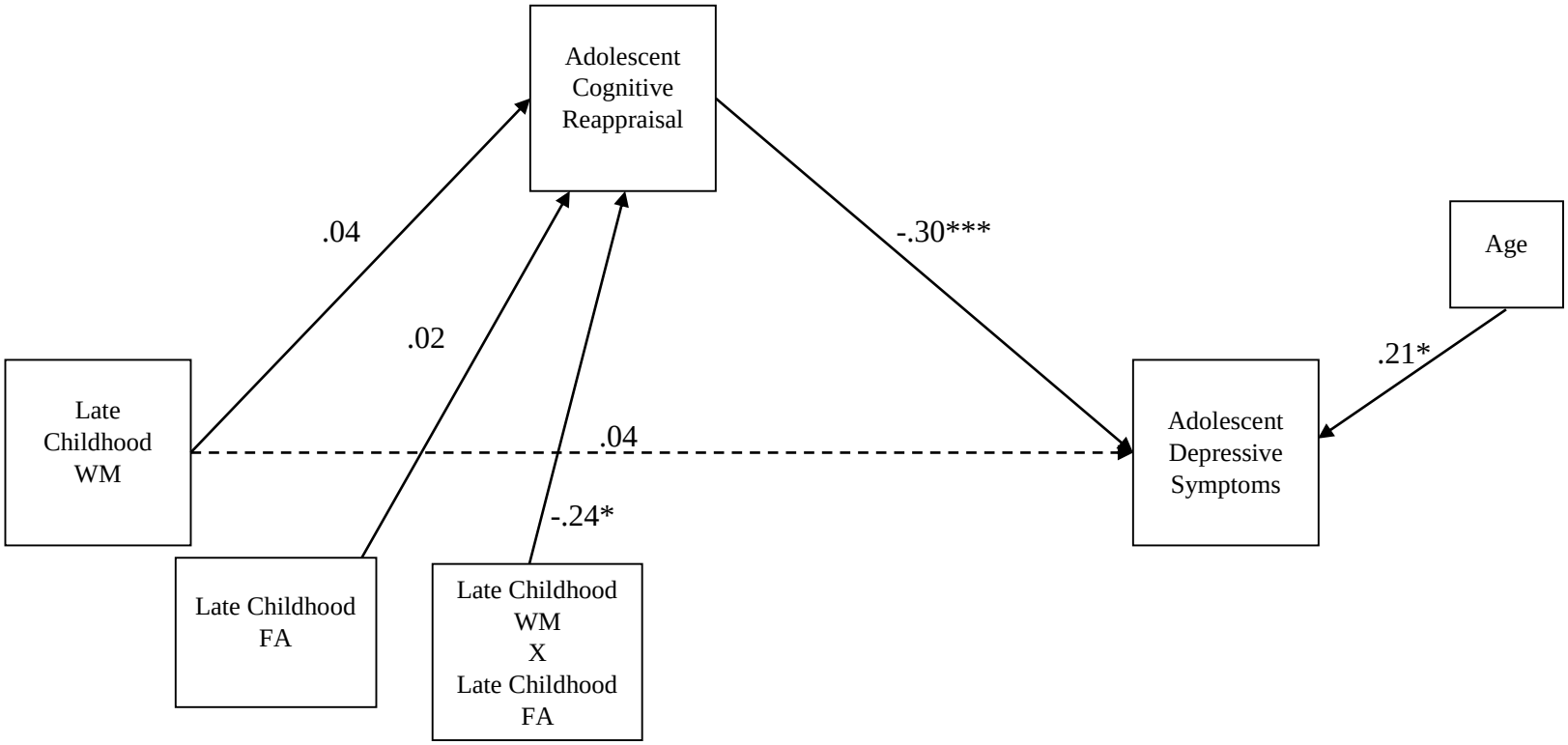

Figure 8. Summarized model fitting results of associations among late childhood WM (working memory) adolescent cognitive reappraisal, and adolescent depressive symptoms moderated by late childhood FA (frontal EEG asymmetry). Parentheses indicate the indirect effect estimate of late childhood WM on adolescent depressive symptoms. Standardized estimates are presented. **p < .01, *p < .05.

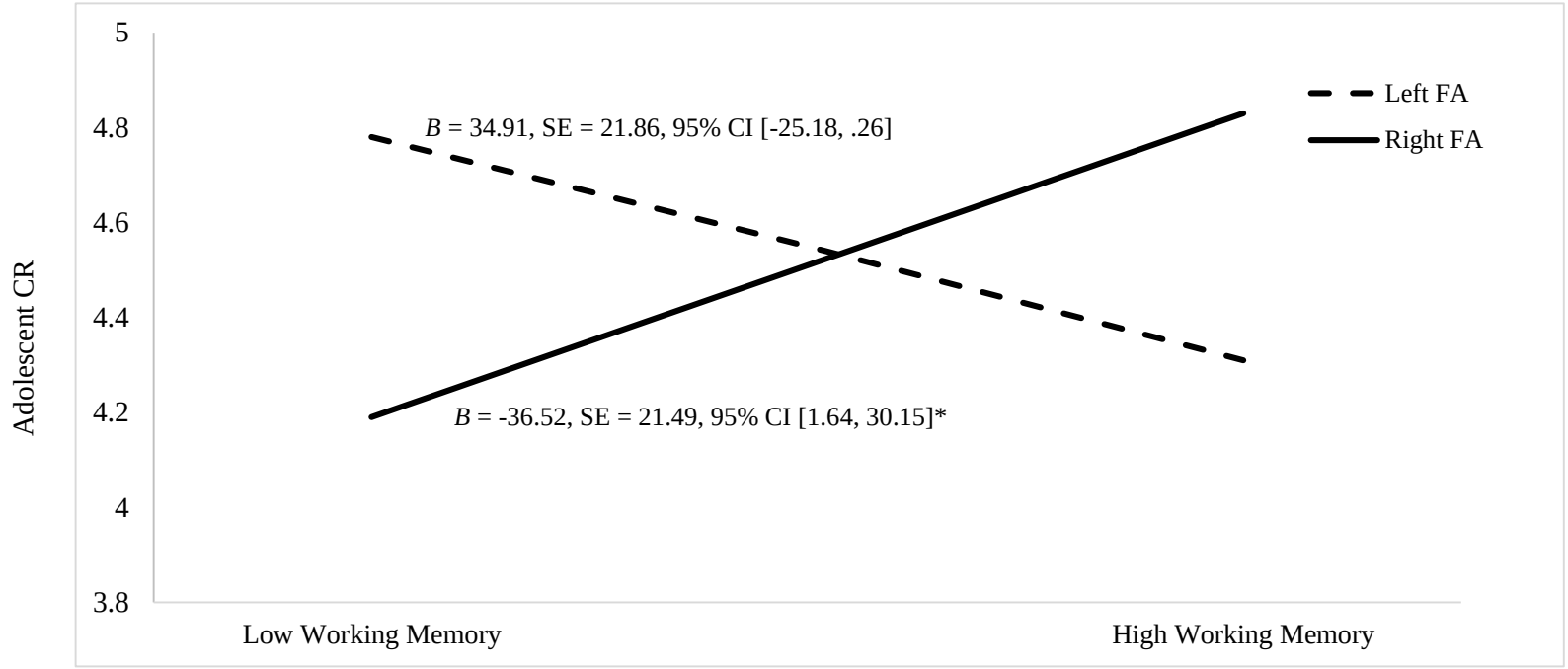

Figure 9. Simple slope analyses comparing the relation between late childhood WM (working memory) and adolescent CR (cognitive reappraisal) for adolescents who had left FA (frontal EEG asymmetry) and right FA during late chldhood.

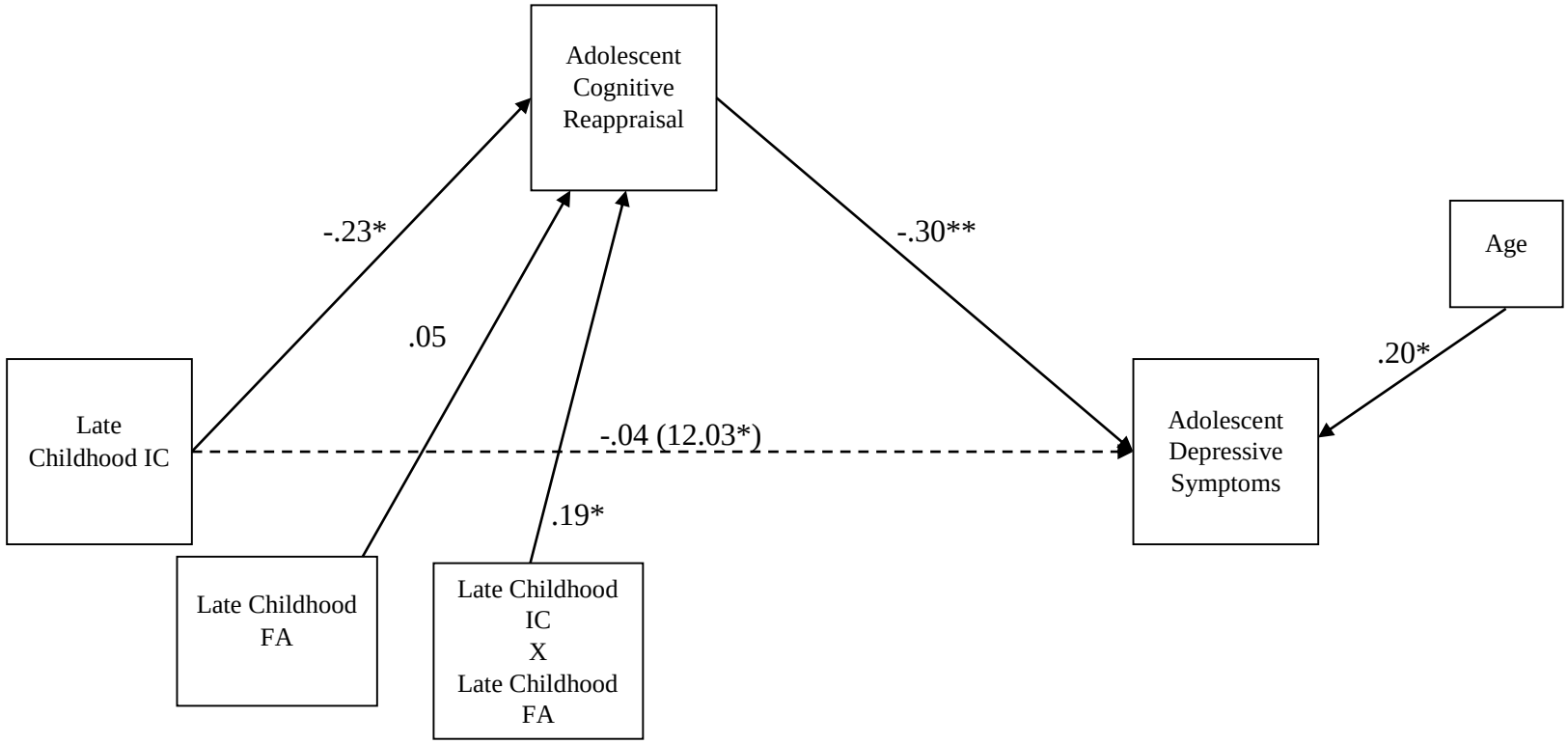

Figure 10. Summarized model fitting results of associations among late childhood IC (inhibitory control), adolescent cognitive reappraisal, and adolescent depressive symptoms moderated by late childhood FA (frontal EEG asymmetry). Parentheses indicate the indirect effect estimate of late childhood IC on adolescent depressive symptoms. Standardized estimates are presented. **p < .01, *p < .05.

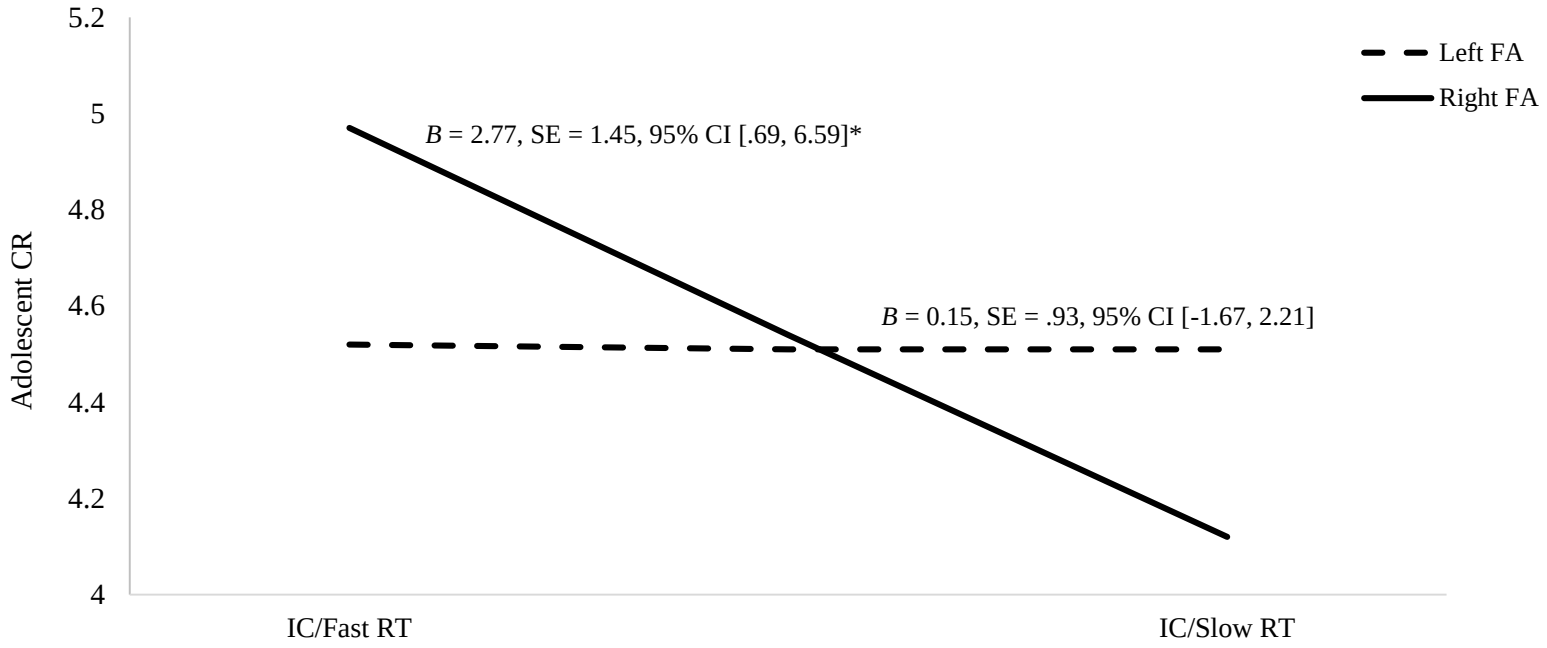

Figure 11. Simple slope analyses comparing the relation between late childhood IC (inhibitory control reaction time) and adolescent CR (cognitive reappraisal) for adolescents who had left FA (frontal EEG asymmetry) and right FA during late chldhood.

Appendices

Appendix A

Coping with Children's Negative Emotions Scale (CCNES) – Modified for Adolescent's

My Ideas about Parenting

Please indicate on a scale from 1 (very unlikely) to 7 (very likely) the likelihood that you would respond in the ways listed for each item. Please read each item carefully and respond as honestly and sincerely as you can.

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

1. If my teenager becomes angry because s/he is sick or hurt and can't go to a friend's birthday party, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. send my teen to her/his room to cool off.	O	O	O	O	O	O	O
b. get angry at my teen.	O	O	O	O	O	O	O
c. help my teen think about ways that s/he can still be with friends (e.g., invite some friends over after the party).	O	O	O	O	O	O	O
d. tell my teen not to make a big deal out of missing the party.	O	O	O	O	O	O	O
e. encourage my teen to express her/his feelings of anger and frustration.	O	O	O	O	O	O	O
f. soothe my teen and do something fun with her/him to make her/him feel better about missing the party.	O	O	O	O	O	O	O

2. If my teenager seriously damages a valuable item (like their stereo), and then becomes visibly angry about it, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. remain calm and not let myself get anxious.	O	O	O	O	O	O	O
b. comfort my teen and try to get her/him not to worry about it.	O	O	O	O	O	O	O
c. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
d. help my teen figure out how to get the item fixed or replaced.	O	O	O	O	O	O	O
e. tell my teen it is okay to be upset.	O	O	O	O	O	O	O
f. tell my teen to stop complaining or s/he won't be allowed to use the item anytime soon.	O	O	O	O	O	O	O

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

3. If my teenager loses some prized possession and becomes very sad and emotional, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. get upset with my teen for being so careless and then complaining about it.	O	O	O	O	O	O	O
b. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
c. help my teen think of places s/he hasn't looked yet.	O	O	O	O	O	O	O
d. distract my teen by talking about good things that are happening.	O	O	O	O	O	O	O
e. tell my teen that it's okay to be sad when you lose something.	O	O	O	O	O	O	O
f. tell my teen that's what happens when you're not careful.	O	O	O	O	O	O	O

4. If my teenager is very distressed about a mistake s/he made in front of friends at school, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. comfort my teen to try to make her/him feel better.	O	O	O	O	O	O	O
b. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
c. feel uncomfortable and embarrassed.	O	O	O	O	O	O	O
d. tell my teen to straighten up or I won't talk to her/him about it.	O	O	O	O	O	O	O
e. encourage my teen to talk about her/his feelings.	O	O	O	O	O	O	O
f. offer to help my teen practice so that s/he can do better next time.	O	O	O	O	O	O	O

5. If my teenager comes home from school and is very sad and upset because s/he feels excluded by the other kids at school, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. <u>NOT</u> get upset myself.	O	O	O	O	O	O	O
b. tell my teen that if s/he can't control her/himself, s/he will have to go to their room.	O	O	O	O	O	O	O
c. tell my teen it's okay to act upset when s/he feels bad.	O	O	O	O	O	O	O
d. comfort my teen and try to get her/him to think about something else s/he has to look forward to.	O	O	O	O	O	O	O
e. help my teen think of ways to make friends.	O	O	O	O	O	O	O
f. tell my teen that s/he will feel better soon.	O	O	O	O	O	O	O

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

6. If my teenager is visibly angry about being teased at school, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. tell my teen not to make a big deal out of it.	O	O	O	O	O	O	O
b. feel upset.	O	O	O	O	O	O	O
c. tell my teen to behave or s/he will have to work it out by her/himself.	O	O	O	O	O	O	O
d. help my teen think of constructive things to do when other kids tease her/him (like find other things to do).	O	O	O	O	O	O	O
e. comfort my teen and suggest something enjoyable to take her/his mind off the upsetting event.	O	O	O	O	O	O	O
f. encourage her/him to talk about how it hurts to be teased.	O	O	O	O	O	O	O

7. If my teenager is feeling very sad and wants to just stay in her/his room after breaking up with a girl/boyfriend, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. tell my teen that we can find chores for her/him to do if s/he has nothing better to do than moping.	O	O	O	O	O	O	O
b. feel angry at my teen for sulking.	O	O	O	O	O	O	O
c. help my teen think about ways that s/he can still have fun with friends.	O	O	O	O	O	O	O
d. tell my teen that there are lots of other people out there.	O	O	O	O	O	O	O
e. encourage my teen to express her/his feelings.	O	O	O	O	O	O	O
f. console my teen and do something enjoyable with her/him to make her/him feel better.	O	O	O	O	O	O	O

8. If my teenager is acting sad and glum because I won't allow her/him to stay out as late as her/his friends, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. remind myself to remain calm and not get upset.	O	O	O	O	O	O	O
b. try to comfort her/him.	O	O	O	O	O	O	O
c. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
d. help my teen figure out how to work things out so that s/he can still go out with her/his friends.	O	O	O	O	O	O	O
e. tell my teen that I understand that s/he is upset.	O	O	O	O	O	O	O
f. tell my teen to stop complaining or s/he won't be allowed to go out at all.	O	O	O	O	O	O	O

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

9. If my teenager is very distressed about doing poorly on an exam, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. get upset with my teen for not studying hard enough and then complaining about it.	O	O	O	O	O	O	O
b. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
c. help my teen think of ways to do better next time.	O	O	O	O	O	O	O
d. distract my teen by talking about good things that are happening.	O	O	O	O	O	O	O
e. tell my teen that it's okay to be sad when you don't do as well as you'd like.	O	O	O	O	O	O	O
f. tell my teen that's what happens when you don't study.	O	O	O	O	O	O	O

10. If my teenager is very disappointed about not making a team, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. comfort my teen and try to make her/him feel better.	O	O	O	O	O	O	O
b. tell my teen that it's not that big of a deal.	O	O	O	O	O	O	O
c. feel upset that I couldn't do anything to help.	O	O	O	O	O	O	O
d. tell my teen that if s/he can't deal with disappointment, s/he can't compete anymore.	O	O	O	O	O	O	O
e. encourage my teen to talk about her/his feelings.	O	O	O	O	O	O	O
f. offer to help her/him practice so that s/he can do better next time.	O	O	O	O	O	O	O

11. If my teenager is very angry about being unfairly disciplined at school, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. tell my teen not to make a big deal out of it.	O	O	O	O	O	O	O
b. feel angry.	O	O	O	O	O	O	O
c. tell my teen to calm down or s/he will have to work it out by her/himself.	O	O	O	O	O	O	O
d. help my teen think of ways to work out the problem at school.	O	O	O	O	O	O	O
e. comfort my teen and suggest something enjoyable to take her/his mind off the upsetting event.	O	O	O	O	O	O	O
f. encourage my teen to talk about how it feels to be punished unfairly.	O	O	O	O	O	O	O

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

12. If my teenager is feeling down after a friend moves away, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. NOT get upset.	O	O	O	O	O	O	O
b. tell my teen not to mope around and to go to her/his room until s/he calms down.	O	O	O	O	O	O	O
c. tell my teen that I understand that this is a hard loss for her/him.	O	O	O	O	O	O	O
d. comfort my teen and try to get her/him to think about something s/he has to look forward to.	O	O	O	O	O	O	O
e. help my teen think of ways to stay in touch.	O	O	O	O	O	O	O
f. tell my teen that s/he will feel better over time.	O	O	O	O	O	O	O

13. If my teenager acts irritable with me after having an argument with a friend, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. send my teen to her/his room to cool off.	O	O	O	O	O	O	O
b. get angry at my teen.	O	O	O	O	O	O	O
c. help my teen think about ways to resolve the misunderstanding with her/his friend.	O	O	O	O	O	O	O
d. tell my teen not to make a big deal out of nothing.	O	O	O	O	O	O	O
e. encourage my teen to express her/his feelings of anger and frustration.	O	O	O	O	O	O	O
f. suggest an enjoyable activity to make her/him feel better.	O	O	O	O	O	O	O

14. If my teenager is angry with me after I discipline her/him, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. tell my teen to stop acting like a teen.	O	O	O	O	O	O	O
b. feel angry.	O	O	O	O	O	O	O
c. tell my teen that if s/he keeps complaining, I'll give her/him something to complain about.	O	O	O	O	O	O	O
d. help my teen think of ways to avoid this problem in the future.	O	O	O	O	O	O	O
e. comfort my teen by reminding her/him that the punishment won't last forever.	O	O	O	O	O	O	O
f. encourage my teen to talk about her/his feelings.	O	O	O	O	O	O	O

1	2	3	4	5	6	7
Very Unlikely			**Medium**			**Very Likely**

15. If my teenager is irritable after her/his team loses an important game, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. comfort my teen and try to make her/him feel better.	O	O	O	O	O	O	O
b. tell my teen that s/he is overreacting.	O	O	O	O	O	O	O
c. feel upset about her/his loss.	O	O	O	O	O	O	O
d. tell my teen to keep their distance until s/he is able to be pleasant.	O	O	O	O	O	O	O
e. encourage my teen to talk about her/his feelings.	O	O	O	O	O	O	O
f. help my teen think of things that the team can do differently next time.	O	O	O	O	O	O	O

16. If my teenager is angry after having her/his backpack stolen at school, I would:	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a. get upset with my teen.	O	O	O	O	O	O	O
b. tell my teen not to make a mountain out of a mole hill.	O	O	O	O	O	O	O
c. help my teen think of ways to replace the backpack and the things in it.	O	O	O	O	O	O	O
d. distract my teen by talking about other things.	O	O	O	O	O	O	O
e. tell her/him that it helps to talk about it so that you don't bottle up the anger.	O	O	O	O	O	O	O
f. tell my teen that's what happens when you're not careful.	O	O	O	O	O	O	O

Appendix B
BRANY Approval Letter

BRANY

BRANY SBER IRB

DATE: 07/17/2020
TO: Martha Ann Bell, PhD
CC: commercialirb@vt.edu
FROM: Raffaella Hart, MS, CIP, BRANY SBER IRB (IRB00010793)

SUBMISSION TYPE: SBER-Modification (Event ID# 171439)
PROTOCOL NUMBER: 19-030-568 / VT# 19-352
STUDY TITLE: Psychobiology of Cognitive Development in Early Adolescence

REVIEW TYPE: Protocol (v. Jul.20200), Revised Parent Consent Form, Revised Assent Form, New COVID-119 Questionnaire, Revised Recruitment Emails and Phone Scripts, Survey and Recruitment Video Links, Thank you and Instructions Email, Video Scripts (05)

Thank you for your submission.

BRANY SBER IRB has approved the following for the above-referenced research:

- **Protocol (v.2, Jul.20200)**
- **New COVID-119 Questionnaire (BRANY stamp 7/17/2020)**
- **Revised Recruitment Emails and Phone Scripts (BRANY stamp 7/17/2020)**
- **Survey and Recruitment Video Links (BRANY stamp 7/17/2020)**
- **Thank you and Instructions Email (BRANY stamp 7/17/2020)**
- **Video Scripts (BRANY stamp 7/17/2020)**
- **Revised Parent Questionnaire Only Group Consent Form (Version B)**
- **Revised Assent Form – Questionnaire Group (Version B)**
  - Re-consent Required: If the research remains open to accrual at your site, use the enclosed to obtain consent from new subjects. For previously consented subjects still active or in follow-up (not including subjects in long term survival follow-up for whom the revisions are not applicable), use the enclosed to re-consent.

Non-Expiring IRB Approval Period:
This study was reviewed under the Revised Common Rule (2018 requirements) and therefore **does not require continuing review in accordance with 45 CFR 46.109(f)(1)(i).**

However, BRANY SBER IRB requires you "check in" at least annually to ensure your study status is up to date and in compliance. **Your Annual Report to BRANY SBER IRB is due on 07/07/2021.** If your research is completed before then, you must submit a notification of study closure to BRANY SBER IRB (use the xForm called: SBER-Study Status Change (Closed/Enrollment Closed)).

If you have any questions or require any additional information, please call me at 516-470-6909 or send an email to me at rhart@brany.com. Thank you.