Contextualizing the Development of Emotion Regulation in Early Adolescence: Results from the ABCD Study

by
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Abstract

Emotion regulation (ER) is known to be an important cognitive process which underlies both adaptive and maladaptive functioning. This thesis aimed to evaluate the associations between key micro- and macro-contexts and the levels of emotion dysregulation and strategy use in a longitudinal sample of early adolescence from the fourth wave of the Adolescent Brain and Cognitive Development (ABCD) study (N = 6,251, M_{age} = 12.9, SD = 0.64, 47.3% female, 58.1% Caucasian, 12.8% African American, 13.1% Hispanic). Proximal processes associated with family, school, and peer domains included child and parent reported family conflict, child reported school environment, and child reported prosocial and antisocial peer affiliation at the baseline assessment (Wave 1) and the three annual follow-up assessments (Waves 3-4). Key macro-contexts included parent reported family socioeconomic status and neighborhood deprivation at Wave 1. ER outcomes included both parent (overall dysregulation) and child report (strategies), assessed at Wave 4 only. Results indicate that micro-contexts are associated with emotion dysregulation and strategies at varying degrees of strength. On the contrary, macro-contexts were largely unassociated with emotion dysregulation or strategies and there was little evidence of consistent interactions between micro- and macro-contexts as predictors of such outcomes. Findings demonstrate some support for social ecological theory but suggest other factors may be relevant to the development of ER in early adolescence. Future directions addressed include need for analysis of other key micro-contexts (e.g., peer victimization experiences, parent ER). This was the first study to simultaneously investigate key micro- and macro-contexts as predictors of ER in early adolescence which furthers the understanding of how environmental contexts shape youth development during this sensitive period and provides a foundation for investigating the social-ecological predictors of ER.

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Chapter 1: Introduction

Taking a social ecological approach (Bronfenbrenner, 1977; Bronfenbrenner & Morris, 2006), the purpose of this thesis is to further understand the development of emotion regulation (ER) by investigating how the macro- and micro-contexts of family, neighborhood, school, and peers alone, as well as their interactions are associated with overall emotional dysregulation and use of ER strategies in early adolescence. ER is conceptualized as an individual's ability to identify and evaluate emotions then regulate responses to positive or negative stimuli and experiences (Gratz & Roemer, 2004; Gross, 2015; McRae & Gross, 2020; Zeman et al., 2006). I specifically selected ER as the outcome because there is strong evidence that it operates as an important transdiagnostic factor relevant to predicting a plethora of positive and negative psychological and behavioral outcomes, including a broad array of internalizing and externalizing problems (Aldao et al., 2016; Amstadter, 2008; Cludius et al., 2020; Sloan et al., 2017; Weissman et al., 2019).

ER has been widely studied in infancy and early childhood (Gilpin et al., 2015; Halligan et al., 2013; Harrington et al., 2020; Lincoln et al., 2017; Meyer et al., 2014). As children age, ER is theorized to shift from being external and other-regulated to being more internally regulated by the child (Sameroff, 2010). This implies that such regulation is influenced by the micro- and macro-contexts youth are embedded in, yet there is less literature regarding how various social ecologies might influence the development of ER beyond the foundation in which it develops in early childhood (Cole, 2014; Silvers, 2022). I will extend this work by evaluating what influences ER strategies and abilities in early adolescence.

Chapter 2: Literature Review

There are two primary conceptualizations of ER: emotion dysregulation and regulation strategies (Beauchaine et al., 2020; Crowell et al., 2020; Gross, 2014). Emotion dysregulation takes a holistic, deficit-oriented view of ER by focusing on an individual's overall inability to identify and regulate emotions (Bunford et al., 2020; Gratz & Roemer, 2004; Linehan, 2018; Paulus et al., 2021) and is often considered a broader, latent domain of ER (Compas et al., 2017). Alternately, ER strategies focus on individual cognitive techniques that one uses to regulate emotions and consider how each strategy differentially affects behavioral and psychological outcomes (Gross, 2015; McRae, 2016).

Emotional Dysregulation

Emotion dysregulation is broadly defined as one's general ability (or inability) to regulate their emotions (Compas et al., 2017). Measures that tap into this conceptualization capture individuals' perceptions of success when attempting to maintain mastery over their emotions and reactions (Gill et al., 2021; Gratz & Roemer, 2004). Currently, there are four generally accepted components: emotional awareness and understanding; emotional acceptance; ability to exercise impulse control during the experience of negative emotions; and the ability to utilize any ER strategy that is appropriate for specific situations and modulate emotional responses to achieve individual goals (Bunford et al., 2020; Gratz & Roemer, 2004).

Emotion dysregulation is commonly studied in relation to psychopathologies in clinical and community populations (Bunford et al., 2018; Dvir et al., 2014; Janiri et al., 2021; Laghi et al., 2021; McLaughlin et al., 2011) as it is poorly regulated emotional responses that link to psychopathology, rather than the experience of intense emotions alone (Hankin et al., 2005). Interestingly, one study with a sample of 6th-8th graders evaluated change in emotion regulation

and psychopathology symptoms (anxiety, aggressive behavior, eating pathology) at two timepoints (7 months apart) found that emotion dysregulation was predictive of psychopathology symptoms, but such symptoms were not predictive of emotion dysregulation (McLaughlin et al., 2011). These results indicate that emotion dysregulation functions as a risk factor for, rather than a consequence of, multiple psychopathologies.

Emotion Regulation Strategies

ER strategies are commonly framed using the process model of ER (Dryman & Heimberg, 2018; Gross, 1998; López-Pérez et al., 2017; Sala et al., 2014). This model focuses on the normative use of ER strategies and proposes that when experiencing any situation, people attend to, appraise, and respond to stimuli in an automatic cycle. ER strategies are employed when people consciously alter their attention, appraisal, or response to a situation with the goal of changing the trajectory of their emotions and subsequent reactions. Strategies include situation selection or modification, attentional deployment, cognitive reappraisal, and response modulations such as expressive suppression (Gross, 2015; López-Pérez et al., 2017; McRae, 2016). In some cases, ER strategies are categorized as "adaptive" or "maladaptive" (Aldao et al., 2015; Cavicchioli et al., 2022). The most studied strategies, and two of the outcome variables for this thesis, are cognitive reappraisal and expressive suppression (Gross & John, 2003; Gullone & Taffe, 2012; Spaapen et al., 2014).

Cognitive reappraisal occurs when an emotion is developing and focuses on altering one's appraisal of the situation which in turn alters their emotional reaction (Gross, 2015; McRae, 2016). In general, cognitive reappraisal is considered an adaptive strategy and has consistent links to greater well-being and social functioning (Cutuli, 2014; Jacobs & Gross, 2014; Troy et al., 2018). Yet, research has also shown that cognitive reappraisal requires higher

levels of effortful processing (López-Pérez et al., 2017; McRae et al., 2012). These trends were observed in Troy et al. (2018) where cognitive reappraisal was associated with various adaptive functions such as increasing positive emotions when exposed to sad film clips; however, it was also found that cognitive reappraisal was harder to employ compared to simply accepting one's feelings of sadness (i.e., engaging with one's emotions without judgment; Troy et al., 2018).

Alternately, expressive suppression occurs after an emotion is well developed and involves directly influencing the expression of emotion by inhibiting emotion expressive behavior (e.g., suppressing tears; Gullone & Taffe, 2012; Weissman et al., 2019). This strategy has had mixed reviews of adaptiveness in literature vis-à-vis its role in internalizing and externalizing disorders. Specifically, whereas some argue that expressive suppression is maladaptive due to its links with rumination and broader psychopathological symptoms (Weissman et al., 2019), others suggest it is adaptive that higher expressive suppression ability is related to lower levels of anxiety and depression (Chen et al., 2018). Theoretically, any ER strategy is beneficial compared to a lack of strategy (Aldao et al., 2015).

Early Adolescence as a Sensitive Context

Adolescence is a time of great emotional, behavioral, and relational change (Crocket & Petersen, 1993). In tandem with the onset of a sensitive period of brain development (Fuhrmann et al., 2015; Vijayakumar et al., 2018), there are several changes to social context that began in early adolescence including greater susceptibility to peer influence (Hashmi, 2013) and experiencing less adult supervision (Lam et al., 2014). Early adolescence has also been identified as a time which substance use and other mental health disorders are most likely to onset (e.g., Jordan & Andersen, 2017; Sharp & Wall, 2018). Taken together, changes in social contexts

coupled with the increased risk and demonstrated onset of mental health issues make this period especially impactful for development.

Those same factors also make early adolescence has also been identified as a key point for intervention work. Multiple programs targeting anti-bullying attitudes (Wójcik & Hełka, 2019), risky sexual behavior reduction (Blesson et al., 2022), and substance use avoidance (Teesson et al., 2020) have been implemented and found to be effective during this period. From a broader lens, fostering the development or maintenance of ER could have lasting implications across multiple domains of adaptive functioning. Taken together, the convergence of cognitive and social development leads to a fork in the road for development and the promotion of skills such as ER in early adolescence can have lasting implications on mental and behavioral outcomes.

Micro- and Macro-Contexts Relevant to Adolescent Emotion Regulation

The social ecological theory of development (Bronfenbrenner, 1977) transformed the study of human development to focus on the interplay between the various social contexts a person resides in and the person's subsequent developmental outcomes. Over the past 50 years, further theoretical iterations were conceptualized by Bronfenbrenner (Bronfenbrenner & Morris, 2006) and various other theories which also focus on the impact environment has on development have been created (Manuck & McCaffery, 2014; Moos, 1984; Waters et al., 2009). Across these models, and the plethora of empirical literature corroborating their assertions, it is well-established that a person's social context (i.e., family, school, peer, neighborhoods) can exert a significant effect on their development across the lifespan (for a review, see Morris et al., 2021). Yet, an ecological systems perspective has been rarely applied to understanding ER development in adolescence despite researchers having called for a more nuanced view into how

micro- and macro- level contexts serve as antecedents to and outcomes of specific ER strategies and overall ability (Aldao, 2013; Bariola et al., 2011; Bonanno & Burton, 2013; Eisenberg et al., 2010; McRae, 2016; Troy et al., 2017).

It is likely that the micro-systems of family, school, and peer contexts impact ER development via emotional socialization processes (Sameroff, 2010; Tyson et al., 2009). Research supporting these associations in ER has been shown in relation to supportive parent-child interactions (i.e., Berona et al., 2022; Cui et al., 2020), engaging school environment (Jacobs & Gross, 2014; Vierhaus et al., 2016), and prosocial peer behavior (Criss et al., 2021). To my knowledge, no study to date has evaluated all three micro-contexts as predictors of ER processes in one simultaneous analysis. Following prior work and social ecological theory, I hypothesize that family, school, and peer processes (i.e., heightened family conflict, poorer school environment, higher anti-social and lower pro-social peer affiliation) as well as lower SES and higher neighborhood deprivation would predict greater emotion dysregulation, decreased use of cognitive reappraisal, and increased use of expressive suppression.

Further, I expect that the association between micro-contextual processes and ER may be moderated by macro-contexts. As stipulated by ecological theory, micro-contexts are influenced by the larger macro-contexts they are embedded in and support of this relationship in regard to ER has appeared in the literature; however, those studies were focused on adults samples and limited to macro-context being measured by SES (i.e., De France & Evans, 2021; Hittner et al., 2019; Troy et al., 2017). While there is a lack of investigation on such associations in early adolescence, research across multiple other developmental periods does support an association between macro-contexts of SES and neighborhood deprivation on family functioning (Aber et al., 1997; Roubinov & Boyce 2017; Russell et al., 2014), academic engagement (Li et al., 2022;

Willms et al., 2009), and pro- or anti-social peer affiliation (Fergusson & Horwood, 1999; Visser et al., 2021). What is not clear is if SES and neighborhood deprivation additionally moderate these associations, such that micro-contexts become stronger predictors of ER under conditions of poorer resources (i.e., lower SES, greater neighborhood deprivation). In line with a social ecological framework, I hypothesized that would be the case and that associations been micro-contexts and ER will be stronger for those with less resources compared to those living in neighborhoods with greater resources.

Chapter 3: Methods

Participants

This project used publicly available longitudinal data from the Adolescent Brain Cognitive Development (ABCD) Study. The data used spans from baseline to the most recent release of Wave 4 (Karcher & Barch, 2021) and is accessed through the National Institute of Mental Health (NIMH) data archive. Participant recruitment was conducted using stratified probability sampling, primarily in schools within 50 miles of the 21 study cites throughout the United States (Garavan et al., 2018). Each assessment period happened annually with the baseline assessment occurring at age 9/10 and the follow-ups at ages 10/11, 11/12, and 12/13. At baseline, there were 11,876 youth participants (M_{age} = 9.92, SD = 0.62) along with their parent or guardian. By Wave 4, the most recent ABCD release (4.0), approximately half of the data are available for analysis (N = 6,251, M_{age} = 12.9, SD = 0.64, 47.3% female, 58.1% Caucasian, 12.8% African American, 13.1% Hispanic, 15.7% All Other[1]). As the outcome ER measures began being collected in Wave 4, analysis from the present study used only participants that have completed Wave 4 – though I included data from Waves 1-3 to predict ER at Wave 4.

I evaluated how those who participated in Wave 4 differed from those who did not and found negligible differences. Regarding race/ethnicity, there was a slightly higher proportion White participants at Wave 4 than Wave 1 (58.1% vs. 52.1%) and a slightly lower proportion of African American participants (12.8% vs 17.9%). There were also significant but small differences Wave 4 participation based on Wave 1 SES (Cohen's d = 0.11), ADI (d = 0.09), family conflict (d = 0.09), and school environment (d = 0.15) for those participating at Wave 4

[1] Child biological sex and race/ethnicity were reported by parent at the baseline assessment.

than those not participating. In general, these effect sizes were small and suggest little meaningful differences in participation (see Table 1 for details).

Table 1.

Missing Data Analysis

	Wave 1		Wave 4		
	n	%	*n*	%	*z*-test
% Female	5,680	47.8	2,955	47.3	0.44
Race/Ethnicity					
White	6,094	52.1	3,521	58.1	-7.71***
Black	2,112	18.1	785	12.9	9.01***
Asian	614	5.3	326	5.4	0.28
Hispanic	2,411	20.6	1,176	19.6	1.59
All Other	456	3.9	238	3.9	0.00
	M	*SD*	*M*	*SD*	Cohen's d
SES	0.00	1.90	0.21	1.79	0.11***
ADI	40.04	26.97	37.45	25.50	0.09***
Family Conflict	2.54	1.96	2.36	1.95	0.09***
School Environment	3.32	0.47	3.25	0.46	0.15***

Notes. This table shows differences in study demographics (sex, race/ethnicity, predictor variables at Wave 1) by participation and non-participation at Wave 4. SES = Socioeconomic status, ADI = Area Deprivation Index. Statistical significance is denoted by *** $p < .001$.

Measures

Emotion Dysregulation (parent report, Wave 4)

The Difficulties in Emotion Regulation Scale- Parent Report (DERS-P; Bunford et al., 2020) measures emotional dysregulation. The DERS-P was developed from the DERS self-report (Gratz & Roemer, 2004) by Bunford et al. (2020). The parent-report scale is 29 items broken down into four subscales: 1. Catastrophize (ex., "When my child is upset, he/she feels out of control."), 2. Negative Secondary (ex., "When my child is upset, he/she feels guilty for feeling that way."), 3. Attuned (ex., "My child knows exactly how he/she is feeling."), and 4. Distracted (ex., "When my child is upset, he/she has difficulty focusing on other things."; αs = .88 - .93). Items are rated on a Likert scale ranging from 1 (*almost never*) to 5 (*almost always*) with higher scores indicating higher rates of emotion dysregulation.

Emotion Regulation Strategies (child report, Wave 4)

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) measures two distinct emotion regulation strategies: cognitive reappraisal (ex., "When I want to feel less bad (e.g., sad, angry, worried) about something, I change the way I'm thinking about it"; .α = .72) and expressive suppression (ex., "When I want to feel less bad (e.g., sad, angry, worried) about something, I think about something different."; α = .75). Each subscale has three items which are rated on a Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Higher scores in each subscale indicates higher use of that regulation strategy.

Family Conflict (parent and child report, Wave 1, 2, 3, and 4)

A modified version of the Conflict Subscale from Family Environment Scale (FES; Moos & Moos, 1976) was used to measure family conflict. The Conflict Subscale was administered to both youth and parents and is composed of 9 items (ex., "Family members often criticize each

other."; "Family members sometimes hit each other."). For the ABCD study, the questions were answered on a dichotomous scale of 0 (*no*) or 1 (*yes*) and scores were summed to create an index with higher scores indicating greater amounts of family conflict. For each wave, parent and child sum scores were averaged for analysis (rs = .20-.27 across Waves, ps < .001).

School Environment (child report, Wave 1, 2, 3, and 4)

The School Environment Subscale of the PhenX School Risk and Protective Factor Scale (Zucker et al., 2018) was used as the measure of school context. The subscale consists of 8 items (ex., "My teacher(s) notices when I am doing a good job and lets me know about it."; "In my school, students have lots of chances to help decide things like class activities and rules."); αs ranged from .61 to .70 across waves. Items were scored on a scale of 1 (*NO! – Definitely not true*) to 4 (*YES! – Definitely true*). An average score was calculated with higher scores indicating a better school environment.

Prosocial and Antisocial Peer Affiliation (child report, Wave 3 and 4)

Peer affiliation was measured by the Peer Behavior Profile (Bingham et al., 1995). The measure includes two subscales: Prosocial Peer Involvement (i.e., my friends are athletes, go to church once a month or more, are excellent students) and Rule Breaking/Delinquent Peer Involvement (i.e., my friends have skipped school, been suspended from school, shoplift occasionally). Each item was answered on a scale of 1 (*none or almost none*) to 5 (*all or almost all*). Due to poor reliability of prosocial peer affiliation (α = .45-.47) and disagreement with the notion that athletes and going to church are core to the measure of prosocial peer affiliation, I elected to use a single item for prosocial peer affiliation, "[My friends] are excellent students (GPA 3.5 [B+] or better)." Due to low frequency of antisocial peer affiliation and poor reliability

(α = .55-.59), values for the 3 items were recoded to be dichotomous such that 0 (*none of my friends*) and 1 (*some or more of my friends*) then summed.

Socioeconomic Status (parent report, Wave 1)

Socioeconomic status (SES) was calculated by summing the z-scores of household income (1 = *Less than $5,000* to 10 = *$200,000 and greater*), parental education level (12 = *12th grade* to 21 = *Doctoral degree*), and parent partner's education level (12 = *12th grade* to 21 = *Doctoral degree*). The average parental and partner education level was an associates or occupational degree. The average household income rating was 7.22 (*SD* = 2.42) with a median of 8 (7 = *$50,000 through $74,999*; 8 = *$75,000 through $99,999*).

Neighborhood Deprivation (parent report, Wave 1)

The Area Deprivation Index (ADI) was used to measure neighborhood deprivation. ADI is a system which uses 17 criteria (i.e., population education level; percentage of people living below the poverty level; medium family income) to quantify structural disadvantages across each neighborhood in the United States as measured in percentile (1-100 with the higher score indicating more deprivation; Kind & Buckingham, 2018). As there was little change in residence and/or associated ADI and given the strong correlations in ADI across assessment periods (*r*s = .73-.80), and to reduce issues with multicollinearity in the modeling, we elected to use the percentile score from the baseline assessment only.

Data Analytic Plan

Given the factor structure of the emotion dysregulation measure for parent report (DERS-P) is relatively new (Bunford et al., 2018) compared to the DERS self-report (Bardeen et al., 2016; Gratz & Roemer, 2004; Victor & Klonsky, 2016), I first conducted a confirmatory factor analysis (CFA) of emotion dysregulation. I tested the four-factor solution of the DERS-P

identified by Bunford and colleagues (2020) with a sample of adolescent parents recruited online through MTurk as well the six-factor solution demonstrated by Gratz & Roemer (2004) with a sample of college undergraduates. The factor loadings and fit statistics of each model were evaluated and any appropriate changes were made for the final scale structure. Due to the large sample size, the model is nearly guaranteed to have a significant Chi-Square value, thus, RMSEA and SRMR are better indicators of model fit (Kline, 2005; Hu & Bentler, 1999). RMSEA values of 0.01 or below are considered excellent fit, between 0.02 and 0.08 is considered adequate fit, and greater than 0.10 is considered poor fit (Kline, 2005). For SRMR, values of less than 0.08 are considered adequate fit and for TLI, values equal to or greater than 0.95 will be considered adequate (Hu & Bentler, 1999).

I then tested for measurement invariance by sex and race/ethnicity in the DERS-P using multiple-group modeling in Mplus. As the DERS-P is a newer measure, to my knowledge measurement invariance has not yet been tested at the time of this project. Invariance of structure pattern (configural), factor loadings (metric), intercepts (scalar), and residual variances were compared across groups for the current measurement model. As with the factor analyses, large sample sizes can inflate the chi-square differences and cause statistical significance while the true differences are not substantial (Cheung & Rensvold, 2002), thus, model fit indices have been referred to better indicators of measurement invariance for large sample sizes (Kline, 2015; Putnick & Bornstein, 2016). The most common fit indices used to evaluate measurement invariance is CFI with acceptable changes ranging from 0.002 (Meade et al., 2008) to 0.01 (Cheung & Rensvold, 2002). Additional RMSEA and SRMR statistics can be added to further validate the invariance. RMSEA changes of 0.015 or less are considered good. SRMR changes very by measurement model with a change of 0.030 or less being accepted for metric invariance

and a change of 0.015 or less being accepted for scalar and residual invariance. Models were considered invariant if they have a change in CFI less than or equal to 0.01 combined with the recommended RMSEA and SRMR values per model type.

After finalizing the measurement model of ER, I evaluated the predictors of emotion dysregulation and the ER strategies via a main effects model (see Figure 1 for a conceptual overview). To take full advantage of the data and analyze for potential nuance of developmental context, and given the large sample size, I evaluated the effect of each micro-contextual predictor at each wave for all waves available (i.e., family conflict at Wave 1, 2, 3, and 4; school environment at Wave 1, 2, 3, and 4; and prosocial and antisocial affiliation at Wave 3 and 4), in addition to macro-contextual factors (family SES and ADI at Wave 1). All predictors were specified to correlate with one another as well as with the residual correlations between emotion dysregulation and strategies. Covariates included were sex (1 = male, 0 = female) and race/ethnicity (White = 1, Adolescents of Color = 0) given initial analyses showed these demographics explained significant variance in ER outcomes.

Finally, I evaluated the interactions between each pair of macro- with micro-contexts at each wave for a total of 24 interactions tested in one simultaneous model (family SES x 4 family conflict, 4 school environment, 4 peer factors; neighborhood deprivation x 4 family conflict, 4 school environment, 4 peer factors). All predictors were grand mean-centered prior to computing interaction terms. Any significant interactions will be plotted, and follow-up analyses of conditional slopes will be tested at +/- 1 SD of the mean centered moderator (Whisman & McClelland, 2005). Given the many interactions tested, I elected to use an adjusted *p*-value ($p < .01$) and review the overall pattern of interaction results rather than relying on any one specific finding to support the hypothesis.

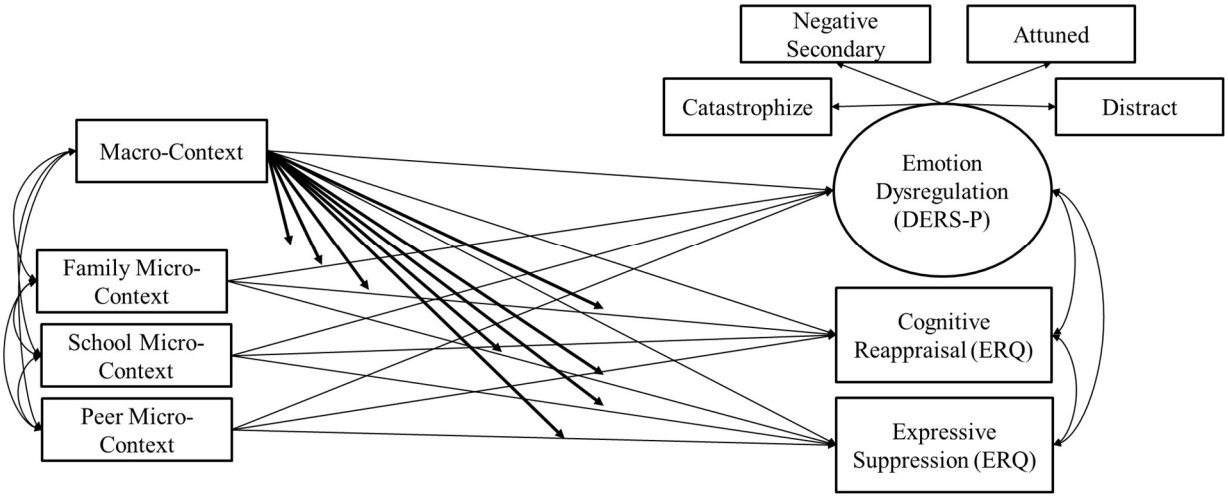

Figure 1.

Conceptual Model Describing Study Hypotheses

Notes. DERS-P = the Difficulties in Emotion Regulation Scale-Parent Report, ERQ = the Emotion Regulation Questionnaire. This figure describes the study hypotheses. Macro-context refers to family socioeconomic status and neighborhood deprivation. Family micro-context refers to family conflict, school micro-context to school environment, and peer micro-context to prosocial and antisocial peer affiliation. In addition to main effects, I evaluated interactions between each macro and micro-context construct. I expected associations been micro-contexts and ER (both ability and strategies) will be stronger for those with greater neighborhood deprivation and lower family SES compared to those living in more privileged neighborhoods and in families with greater resources. I estimated a latent factor of ER based on the DERS-P sub-scales and correlate the residual with the two ER strategy scales and explore how results may vary by ER ability vs. strategies.

Chapter 4: Results

Confirmatory Factor Analysis

To begin, a confirmatory factor analysis (CFA) of Bunford and colleagues' (2020) four factor model for the DERS-Parent Report was conducted. The data fit the model adequately (χ^2 = 16613.79, *df* = 371, *p* < .001; RMSEA = .08, 90% CI: .08, .09; SRMR = .07; TLI = .86). The six-factor model reported by Gratz and Roemer (2004) for the self-report DERS was also tested. The fit was also adequate (χ^2 = 13908.93, *df* = 362, *p* < .001; RMSEA = .08, 90% CI: .08, .08; SRMR = .06; TLI = .88) but demonstrated linear dependency with the Clarity and Awareness subscales correlating at 1.02 which indicates that there is no conceptual difference between these two scales. For each factor structure, two items ("When my child is upset, he/she knows that he/she can find a way to eventually feel better.", and "When my child is upset, he/she feels like he/she can remain in control of his/her behaviors.") had a factor loading < .40. Those items were removed, and each structure was re-run. The model fit for Bunford and colleague's (2020) four-factor structure improved slightly but remained in the adequate range (χ^2 = 13793.37, *df* = 318, *p* < .001; RMSEA = .08, 90% CI: .08, .08; SRMR = .06; CFI = .89; TLI = .87). The fit of Gratz and Roemer (2004) six-factor model also improved slightly, however the structure still demonstrated linear codependency (*r* = 1.02). See Table 2 for a comparison of model fit indices. Overall, the results of the four-factor CFA with two items removed demonstrated the best fit of models tested and the factors were conceptually sound, thus the four-factor model with two items removed was deemed the most appropriate structure. Items and factor loadings for the final 4-factor solution are provided in Table 3.

Table 2.

The Difficulties in Emotion Regulation Scale- Parent Report: Factor Structure Fit Statistics Comparisons

Measures of Goodness of Fit	Acceptable Value	Factor Structure			
		Four Factor		Six Factors	
		All 29 Items	27 Items	All 29 Items	27 Items
χ^2 (df)		16613.794*** (371)	13793.369*** (318)	13908.928*** (362)	11105.672*** (309)
TLI	< .95	0.856	0.876	0.877	0.897
SRMR	< .08	0.065	0.055	0.062	0.050
RMSEA	< .10	0.084***	0.083***	0.078***	0.075***
90% CI		0.083, 0.086	0.082, 0.084	0.077, 0.079	0.074, 0.077

Notes. This table shows differences in fit statistics in comparing the four- and six-factor models. df = degrees of freedom; CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual, CI = Confidence interval. Statistical significance denoted by *** $p < .001$

Table 3.

The Difficulties in Emotion Regulation Scale- Parent Report: Factor Loadings and Items Following Confirmatory Factor Analysis

Items by Subscale	Factor Loading
Catastrophizing	
My child experiences his/her emotions as overwhelming and out of control	0.60
When my child is upset, he/she has difficulty controlling his/her behaviors.	0.82
When my child is upset, he/she becomes out of control.	0.80
When my child is upset, he/she believes that he/she will end up feeling very depressed.	0.64
When my child is upset, his/her emotions feel overwhelming.	0.80
When my child is upset, he/she believes that there is nothing he/she can do to make him/herself feel better.	0.74
When my child is upset, it takes him/her a long time to feel better.	0.77
When my child is upset, he/she loses control over his/her behaviors.	0.82
When my child is upset, he/she feels out of control.	0.84
When my child is upset, he/she believes that he/she will remain that way for a long time.	0.73
Negative Secondary	
When my child is upset, he/she becomes angry with him/herself for feeling that way.	0.64
When my child is upset, he/she feels ashamed with him/herself for feeling that way.	0.80
When my child is upset, he/she becomes embarrassed for feeling that way.	0.64
When my child is upset, he/she starts to feel very bad about him/herself.	0.78
When my child is upset, he/she feels guilty for feeling that way.	0.74
When my child is upset, he/she becomes irritated with him/herself for feeling that way.	0.81
When my child is upset, he/she feels like he/she is weak.	0.67
Attuned	
My child pays attention to how he/she feels.	0.88
My child is clear about his/her feelings.	0.80
My child is attentive to his/her feelings.	0.81
My child cares about what he/she is feeling.	0.79
My child knows exactly how he/she is feeling.	0.81
When my child is upset, he/she acknowledges his/her emotions.	0.74
Distracted	
When my child is upset, he/she has difficulty concentrating.	0.87
When my child is upset, he/she has difficulty getting work done.	0.81
When my child is upset, he/she has difficulty thinking about anything else.	0.83
When my child is upset, he/she has difficulty focusing on other things.	0.89

Notes. Showing standardized factor loadings for each item from the final four factor model.

Measurement Invariance Analysis

Once concluding that the four-factor structure fit the data best, measurement invariance analyses were conducted for sex and racial/ethnic groupings. As shown in Table 4, for biological sex (n = 3,296 males, n = 2,955 females), change in fit statistics were within the acceptable range when comparing metric, scalar and residual variance models. Thus, there were no notable differences in factor loadings, intercepts, or residual variances based on male or female status.

Table 4.

The Difficulties in Emotion Regulation Scale- Parent Report: Sex Invariance Test Results

Model	$\chi2$ (*df*)	CFI	RMSEA (90% CI)	SRMR	Comp. Model	$\Delta\chi2$ (Δdf)	ΔCFI $\leq .010$	ΔRMSEA $\leq .015$	ΔSRMR $\leq .015$	Decision
M1: Configural Invariance	14169 (689)	0.887	0.079	0.053	--	--	--	--	--	--
M2: Metric Invariance	14327 (712)	0.886	0.078	0.055	M1	158 (23)	0.001	0.001	0.002	Accept
M3: Scalar Invariance	14723 (735)	0.883	0.078	0.055	M2	396 (23)	0.003	0.000	0.002	Accept
M4: Residual Invariance	14876 (708)	0.881	0.077	0.056	M3	153 (27)	0.002	0.001	0.001	Accept

Notes. This figure shows fit statistics for each of the four models tested. M1 evaluates the structural pattern, M2 the factor loadings, M3 the intercepts, and M4 the residual variances. *df* = Degrees of Freedom, CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual.

For racial/ethnic groupings, participants were organized into five categories for each group to have large and relatively even sample sizes for the analysis. Non-Hispanic White was the largest grouping and thus served as the reference group (n = 3,575) with Black/African American being the second grouping (n = 794), Asian the third grouping (n = 334), Hispanic (of any race) the fourth grouping (n = 1,208), and all other identities (American Indian, Alaskan Native, Native Hawaiian, and Pacific Islanders) in a fourth grouping (n = 243). The change in fit statistics was within acceptable ranges for metric and scalar invariance; however, the ΔCFI for residual invariance was outside of acceptable range (≤ .01). Based on the modification indices provided, the residual variances for two items ("When my child is upset, he/she becomes angry with him/herself for feeling that way." And "My child experiences his/her emotions as overwhelming and out of control.") were freed across groups and the change in CFI fell into the acceptable range allowing for partial residual invariance. Model comparisons are shown in Table 5. With both items' residual variances allowed to vary between groups, results showed that the model was able to explain more variance in responses for participants who identified as White or any other category (βs ranged from .49 to .54, ps <.001). than those who identified as Black, Asian, or Hispanic (βs ranged from .59 to .75, ps <.001). As the overall factor structure was invariant and to test moderation achieving configural, metric, and scalar, but not residual invariance, has been deemed necessary (Memon et al., 2019; Milfont & Fischer, 2015), I proceeded to analyze results for the entire sample.

Table 5.

The Difficulties in Emotion Regulation Scale-Parent Report: Race/Ethnicity Invariance Test Results

Model	χ2 (df)	CFI	RMSEA	SRMR	Comp. Model	Δχ2 (Δdf)	ΔCFI ≤.010	ΔRMSEA ≤ .015	ΔSRMR ≤ .015	Decision
M1: Configural Invariance	15479 (1586)	0.884	0.085	0.058	--	--	--	--	--	--
M2: Metric Invariance	15818 (1678)	0.882	0.083	0.061	M1	339 (92)	0.002	0.002	0.003	Accept
M3: Scalar Invariance	16351 (1770)	0.878	0.083	0.061	M2	533 (92)	0.004	0.000	0.000	Accept
M4: Residual Invariance	18239 (1878)	0.863	0.085	0.068	M3	1888 (108)	*0.015*	0.002	0.007	Reject
M5: Partial Residual Invariance	17521 (1870)	0.869	0.083	0.064	M3	1170 (100)	0.006	0.002	0.003	Accept

Notes. This figure shows fit statistics for each of the four models tested. M1 evaluates the structural pattern, M2 the factor loadings, M3 the intercepts, and M4 the residual variances. M5 was also tested (frees two items from invariance across groups) after rejecting total residual invariance based on M4 results. *df* = Degrees of Freedom, CFI = Comparative Fit Index, RMSEA = Root Mean Square Error of Approximation, SRMR = Standardized Root Mean Square Residual.

Preliminary Analysis

Correlations and descriptive statistics for ER and predictor variables are in Tables 6 and 7, respectively. Correlations were largely significant and in the expected directions, however, weaker than anticipated. ER variable by predictor correlations are presented in Table 8. These correlations were also largely significant and in the expected direction, with the exception of neighborhood deprivation. These correlations were also small in effect size.

Table 6.

Emotion Regulation Variable Correlations and Descriptive Statistics

	1	2	3	4	5	6
1. ERQ Cognitive Reappraisal	1.0					
2. ERQ Expressive Suppression	.27***	1.0				
3. DERS-P Catastrophize	-.05***	.03*	1.0			
4. DERS-P Negative Secondary	-.02***	.05***	.63**	1.0		
5. DERS-P Attune	-.05***	.08***	.25***	.11***	1.0	
6. DERS-P Distract	-.05***	<.01	.75***	.48**	.23***	1.0
M	3.36	3.05	1.62	1.61	2.22	2.32
SD	0.79	0.86	0.74	0.70	0.91	1.07
Min	1.00	1.00	1.00	1.00	1.00	1.00
Max	5.00	5.00	5.00	5.00	5.00	5.00
Skew	-0.48	.05	1.81	1.73	0.61	0.88
Kurtosis	0.28	-0.26	3.43	3.54	-0.42	-0.06
N	6233	6234	6140	6130	6138	6136
α	.72	.75	.93	.88	.92	.91

Notes. This table shows correlations between the subscales of each ER outcomes measure ERQ = Emotion Regulation Questionnaire, DERS-P = Difficulty in Emotion Regulation Scale- Parent Report. Statistical significance is denoted by * $p < .05$, ** $p < .01$, *** $p < .001$

Table 7.

Predictor Correlations and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. ADI	1.0													
2. Family SES	-.39***	1.0												
3. Family Con W1	.10***	-.09***	1.0											
4. Family Con W2	.08***	-.07***	.59***	1.0										
5. Family Con W3	.06***	-.06***	.56***	.63***	1.0									
6. Family Con W4	<.01	.02	.51***	.60***	.66***	1.0								
7. Sch Env W1	-.01	-.02	-.15***	-.11***	-.10***	-.10***	1.0							
8. Sch Env W2	-.08***	.05***	-.13***	-.18***	-.16***	-.14***	.38***	1.0						
9. Sch Env W3	-.03*	.01	-.09***	-.14***	-.17***	-.16***	0.31***	.44***	1.0					
10. Sch Env W4	-.01	.01	-.08***	-.11***	-.14***	-.20***	0.25***	.37***	.49***	1.0				
11. Pros Peer W3	-.10***	.13***	-.07***	-.09***	-.10***	-.07***	.10***	.17***	.19***	.15***	1.0			
11. Pro Peer W4	-.12***	.16***	-.09***	-.12***	-.12***	-.13***	.07***	.14***	.16***	.22***	.38***	1.0		
13. Anti Peer W3	.23***	-.22***	.11***	.12***	.16***	.12***	-.06***	-.14***	-.16***	-.16***	-.20***	-.20***	1.0	
14. Antis Peer W4	.23***	-.21***	.10***	.11***	.16***	.19***	-.06***	-.13***	-.15***	-.22***	-.19***	-.26***	.50***	1.0
M	37.45	0.21	2.22	2.11	2.13	2.20	3.33	3.41	3.27	3.25	3.61	3.70	0.47	0.51
SD	25.50	1.79	1.47	1.45	1.51	1.56	0.46	0.44	0.47	0.46	1.12	1.09	0.74	0.78
Min	1.00	-7.60	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
Max	100.00	13.21	8.50	9.00	8.50	9.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00
Skewness	0.75	0.21	0.71	0.81	0.79	0.77	-0.83	-0.95	-0.63	-0.58	-0.47	-0.58	1.52	1.43
Kurtosis	-0.24	6.65	0.23	0.56	0.32	0.31	0.98	1.24	0.58	0.30	-0.75	-0.58	1.64	1.24
N	5981	6248	6231	6096	6126	6246	6238	6105	6131	6243	5943	5709	6073	6028
α	N/A	N/A	.66-.68	.66-70	.67-.69	.69[e]	.61	.65	.69	.70	N/A	N/A	N/A	N/A

Notes. This table shows correlations between the 14 predictor variables (ADI = area deprivation index, SES = socioeconomic status, Fam Con = Family Conflict, Sch Env = School Environment, Pro Peers = Prosocial Peer Affiliation, Anti Peers = Antisocial Peer Affiliation) and associated descriptive statistics.

Table 8.

Emotion Regulation Variables by Predictor Correlations

	ERQ Cognitive Reappraisal	ERQ Expressive Suppression	DERS-P Catastrophize	DERS-P Negative Secondary	DERS-P Attuned	DERS-P Distract
1. ADI	.02	.07***	-.01	.02	-.05***	-.07***
2. Family SES	.01	-.07***	-.01	-.05***	.05***	.09***
3. Family Con W1	-.02	.08***	.22***	.13***	.12***	.17***
4. Family Con W2	-.03*	.09***	.24***	.12***	.13***	.19***
5. Family Con W3	-.01	.11***	.27***	.14***	.15***	.20***
6. Family Con W4	-.03	.13***	.29***	.15***	.17***	.22***
7. Sch Env W1	.06***	-.07***	-.05***	-.02	-.08***	-.08***
8. Sch Env W2	.06***	-.13***	-.08***	-.05***	-.07***	-.09***
9. Sch Env W3	.10***	-.14***	-.08***	-.04**	-.07***	-.07***
10. Sch Env W4	.10***	-.19***	-.09***	-.06***	-.08***	-.09***
11. Pros Peer W3	.04***	-.06***	-.04**	-.01	-.02	-.04*
11. Pro Peer W4	.05***	-.11***	-.08***	-.03	-.07***	-.07***
13. Anti Peer W3	-.01	.14***	.05***	.03*	.02	.01
14. Antis Peer W4	-.02	.16***	.07***	.06***	.04*	.02

Notes. This table shows correlations between the subscales of each ER outcomes measure and 14 predictor variables (ERQ = Emotion Regulation Questionnaire, DERS-P = Difficulties in Emotion Regulation-Parent Report, ADI = area deprivation index, SES = socioeconomic status, Fam Con = Family Conflict, Sch Env = School Environment, Pro Peers = Prosocial Peer Affiliation, Anti Peers = Antisocial Peer Affiliation). Statistical significance is denoted by * $p < .05$, ** $p < .01$, *** $p < .0$

Emotion Dysregulation Latent Variable Modeling

As the DERS-P is intended to be used as an overall measure of emotion dysregulation, I estimated a latent factor as indicated by the four subscales aligning with the Bunford et al.'s (2018) original labelling (Catastrophizing, Negative Secondary, Attuned, and Distracted). I included Cognitive Reappraisal and Expressive Suppression as covarying dependent variables. Model fit indices showed adequate fit ($\chi^2 = 128.57$, $df = 8$, $p < .001$; RMSEA = .05, 90% CI: .04, .06; SRMR = .02; TLI = .98). However, the Attuned subscale had a standardized factor loading of .25, well below the .40 cut off though statistically significant at $p < .001$. Thus, the latent variable was refitted with the remaining three subscales and Attuned was included as a covarying dependent variable along with the two ER strategies. The refitted model continued to show adequate fit ($\chi2 = 80.69$, $df = 6$, $p < .001$; RMSEA = .05, 90% CI: .04, .05; SRMR = .02; TLI = .98) and all three subscales now loaded onto the latent factor well (standardized loadings ≥ .64). The attuned subscale showed a weak correlation ($r = .25$, $p < .001$) with the latent variable. The final measurement model selected is presented in Figure 2.

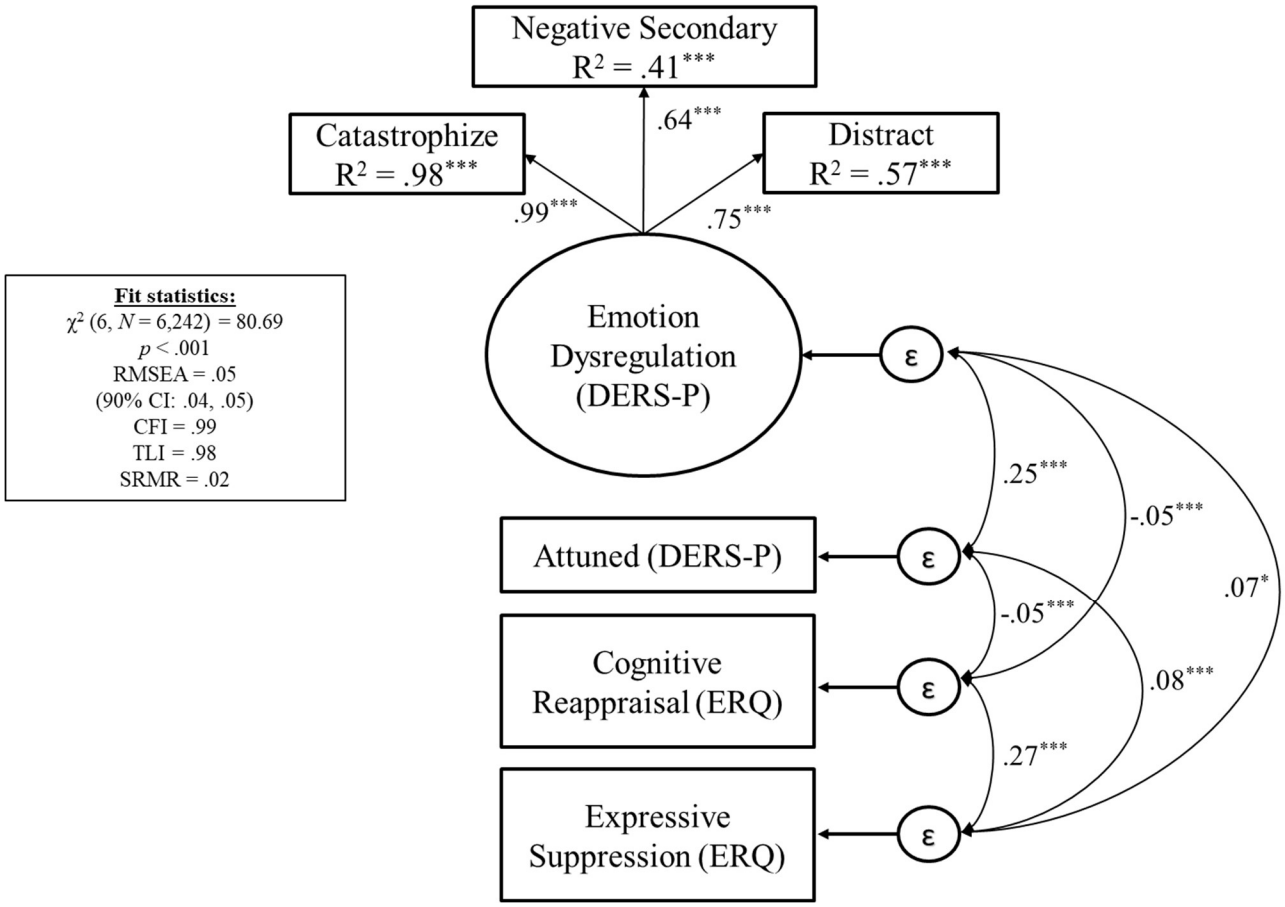

Figure 2.

Final Measurement Model of the Difficulties in Emotion Regulation Scale- Parent Report

Notes. DERS-P = the Difficulties in Emotion Regulation Scale-Parent Report, ERQ = the Emotion Regulation Questionnaire, Ɛ = residual variance. Showing standardized coefficients. Statistical significance is denoted by * $p < .05$, ** $p < .01$, *** $p < .001$

Main Effects Predicting Emotion Dysregulation and Emotion Regulation Strategies

Structural equation modeling was used to evaluate the effect of each set of predictors on the outcome. Following social ecological theory, the effects of an individual's demographics (sex and racial/ethnic identity) in tandem with different levels of environmental influence and their interactions were tested across four models, all of which indicated adequate fit. Model 1 tested

the effects of covariates alone ($\chi 2 = 282.17$, df = 18, $p < .001$; RMSEA = .05; 90% CI: .04, .05; SRMR = .02; TLI = .95). Model 2 then added micro-contexts ($\chi 2 = 554.37$, df = 54, $p < .001$; RMSEA = .04; 90% CI: .04, .04; SRMR = .02; TLI = .90). Model 3 added macro-contexts ($\chi 2 = 653.99$, df = 60, $p < .001$; RMSEA = .04; 90% CI: .04, .04; SRMR = .02; TLI = .88) then finally Model 4 included the addition of interaction effects of macro x micro-contexts ($\chi 2 = 782.94$, df = 132, $p < .001$; RMSEA = .03; 90% CI: .03, .03; SRMR = .01; TLI = .87). Results from each model are shown in Table 9.

Model 1 results showed covariates (being male, being non-Hispanic White) were significantly associated with greater emotion dysregulation and a lack of emotional attunement (βs ranged from .03 to .12, ps ≤ .04). Being male was also significantly associated with a lower likelihood of using cognitive reappraisal (β = -.04, $p = .002$). Being non-Hispanic White was also associated with less expressive suppression (β = -.10, $p < .001$).

Model 2 included both covariates and micro-contextual factors and addresses my first central study hypotheses. The aforementioned effects of sex and race/ethnicity held, and multiple, yet differing, micro-context processes were significant predictors of each outcome. For latent emotion dysregulation, family conflict at Waves 1, 3, and 4 showed significant, positive associations (βs ranged from .05 to .17, ps ≤ .002), while school environment at Wave 4 showed a significant, negative association (β = -.03, $p = .03$). For emotional attunement, which higher scores indicate less clarity or awareness of emotions, family conflict at Waves 3 and 4 showed significant, positive associations (βs = .04 and .11, respectively, ps ≤ .04), while school environment at Wave 1 and Wave 4 and pro-social peer affiliation at Wave 4 showed significant, negative associations (βs = -.03 - -.05, ps ≤ .04). Cognitive reappraisal showed significant,

Table 9.

Multivariate Structural Equation Results (N = 6251)

	Model 1: Covariates				Model 2: Covariates + Micro Main effects				Model 3: Covariates + Micro and Macro Main effects				Model 4: Covariates + Micro and Macro Main effects + Interactions			
	ED	AT	CR	ES	ED	AT	CR	ES	ED	AT	CR	ES	ED	AT	CR	ES
Covariates																
Sex (1=male)	.06***	.12***	-.04**	.02	.05***	.11***	-.03*	-.01	.04**	.10***	-.03*	-.01	.04**	.10***	-.03*	-.01
Race (1=white)	.03*	.07***	-.02	-.10***	.03*	.07***	-.02	-.07***	.02	.05***	-.03	-.06***	.03	.05***	-.03	-.06***
R^2	.01**	.02***	<.01	.01***	--	--	--	--	--	--	--	--	--	--	--	--
Micro-Contexts																
Fam Con W1					.05**	.02	-.01	<.01	.05**	.01	<.01	<.01	.05**	.03	-.01	<.01
Fam Con W2					.03	.02	-.02	-.01	.04*	.01	.01	-.01	.04*	.02	-.02	-.01
Fam Con W3					.10***	.04*	.04*	.02	.10***	.06**	.01	.01	.10***	.04*	.04*	.02
Fam Con W4					.17***	.11***	-.01	.06***	.17***	.13***	<.01	.01	.17***	.10***	-.01	.07***
Sch En W1					<.01	-.04*	.02	<.01	-.01	-.04**	.02	<.01	<.01	-.03*	.03	.00
Sch En W2					-.01	-.01	.01	-.04**	-.03	-.02	.01	-.04**	<.01	-.01	.01	-.04**
Sch En W3					<.01	-.01	.05**	-.03	-.01	-.01	.05**	-.04*	<.01	.00	.05**	-.03
Sch En W4					-.03*	-.03*	.06***	-.12***	-.05**	-.04*	.06***	-.13***	-.03*	-.02	.06***	-.13***
Pro Peers W3					<.01	.02	.02	.01	-.01	.02	.02	.01	<.01	.02	.01	.01
Pro Peers W4					-.02	-.05**	.03	-.03*	-.03*	-.05***	.02	-.03*	-.03	-.05**	.03*	-.03*
Anti Peers W3					<.01	-.02	.02	.05**	.01	-.01	.02	.05**	<.01	-.01	.02	.05**
Anti Peers W4					<.01	<.01	<.01	.06***	.02	.02	<.01	.07***	<.01	.01	.00	.06***
ΔR^2					.10	.04	.02	.06	--	--	--	--	--	--	--	--
R^2					.11***	.06***	.02***	.07***	--	--	--	--	--	--	--	--
Macro-Contexts																
Family SES									-.01	.02	.03	-.02	<.01	.02	.02	-.03
ADI									-.02	-.04*	.03	.01	-.03	-.04**	.02	<.01
ΔR^2									.01	.01	<.01	-.01	--	--	--	--
R^2									.12***	.07***	.02***	.06***	--	--	--	--
Interactions																
SES x Fam Con W1													-.05**	-.01	-.01	-.02

SES x Fam Con W2	<.01	.01	.02	.02
SES x Fam Con W3	.03	-.01	-.05*	-.06**
SES x Fam Con W4	.01	-.03	.02	.02
SES x Sch En W1	-.03	-.02	.01	.00
SES x Sch En W2	.04*	-.04*	.01	.00
SES x Sch En W3	-.03	.02	-.01	.00
SES x Sch En W4	.01	.02	.00	-.01
SES x Pro Peers W3	-.01	-.01	-.03*	-.02
SES x Pro Peers W4	-.03	-.01	.04*	.00
SES x Anti Peers W3	-.03	.04**	.02	.03*
SES x Anti Peers W4	.02	-.01	.01	.01
ADI x Fam Con W1	.01	.00	-.01	-.03
ADI x Fam Con W2	-.04	-.03	.00	.01
ADI x Fam Con W3	.04	-.01	-.03	.01
ADI x Fam Con W4	<.01	.02	.03	-.01
ADI x Sch En W1	-.01	-.02	-.02	.00
ADI x Sch En W2	.02	-.04*	.01	.01
ADI x Sch En W3	-.01	.02	-.01	-.02
ADI x Sch En W4	<.01	.01	.00	.04*
ADI x Pro Peers W3	<.01	-.01	.00	.00
ADI x Pro Peers W4	.02	.00	.02	.04*
ADI x Anti Peers W3	-.02	.01	.01	.02
ADI x Anti Peers W4	.04*	-.01	.01	.03
ΔR^2	-.01	-.01	<.01	.03
R^2	.11***	.06***	.02***	.09***

Notes. This table shows standardized coefficients predicting the four emotion regulation (ER) outcomes (ED = Emotion Dysregulation, AT = Emotional Attunement, CR = Cognitive Reappraisal, ES = Expressive Suppression). Other abbreviations: Fam Con = Family Conflict, Sch Env = School Environment, Pro Peers = Prosocial Peer Affiliation, Anti Peers = Antisocial Peer Affiliation, SES = socioeconomic status, ADI = area deprivation index. Model 1 includes just covariates predict the ED latent factor and correlated ER variables at Wave 4, Model 2 included micro-context predictors (family conflict, school environment, prosocial peer affiliation, and anti-social peer affiliation) at all available waves, Model 3 adds macro-level predictors of ADI and SES as measured at baseline, and Model 4 includes interaction terms between macro- and micro-contexts. Statistical significance denoted by $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Interaction effects were considered significant at $p < .01$ (set *apriori* given the many interactions tested).

positive associations with family conflict at Wave 3 (β = .04, p = .04) and school environment at Waves 3 and 4 (βs = .05 and .06, respectively ps ≤ .001). Expressive suppression showed significant, positive association with family conflict at Wave 4 (β = .06, p < .001) and anti-social peer affiliation at Waves 3 and 4 (βs = .05 and .06, respectively, ps ≤ .001) as well as negative associations with school environment at Waves 2 and 4 (βs = -.04 and -.12, respectively, ps ≤ .005) and pro-social peer affiliation at Wave 4 (β = -.03, p = .04). Aside from the positive link between family conflict and Wave 2 and cognitive reappraisal, these patterns are consistent with hypotheses. The addition of micro-contexts into the model increased the amount of variance explained by each outcome (ΔR^2 = .02 - .10).

Model 3 expanded to include macro-contexts of SES and ADI along with the covariates and micro-contexts to address my second central hypothesis. Model 1 and 2 effects generally held. Contrary to expectations, there was no significant impact of SES as a predictor of any ER variables and only a single significant association between ADI and emotional attunement (β = -.04, p = .01).

Model 4 included the interactions between macro- and micro-contexts. Only three interactions met my threshold of statistical significance for the many interactions tested (p < .01). This included SES x Family Conflict at Wave 1 met as a significant predictor of emotion dysregulation (β = -.05, p = .002), SES x Antisocial Peer Affiliation at Wave 3 as a significant predictor of emotional attunement (β = .04, p = .007), and SES x Family Conflict at Wave 3 as a significant predictor of expressive suppression (β = - .06, p = .004). Follow-up analyses of the conditional slopes were then conducted for the three interaction terms that reached significance at p < .01.

Figure 3 shows the interaction between family conflict at Wave 1 and family SES in relation to latent emotion dysregulation. For those with low SES, greater family conflict was associated with greater emotional dysregulation compared to those with high SES. There was little difference in emotional dysregulation at high or low family conflict for those with high SES. Follow-up analyses of conditional slopes that tested relations at +/- 1 *SD* to the mean-centered moderator (family SES) confirmed this. For those with low SES, greater family conflict was significantly associated with greater dysregulation (B = .05, *S.E.* = .01, 95% CI: .03, .07, $p <$ .001). For those high in SES, greater family conflict was also significantly associated with greater dysregulation but with a weaker slope (*B* = .02, *S.E.* = .01, 95% CI: .01, .04, *p* = .004). This is consistent with my hypothesis, but the overall effect size is negligible.

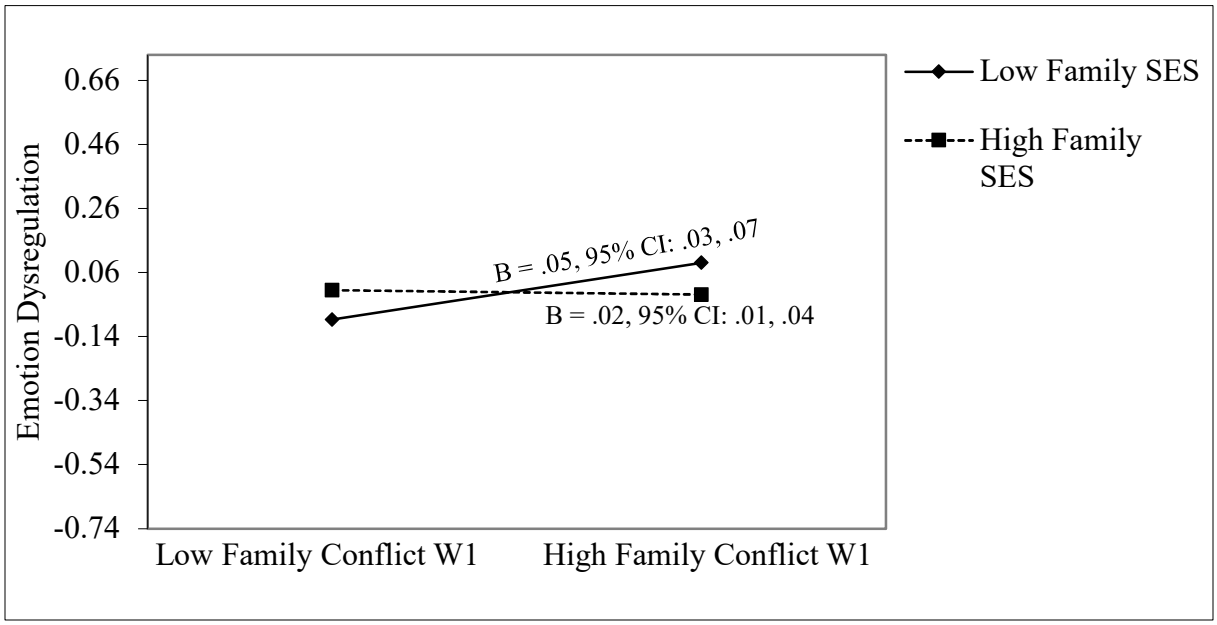

Figure 3.

SES x Family Conflict at Wave 1 predicting Emotional Dysregulation

This diagram shows associations between low/high family conflict (+/- 1 SD) and emotional dysregulation (latent variable) at high/low (+/- 1 SD) levels of family socioeconomic status.

Figure 4 shows the interaction between anti-social peer affiliation at Wave 4 and family SES in relation to the Attuned subscale of the DERS-P. The plot shows that for those with low SES, greater anti-social peer affiliation was associated with greater attunement scores (reflecting poorer awareness or clarity of emotions) compared to those with high SES. There was essentially no difference between high and low SES participants on emotional attunement when anti-social peer affiliation was low. Follow-up analyses of conditional slopes that tested relations at +/- 1 *SD* to the mean-centered moderator (family SES) confirmed this. For those low in family SES, greater anti-social peer affiliation was significantly associated with better emotional attunement (B = -.05, *S.E.* = .02, 95% CI: -.09, .05, p = .04). For those high in family SES, this association was not statistically different than zero (B = -.01, *S.E.* = .02, 95% CI: -.06, .03, p = .69). This is inconsistent with my hypothesis, though the effect size is again negligible.

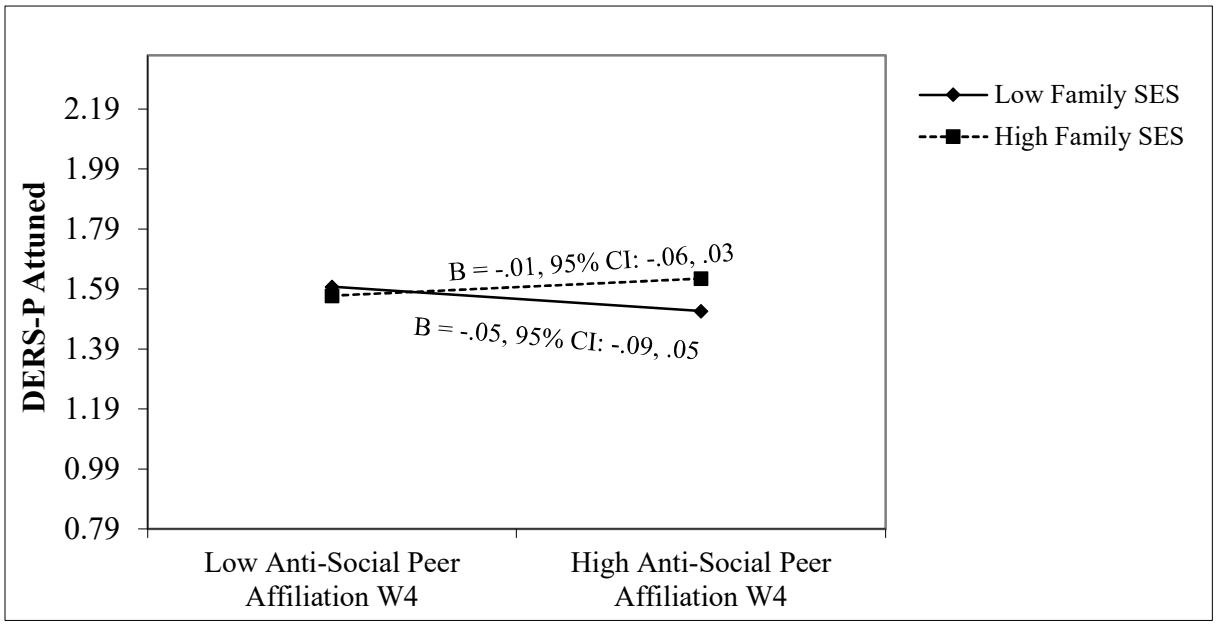

Figure 4.

SES x Anti-Social Peer Affiliation at Wave 4 predicting (Lack of) Attunement to Emotions

This diagram shows associations between low/high antisocial peer affiliation (+/- 1 SD) and (lack of) Attunement to Emotions.

Lastly, Figure 5 shows the interaction between SES and family conflict at Wave 3 in relation to expressive suppression. For those with low SES, greater family conflict was associated with greater use of expressive suppression compared to those with high SES. Follow-up analyses of conditional slopes that tested relations at +/- 1 *SD* to the mean-centered moderator (family SES) confirmed this. For those low in family SES, greater family conflict at Wave 3 was significantly associated with a greater use of expressive suppression (B = .04, *S.E.* = .01, 95% CI: .01, .07, *p* = .006). For those high in family SES, this association was not statistically different than zero (*B* = .01, *S.E.* = .01, 95% CI: -.01, .03, *p* = .341). This is consistent with my hypothesis, though the overall effect size continued to be negligible. Given these small effects interactions were observed for only 3 out of the 24 interactions tested, and not always in the same direction, I concluded there was not robust support for the interaction effects hypothesized.

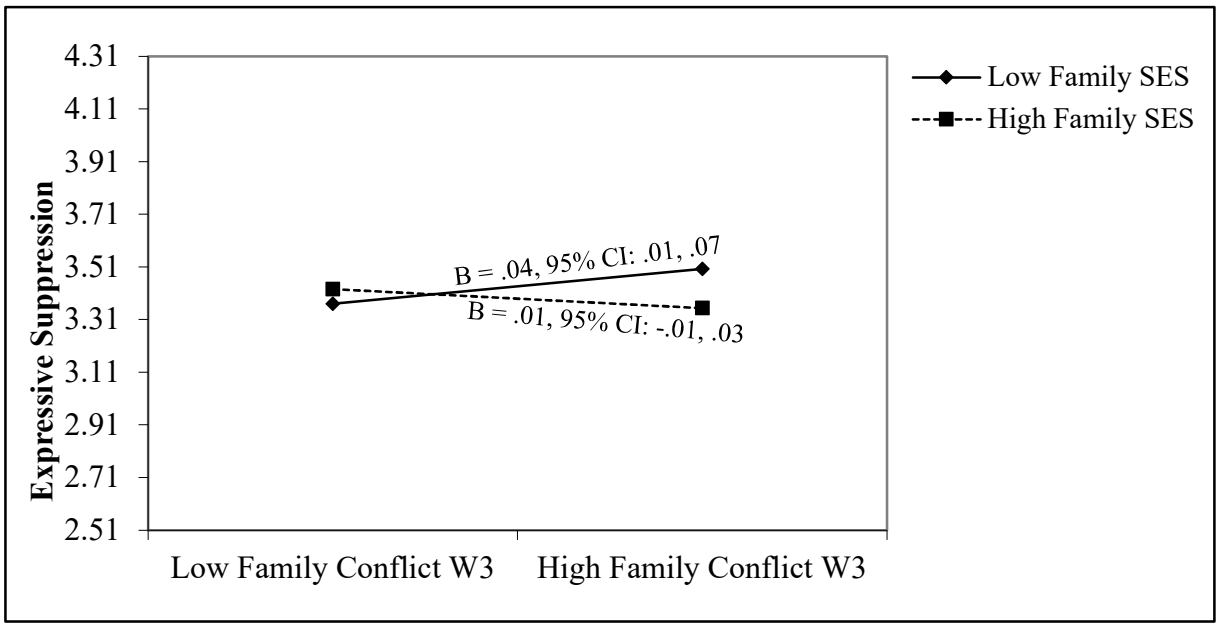

Figure 5.

SES x Family Conflict at Wave 3 Predicting Expressive Suppression

This diagram shows associations between low/high family conflict (+/- 1 SD) and Expressive Suppression at high/low (+/-1 SD) values of family socioeconomic scales.

Chapter 5: Discussion

The purpose of this thesis was to evaluate environmental predictors of emotion regulation in early adolescence through a social ecological lens. To achieve this, I first had to take a step back to evaluate the measurement model of emotional dysregulation as the scale used in the ABCD study is relatively new with limited validation and, to my knowledge, had never received invariance testing. Firstly, I conducted a confirmatory factor analysis to compare the four-factor structure hypothesized by Bunford et al. (2020) to the original six-factor self-report structure found by Gratz and Roemer (2004). Interestingly, for both the four- and six-factor models, two items did not load onto the intended factor and due to that consistent lack of loading, were removed from this analysis. I then chose to conduct, to my knowledge, the first invariance test of the DERS-P. This process was necessary to ensure that the items from the Difficulty in Emotion Regulation Parent Report (DERS-P) had an equivalent meaning and structure across groups. If a measure is not invariant, results derived from that scale do not hold the same meaningfulness across groups (Putnick & Bornstein, 2016). The results showed full invariance between the sexes and full configural, metric, and scalar invariance between racial/ethnic groups, however, to reach residual invariance, two of 27 residuals needed to be freed reach invariance. Despite partial residual invariance, these results indicate satisfactory equivalence across groups making them appropriate for the analyses conducted. Specifically, when conducting moderation analysis, achieving configural, metric, and scalar invariance has been deemed necessary while residual variance is an extra, but not necessary, step (Memon et al., 2019). The results of these two analyses provide underlying support for the validity of the findings by demonstrating that the DERS-P has strong internal consistency, the associations with predictors can be interpreted meaningfully across demographic groups and can be reliably used in subsequent studies.

Micro- and Macro-Contexts Relevant to Emotion Regulation

I hypothesized that heightened family conflict, poorer school environment, higher anti-social and lower pro-social peer affiliation as well as lower SES and higher neighborhood deprivation would predict greater emotion dysregulation, decreased use of cognitive reappraisal, and increased use of expressive suppression. Trends across results of the four models indicate that micro-contextual factors are significantly associated with multiple ER processes in largely the expected directions. I also hypothesized that associations been micro-contexts and ER will be stronger for those with less resources (i.e., greater neighborhood deprivation and lower family SES) compared to those living in neighborhoods with greater resources (i.e., lower area deprivation and in families with greater SES). In general, there was little support that SES and ADI were salient predictors of ER or meaningful moderators of micro-contextual factors in relation to predicting ER. I expand on why this might be after first reviewing the effect sizes associated with main effects and general support of the micro-contextual component of the social ecological theory.

In general, effect sizes reported in this study were small. Across main effects and interactions, most significant standardized beta coefficients were in the .03 to .10 range. Over the past two decades, there has been a push for a reevaluation of what qualifies as a 'small' or 'large' effect size in the social sciences as the quantifier of 'small' holds no meaning without a comparative value, thus, researchers have called for effect sizes to be interpreted in relation to those from other related studies (Funder & Ozer, 2019; LeCroy & Krysik, 2007; Valentine & Cooper, 2003). When using standardized coefficients from comparable studies to norm effect sizes, the effects found by this thesis are not all that small (Brieant et al., 2022; Brislin et al., 2021; Owens et al., 2021).

An analysis aiming to identify normative effect sizes for the ABCD Study dataset has been conducted and concluded that .05 can be considered the average effect size (below average being .03, above average being .09, and greatly above average being .18; Owens et al., 2021). Based on the comparative norms for effect sizes, of the 24 significant main effect paths in the final model, 10 were below average, 9 were between average and above average, and 5 were above average. Interaction effects showed a similar trend with one slightly below average and the other two in the average range. This readjusted quantification of effect sizes based on criteria recommendations from this millennium and multiple previous studies conducted using ABCD data, support the notion that the micro-contexts an early adolescent exists in exert an average effect on emotion dysregulation and ER strategy use. Ultimately, the results of this study also have a high probability of being realistic representations of the effects of multiple micro-contexts as well as the lack of effect of macro-context, on ER processes and provide valuable contributions to the literature.

Micro-context as Predictors of Emotion Regulation

In addition to the overall magnitude of effects, it is worthwhile to highlight the patterns of associations with and which micro-contexts had the strongest effects on each ER outcome measure. In summary, family conflict at Waves 3 and 4 consistently showed the strongest associations with emotion dysregulation. School environment at Waves 3 and 4 showed the strongest association with ER strategies where it was positively associated with the use of cognitive reappraisal and negatively associated with the use of expressive suppression. Prosocial peer affiliation and antisocial peer affiliation had significant but weak associations with emotion regulation strategies.

This pattern of effects may be due to the different types of social interactions which occur at home versus at school. When at school, youth have more people to interact with, which may lead to more instances where utilizing emotion regulation strategies could be necessary. This increased interaction with peers may also shape which strategies are used by the adolescent (Cui et al., 2020; Hale et al, 2023). Another possible explanation of this pattern could be developmental changes between waves. When youth entered the study at Wave 1, they were on average 10 years old and at Wave 4 are now on average 13 years old. During this period, it is likely that family conflict (Gutgesell & Payne, 2010; Hummel et al., 2012) and the salience of peer opinions (Dijkstra & Jest, 2015) increased. This could strengthen the associations between those micro-contexts and emotion dysregulation and/or ER strategy use as youth aged.

On the other hand, these sizes and patterns may be related to reporter effect. The predictor and outcome measures were a mix of parent and child report. However, family conflict was the only micro-predictor which included both parent and child report; the remainder of the micro-context variables (school environment, prosocial and antisocial peer affiliation) were child report only. For the outcome measures, there was measure with multiple reporters: emotion dysregulation was parent report and ER strategies were child report. Patterns indicative of rater effects were present through the use of ER strategies (child report only) having weaker and inconsistent associations with family conflict (averaged parent and child) but stronger and more consistent associations with school environment (child report only). Additionally, family conflict (the only micro-context with a parent report available) consistently showed significant associations at a higher magnitude with emotional dysregulation (parent report) than with ER strategies (child report). This will be further explored in the limitations section.

Moderating Role of Macro-Context

My second hypothesis regarded testing if macro-contexts (SES and neighborhood deprivation) functioned as a moderator between micro-contexts and ER processes. Results demonstrated limited evidence such that SES, but not neighborhood deprivation, interacted with select micro-contexts in such a way that lower SES magnified the associations between micro-contexts and emotion dysregulation or expressive suppression. Although unexpected, this lack of effect provided some initial indication that SES or area deprivation may not function as a moderator between micro-contexts and ER process (Chmura Kraemer et al., 2008; Memon et al., 2019).

One potential reason for the lack of moderation effects and even direct effects of macro-contextual factors is that such effects may be more relevant earlier or later in development than in early adolescence. Although early adolescence is a sensitive period with the onset of many unique changes (i.e., increased autonomy, greater peer influence; Hashmi, 2013; Lam et al., 2014), ER patterns may already be engrained in an individual through years of socialization and attachment bonds formed in infancy. These socialization effects may compile over childhood and by early adolescent, leaving broader social environmental factors such as those measured in this study with weaker associations than more proximal influences.

Other aspects of the micro-context may also be more relevant to moderation by the macro-context. For example, parent emotion regulation would be an important context to consider in future research as emotion regulation initially develops through caregiver socialization (Sameroff, 2010) and as children age, parent's own emotion regulation skills impact their parenting behaviors and subsequently, child behavior and emotions (Hajal & Paley, 2020).

Similarity, rather than school environment broadly or peer-affiliations, teacher-student relationships and peer interaction patterns may have stronger associations with ER processes (i.e., De Neve et al., 2022). Following this, student-teacher closeness and conflict are linked to child emotion regulation such that close student teacher relationships were associated with better emotion regulation while greater student teacher conflict was associated with worse student emotion regulation (Pallini et al., 2019). Such associations have also been evidenced in peer relationships but literature thus far has demonstrated the relationship between regulation and peer relationships is complex and bidirectional (Herd & Kim-Spoon, 2021; Kim & Cicchetti, 2010; Riley et al., 2019; Troop-Gordon et al., 2021).

Following this, other theories may be more relevant to explaining the development or ER through early adolescence than the social ecological theory alone. A transactional lens stipulates that just as much as an environment affects the child, the child also affects the environment. This requires researchers to view both the child and its environment as dynamic entities, rather than static as is the case with interactive models (Sameroff, 2009). Similar to social ecological theory, it also includes contexts of the family, school, peers, and larger society but terms these factors the "environtype" (p. 14, Sameroff, 2009). The environtype encompasses those processes and investigates them in a sense that the problem or solution is never solely the individual or the environment, but in their relationship. The inclusion of multiple social and environmental contexts and the emphasis that the child and its environment actively impact each other's growth, make the transactional theory an especially applicable framework for further investigating emotion regulation development.

Strengths and Limitations

This thesis adds important information to the ER literature. As discussed, this is the most comprehensive study I am aware of for evaluating emotion regulation from a social ecological framework. Leveraging secondary data from the ABCD study provided the opportunity to investigate my research questions using a large, nationally representative, sample with the potential for longitudinal follow-up studies as more waves of data are released. Findings have provided an initial estimate of the associations between micro-contexts of family, school, and peer, as well as macro-contexts of SES and neighborhood deprivation on ER processes in early adolescence. The findings also show preliminary evidence that there may be alternate theoretical frameworks which could better contextualize the influence of social environmental contexts on ER. Further, though not the main focus, the factor analysis and invariance testing of the DERS-P provide valuable information to any researchers or clinicians who would be interested in a parent report of their adolescent's emotion dysregulation but may have been dissuaded by the newness of the measure.

This thesis is not without limitations. Foundationally, the internal reliability of micro-contextual measures was sub-par. While this has been acknowledged in reviews of the ABCD environmental measures with hopes that reliability will improve as youth age (Gonzales et al., 2021), it is necessary to take into account that the predictor measures may have not been capturing the intended construct consistently. This assumption violation may have an impact on the associations found with the outcome ER measures such that they are imperfect estimations of the true relationships. Further, ER was not evaluated at baseline, thus it is unclear how earlier ER may impact family, school, or peer contexts. Additional longitudinal analysis is needed to determine ordering of effects.

A specific consideration extends to using the Area Deprivation Index (ADI) to measure neighborhood deprivation. In this thesis, ADI had lower correlations with all other variables, including SES, and the one significant association with emotional attunement was in the opposite direction expected where greater area deprivation was associated with higher emotional attunement. Further, there were no significant interactions between ADI and any micro-predictors. Consistent with these patterns, previous studies have found that ADI is weakly correlate with psychological and behavioral outcome such as internalizing symptoms (Ip et al., 2021) and was not a significant predictor for internalizing behaviors, externalizing behaviors, or a general psychopathology factor (Brislin et al., 2022). Yet, these findings are inconsistent with neurological findings from previous ABCD studies which have found ADI to be consistently associated with various aspects of brain development (Adise et al., 2022; Dennis et al., 2022; Rakesh et al., 2021). Further research is needed to understand why ADI is consistently associated with brain development yet largely unassociated with behavioral outcomes.

Lastly, while generally considered a strength to have multiple reporters, the variables used in this thesis were a mixture of parent and child report, however family conflict was the only measure to have both parent and child report. A direct comparison where all measures were rated by parent and child would be ideal. While multiple raters are considered the gold standard of data collection, caution should be exercised when predictors and outcomes have different reporters. With this effect, we cannot make conclusive statements on if family conflict is more relevant to emotion dysregulation while school environment and peers are more relevant to ER strategy use or if it was a matter of reporter effects.

Future Directions

The aforementioned strengths can be leveraged and limitations addressed through continued research with the ABCD dataset. The project provides ample opportunities for researchers to examine longitudinal change in a plethora of measures from early adolescence into adulthood. Specific to this thesis, as new waves of data are released, future research could investigate if transactional theory is a more accurate lens of which to study emotion regulation through. For example, while the sample size is roughly a fourth of the full sample (N = 2,300), there is a measure of the self-report DERS filled out by both parents on their own emotion regulation and children on their own emotion regulation. This scale can help to parse out rater effects by providing an outcome measure with both parent and child raters as well as allow for the investigation of if parent emotion regulation is a stronger predictor of their child's emotion regulation than family conflict in general.

Practical Implications

Using such a large dataset, the difference between statistical and practical significance has been continually considered when interpreting the results. Although some effects were contradictory to my hypotheses, the results from the structural equation models indicate that in early adolescence, multiple environmental contexts appear to exert an influence on ER dysregulation and strategy use in the expected directions. Specifically, the current results indicate that of the variables measured, lowering family conflict has the best propensity to lower emotion dysregulation and increasing school engagement has the best propensity to promote use of cognitive reappraisal and decrease expressive suppression. Yet, considerations of subpar internal consistency and further longitudinal analysis is needed.

Though not the main focus of this thesis, valuable reliability and validity findings which can be leveraged in clinical and research practice came from the CFA and invariance testing. Those tests indicated that the DERS-P is a sound parental report measure for their adolescent's emotion regulation. This opens researchers and clinicians to be able to have corresponding measures of emotion dysregulation from both adolescents (DERS Self Report; Gratz & Roemer, 2004) and their parents (DERS-P; Bunford et al., 2020) which can raise the accuracy of reporting and combat reporter bias.

Conclusion

This project was my first time working with such a large secondary data set. Throughout this process, I have learned the complexities of managing large datasets, especially when one is not familiar with the initial organization. After many, many, errors in SPSS cleaning the data and realizing weeks later that something wasn't working with a variable's creation, I have gained invaluable data management skills. Further, as I was not the one to choose the measures included in the data collection, I have also learned a lot about the importance of psychometric testing and understanding the bounds of what data is able to tell you. Overall, I believe that this project has helped me to develop foundational skills I will need as I progress into the PhD program. Moving forward, I am extremely excited to continue to work with the ABCD data set and grow my expertise in emotion regulation.

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