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ORIGINAL PAPER

Emotion Regulation in Young Children with Autism Spectrum Disorders

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Abstract There has been little research connecting underlying emotion processes (e.g., emotion regulation) to frequent behavior problems in young children with autism spectrum disorder (ASD). This study examined the stability of emotion regulation and its relationship with other aspects of child functioning. Participants included 108 children with ASD, ages 4–7, and their primary caregivers. ASD symptoms and cognitive/language abilities were assessed upon study entry. Parents reported on children's emotion regulation, social skills and behavior problems at two time points, 10 months apart. Emotion dysregulation was stable and related strongly to social and behavioral functioning but was largely independent of IQ. Further analyses suggested that emotion dysregulation predicts increases in social and behavioral difficulties across time. Implications for intervention are discussed.

Keywords Emotion regulation · Emotional development · Social development · Self-regulation

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Introduction

Extensive research documents the heightened behavioral difficulties facing children with autism spectrum disorders (ASD; e.g., Georgiades et al. 2011; Hill et al. 2014), but a specific focus on emotion regulation, particularly during the early school years, is lacking with few exceptions (Jahromi et al. 2012, 2013; Mazefsky et al. 2013). This limited research suggests that emotion regulation and elevations in emotion-related symptoms is an area of particular difficulty for children with ASD (Totsika et al. 2011). In the general developmental literature, the term "emotion regulation" refers to the range of cognitive, physiological, and behavioral abilities that allow an individual to monitor and modulate the occurrence, valence, intensity, and expression of one's emotions and arousal (Cole et al. 1994; Morris et al. 2007; Thompson 1994). Emotion regulation underlies multiple key areas of development for children, as it is central to children's abilities to interact successfully with their surrounding social and physical environment.

Successfully regulating one's emotions theoretically requires a child to be able to: (a) recognize his or her own emotional states at age-appropriate levels, (b) access strategies to self-soothe or relax when experiencing a negative emotion or strong levels of excitement or arousal, and (c) maintain progress in current activities in the face of potentially interfering emotions (Gratz and Roemer 2004; Southam-Gerow and Kendall 2002). In contrast, children who exhibit high levels of emotion dysregulation lack these abilities and, thus, have difficulties modulating their emotional intensity such that their emotions frequently interfere with goal-directed and interpersonal activities. Emotion regulation is considered to be one aspect of the broader construct of self-regulation, or the ability to control one's actions and responses to stimuli in order to effectively

pursue a goal. Two other aspects of self-regulation that are frequently discussed are cognitive regulation, such as executive functioning and goal-directed reasoning, and behavioral regulation, such as the monitoring of physical movement and inhibiting or delaying impulses or gratification (Jahromi and Stifter 2008; Williford et al. 2013). Though these three facets of self-regulation are related, evidence suggests that they may hold independent predictive power for children's development. For example, in one study, only cognitive self-regulation predicted theory of mind development, while emotional and behavioral regulation were unrelated to theory of mind (Jahromi and Stifter 2008). Furthermore, ratings of emotion regulation have not shown strong connections to general cognitive or language abilities in typically developing children (Graziano et al. 2007).

Among typically developing children, the preschool-age period is commonly considered the period of largest growth in self-regulation abilities (Jahromi and Stifter 2008; Williford et al. 2013), and has strong implications for children's social functioning. Preschool children with higher levels of emotional intensity and dysregulation in the classroom are rated to have fewer social skills, are less accepted by peers, and engage in more peer conflict (Eisenberg et al. 1993; Miller et al. 2004). For children with developmental disabilities not including ASD, emotion regulation has been shown to predict children's social difficulties above and beyond cognitive ability (Wilson et al. 2007).

Among children with ASD, in spite of the limited information about emotion regulation capacities, certain other aspects of emotional development are well understood. For instance, research on facial perception and emotion labeling has largely indicated difficulties in recognizing emotional facial expressions (e.g., Uljarevic and Hamilton 2013), despite some inconsistencies across studies (e.g., Begeer et al. 2008). Additionally, it is clinically recognized that many children with ASD have difficulties with one or more emotion regulation abilities. For example, some children with ASD exhibit disruptive behaviors in the face of negative emotions (e.g., engaging in tantrums or physical aggression when frustrated or angry) while others may experience emotions in a way that interferes with their goal-directed behaviors (e.g., overexcitement or frustration impeding with one's ability to maintain focus on a task/activity or interact successfully with others). However, "emotion regulation" is a term not often used in the autism spectrum literature, as the behavioral symptoms that likely represent emotion regulation difficulties, including tantrums, "meltdowns," aggression, and self-injury, are highlighted instead (e.g., Mazefsky et al. 2013). While this is a subtle distinction, it hasimplications for our understanding of intervention programs and their efficacy. In particular, a focus on the emotion regulation of children with ASD may provide insight into a common pathway for many of the symptoms associated with ASD (e.g., social difficulties, repetitive behaviors, sensorysensitivities) as well as frequent comorbid mental health conditions (e.g., anxiety disorders, disruptive behavior disorders) within this population. If emotion regulation is linked to increases or maintenance of these symptoms, then targeting emotion regulation may be a more parsimonious way to provide effective interventions.

The few studies that have attempted to understand emotion regulation in children with ASD have consistently found more emotional dysregulation compared to typically developing children throughout early childhood development. For example, Garon et al. (2009) found that 'ASD sibs' (children at high-risk for ASD because they had an older sibling with ASD and who were themselves also diagnosed with ASD at age 3) exhibited a reduced ability to manage negative emotions at age 2 compared to high-risk siblings who did *not* develop ASD and compared to low-risk controls. Two studies observed emotion regulation of preschool and early school-aged children in the laboratory by coding children's behaviors in the face of frustration (e.g., abrupt removal of a desired toy). Jahromi et al. (2012) found that children with ASD (ages 3–7) exhibited less advanced emotion regulation when frustrated compared to typically developing peers, and that use of emotion regulation strategies among children with ASD did not consistently predict improvements in negativity or resignation, as it did for typically developing children. Konstantareas and Stewart (2006) also reported that children with ASD (ages 3–10) had significantly lower average ratings of emotion regulation strategies, demonstrating more hiding of the toy, fewer attempts to ask the examiner directly to play longer with the toy, and fewer instances of complying with the examiner's request for the toy.

Difficulties with emotion regulation among youth with ASD, including higher use of maladaptive and involuntary emotion regulation strategies, appear to continue into later childhood and adolescence and relate to higher levels of internalizing and externalizing symptoms (Mazefsky et al. 2014). Teachers rate school-age children with ASD (ages 6–10) as significantly more emotionally labile than their peers without ASD, with a much higher percentage of students with ASD falling in the borderline-clinical and clinical ranges of standardized measures of dysregulation (Ashburner et al. 2010). Parents also tended to report that their 12-year-old children with ASD experienced negative emotions (i.e., sadness, fear, anger, shame, and guilt) more frequently and positive emotions (i.e., joy) less frequently than reported by parents of typically developing children (Capps et al. 1993). Among studies of children and adolescents with ASD with broader age ranges, Samson et al. (2014) found that youth (ages 6–16) with ASD exhibited higher levels

of dysregulation than their typically developing peers, and that emotion dysregulation was independent of children's IQ but related to their core autism symptoms, including sensory and repetitive behaviors, social cognition, and social communication. Totsika et al. (2011) also demonstrated that children and adolescents (ages 5–16) with ASD were more likely to have elevations in parent-rated emotional symptoms (i.e., internalizing symptoms, such as being easily scared or often being unhappy) than youth with ID only or a non-clinical comparison group. Indeed, the presence of ASD increased the odds of children's scores falling in the elevated range for emotional symptoms (OR = 7.81).

Together, these studies all suggest that children with ASD have difficulties with underlying emotion regulation processes beginning at an early age, and that they go on to experience higher levels of negative emotionality and develop fewer adaptive emotion regulation strategies throughout later childhood. However, the majority of these studies were cross-sectional measurements of the emotional functioning of children with ASD, thus not allowing for an analysis of the ways in which emotion regulation or other emotional factors develop for these children. Furthermore, those studies that had a longitudinal component (e.g., Garon et al. 2009) did not incorporate multiple measures of emotion regulation to examine the development of emotion regulation skills for children with ASD, despite other use of the multiple time-points within their analyses. The current study contributes to the literature by assessing the developmental nature of emotion regulation among young children with ASD, using a longitudinal design with measurement of children's emotion regulation abilities and difficulties at two time-points.

Given strong links between emotion regulation and social functioning among typically developing children and children with other developmental disorders (e.g., Miller et al. 2004; Wilson et al. 2007), it follows that these deficits in emotion regulation among children with ASD might relate to social development within this population as well. However, the potential impact of emotional regulation delays on social functioning has received little study among children with ASD. One known study of preschool-aged children with ASD (Jahromi et al. 2013) has linked emotion regulation among children with ASD to social outcomes, finding that better emotion regulation predicted more prosocial peer engagement, thus buffering their social deficits. Given the social and communicative difficulties that represent hallmarks of ASD, research into the underlying emotion dysregulation they experience might highlight how these emotional factors can influence children's broader social development.

Current Study

The purpose of this study was to describe emotion regulation deficits for young children (ages 4–7) with ASD over time and to explore child characteristics that might relate to emotion regulation development. Research questions included: (1) To what extent does emotion regulation change over time for children with ASD? (2) How does emotion regulation relate to children's overall level of functioning (e.g., severity of autism symptoms, language and cognitive functioning)? (3) Does child emotion regulation explain changes in child social and behavioral functioning across assessment points?

Methods

Participants

Participants ($N = 108$) were a subset of children with ASD and their primary caregivers who participated in an ongoing, cross-site, longitudinal study consisting of an eligibility (assessment) visit and three later time-points across two academic years. Eligible participants were assessed twice during the first academic year (the first within 3 months of the start of the academic year and the next 7–10 months after the start of the academic year, approximately 6 months apart) and once during the second academic year (4–6 months after the start of the academic year, approximately 10 months after the previous visit). This study used data from the second and third assessments, when emotion regulation measures were collected from the sample. For the purposes of this paper, we will refer to these as the Year 1 and Year 2 assessments, respectively.

The sample included in these analyses had completed both of the Year 1 and Year 2 assessments. This sample was compared on key demographic variables to those who were eligible and enrolled in the longitudinal study but were missing one or both of these assessments (i.e., 19 additional participants) to assess if participant attrition was random; the sample differed significantly on child IQ as measured by an abbreviated version of the Wechsler Preschool and Primary Scales of Intelligence, 3rd edition (WPPSI-III sample mean = 90.3; WPPSI-III mean of participants excluded due to missing time-points = 80.37; $t(125) = 2.33$, $p < .05$), but did not differ on any other key demographic or child variables (e.g., child age, child gender, mother age or education, family income, ADOS-2 comparison score, SRS score, CASL score). Given the difference in child IQ on the WPPSI-III, it is possible that results of these analyses may not be fully representative of the full range of functioning among children with ASD as these 19 families of children with lower cognitive functioning may have selectively

Table 1 Participant demographics (N = 108)

	% of sample or mean (SD)
Child demographic variables	
Age at Year 1 assessment (years)	5.7 (1.1)
Gender (male %)	82.4 %
Child functioning	
Estimated FSIQ (WPPSI-III)	90.3 (17.1)
IQ Below 70	12.0 %
Spoken language level	
Syntax construction	81.7 (17.8)
Pragmatic language	84.8 (19.1)
Currently receiving any special education services	88.9 %
ADOS-2 module administered	
Module 1	13.0 %
Module 2	33.3 %
Module 3	53.7 %
ASD symptom severity (ADOS-2 comparison score)	7.4 (1.8)
Level of Autism symptoms (SRS total T-score)	77.7 (11.4)
Parent/family demographic variables	
Annual family income (% >$50,000)	75.5 %
Maternal age (years)	38.4 (5.5)
Maternal race/ethnicity (% white)	66.7 %
Maternal education	
(4-year college degree or higher)	72.2 %
Marital status (% married)	85.2 %

missed an assessment point. Of the 108 included participants, missing data for parent-measures was minimal (i.e., between four and ten participants excluded for any given analysis) and appeared to be random. Children and their parents were recruited through community agencies (e.g., autism service providers, support groups, summer camps), preschools and elementary schools, websites, and local autism-specific events (e.g., fundraising walks, social events for families with children on the autism spectrum). The primarycaregivers of all participating children provided informed consent for study participation; IRB approval for all study procedures was obtained.

Children had a mean age of 5.7 years at the Year 1 assessment (SD = 1.1; Range = 4–7 years) and were predominantly male (82.4 %). They demonstrated a mean Estimated Full Scale IQ of 90.3 (range = 46 to 123), assessed upon study entry. Only 12.0 % of the children had IQ scores below 70, consistent with a comorbid intellectual disability (American Psychiatric Association 2013). The majority of caregivers were mothers (91 %); hence the term "mother" or "maternal" will be used when referring to the caregivers. This sample represents diverse ethnic and racial backgrounds, with mothers reporting their race/ethnicity via an aggregation of checkbox and open-ended responses about their racial/ethnic identities as White (67 %), Latina/Hispanic (16 %), Asian/Asian-American (7 %), Black/African-American (5 %), and the remainder reporting other racial identities (e.g., multi- or bi-racial). The majority of mothers reported an annual family income greater than $50,000 (75.5 %). Other participant demographics are presented in Table 1.

Procedures

Children were screened for eligibility prior to beginning the study, at the start of the school year. Inclusion criteria were: (a) diagnosis of an autism spectrum disorder from a full psychological assessment and/or diagnosis of autistic-like behaviors from a school district; (b) child meeting the autism spectrum cutoff on the Autism Diagnostic Observation Schedule (ADOS-2; Lord et al. 2012) administered as part of study procedures [as well as the Autism Diagnostic Interview-Revised (ADI-R; Lord et al. 1994), if prior diagnoses only included school district diagnoses]; (c) IQ ≥ 50 on the Wechsler Preschool and Primary Scales of Intelligence, 3rd Edition (WPPSI-III); and (d) aged 4–7 and entering elementary school (grades K—3) or their final year of preschool at the time of study entry. The ADOS-2 comparison score was also derived as a measure of ASD symptom severity for those children qualifying for the study (as shown on Table 1).

After eligibility was determined, children were scheduled for a series of three visits at the university lab over two academic years (timing of visits described above). Families received an honorarium for each visit in appreciation of their participation, as well as a summary of their child's performance on standardized measures. Although this study primarily used data from the Year 1 and Year 2 assessments, other measures of child functioning collected during the screening process or the first assessment (held contiguously) were used in analyses as covariates or for descriptive data.

Measures

Emotion Regulation Checklist (ERC; Shields and Cicchetti 1997)

Children's emotion regulation capacity, the dependent variable of interest, was measured with maternal ratings on the ERC at the Year 1 and Year 2 assessments. The ERC is a 24-item parent-report measure that yields two subscale scores. The emotion regulation subscale (ERC-ER) assesses children's overall mood, their ability to label and express emotions, and their ability to display appropriate emotions in positive and negative social situations.

Higher scores on the ERC-ER represent higher levels of emotion regulation abilities. The Lability/Negativity subscale (ERC-LN) assesses children's lack of flexibility, rapid changes and variation in mood states, dysregulation of negative affect, and a tendency to behave in an overly exuberant manner. Higher scores on the ERC-LN represent higher levels of emotion dysregulation or emotion regulation difficulties. Though the ERC was initially developed with children ages 6–12, it has also been used in children as young as 5 years of age (Graziano et al. 2007). In this study, no significant age differences in scores were observed for either the ERC-ER ($p = .64$) or ERC-LN ($p = .35$) as tested via ANOVAs, suggesting that this measure can be used with this slightly younger population. Available measures of reliability (internal consistency; ERC-LN: $\alpha = 0.96$; ERC-ER: $\alpha = 0.83$) are high as reported by Shields and Chicchetti (1997). Within the study sample, internal consistencies were also acceptable for the ERC-LN ($\alpha = 0.81$) and ERC-ER ($\alpha = 0.80$) at the Year 1 assessment and for the ERC-LN ($\alpha = 0.85$) and ERC-ER ($\alpha = 0.74$) at the Year 2 assessment.

Child Behavior Checklist 1½–5 and 6–18 (CBCL; Achenbach and Rescorla 2000, 2001)

The CBCL is one of the most widely used report measures of children's socio-emotional and behavioral functioning and was administered during both the Year 1 and Year 2 assessments. Both the 1½–5 and 6–18 versions contain items that are rated on 3-point scales (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true) and have high reliability and validity. The CBCL 1½–5 version contains 100 items while the CBCL 6–18 version contains 113 items. The Total Problems scale was used as an overall measure of child behavior problems in analyses exploring the relationship between emotionregulation problems and child problem behavior. This scale has high levels of internal consistency (CBCL 1½–5 and 6–18: $\alpha = 0.97$) and high test–retest reliability at an average interval of 8–16 days (CBCL 1½–5: $r = .90$; CBCL 6–18: $r = .94$; Achenbach and Rescorla 2000, 2001). Analyses were completed with T-scores as they are independent of the number of items and allow comparisons across the two versions.

In order to explore behavior problems in more detail, children's behaviors were also measured in terms of internalizing and externalizing behavior problems. Across the 1½–5 and 6–18 versions of the CBCL, the subscales in the internalizing composite are largely consistent, so the internalizing behaviors T-score could be used. However, the subscales in the externalizing behaviors T-score are more inconsistent; the externalizing composite consists of attention problems and aggressive behavior in the 1½–5 version, but aggressive behavior and rule-breaking behavior in the 6–18 version. In order to increase the consistency in ratings of externalizing behaviors across the two versions of the CBCL, a composite score was created of attention problems and aggressive behavior to represent externalizing behaviors in this sample. This externalizing behaviors composite score was created from both the 1½–5 and 6–18 versions by averaging the T-scores across the two scales.

Emotion Dysregulation Index The emotion dysregulation index (CBCL-EDI) is a newly published approach to assessing emotion dysregulation among children using items from the CBCL (Samson et al. 2014). This index score was formed via an expert rating process and has been used with children with ASD (see Samson et al. 2014 for more information). This index was initially used with children ages 6–16, and included 18 items from the CBCL 6–18 version with high reported internal consistency ($\alpha = 0.90$). Two items addressing self-harm and suicidality were endorsed at a very low frequency within this younger sample and were removed from the index for the purposes of this study given the lack of comparable questions on the CBCL 1½–5 version (see below), leaving 16 of the original CBCL-EDI items to create this index score. Among children who were administered the CBCL 6–18 version in this study, this revised CBCL-EDI had similar internal consistency ($\alpha = 0.85$) compared to the original sample. Additionally, a comparable CBCL-EDI scale was formed using the CBCL 1½-5 version with 14 identical items and two substitute items representing analogous constructs for items not present verbatim in this younger version ("defiant" substituted for "argues a lot"; "hits others" for "threatens people"). This scale also had high internal consistency within our sample ($\alpha = 0.81$). These index scores were not used in analyses in conjunction with the CBCL Externalizing, Internalizing or Total scores due to overlapping items.

Social Skills Improvement System (SSIS; Gresham and Elliott 2008)

The SSIS is a parent-report questionnaire administered at Year 1 and Year 2 that provides a broad assessment of social skills, problem behaviors, and academic competence. It is normed for children ages 3–18, and has been used to assess social skills in children with autism (Frankel et al. 2007). Parents rated the frequency of occurrence of specific social skills on a 4-point scale (*never, seldom, often, almost always*); scores are converted to standard scores with mean of 100 (SD of 15). For this study, the Total Social Skills score was used in analyses. The SSIS Total Social Skills score has high internal consistency ($\alpha = 0.96$ for parent-report) and high levels of test–retest reliability ($r = .84$

across an interval of 42–66 days; Gresham and Elliott 2008; Gresham et al. 2010).

Wechsler Preschool and Primary Scales of Intelligence, 3rd Edition (WPPSI-III; Wechsler 2002)

The WPPSI-III is a widely used assessment of cognitive ability for children aged 2:6–7:3 (Wechsler 2002). An abbreviated version of the WPPSI-III was administered during the screening process to assess children's IQ in order to determine eligibility for this study. This abbreviated version consists of three subtests across the perceptual and verbal domains (Vocabulary, Matrix Reasoning, and Picture Completion), the sum of which was converted to the estimated Full-Scale IQ used in our analyses (Sattler 2008). Abbreviated versions of the WPPSI have demonstrated high reliability and convergent validity (e.g., LoBello 1991). All subtests used exhibit high internal consistency for the age ranges of this sample (r_{xx} = 0.86-0.92; Wechsler 2002).

Comprehensive Assessment of Spoken Language (CASL-2; Carrow-Woolfolk 1999)

The CASL-2 is a standardized assessment of language in individuals aged 3–21 years, administered orally prior to the Year 1 assessment to allow measurement of children's spoken language abilities. Two subtests of the CASL-2 were used as predictors here: Syntax (measuring grammatical and syntactical skills) and Pragmatic Judgment (measuring children's use of language in social situations). This measure has strong reliability, including high internal consistency for both subtests across the ages in this study (r = .73–0.90; Carrow-Woolfolk 1999). It has also been used with children with a variety of developmental and language disabilities (e.g., Reichow et al. 2008).

Social Responsiveness Scale (SRS; Constantino 2002)

The SRS is a 65-item questionnaire normed for children ages 4–18 that assesses children's social behaviors, including receptive, cognitive, expressive, and motivational aspects of social behavior, as well as autistic preoccupations. The SRS was used as a measure of children's autism symptomatology and was administered prior to the Year 1 assessment. This study used the SRS total score as a measure of the severity of ASD symptoms. The SRS total score has strong ability to distinguish children with autism spectrum disorders from children with other psychiatric disorders or typically developing children (Constantino et al. 2000). Within this sample, 90.3 % of children scored in the clinical range on the SRS (total T-score ≥60).

Autism Diagnostic Observation Schedule (ADOS-2; Lord et al. 2012)

The ADOS-2 is a semi-structured, standardized assessment of communication, social interaction, play, and restricted and repetitive behaviors. This measure is considered one of the gold-standard tools used to assess autism spectrum disorders across the lifespan. The ADOS-2 consists of five modules based upon the individual's language ability and age; in this study, Modules 1, 2, and 3 were used. The ADOS-2 comparison score is a measure of children's ASD symptom severity, to allow for standardization of symptoms and comparison across the three modules utilized.

Data Analysis

Preliminary analyses included correlations to examine the relationships between the emotion regulation measures collected. Paired-sample t-tests and correlations between the same measures at the two timepoints were used to assess stability of children's emotion regulation (question 1). Correlational analyses also explored relationships between children's emotion regulation and other measures of children's functioning (question 2).

Follow-up analyses were conducted via hierarchical linear regressions to assess if child emotion regulation might predict developmental change in children's social and behavioral functioning from Year 1 to Year 2 (question 3). Demographic variables (e.g., child age, child gender, maternal education, family income) that correlated with a given outcome variable at $p < .10$ were entered as covariates in all analyses utilizing that outcome measure. If multiple covariates were relevant for a given outcome measure, all covariates were entered into the regression and retained if their coefficients were significant at $p < .10$. Hierarchical regressions were run predicting child social skills and behavior problems (SSIS social skills and CBCL internalizing and externalizing scores at Year 2). In order to explore interactions, all predictor variables were centered to the mean of the sample. Variables were entered into the hierarchical regression in the following blocks: (1) Demographic covariates, if relevant; (2) Child's score on the parallel measure at Year 1, to control for prior levels and thus predict change to the same measure at Year 2; (3) Child IQ; and (4) child emotion regulation measures, entered individually in separate regressions. Two-way interactions between Child IQ and each emotion regulation measure were explored, but findings were non-significant and therefore not reported in the finalmodels.

Table 2 Correlations between emotion regulation measures

	Emotion regulation (ERC-ER)	Lability/negativity (ERC-LN)	Emotion dysregulation (CBCL-EDI)
Emotion regulation (ERC-ER)		−0.37***	−0.46***
Lability/negativity (ERC-LN)	−0.49***		0.79***
Emotion dysregulation (CBCL-EDI)	−0.42***	0.68***	

ERC-ER emotion regulation subscale of the emotion regulation checklist, *ERC-LN* lability negative subscale of the emotion regulation checklist, *CBCL-EDI* emotion dysregulation index of the child behavior checklist, *Year 1* un-shaded (upper-right) correlations, *Year 2* shaded (bottom-left) correlations

***$p < .001$

Table 3 Stability of emotion regulation measures across time

	Year 1 scores M(SD)	Year 2 scores M(SD)	Paired t-tests (Year 1–2)	Correlations (Year 1–2)
Emotion regulation (ERC-ER)	23.8 (4.1)	24.3 (3.8)	$p > .05$	0.78***
Lability/negativity (ERC-LN)	33.3 (6.3)	33.1 (6.8)	$p > .05$	0.71***
Emotion dysregulation (CBCL-EDI)	0.54 (0.36)	0.53 (0.37)	$p > .05$	0.61***

***$p < .001$

Results

Relationships Between Emotion Regulation Measures and Stability Across Time

Given that several measures of child emotion regulation and dysregulation were administered to participants, initial analyses explored how these measures related to one another. Significant relationships existed between the scales measuring emotion regulation, lending validity to the larger construct of emotion regulation. Furthermore, these relationships, shown in the moderate to high correlations among the three ratings, were consistent for both Years 1 and 2 (see Table 2). Children's emotion regulation scores were highly stable across the 2 years as indicated by non-significant changes in each measure (see Table 3), as well as moderate to high correlations within each measure across the 2 years. No formal normative data exists for the ERC or CBCL-EDI.[1]

[1] Although no formal normative data exists for the ERC, we compared scores from our sample of children with ASD to a sample of children "at risk" (i.e., in Head Start), ages 33–70 months of age ($n = 331$; Cohen and Mendez 2009). The children in this study with ASD exhibited significantly higher levels of lability/negativity symptoms on the ERC-LN ($t(202) = -12.01$, $p < .001$), but equal levels of emotion regulation skills on the ERC-ER ($t(195) = -0.30$, $p > .05$). Comparisons of the CBCL-EDI with data from Samson et al. (2014) show comparable scores to their ASD group ($t(157) = -0.33$, $p > .05$), but higher levels of dysregulation compared to their typically developing group ($t(138) = -9.73$, $p < .001$).

Relationships Between Emotion Regulation and Child Functioning

Emotion regulation appears to be a construct independent of some core measures of child functioning (i.e., cognitive development, language functioning), given non-significant correlations with these domains. However, emotion regulation is highly correlated with measures of children's autism symptomatology, social skills, and behavioral functioning (see Table 4).

Prediction of Social and Behavioral Functioning by Emotion Regulation

Both social skills and behavior problems had highly stable sample means from Year 1 to Year 2, with moderate to high correlations across time (see Table 5). A series of hierarchical linear regressions was conducted to determine if children's initial levels of emotion regulation/dysregulation predicted the small amounts of change in social or behavioral functioning. When assessing change in behavioral functioning, the CBCL-EDI was not used as a predictor given overlap of items.

Child emotion regulation on the ERC-ER was a significant predictor of change in child social skills, such that children with higher emotion regulation scores at Year 1 exhibited increases in social skills scores at Year 2 (see Table 6). Child emotion regulation on the ERC-ER also predicted change in children's externalizing, but not internalizing, behaviors on the CBCL. Children with higher

Table 4 Relationships among emotion regulation measures (Year 1) and child functioning

	Estimated FSIQ	CASL syntax	CASL pragmatics	Autism severity score (ADOS-2)	Autism symptoms (SRS)	Social skills (SSIS-SS)	Behavior problems (CBCL-TOT)
Emotion regulation (ERC-ER)	0.05	0.09	0.06	−0.11	−0.48***	0.73***	−0.48***
Lability/negativity (ERC-LN)	0.01	−0.07	−0.04	0.15	0.54***	−0.45***	0.75***
Emotion dysregulation (CBCL-EDI)	0.01	0.08	0.08	−0.19^{+}	0.50***	−0.44***	–

Dashes represent correlations that were not run, due to overlap of items between measures

***$p < .001$, $^{+}p < .10$

Table 5 Stability of social and behavioral functioning across time

	Year 1 M(SD)	Year 2 M(SD)	Paired t-tests (Year 1 to 2)	Correlations (Year 1 to 2)
SSIS social skills	80.1 (17.3)	79.9 (17.1)	*N.S.*, $p > .05$	0.67***
CBCL total problems	61.6 (9.3)	62.0 (10.6)	*N.S.*, $p > .05$	0.74***
Externalizing composite	61.4 (8.3)	62.9 (10.0)	$t(104) = -2.45$, $p = .016$	0.78***
Internalizing	59.8 (9.5)	59.4 (11.7)	*N.S.*, $p > .05$	0.63***

***$p < .001$

Table 6 Prediction of change in child functioning by child emotion regulation on ERC-ER

Variable	Outcome: SSIS social skills (Year 2)			Outcome: CBCL externalizing behavior composite (Year 2)		
	β	R^2	ΔR^2	β	R^2	ΔR^2
Block 1		–			0.061	
Child age	–			0.247*		
Block 2		0.441			0.609	0.548***
Child age	–			−0.010		
Parent rating (Year 1)	0.664***			0.784***		
Block 3		0.460	0.019^{+}		0.614	0.005
Child age	–			−0.009		
Parent rating (Year 1)	0.639***			0.776***		
IQ	0.140^{+}			−0.068		
Block 4		0.506	0.046**		0.631	0.017*
Child age	–			−0.007		
Parent rating (Year 1)	0.404***			0.714***		
IQ	0.178*			−0.070		
ERC-ER (Year 1)	0.315**			−0.145*		

Dashes represents that a particular variable/block was not relevant for the outcome measure listed

Parent rating (Year 1) variable entered is social skills at Year 1 for the first column and externalizing behavior composite at Year 1 for the second column

***$p < .001$, **$p < .01$, *$p < .05$

levels of emotion regulation at Year 1 exhibited lowered externalizing behaviors at Year 2 (see Table 6). Meanwhile, child emotion dysregulation on the ERC-LN was a significant predictor of change in child internalizing, but not externalizing, behavior problems on the CBCL. Children with lower levels of emotion dysregulation at Year 1 exhibited lowered internalizing behaviors on the CBCL at Year 2 (see Table 7).

Table 7 Prediction of change in child functioning by child emotion dysregulation on ERC-LN

Variable	Outcome: CBCL internalizing behaviors (Year 2)		
	β	R^2	ΔR^2
Block 1		–	
Block 2		0.400	
CBCL internalizing behaviors (Year 1)	0.632***		
Block 3		0.403	0.003
CBCL internalizing behaviors (Year 1)	0.627***		
IQ	0.052		
Block 4		0.433	0.030*
CBCL internalizing behaviors (Year 1)	0.529***		
IQ	0.051		
ERC-LN (Year 1)	0.199*		

***$p < .001$, *$p < .05$

Discussion

This study examined parent ratings of emotion regulation and dysregulation among young children with ASD. Ratings of children's emotion regulation were largely stable across two assessments, 10 months apart. This level of stability indicates that one can reliably measure children's emotion regulation and dysregulation across time through parent ratings. However, it also suggests that, without targeted intervention, emotion dysregulation is a largely stable construct during the preschool and early school years. Children's emotion regulation was moderately correlated with ratings of their overall social and behavioral functioning and autism symptomatology. These strong relationships suggest that emotion dysregulation may be at the core of some of the behavior problems young children with ASD exhibit during the early school years.

Furthermore, longitudinal analyses indicated that children with ASD who have poorer emotion regulation, as reported by parents, showed declines in social skills and worsening of internalizing and externalizing behaviors across the two assessments. This supports the idea of emotion regulation as a possible pivotal and foundational area for children with ASD, particularly in regards to social and behavioral functioning.

The strong relationships found here between social and emotional functioning mirror those described in the literature for typically developing children (e.g., Blandon et al. 2010; Eisenberg et al. 1993; Rydell et al. 2007). Several models and studies have described how emotions influence social behaviors in positive or negative ways, depending on the appropriateness of the regulation and expression of emotions (Crick and Dodge 1994; Goodman and Southam-Gerow 2010). Thus, children with poor emotion regulation skills may ultimately tend to act in ways that reduce their chances of success in social interactions. For children with ASD, this negative cycle may be particularly salient, as emotion dysregulation exacerbates their social difficulties, resulting in high rates of social rejection or social neglect (Cappadocia et al. 2012; Chamberlain et al. 2007).

To date, many interventions for children with ASD have focused on addressing behavior problems through systematic behavior management (e.g., positive behavior supports, reinforcement of alternative behaviors), while at the same time teaching social skills through modeling and repetition. Even interventions focused on socioemotional development have largely involved teaching children about emotions via tasks that are isolated from the complexities of the social environment (e.g., teaching children to match emotional facial expressions on cards with appropriate labels) and, most importantly, removed from the children's own emotional experiences. However, given the longitudinal prediction of social and behavioral functioning based on child emotion regulation, it appearslikely thatwe may be able to address these difficulties more effectively by working from the ground up, teaching young children with ASD to recognize their own emotional states and helping them learn strategies to manage interfering emotions. In other words, interventions targeting emotion regulation directly might lead to improvements in social abilities and behaviors, supplementing more targeted social and behavioral interventions for these children so that they can more smoothly integrate into settings with their typical peers. Several intervention approaches have begun to target children's emotion dysregulation directly with promising results. Scarpa and Reyes (2011) utilized cognitive-behavioral therapy to address emotion regulation in young children with ASD, with results showing fewer tantrum episodes, shorter tantrums, and improvements in ratings on the ERC as a result of treatment. Additionally, the SCERTS model, a school-based intervention, has a primary goal for children to develop the ability to regulate their emotions in order to cope with stressors and to maintain an emotional state conducive to learning and interacting with others (Prizant et al. 2006). Given the results of these longitudinal analyses, it is predicted that interventions targeting emotion regulation will continue to demonstrate positive benefits across social and behavioral areas for children with ASD.

In contrast to the relationships with social and behavioral functioning, ratings of emotion regulation were unrelated to cognitive or language abilities. This is significant in this study, as 88 % of the children had IQ scores in the typical range, suggesting that high levels of cognitive abilities may not be a protective factor for children with ASD against emotional regulation difficulties. In typically developing populations, some aspects of self-regulation appear to be related to IQ (Calero et al. 2007), but these tend to

be aspects of self-regulation that are generally considered more aligned with attention and executive functioning domains. Meanwhile, regulation of one's emotions and IQ seem to be unrelated constructs even in typically developing populations, given non-significant correlations between emotion regulation and IQ scores (e.g., Graziano et al. 2007). Thus, it appears that emotion regulation is a construct unrelated to cognitive abilities for children with ASD as well as for children with typical development, although further research with children with ASD with the full range of cognitive functioning is needed to clarify this point.

Several limitations exist to the current study that provides potential pathways for future research in this domain. First, despite the significant findings linking emotion regulation to changes in children's social and behavioral functioning, the results differed somewhat across measures (i.e., CBCL-EDI and ERC) and subscales (i.e., ERC-LN and ERC-ER). More studies are needed to demonstrate and bolster this finding, particularly using distinct measures of child emotion regulation. Furthermore, while one of the strengths of this study is the use of multiple measures of emotion dysregulation, further research would benefit from incorporating a direct observational measure of child emotion regulation. In particular, children's difficulties with emotion regulation may influence parents' ratings on profiles or questionnaires relating to total problem behaviors, inflating the correlation between these two constructs. Additionally, as this study utilized an ASD-only sample, direct comparisons with the typically developing population were not possible. Future longitudinal studies utilizing a comparison group of typically developing children and/or children with intellectual disability but without ASD could provide information on how the developmental pathway of emotion regulation might differ for children with ASD.

Author Contributions LB conceived of the study, participated in analysis and interpretation of data, and drafted the manuscript. AE participated in the design of the study and revision of the manuscript. JB participated in the design of the study, data analysis/interpretation and revision of the manuscript. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of Interest Lauren Berkovits declares that she has no conflict of interest. Abbey Eisenhower declares that she has no conflict of interest. Jan Blacher declares that she has no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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