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Assessment of a conceptually informed measure of emotion dysregulation: Evidence of construct validity *vis a vis* impulsivity and internalizing symptoms in adolescents with ADHD

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Abstract

Objectives: Despite advances in understanding associations among attention-deficit hyperactivity disorder (ADHD), emotion dysregulation (ED), and related outcomes, there is incongruity between ADHD-relevant conceptualizations of ED and available measures of ED. To assess the psychometric properties of a parent-report questionnaire of ED conceptualized as deficits in the ability to modulate the (a) speed/degree of emotion escalation; (b) expression intensity; and (c) speed/degree of de-escalation.

Methods: Participants were 209 adolescents with ADHD (78% male; 13.5–17.8 years old [M = 15.2 SD = 0.91]). Questionnaire items were selected from parent-report scales of ED and oppositional defiant disorder and subjected to exploratory factor analysis (EFA) and validity analyses.

Results: The EFA revealed two factors, with speed/degree of escalation combined with intensity as factor one, and speed/degree of de-escalation as factor two. Factor one scores were related to ADHD impulsivity symptoms but not to anxiety and depression symptoms and they remained predictors of impulsivity even in the presence of self-report ED, evincing convergent, discriminant, and incremental validity. Factor two scores were related to anxiety and depression but not impulsivity, evincing convergent and discriminant validity.

Conclusion: These results inform our understanding of ADHD-relevant ED in adolescence and offer avenues for future research in measurement development, as well as for understanding ED and ADHD-related impairment.

KEYWORDS

ADHD, adolescence, emotion dysregulation, psychometrics, validity

Portions of this study were presented at the annual Society for Prevention Research Conference in 2018.

1 | INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a prevalent neurodevelopmental disorder that often persists into adulthood (Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014; Caye et al., 2016), and is associated with negative outcomes (e.g., substance use; Mitchell et al., 2012) and functional impairments (e.g., social impairment; Bunford et al., 2015). A portion of youth with ADHD, especially adolescents, does not respond to available evidence-based therapies (Evans, Owens, Wymbs, & Ray, 2018). It is thus essential to better understand characteristics that are not only associated with the disorder and negative outcomes, but are also potential novel treatment targets. One such characteristic is emotion dysregulation (ED) (Bunford, Evans, & Wymbs, 2015). Emotion regulation is the process via which an emotional state is modified either in that it is decreased or attenuated, or that it is increased or strengthened (Cole, Marin, & Dennis, 2004). Specific processes involved in the modification process include the modulation of physiological, experiential, or behavioral correlates of emotions (Gross, 1999). Physiological regulatory processes are often automatic, and experiential/psychological and behavioral/expressive ones are often controlled (Dan-Glauser & Gross, 2011). Youth with ADHD have been described as being prone to excessive displays of both negative and positive emotions (e.g., being emotionally immature, overly exuberant, rambunctious, and as having low tolerance for anger and frustration; Barkley, Anastopoulos, Guevremont, & Fletcher, 1992; Henker & Whalen, 1989; Landau & Moore, 1991; Richter et al., 2012). These descriptions have led to definitions of ED in the context of ADHD (Barkley, 2010), in keeping with Gottman and Katz (Gottman & Katz, 1989), as deficits in the ability to (a) inhibit a behavioral response to a strong emotion, (b) self-soothe the physiological arousal induced by the emotion, (c) refocus attention, and/or (d) organize oneself for coordinated behaviors in service of a goal.

Although behavioral responses to stimuli are addressed in this definition, physiological or experiential/cognitive aspects of arousal are not, despite biological processes being integral to emotion regulation. Of note, several brain regions implicated in ADHD-associated morphometric alterations, for example, the amygdala, orbitofrontal cortex, dorsolateral frontal cortex (DLPFC), and ventrolateral frontal cortex, are also implicated in emotion regulation (Ochsner et al., 2009). Others have defined emotion processing as involving (a) identification of a stimulus as emotionally significant; (b) in response to such identification, production of an affective state including autonomic, neuroendocrine, and somatomotor (facial, gestural, vocal, behavioral) responses, as well as conscious emotional feeling(s); and (c) regulation of that affective state, via modulation or inhibition of either one or both of the first two processes (Phillips, Drevets, Rauch, & Lane, 2003a). Empirical findings related to this model also correspond to conceptual models positing common neural substrates of ADHD and ED (e.g., the anterior cingulate gyrus [ACG] and PFC; Barkley, 2010). The third process in the aforementioned model, emotion regulation, relies on a dorsal neural system comprised of the hippocampus and dorsal regions of the ACG and PFC (Phillips et al., 2003a). To account for the role of these physiological bases, our group has further refined this definition as follows: *in association with ADHD*, ED involves difficulties in modulation of the (a) the speed with which and degree to which the physiological, experiential, and behavioral expression of an emotion escalates; (b) the intensity of these expressions of an emotion; and (c) the speed with which and degree to which physiological, experiential, and behavioral expression of an emotion deescalates, in a manner congruent with optimal functioning (Barkley, 2010; Bunford, Evans, & Wymbs, 2015; Gottman & Katz, 1989; Rothbart & Derryberry, 1981).

Emotion processing deficits are transdiagnostic, as is ED, with certain manifestations more and others less relevant to any given psychiatric disorder. Not surprisingly, these distinct manifestations are associated with distinct patterns of structural and functional abnormalities in emotion processing neural systems (Phillips, Drevets, Rauch, & Lane, 2003b). For example, emotion processing deficits are characterized by anhedonia, emotional flattening, and persecutory delusions in schizophrenia (Phillips et al., 2003b), emotional lability and mood swings in bipolar disorder during depression and mania (Phillips et al., 2003b), and anhedonia and depressed mood in major depressive disorder (Phillips et al., 2003b). Manifestations relevant to schizophrenia and major depressive disorder are not typically characteristic of ED in association with ADHD (Barkley, 2010; Bunford, Evans, & Wymbs, 2015; Graziano & Garcia, 2016) and there are established differences between manifestations across bipolar disorder and ADHD as well. Youth with pediatric bipolar disorder have been shown to exhibit greater affective stability and variability—but less predictability—than youth with ADHD, whereas youth with ADHD exhibit a chronic pattern of dysregulation compared to youth with bipolar disorder, who exhibit episodic pattern of dysregulation (Rosen & Epstein, 2010). In addition, unlike in bipolar disorder (Phillips et al., 2003b), emotion recognition deficits seem to not apply to ADHD (Wells, Day, Harmon, Groves, & Kofler, 2018).

Although it is beyond the scope of this paper to include extensive discussion on the specific definition of ED, we employ when referring to it in association with ADHD (we refer the interested reader to earlier works wherein such detail is provided; Barkley, 2010; Bunford, Evans, & Wymbs, 2015), a brief overview of prior theory and findings is warranted. Historically, since as early as the 1900s, individuals with ADHD were already described by psychiatrists and psychologists as *being easily aroused to emotion*, or as *easily upset*, and as exhibiting *quickness to anger*, a "*morbid exaggeration of emotional excitability*" (reminiscent of "speed and degree of escalation") or a "*mood intensity*," "*tendency to become overexcited*" (reminiscent of "intensity") and as being unable *self-soothe emotional, physiological arousal induced by strong affect* (reminiscent of "speed of de-escalation") (Barkley, 2010). More recent empirical findings suggest The Behavior Rating Inventory of Executive Function (BRIEF) Emotional Control subscale is associated with DSM-IV hyperactive–impulsive items (r = .56) (Mahone et al., 2002). Of import from our perspective, the Emotional Control subscale is comprised of items reminiscent of speed and

degree of escalation (e.g., becomes upset too easily; becomes tearful easily) and intensity (e.g., reacts more strongly to situations than other children; small events trigger big reactions). Additional items refer to angry, explosive outbursts, frequent mood changes, and increased vulnerability in mood to situational influences. In addition to demonstrating difficulties with speed and degree of escalation, and intensity, adolescents with ADHD (both boys and girls) also experience difficulty with behaviors redolent of speed and degree of *de-escalation* (i.e., return to baseline) as indicated by their scores on the Strategies subscale of the Difficulties with Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) (Bunford, Evans, & Langberg, 2018). Importantly, this subscale is comprised of items that reflect this aspect of ED (e.g., when one gets upset, it takes a long time for one to feel better; when one gets upset, they will not be able to do anything to feel better). Adolescents with ADHD (again, both boys and girls) also experience difficulty with this aspect of emotion regulation as indicated by their scores on the Self-Awareness subscale of the Emotion Regulation Index for Children and Adolescents (ERICA; MacDermott, Gullone, Allen, King, & Tonge, 2010) (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, Fitzgerald, Monk, & Phan, 2018). This subscale is comprised of items that describe an individual who exhibits a generally euthymic emotional style to which he/she is able to return in a timely manner (e.g., "when I get upset, I can get over it quickly") (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018).

During the past two decades, there has been a re-emergence of scientific focus on ADHD-related ED, including in studies with children (e.g., Bunford & Evans, 2017; Maedgen & Carlson, 2000; Melnick & Hinshaw, 2000; Musser et al., 2011), adolescents (e.g., Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018; Seymour et al., 2012), and adults (e.g., Shushakova, Ohrmann, & Pedersen, 2017). Research has focused on the relations of ADHD and ED to comorbidities (e.g., Bunford, Evans, Becker, & Langberg, 2015; Graziano & Garcia, 2016) negative outcomes (e.g., aggression; Melnick & Hinshaw, 2000, alcohol problems; Bunford, Wymbs, Dawson, & Shorey, 2017) and academic and social impairment (e.g., Bunford, Evans, Becker, & Langberg, 2015; Fischer, Barkley, Smallish, & Fletcher, 2007). Some findings indicate that behaviors redolent of ED differentiate individuals who respond to treatment from those who do not (Galanter et al., 2003; Waxmonsky et al., 2008). Together, findings indicate that ADHD is associated with ED across the lifespan and that ED further complicates, exacerbates, or even partially causes certain ADHD-related comorbidities, outcomes, and impairments (Barkley, 2010; Bunford, Evans, & Wymbs, 2015; Graziano & Garcia, 2016; Shaw, Stringaris, Nigg, & Leibenluft, 2015). However, these advances have not been paralleled by research establishing conceptually informed, developmentally appropriate, and psychometrically sound measures of ADHD-related ED—an important gap in knowledge for utility in clinical assessment, treatment recommendation, and progress monitoring (Mash & Hunsley, 2005). Our goal was to evaluate the psychometric properties of a conceptually informed and developmentally appropriate parent-report ED rating scale in adolescents with ADHD.

2 | CONCEPTUALLY-INFORMED, DEVELOPMENTALLY APPROPRIATE, AND PSYCHOMETRICALLY SOUND MEASURES

Although a recent, well-accepted definition of ED (in association with ADHD) that is consistent with others (Barkley, 2010; Gottman & Katz, 1989; Gross, 1999; Linehan, 1993; Lineman, Bohus, & Lynch, 2007) centers around three aspects of the phenomenon (speed of escalation, intensity, and speed of de-escalation; Barkley, 2010; Bunford, Evans, & Wymbs, 2015; Graziano & Garcia, 2016), available rating scale measures—despite their utility in assessing some aspects of ED—do not correspond to these definitions. From among multiple available measures, two pertinent examples are the aforementioned DERS and ERICA. The DERS is based on a conceptualization of emotion regulation as an adaptive way of responding to emotions, including the ability to experience and differentiate the full range of emotions, accept emotional responses, and control behaviors in the face of emotional distress (see Gratz & Roemer, 2004). Yet, there are aspects of that definition that are less relevant to ADHD and related impairments, and there may be aspects missing from that definition that are more relevant to the disorder, as only one DERS subscale out of six (impulsive behavior) was associated with social impairment in youth with ADHD (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018). Further, that aspect of ED did not mediate the relation between ADHD and social skills beyond ODD and depression (Bunford, Evans, Becker, & Langberg, 2015). The ERICA is based on a definition of emotion regulation as the ability to modulate one's emotional arousal in a manner that ensures an optimal level of engagement with the environment (Thompson, 1994). Interestingly, scores on two of three—emotional control (consisting of items that may be indicative of low threshold for emotional excitability/impatience) and emotional self-awareness (consisting of some content indicative of inflexibility)—have been associated with poor social skills in the context of ADHD (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018), and mediated the relation beyond ODD, but only at nonclinical levels of depression (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018). Taken together, these conceptualizations and findings suggest that there are *aspects* of each that may be relevant in the context of ADHD, but separately, neither corresponds to the aforementioned accepted definitions of ED in the context of ADHD. Other rating scale measures target relevant characteristics, such as temperament (Capaldi & Rothbart, 1992) and emotional lability (Harvey, Greenberg, & Serper, 1989) but our focus here is strictly on emotion regulation (*particularly on behavioral aspects thereof given their relevance to ADHD [as opposed to cognitive aspects such as reappraisal, suppression, or distraction, which would be more applicable in case of anxiety or depression*; Bunford, Evans, & Wymbs, 2015*] and aspects that pertain to regulatory processes that take place after the point of exposure and arousal [as opposed to before, such as in* Gross, 1998]).

Despite evidence of feasibility and reliability/validity of a range of measures of ADHD-related ED in children (e.g., observation: Lee et al., 2017; Melnick & Hinshaw, 2000, parent- and self-reported rating scale: Seymour, Chronis-Tuscano, Iwamoto, Kurdziel, & MacPherson, 2014, physiology: Bunford et al., 2017, ecological momentary assessment: Rosen, Epstein, & Van Orden, 2013), these

results may not generalize across development given the uniqueness of adolescence with regard to acquirement of emotion regulation skills (Bunford & Evans, 2017; Silk, Steinberg, & Morris, 2003). A large portion of the available relevant studies in adolescents relied on adolescent self-report (e.g., Bunford, Evans, Becker, & Langberg, 2015; Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018; but see Seymour et al., 2012, for exception) and although self-report measures of ED have been used to good effect in adolescents with ADHD, there is little to no research on parent-report measures of ED that have been established as appropriate for use in this group. This is a limitation given advantages of multi-informant assessment (Mash & Hunsley, 2005) which may be particularly applicable to ED as it has both externalizing (calling primarily for adult report) and internalizing (calling primarily for self-report) features (Mash & Hunsley, 2005). Multi-informant assessment is necessary to capture each informant's unique perspective (Hunsley & Mash, 2007) and discrepancies across informants reflect meaningful contextual variation in functioning (Kraemer et al., 2003). Along these motivations, evidence supporting a DERS—Parent report (Bunford, Dawson, et al., 2018) was recently obtained, though this measure shares a conceptual background with the DERS self-report (Gratz & Roemer, 2004), and as such, has similar concerns with regard to its applicability for ADHD youth.

Finally, the degree to which measures are related to measures of other characteristics they should be related to (i.e., concurrent validity) and the extent to which they nevertheless are distinct from measures of related but conceptually different constructs (i.e., discriminant validity) are key psychometric properties. However, establishing concurrent and discriminant validity of ADHD-related ED measures is complicated by overlap in etiological mechanisms and phenotypic expression both between ADHD-related impulsivity (Barkley, 1997, 2010; Sonuga-Barke, 2003) and ED, as well as between ADHD-related comorbid conditions, such as internalizing symptoms, and ED (Nolen-Hoeksma, Gilbert, & Hilt, 2015). Leading neuropsychological models of ADHD (Barkley, 1997; Sonuga-Barke, 2003) suggest that disinhibition underlies both impulsivity and ED. Based on our model of ED in youth with ADHD, impulsivity may be most aligned with initial speed and intensity of escalation of emotions, but unrelated to the speed of de-escalation. The rumination common among individuals with depression and anxiety may be related to this third component as obsessive and repetitive thinking about the distressing event can extend emotionally dysregulated responses and delay a return to baseline. Taken together, although ED may have shared and unique manifestations with impulsivity and internalizing disorders, no research evaluates the sensitivity of measures that differentiate these characteristics as they relate to ED in individuals with ADHD.

3 | CURRENT STUDY

To address these limitations in assessment of ADHD-related ED in adolescents our goals were to examine (a) whether a conceptual model of ADHD-related ED can be identified in the factor structure of a parent-report questionnaire and (b) examine evidence of the validity of this questionnaire relative to other ADHD-related characteristics (i.e., impulsivity, anxiety, and depression) and self-reported ED in adolescents with ADHD. The parent-report questionnaire comprised items from two measures of ED (ERICA, DERS) that have been previously used with adolescents with ADHD to show that this population exhibits greater ED than their typically developing counterparts and also that ED is associated with parent- and self-rated social impairment beyond ADHD symptoms (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018). The parent-report questionnaire is also comprised of items from a measure of ODD symptoms (Disruptive Behavior Disorders Rating Scale [DBD-RS]; Pelham, Gnagy, Greenslade, & Milich, 1992), given overlap between some manifestations of ED and ODD (Bunford, Evans, & Wymbs, 2015). Evidence of convergent validity would require some relationship among ED, impulsivity, anxiety, and depression whereas evidence of discriminant validity would require that the magnitude of that relationship is not so large as to indicate isomorphism. Evidence of incremental validity requires that the parent-report questionnaire is associated with relevant outcomes beyond self-report.

4 | METHOD

4.1 | Participants

The current sample was obtained from a two-site treatment study of ADHD in high school students. Data analyzed herein were collected at pretreatment eligibility (summer prior to the first treatment year) and at baseline (during the fall of the first treatment year) evaluations (N = 209; M_{age} = 15.2, SD = 0.91, 78.0% male, 78.4% European-American, 15.7% African American, 6.9% Hispanic/Latino, 0.5% Asian or Pacific Islander, and 5.4% other). Based on the assessment process as outlined below, 25.4% met criteria for generalized anxiety disorder, 11.5% met criteria for major depressive disorder, 7.2% met criteria for social anxiety disorder, 8.6% met criteria for conduct disorder (CD), and 44.5% met criteria for oppositional defiant disorder, with 57.4% meeting criteria for at least one of these disorders comorbid to ADHD. Thirty-four percent of participants had a current prescription for medication to treat ADHD. At the time of evaluations, youth were asked to take any prescribed medications as they typically would.

4.2 | Procedures

This research was approved by the (WITHHELD). Informed consent and assent were obtained from the parents of all participants and all participants, respectively.

4.2.1 | Recruitment

Participants were recruited through fliers distributed in local high schools and community and mailed to students in ninth, 10th, or 11th grades between February and June. Fliers advertised an opportunity

for adolescents with trouble paying attention, staying organized, and acting on impulse. Following passing of an initial phone screen (i.e., parent-reported ≥ four inattention symptoms), youth participated in an eligibility evaluation that was standard across all participants, which included cognitive testing, diagnostic interviews with parents and children, and rating scales completed by parents, children, and teachers. Parents completed ratings for their children based on their child's behavior when they were not taking medication. Inclusionary criteria were that children (a) attend one of the participating schools; (b) meet diagnostic criteria for ADHD either on the Parent Children's Interview for Psychiatric Syndromes (Weller, Weller, Rooney, & Fristad, 1999) or parent and teacher report on the ADHD Rating Scale-5 (ARS-5; DuPaul et al., 2016); (c) demonstrate an IQ of ≥75 on a two-subtest score of the Wechsler Abbreviated Scale of Intelligence–Second Edition (Wechsler, 2011); (d) do not exhibit high probability of a substance use disorder on the Substance Abuse Subtle Screening Inventory, Adolescent (Miller, 1999) and (e) do not meet diagnostic criteria for bipolar disorder, obsessive–compulsive disorder, or psychosis on the P-ChIPS. Those who met criteria for these diagnoses were excluded as their symptoms likely would have prevented the student from benefiting from the treatment program. Other resources were recommended to these excluded families. Graduate students in clinical psychology and school psychology and Master's level clinicians completed the eligibility evaluations. All eligibility and diagnostic decisions were reviewed by doctoral-level psychologists and 25% of those decisions were randomly selected for blind cross-site review (i.e., by doctoral-level psychologists at the other research site). Diagnostic reliability across sites was 100%.

The ERICA-Parent, DERS-Parent, and DBD-RS were used to create the conceptually informed measure of ED (see Table 1) and completed at the eligibility evaluation, which took place during the spring or summer prior to the treatment year. The remaining measures were used to assess impulsivity, anxiety, depression, and self-reported ED and were completed at baseline (September of the school year).

4.3 | Measures

4.3.1 | Emotion regulation index for children and adolescents—Self- and parent report (ERICA-S and ERICA-P)

The 16-item ERICA (MacDermott et al., 2010) is a self-report measure of emotion regulation, with adequate psychometric properties (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018; MacDermott et al., 2010). Higher scores indicate better emotion regulation. Items are rated on a five-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). In the current sample, the ERICA-S

TABLE 1 Factor loadings and descriptive statistics for items selected from ERICA, DERS, and DBD-RS

Items	Factor 1	Factor 2	*M*	*SD*	Skew	Kurtosis
DBD 26—My child is often touchy or easily by annoyed by others.	0.64*	0.07	1.48	.94	0.24	−0.87
DBD 28—My child often loses their temper.	0.83*	- 0.08	1.31	.97	0.28	−0.88
ERICA 5—When things do not go my child's way, they get upset easily.	- 0.61*	- 0.04	2.55	.99	0.21	−0.57
ERICA 14—My child does things without thinking about them first.	- 0.43*	0.01	2.43	1.00	0.13	−0.60
DERS 3—My child experiences their emotions as overwhelming and out of control.	0.52*	0.30*	2.16	1.07	0.85	0.10
DERS 14—When my child is upset, they become out of control.	0.86*	0.00	1.95	1.17	1.21	0.55
DERS 19—When my child is upset, they feel out of control.	0.70*	0.21*	2.22	1.19	0.83	−0.15
DERS 24—When my child is upset, they feel like they can remain in control of their behaviors.	0.48*	0.14	3.10	1.21	−0.32	−1.10
DERS 27—When my child is upset, they have difficulty controlling their behaviors.	0.88*	- 0.01	2.46	1.30	0.64	−0.76
DERS 32 – When my child is upset, they lose control over their behavior.	0.79*	0.09	2.07	1.20	1.09	0.27
ERICA 7—My child has angry outbursts.	- 0.84*	0.07	3.33	1.32	−0.31	−1.05
ERICA 4—When my child gets upset, they can get over it quickly.	- 0.13	- 0.54*	3.04	.93	−0.04	0.04
DERS 15—When my child is upset, they believe that they will remain that way for a long time.	- 0.01	0.80*	1.82	1.01	1.25	1.04
DERS 28—When my child is upset, they believe there is nothing they can do to feel better.	0.11	0.68*	2.10	1.09	1.02	0.41
DERS 31—When my child is upset, they believe that wallowing in it as all they can do.	0.01	0.79*	1.86	1.00	1.41	1.83
DERS 33—When my child is upset, they have difficulty thinking about anything else.	0.20*	0.57*	2.87	1.29	0.32	−1.13
DERS 35—When my child is upset, it takes them a long time to feel better.	- 0.03	0.82*	2.16	.99	0.89	0.52

Note: Factor 1 = ED speed of escalation and intensity of response; Factor 2 = ED speed of de-escalation. Two items (DERS 13 = when my child is upset, they have difficulty getting work done; DERS 18 = when my child is upset, they have difficulty focusing on other things) were removed from previous solutions because they cross-loaded on multiple factors. One other item (DERS 34 = when my child is upset, they take time to figure out how they are really feeling) was removed because it weakly loaded on one factor.

Abbreviations: DBD, Disruptive Behavior Disorders Rating Scale—Parent Report; DERS, Difficulties in Emotion Regulation Scale—Parent Report; ERICA, Emotion Regulation Index for Children and Adolescents Scale—Parent Report.

*$p < .05$.

demonstrated adequate internal consistency (α = .77), and the total score was used in analyses examining the incremental validity of the parent-report questionnaire developed in this study.

As in Bunford, Dawson, et al. (2018), items of the original measure were adapted to assess parental perceptions of adolescent emotion regulation. Similar to the ERICA-S, items are also rated on a five-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). In the current sample, the ERICA-P demonstrated good internal consistency (α = .82).

4.3.2 | Difficulties in emotion regulation scale—Self-report and parent report (DERS-S and DERS-P)

The 36-item DERS-S is a self-report measure of ED (Gratz & Roemer, 2004), with adequate psychometric properties (see Adrian et al., 2009; Vasilev, Crowell, Beauchaine, Mead, & Gatzke-Kopp, 2009; Weinberg & Klonsky, 2009). Higher scores indicated greater ED (and thus, *worse* regulation). Items are rated on a five-point Likert scale (1 = *almost never*; 5 = *almost always*). In the current sample, the DERS-S demonstrated excellent internal consistency (α = .93), and the total score was used in analyses examining the incremental validity of the parent-report questionnaire developed in this study.

The DERS-P is a 29-item parent-report measure of child ED (Bunford, Dawson, et al., 2018), with adequate convergent, concurrent, and incremental validity as well as internal consistency (Bunford, Dawson, et al., 2018). Higher scores indicate greater ED (and thus, *worse* regulation). Items are rated on a five-point Likert scale (1 = *almost never*; 5 = *almost always*). In the current sample, the DERS-P demonstrated excellent internal consistency (α = .93).

4.3.3 | Disruptive behavior disorders rating scale—Parent report (DBD-RS)

The 45-item DBD-RS is a parent-report measure of ADHD, ODD, and CD symptoms (Pelham et al., 1992), with adequate psychometric properties (e.g., van Eck, Finney, & Evans, 2010). Higher scores indicate greater number and severity of symptoms. Items are rated on a four-point Likert scale (0 = *not at all*; 3 = *very much*). In the current research, the DBD demonstrated adequate internal consistency (α = .72).

4.3.4 | ADHD rating scale−5 (ARS-5)

The 30-item ARS-5 (DuPaul et al., 2016) is a parent-report measure of ADHD symptoms and impairment, with strong psychometric properties (DuPaul et al., 2016). Higher scores indicate greater number and severity of symptoms. Items are rated on a four-point Likert scale (0 = *not at all or never*; 3 = *very often*). The three ADHD impulsivity symptoms were summed to index impulsivity. In this study, the ARS-5 items demonstrated excellent reliability (α = .92).

4.3.5 | Barratt impulsiveness scale (BIS-11)

The 30-item BIS-11 (Patton, Stanford, & Barratt, 1995) is a self-report measure of behavioral/personality dimensions of impulsivity, with acceptable psychometric properties (Vasconcelos, Malloy-Diniz, & Correa, 2012). Higher scores indicate greater impulsivity. Items are rated on a four-point Likert scale (1 = *rarely/never*; 4 = *almost always*). In this study, two subscales supported by previous research (Haden & Shiva, 2009; Reise, Moore, Sabb, Brown, & London, 2013)—behavioral (i.e., acting impulsively or in spur of the moment) and cognitive (i.e., "attentional control, concentration, careful and deliberate thinking and planning"; Reise et al., 2013, p. 640) impulsivity—were used. However, scores on these subscales demonstrated questionable internal consistency (α = .64, behavioral; α = .68, cognitive).

4.3.6 | Beck youth inventory II—Anxiety (BYI-II-Anxiety)

The BYI-II-Anxiety is a 20-item self-report scale of anxiety symptoms in children and adolescents (Beck, Beck, Jolly, & Steer, 2005), with adequate psychometric properties (Beck et al., 2005). Higher scores indicate greater anxiety. Items are rated on a four-point Likert scale (0 = *never*; 3 = *always*). In the current study, the BYI-II-Anxiety demonstrated excellent internal consistency (α = .91).

4.3.7 | Reynolds adolescent depression scale-II (RADS-2)

The RADS-2 is a 10-item self-report scale of depressive symptoms in children and adolescents (Reynolds, 2002), with evidence of reliability and validity (Reynolds, 2002). Higher scores indicate greater depression. The total depression *T* score was used and the RADS-2 demonstrated good internal consistency (α = .87).

4.4 | Analytic plan

First, considering all ERICA-Parent, DERS-Parent, and DBD-RS ODD items, two authors (WITHHELD) worked together to develop a list of items hypothesized to correspond to the three aspects of ED (speed of escalation, intensity, speed of de-escalation; Bunford, Evans, & Wymbs, 2015). A third author (WITHHELD) offered feedback, and in cases of disagreement, conclusion was established through discussion, determining a final item list via this iterative process.

Next, exploratory factor analysis (EFA) in Mplus Version 8 (Muthen & Muthen, 2017) and using a Maximum Likelihood Robust estimator with geo-min oblique rotation was conducted to address the first research question. To determine the number of factors to extract, procedures recommended by Kline (2016) were followed. First, model fit indices including the Comparative Fit Index, (CFI), root mean square error approximation (RMSEA), and the Standardized

Root Mean Square Residual (SRMR) were examined. As pertinent cut-offs are general guidelines, model fit was considered based on multiple indices (CFI ≥.90 suggest adequate fit; RMSEA <.06 indicate good fit, <.08 adequate fit, >.08 and < .10 indicate mediocre fit, and ≥ .10 indicate poor fit; and SRMR <1.00 suggest adequate fit; Brown, 2015; Hu & Bentler, 1999). Second, the eigenvalue-greater-than-one approach was used (Kaiser, 1960) and third, parallel analysis was conducted (Horn, 1965) to account for sampling error associated with the eigenvalue-greater-than-one approach (eigenvalues produced by parallel analysis are compared to those produced by Kaiser's [1960] approach). The best fitting model was the one that fits the data well and provided better fit than models with one fewer or one additional factor (Fabrigar, Wegener, MacCallum, & Strahan, 1999). The pattern of item loadings was also examined and a minimum of three items/factor indicated the factor is interpretable (Velicer & Fava, 1998). Items were considered to cross-load if they loaded significantly on two factors but did not load ≥.40 on one of them (Osborne & Costello, 2005). Items were considered to load weakly if they loaded significantly on one factor, but at less than .32 (Tabachnick & Fidell, 2007). Significant values of factor loadings were Benjamini-Hochberg-corrected (Benajmini & Hochberg, 1995). Because there may be differences in comorbid symptoms between boys and girls with ADHD (Gershon, 2002), we examined the relation between ED and sex. We also examined the relation between ED and age, and ED and medication use.

To examine convergent and discriminant validity, relations among the ED factors and impulsivity (indexed by the ARS impulsivity items and two BIS-11 subscales), anxiety, and depression were examined using Exploratory Structural Equation Modelling (ESEM). Age, sex, and medication use were controlled for in all analyses. Preliminary associations among variables were examined in correlational analyses and then unique associations across variables were examined through regression paths. The ED factors were independent variables and impulsivity, anxiety, and depression were dependent variables. To examine incremental validity or the degree to which ED factors were associated with impulsivity, anxiety, and depression (the latter three conceptualized again as manifest variables) above and beyond total scores on the two self-report measures of ED, regression paths were assessed using ESEM.

5 | RESULTS

Twenty items (five speed of escalation, seven intensity, and eight speed of de-escalation) were selected from the ERICA-Parent, DERS-Parent, and DBD-RS as best conceptually aligning with the hypothesized three aspects of ED (see Table 1 for descriptive statistics). Data were examined for outliers using the Mean Absolute Deviation (MAD) method, wherein the median, rather than the mean, is used to determine criteria for what constitutes an outlier (Leys, Ley, Klein, Bernard, & Licata, 2013). A MAD of 2.5 was selected as a cut-off (Miller, 1991) and indicated no outliers. Skewness and kurtosis were in normal range for all items (Curran, West, & Finch, 1996).

5.1 | Aim 1: Assess the factor structure of a conceptually derived, three factor model of ED

Eigenvalues from the correlation matrix suggested up to four factors, whereas parallel analysis indicated eight factors. In all solutions with more than two factors, one or more factors had less than three items (see Velicer & Fava, 1998); thus, only the one- and two-factor solutions were considered. Of these, the two-factor solution better fit the data, though two items cross-loaded (DERS-P-13 = when my child is upset, he/she has difficulty getting work done; and DERS-P-18 = when my child is upset, he/she has difficulty focusing on other things), and one item loaded weakly on one factor (DERS-P-34 = when my child is upset, he/she takes time to figure out how he-she is really feeling). Following removal of these items, 17 remained (see Table 2 for EFA fit indices). For the two-factor solution, model fit indices suggested adequate fit (χ^2 = 234.54, *df* = 103, *p* < .001, CFI = .94, RMSEA = .08, SRMR = .04). The two factors accounted for 60% of the variance in all items and were correlated (*r* = .51; *p* < .05). Eleven items loaded onto one factor, conceptualized as speed and degree of escalation (intensity) and six items loaded onto a second factor, conceptualized as speed of de-escalation (return to baseline; see Table 1 for factor loadings). Reliability estimates were α = .92 for speed and degree of escalation (intensity) and α = .87 for speed of de-escalation (return to baseline).

5.2 | Research aim 2: Evaluate evidence for validity of this measure

5.2.1 | Control variables

To examine the relations between age, sex, medication use (yes or no), and ED, exploratory structural equation modeling (ESEM) was conducted. None of these variables were associated with scores on either ED factor. However, given their theoretical importance in the variables used to examine convergent and discriminant validity (Gershon, 2002), they were retained for validity analyses.

5.2.2 | Convergent and discriminant validity

To establish discriminant validity, relations among the ED factors and impulsivity, anxiety, and depression were also examined using ESEM. See Table 3 for correlations among the two ED factors, impulsivity, anxiety, and depression. Because the two ED factors were correlated, their relations with impulsivity, anxiety, and depression were examined controlling for the other factor, in addition to age, sex, and medication use. These analyses revealed (see Table 4), first, that ADHD impulsivity symptoms were positively related to speed/° of escalation (β = .45, *p* < .001), but not to speed of de-escalation. Second, BIS-11 cognitive and behavioral impulsivity were not related to either ED factor. Finally, anxiety (β = .21, *p* = .02) and depressive (β = .21, *p* = .02) symptoms were related to de-escalation but not speed/° of escalation.

TABLE 2 Final exploratory factor analysis (EFA) model fit indices for the items selected from the DBD, ERICA, and DERS

Factors	χ^2	CFI	RMSEA	SRMR
1	600.49	0.77	0.14	0.10
2	234.53	0.94	0.08	0.04
3	172.40	0.96	0.07	0.03
4	109.68	0.98	0.05	0.02

Note: CFI values >.90 suggest adequate fit; RMSEA values <.06 indicate good fit, <.08 indicate adequate fit, between .08 and .10 indicate mediocre fit, and > .10 indicate poor fit; SRMR values <1.00 suggest adequate fit (Brown, 2015). The two-factor solution was selected adopted as the final model.

Abbreviations: CFI, Comparative Fit Index; DBD, Disruptive Behavior Disorders; DERS, Difficulties with Emotion Regulation Scale.

The ED factors accounted for 18% of the variance in ADHD impulsivity symptoms, 7% of the variance in anxiety, and 7% of the variance in depression.

5.2.3 | Incremental validity

To establish incremental validity, ESEM was conducted in the same manner as described for convergent and discriminant validity. Results can be seen in Table 5. Age, gender, and medication use were controlled for, and ERICA and DERS self-report scores were added to the model. After controlling for ERICA and DERS self-report scores, speed/◦ of escalation remained a significant correlate of ARS impulsivity (β = .45, p < .001) but de-escalation did not remain a significant

TABLE 3 Correlations among the ED factors and anxiety, depression, and impulsivity

Construct	1	2	3	4	5	6
1 ED–factor 1	–					
2 ED–factor 2	.50**	–				
3 BAI	.16†	.27***	–			
4 RADS	.16†	.27***	.76***	–		
5 ARS	.42***	.15†	.04	.06	–	
6 BIS–1	–.03	–.09	.16†	.30***	.03	–
7 BIS–2	.16*	.21*	.57***	.52***	.14†	.17*

Abbreviations: ADHD, attention-deficit hyperactivity disorder; ARS, ADHD impulsivity symptoms; BAI, anxiety symptoms; BIS-1 = cognitive impulsivity; BIS-2 = behavioral impulsivity; ED, emotion dysregulation; ED–factor 1, ED speed of escalation and intensity of response; ED–factor 2, ED speed of de-escalation; RADS, depression symptoms.

†p < .10.

*p < .05.

**p < .01.

***p < .001.

TABLE 4 Unique associations among the ED factors and anxiety, depression, and impulsivity

	BAI		RADS		BIS–1		BIS–2		ARS	
	β	s.e.	β	s.e.	β	s.e.	β	s.e.	β	s.e.
Gender	.17*	.08	.18*	.08	.09	.08	.04	.08	–.01	.06
Medication	.06	.08	.04	.08	–.08	.07	–.05	.08	–.02	.07
Age	.05	.08	.08	.08	–.18	.09	.02	.08	.17	.07
ED–factor 1	.03	.10	.02	.10	–.03	.10	.07	.10	.45***	.07
ED–factor 2	.21*	.09	.21*	.09	–.09	.10	.16	.12	–.08	.08

Note: Gender and medication use were ordinal variables and were coded as follows: for gender, 1 = boys, 2 = girls; for medication, 1 = on medication, 2 = not on medication.

Abbreviations: ADHD, attention-deficit hyperactivity disorder; ARS, ADHD impulsivity symptoms; BAI, anxiety symptoms; BIS-1, cognitive impulsivity; BIS-2, behavioral impulsivity; ED, emotion dysregulation; ED–factor 1, ED speed of escalation and intensity of response; ED–factor 2, ED speed of de-escalation; RADS, depression symptoms.

†p < .10.

*p < .05.

**p < .01.

***p < .001.

TABLE 5 Incremental validity in associations between ED factors and anxiety, depression, and impulsivity

	BAI		RADS		ARS	
	β	s.e.	*β*	s.e.	*β*	s.e.
Gender	.13	.08	.16*	.07	.02	.06
Medication	.04	.08	.03	.06	.17**	.07
Age	.05	.07	.12†	.07	−.01	.07
DERS-S	.36***	.10	.29***	.09	−.14†	.08
ERICA-S	−.12	.09	−.34***	.08	−.11	.09
ED–factor 1	.01	.09	−.01	.08	.45***	.08
ED–factor 2	.14	.09	.12	.08	−.08	.09

Note: Gender and medication use were ordinal variables and were coded as follows: for gender, 1 = boys, 2 = girls; for medication, 1 = on medication, 2 = not on medication.

Abbreviations: ARS, ADHD impulsivity symptoms; BAI, anxiety symptoms; DERS-S, Difficulties in Emotion Regulation Scale self-report scores; ED, emotion dysregulation; ED–factor 1, ED speed of escalation and intensity of response; ED–factor 2, ED speed of de-escalation; ERICA-S, Emotion Regulation Index for Children and Adolescents self-report scores; RADS, depression symptoms.

†$p < .10$.

*$p < .05$.

**$p < .01$.

***$p < .001$.

correlate of anxiety (β = .14, p = .13) or depressive symptoms (β = .12, p = .13).

6 | DISCUSSION

Our goals in this study were to develop a parent-report measure of ED that corresponds to accepted, ADHD-relevant definitions and test for evidence of concurrent, discriminant, and incremental validity in a large sample of adolescents. Findings indicated a two-component characterization of ED (i.e., speed of escalation *combined with* intensity; and speed of de-escalation) and lend preliminary support for evidence of the assessed aspects of reliability and validity as indexed in relation to impulsivity, anxiety, and depression. There was mixed support for incremental validity, as the first component remained a significant correlate of impulsivity—as indexed by the ARS—after controlling for DERS and ERICA self-report scores, age, and sex. However, after controlling for these self-report scores and demographic variables, the second component was no longer related to anxiety or depressive symptoms. Importantly, we note that our results are preliminary, as they are based on EFA; it will be critical for future work to investigate these questions using more theory-driven confirmatory factor analysis (CFA), which will also allow for examination of measurement invariance across age and gender.

The definition of ED that informed creation of the parent-report questionnaire assumes a three-component structure of ED, involving deficits in the regulation of the: (a) speed and degree of emotion escalation; (b) emotion intensity; and (c) speed of de-escalation. Yet, findings indicated a two-factor solution, corresponding to speed of escalation *combined with* intensity, and speed of de-escalation. As such, our data suggest that externally observable ADHD-related ED may be better understood as a two- rather than a three-component characteristic, at least in adolescents. One explanation of these findings is that the items selected were insufficiently specific to reflect nuanced behavioral differences between these theoretically separable components. Or, present results may reflect that parents—or perhaps external observers in general—are unable to differentiate between speed of escalation and emotional intensity, given the rapid co-occurrence of the two, and thus perceive them as unidimensional. Pending replication, it will be a key next step in future research to determine the extent to which the distinction between speed of emotion escalation and emotion intensity is clinically meaningful, and thus whether or not measures more sensitive to it are needed. Certainly, combination of parent report and self-report may be a prudent methodological consideration as adolescents may be better at differentiating these two components as they may have enhanced awareness of the distinction between how *quickly* they feel they become angry or happy compared to *much* they feel they become angry or happy.

It is important to note that the combination of these relatively more subjective measures with more objective ones would best reflect emotion regulation as a multisystemic process that includes physiological, experiential, and behavioral components, with the possibility of congruence and incongruence among such components and respective measures (Bunford & Evans, 2017). Physiological measures are more objective measures and some of these may be especially appropriate for differentiating among speed of escalation, intensity, and speed of de-escalation. For example, event-related potentials (ERPs) reflect changes in electrocortical activity linked to specific events (e.g., the presentation of a stimulus such as a face depicting an emotion). ERPs have excellent temporal resolution and are appropriate for indexing both the temporal progression and the intensity of the stimulus-locked electrophysiological response (Bunford, Kujawa, et al., 2018). As another example, measures of autonomic nervous system (ANS) functioning are also relevant to emotion regulation as the ANS is responsible for transitioning between arousal—which is governed by the sympathetic (SNS) branch—and relaxation, which is governed by the parasympathetic (PNS) branch. Using heart rate variability (HRV) as a physiological marker of parasympathetic engagement, Bunford, Evans, Zoccola, and Rybak (2013) reported that adolescents with ADHD exhibited greater ANS rigidity to a frustration task than adolescents without ADHD, indicating prolonged return to emotional baseline.

Our results generally reflect preliminary evidence of convergent validity, insofar as they indicate some relationship between ED and other ADHD-related characteristics, such as impulsivity and comorbid internalizing symptoms. Greater ADHD impulsivity as indexed by the ARS-5 was associated with factor one (i.e., faster emotional escalation combined with greater emotional intensity), but not factor two (i.e., speed of emotional de-escalation). Similarly, greater anxiety and depression were associated with speed of emotional de-escalation, but exhibited no relationship with speed of escalation combined with

intensity. Our findings also support preliminary evidence of discriminant validity, as none of the observed associations were of such a magnitude as to indicate redundancy. Support for incremental validity was mixed, as first, the relation between parent-reported emotional escalation and intensity and ADHD-related impulsivity remained statistically significant in the present of two indices of self-report emotion regulation, as well as age and gender. However, the relation between parent-reported emotional de-escalation and anxiety and depression became nonsignificant in the presence of self-reported emotion regulation and age and gender. Taken together, these findings suggest that emotional escalation and intensity are more closely related to specific impulsive actions (defined as inability to inhibit a prepotent response; MacKillop et al., 2016), whereas parent-report speed of emotional de-escalation—return to baseline—contributes less variance to anxiety and depressive symptoms above and beyond self-report, and after controlling for age and gender. This result may not be too surprising as adolescents, rather than parents or caregivers, are considered to be the best reporters of internalizing symptoms given the inner turmoil associated with those experiences (Silverman & Ollendick, 2005).

Interestingly, neither component of ED was related to impulsivity as indexed by either of the Barratt impulsivity subscales. The first of these, cognitive impulsivity, is comprised of items related to difficulties with concentration and planning, and to thinking carefully about things. The second, behavioral impulsivity, is comprised of items reflecting a tendency to act on the spur of the moment, frequently change friends, and experience extraneous, racing thoughts. In interpreting these findings, it is important to note that first, neither subscale focuses on reactions to stimuli characterized by acting without thinking and intense emotional responsiveness. Rather, in the context of larger order frameworks used to understand the construct of impulsivity (e.g., MacKillop et al., 2016), these subscales may fall in the personality traits domain, in which impulsivity is conceptualized as a stable characteristic inherent to one's identity. Per this conceptualization, impulsivity is understood as a tendency to engage in larger order, more general behaviors (e.g., acting on spur of the moment). In contrast, impulsivity as measured by the ARS may be more state-based it focuses on more specific behaviors that manifest as a result of the inability to inhibit a prepotent response (e.g., interrupt others frequently). Our results suggest that the ADHD impulsivity symptoms that are central to the disorder may best capture the impulsivity aspects of ED with adolescents with ADHD.

It is interesting to note that internal consistency for the BIS (α = .64; behavioral; α = .68; questionable) was questionable. This is inconsistent with a bulk of prior work (see Vasconcelos et al., 2012, for a review). It is possible that the solution used in the present study—conceptualizing impulsivity as behavioral and cognitive—is less applicable to ADHD samples than typically developing or normative samples. In the future, researchers may wish to clarify aspects of trait-based impulsivity that are most relevant to ADHD samples.

Beyond measurement and psychometric considerations, the data obtained in this study may have implications for advancing knowledge of ADHD-related ED in adolescents. The noted overlap in etiological mechanisms and phenotypic expression across ADHD-related ED and ADHD-related impulsivity and comorbid conditions (Barkley, 2010) contributed to controversy about whether ADHD-related ED is differentiable from—or is anything other than—one of many behavioral manifestations of disinhibition and/or comorbid externalizing or internalizing disorders. Disinhibition is a core deficit in ADHD that underlies both its behavioral manifestation, impulsivity (Bari & Robbins, 2013; Logan, Schachar, & Tannock, 1997), and purportedly also ED (Barkley, 1997; Sonuga-Barke, 2002, 2003). This is what has served as basis for arguments that impulsivity and ED may be different manifestations of the same deficit. Prior empirical data are mixed in this regard (Bunford, Evans, & Wymbs, 2015) though in studies where the association between impulsivity and ED has been examined, the magnitude of the observed effect suggests that the two are distinct (e.g., r = .31; Weiss, Tull, Viana, Anestis, & Gratz, 2012).

Specific to ADHD, the current literature also does not suggest that impulsivity and ED may be different manifestations of the same disinhibitory deficit. Rather, there are additional neurobiological processes, such as attention allocation, motivation, and reward processing that contribute to poor emotion regulation in individuals with ADHD. Corresponding pathophysiological models consider "bottom-up" and "top-down" processes as involved in emotion regulation. The former engage posterior attention systems to detect or orient toward motivationally or emotionally salient stimuli (for review, see Shaw et al., 2015) as well as reward processing systems to evaluate emotionally salient stimuli as signals of potential reward. Electrophysiological findings indicate anomalies in early orienting to emotional stimuli in adults with ADHD (for review, see Shaw et al., 2015) and there is general agreement that ADHD is at least partly associated with reward-system dysregulation (Holroyd & Coles, 2002). Regarding the latter or "top-down" processes, evidence indicates that deficits in autonomic regulation as well as anterior attention (associated with cognitive or executive control) systems are responsible for attention regulation (Shaw et al., 2015). Yet others, in a large sample of youth, found that cognitive and motivational deficits (i.e., executive functions, choice impulsivity, response variability, processing speed, and the influence of energetic and/or motivational factors) did not explain emotional lability beyond ADHD symptom severity, suggesting the role of alternative mechanisms (Banaschewski et al., 2012). This is the first study wherein the difference between ADHD-related ED and trait impulsivity was investigated using rating scale methods in an ADHD sample. Findings that greater ADHD-related impulsivity was related to faster emotional escalation combined with greater emotional intensity—but not speed of emotional de-escalation—lend support to the notion that albeit related, ADHD-related impulsivity, and ED are not redundant and that the relation between the two is specific to certain aspects of emotion regulation.

Current results indicate, similar to impulsivity, that the link between anxiety and depression symptoms and ED is specific to certain aspects of emotion regulation. Our results extend prior work on characteristics redolent of—or related to (but not synonymous with)—ED. Such work has focused on affective instability, emotional impulsivity or lability, and pertinent behavioral functioning (Factor, Reyes, &

Rosen, 2014; Rosen & Factor, 2015; Skirrow, McLoughlin, Kuntsi, & Asherson, 2009); or comorbidity (Anastopoulos et al., 2011). Specifically, unlike in the case of impulsivity, anxiety and depression were related not to emotional escalation and intensity but to emotional de-escalation. Rumination common among individuals anxiety or depression (Nolen-Hoeksma, Gilbert, & Hilt, 2015) may be a mechanism of this link as obsessive and repetitive thinking about an emotionally arousing event can extend emotionally dysregulated responses and delay a return to baseline. Notably, there was no overlap among items on the measures we used to index ED, impulsivity, anxiety, and depression, and as such, we are confident that the associations among these constructs are specific to *certain aspects* of ED.

Although based solely on these data and in the absence of replication, it would be premature to definitively argue for a two-component conceptualization of ADHD-related ED in adolescents, it does seem warranted to discuss what clinical implications such conceptualization would have. Specifically, if speed of escalation cannot be differentiated from intensity, then these two may not be worthwhile to assess or treat as separate intervention targets in psychosocial interventions designed to address difficulties with emotion regulation and related problems in teens with ADHD. Techniques that uniquely address how quickly one becomes emotionally aroused and/or how much one gets emotionally aroused might not need to be tailored to such nuanced differences. Nevertheless, these considerations apply only if it is indeed the case, independent of measurement modality or measurement tool, that these two components of ED are not separable or meaningfully distinct, as noted above.

7 | LIMITATIONS AND FUTURE DIRECTIONS

Limitations to this research, along with additional directions for future research, are as follows: Although our ED measure exhibited evidence of acceptable psychometric properties and two of the measures from which we chose items to create our measure also have established psychometric properties, they nevertheless have some limitations. First, the number of questions assessing dysregulation of positive emotions is negligible, despite the potential importance of deregulation of emotions like excitement or happiness that may lead to negative peer appraisals. Second, as a result of our item selection, there is some overlap with ODD and this measure of ED. This may appear problematic given the need to separate ODD and ADHD-related ED but this amount of overlap is likely acceptable as there is, factually, also some degree of overlap in observable manifestations of ODD symptoms and ED (Bunford, Brandt, Golden, et al., 2015). Third, the ERICA-P has not been validated as the DERS-P has been.

As a means of further psychometric and clinical validation, it will be important to evaluate the association between the two subscales of our measure and areas of functional impairment, particularly in the social domain. Similarly, evaluating stability of the obtained factor structure over time and across development is a likely worthwhile next step in this line of research. Finally, in the absence of another appropriate sample, it cannot be ascertained that this ED model is ADHD specific. Rather, it may well be a general ED model applicable to adolescents is not specific to ADHD but relevant to the externalizing dimension.

8 | CONCLUSION

The current data are among the first to shed light on the degree to which the empirical factor structure of a parent-report questionnaire of ADHD-related ED corresponds to a conceptual three-component approach of that characteristic. The obtained structure best represents two components, with one corresponding to a combination of emotional escalation and intensity—uniquely related to impulsivity, and the other corresponding to emotional de-escalation—uniquely related to internalizing symptoms. In addition, there being little research on measures of ED appropriate for use with adolescents, other than on self-report measures of ED (Bunford, Evans, & Langberg, 2018; Bunford, Kujawa, et al., 2018; Seymour et al., 2014), these results are progress towards fulfilling the need for the development and/or evaluation of additional, multi-informant measures of ADHD-related ED.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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ENDNOTES

[1]As we note in our earlier work, "Relatedly, other authors consider the emotion regulation process to involve more steps than we discuss in this review. For example, Gross (1998) proposes that emotion regulation involves situation selection, situation modification, attention deployment, cognitive changes, and response modulation. As such, Gross (1998) conceptualizes the regulatory process as beginning earlier than we do. The early steps of situation selection and situation modification, attending to (and accurately recognizing), or refocusing attention from, arousing stimuli as well as impairment in such processes may be relevant for the association between ADHD and ED. Our focus […] is on those aspects of emotion regulation that pertain to steps in the regulatory process that take place after the point of arousal." Accordingly, we respectfully disagree that the definition we had been working with and are focusing on in this paper are inconsistent with the said findings or review. It is rather the case that our focus is on a narrower slice of the emotion processing and regulation process.

[2]Because one of the items included in Factor 1 (ERICA 14) is "My child does things without thinking about them first" it would seem that this item likely overlaps substantially with the ARS-5 items about impulsivity. Thus,

we investigated whether the results examining correlations between ED factors and impulsivity hold after removing this item from Factor 1. We conducted item-level correlations between this ERICA item and ARS-5 impulsivity items, and correlations ranged from .30 to .39. When the ERICA item was removed from factor 1, the correlation between factor 1 and ARS impulsivity was .40 ($p < .001$).

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