ADHD and Emotion Dysregulation Among Children and Adolescents

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Abstract Individuals with attention-deficit/hyperactivity disorder (ADHD) experience impairments in a number of functional domains. Although current evidence-based treatments for ADHD reduce symptoms and improve academic and behavioral functioning, they have minimal impact on social functioning or on risky behaviors (see Evans et al. in J Clin Child Adolesc Psychol, 43:527–551, 2014 for review). Preliminary evidence indicates that emotion dysregulation (ED) is associated with impairments across the developmental spectrum, such as social impairment and risky behaviors, and that its relative absence/presence is differentially associated with treatment response. It thus stands to reason that by incorporating a focus on ED in interventions targeting social impairment and risky behaviors, we may be able to increase the number of youth who respond to such interventions and decrease the prevalence or degree of these impairments and behaviors among youth and adults with ADHD. However, a number of questions remain unaddressed about the association between ADHD and ED, such as the portion of individuals with ADHD who experience ED, the extent to which ED is associated with the above impairments and behaviors, and whether or not ED is malleable. To begin addressing these questions, we summarize and critically evaluate the literature on the association between ADHD and ED and make recommendations for future basic, translational, and treatment outcome research.

Attention-deficit/hyperactivity disorder (ADHD) is prevalent (e.g., 8.7 % of youth carry the diagnosis in the USA; Froehlich et al. 2007), and children, adolescents, and adults with ADHD experience impairments in a variety of domains of functioning, including the social domain (e.g., Hoza 2007), as well as engage in risky behaviors such as substance abuse (e.g., Barkley et al. 2006) and risky sex (e.g., Flory et al. 2006; Winters et al. 2009). Given these impairments and risky behaviors, it is concerning that although current evidence-based treatments for ADHD (i.e., stimulant medication, behavioral classroom management, behavioral parent training, and training interventions) are effective in reducing symptoms and in improving academic and behavioral functioning, they have minimal impact on social functioning or on risky behaviors (see Evans et al. 2014 for review). To improve treatment response and therefore decrease social impairment and risky behaviors among individuals with ADHD, it may be fruitful to examine characteristics that are associated with these impairments and behaviors and influence treatment response.

Preliminary evidence indicates that one characteristic that is associated with social impairment among individuals with ADHD is emotion dysregulation (ED) (e.g., Bunford et al. 2014, 2015; Maedgen and Carlson 2000; Melnick and Hinshaw 2000), and there is indication that ADHD and ED are each associated with risky behaviors, such as substance abuse and risky sex (Cooper et al. 1998; Flory et al. 2006; Martin et al. 2000; Wilens et al. 1998;

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Winters et al. 2009). Further, 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). It thus stands to reason that by incorporating a focus on ED in interventions targeting social impairment and risky behaviors, we may be able to increase the number of youth who respond to such interventions and decrease the prevalence, degree, or chronicity of these impairments and behaviors among some individuals.

Given the data on the association between ED and social impairment and between ED and risky behaviors, a call to incorporate a focus on ED into interventions designed to improve the functioning of youth with ADHD is *prima facie* warranted. However, before application to clinical practice, a number of questions need to be addressed and issues clarified regarding the theoretical and empirical bases of such a hypothesis. Specifically, although the science of the behavioral and cognitive correlates of ADHD is fairly well developed, theory and research into its emotional correlates has been less systematic. Notwithstanding that early clinical characterizations of ADHD included descriptions of ED, scientific attention to the association between ADHD and ED began to decline in the late 1960s and the importance of such association became downplayed (see Barkley 2010 for review). It was only recently that there has been an upsurge in theoretical and empirical attention to the association between ADHD and ED. As such, questions concerning this association have only recently begun to be addressed. Although preliminary evidence is available, we do not fully understand what portion of individuals with ADHD experience ED or the extent to which ED is associated with social impairment or risky behaviors. In addition, an association between ADHD, ED, and social impairment or risky behaviors has treatment implications only if ED is malleable. Lastly, although definitions of ED have been provided in the literature, further specificity regarding the processes involved in emotion regulation would improve such definitions.

It is against this backdrop that we summarize and critically evaluate research on the association between ADHD and ED. We examine the following questions: *What is ED and how do we define it when it is associated with ADHD? What portion of youth with ADHD experience ED? How is ED measured? Is ED associated with social impairment and risky behaviors among individuals with ADHD? What characteristics contribute to the development and maintenance of ED?* and finally, *Is ED malleable?* We conclude our review by considering implications with regard to future basic, translational, and treatment outcome research. Although we mostly review the literature from the past 15 years, where purposes necessitate, we incorporate earlier work. To foreshadow some of our conclusions, we are aware of only one study on the prevalence of ED among youth with ADHD; only a handful of authors have investigated the association between ED and social impairment in this population; and no research had been conducted on the association between ED and risky behaviors *among* individuals with ADHD. There are various ways to measure ED, and each measurement modality has advantages and disadvantages. Thus, studies wherein multi-method measurements are employed are needed. It will also be important for the authors of future studies to further explore characteristics associated with the development and maintenance of ED (i.e., genetic and environmental). Finally, findings are mixed on subtype differences with regard to the association between ADHD and ED, and although interventions designed to target ED are effective for individuals with disorders other than ADHD, the literature on the treatment of ED for individuals with ADHD is in its infancy.

What is Emotion Dysregulation When Associated with ADHD?

Children with ADHD have long been understood to exhibit behaviors that resemble ED. For example, children with ADHD who frequently express anger and defiance have often been diagnosed with oppositional defiant disorder (ODD). Indeed, ADHD and ODD frequently co-occur (at a rate of 30–50 % among children; Biederman et al. 1991). However, ODD does not fully account for ED as many children and adolescents with ADHD exhibit behaviors that stem from the dysregulation of negative emotions other than those that are commonly associated with ODD, such as sadness, or from the dysregulation of positive emotions, such as excitement. Furthermore, not all behaviors associated with ODD—or not all symptoms of ODD—involve displays of intense emotions (APA 2013). A child can be defiant in the absence of intense anger, and a child can oppose rules or be vindictive in the absence of ED. Similarly, behaviors indicative of ED have also been attributed to other disorders that frequently co-occur with ADHD, such as intermittent explosive disorder, bipolar disorder (BD), or depression and the irritability that can be a symptom of depression [ADHD and intermittent explosive disorder co-occur at a rate of 19.6 % (Kessler et al. 2006); ADHD and BD at a rate of 62 % (Kowatch et al. 2005); and ADHD and major depression at rates of 42–47 % (Wilens et al. 2002)]. Although many youth with ADHD have comorbid ODD, intermittent explosive disorder, BD, or depression, we propose that there is a subgroup of youth with ADHD who exhibit ED independent—or in the absence—of comorbidities. We further propose that, in this subgroup, ED contributes to impairment.

A classic example of ED exhibited by a youth with ADHD is as follows. Children are sitting in a classroom, listening to the teacher provide instructions. Mike, who has a diagnosis of ADHD, is sitting quietly, listening to the teacher. The teacher hears whispering in the class. She turns to Mike and Hannah, who is sitting next to Mike, and tells them to "Sit quietly, or I will send you to the office!" Neither Mike nor Hannah was whispering and Hannah does not respond to the teacher. Mike, however, tells the teacher that "I was not the one talking!" and does so sarcastically. The teacher reprimands Mike yet again, this time for being disrespectful. This results in Mike being further agitated and accusing the teacher of "Always picking on me! You should be sure about what you are saying before you falsely accuse people!" And so the escalation continues until Mike gets sent to the principal's office and is in serious trouble. Of import, although Mike's behavior is similar to that often exhibited by children with ODD, it is neither oppositional, nor defiant per se. Instead, in Mike's case, it is an example of an intensely angry and frustrated reaction to perceived unfairness, coupled with an inability to regulate the intensity of the emotional reaction, resist a behavioral response, or consider long-term consequences and goals.

In addition to difficulties with managing anger, frustration, and other negative emotions, some youth with ADHD also experience difficulties with managing positive emotions. In the latter cases, ED can manifest as too much enthusiasm or excitement or exuberance. For example, a 15-year-old adolescent male with ADHD might respond to an announcement of an enjoyable group activity by instantaneously picking up his chair and moving it inappropriately close to the group leader (and out of the circle in which the other youth are sitting), jumping up from his chair and sitting back down repeatedly, clapping, and raising his voice with excitement. In turn, his peers will likely perceive him as childish, immature, and odd and therefore ultimately (given repeated instances of this type of behavior) socially reject him.

Both examples involve difficulties with managing emotions that, in turn, lead to problematic outcomes for the youth. Consistent with our examples, youth with ADHD have been described in the literature as prone to excessive displays of both negative and positive emotions. These characterizations include descriptions of these youth being emotionally immature, overly exuberant, rambunctious, and as having low tolerance for anger and frustration (Barkley et al. 1992; Henker and Whalen 1989; Hoy et al. 1978; Landau and Moore 1991). Although many clinicians may know ED when they see it, a specific definition of ED is needed to guide scientifically rigorous research that is aimed at exploring ways in which ED can be measured, prevented, or treated.

Emotion Dysregulation Definition

A proper definition of ED presupposes definitions of emotion and of emotion regulation. *Emotions* are reactions to a stimulus or stimuli that involve both a biological response and a conscious and subjective one (Cicchetti et al. 1995; Gross 1999; Kovacs 2009; Thompson 1994). *Emotion regulation* is the process via which an emotional state is modified either in that is it decreased or attenuated or that it is increased or strengthened (Cole et al. 2004). Specific processes involved in the modification process include the modulation of physiological, experiential, or behavioral correlates of emotions (Bonanno 2001; Gross 1999). Physiological regulatory processes are often automatic, and experiential/psychological and behavioral/expressive ones are often controlled (Dan-Glauser and Gross 2011).[1] Specific to its association with ADHD, others (e.g., Barkley 2010) have adopted the definition of emotion regulation proposed by Gottman and Katz (1989; p. 373). According to these authors, emotion regulation occurs when, in the presence of an emotion, an individual (a) inhibits behavioral responses to the emotion, (b) self-soothes the physiological arousal that the emotion has induced, (c) refocuses his/her attention, and (d) organizes his/her self for a coordinated set of behaviors that are congruent with an external goal. In this definition, emotion regulation is a two-step[2] response (or non-response) to a provoking stimulus. These steps involve the initial arousal and related processes (a and b) and a return to baseline and related processes (c and d). Although behavioral responses to stimuli are addressed in this definition, physiological or experiential/cognitive aspects of arousal are not. We propose that physiological processes play a role in return to emotional baseline (Bunford et al. 2013) and thus warrant mention in relation to the corresponding aspect of the definition. We also propose that cognitions play a role in down-regulating or escalating arousal and, in part as a result of these cognitions, individuals experience either becoming relaxed or distressed or excited. Thus, we propose to improve upon Gottman and Katz's (1989) definition by including in that definition information on the various processes involved in the two steps of emotion regulation (arousal and return to baseline). This enhanced specificity has implications for measurement, prevention,

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[1] Various researchers argue that although emotion regulation may be a heuristically helpful construct, emotion and emotion regulation are intertwined processes that cannot be separated from one another (e.g., Goldsmith and Davidson 2004; Lewis and Stieben 2004).

[2] We use the word "steps" for purposes of manageability with regard to wording our ensuing discussion. It is important to note that in doing so, we do not intend to convey that emotion regulation is not a dynamic process (as we believe it is).

and treatment, in that it identifies particular processes that can be assessed and targeted.

The definition of emotion regulation that we propose is primarily a rewording of the definition in the previous paragraph, includes all three components (physiological, experiential, and behavioral), and refers to the intensity and duration of pertinent reactions to stimuli.

> **Emotion regulation** is an individual's ability to modulate (1) the speed with which and degree to which the physiological, experiential, and behavioral expression of an emotion escalates, (2) the intensity of the physiological, experiential, and behavioral expression of an emotion, and (3) the speed with which and degree to which physiological, experiential, and behavioral expression of an emotion de-escalates in a manner congruent with an optimal level of functioning.

Based on the above definition of emotion regulation, it follows that ED is the inability of an individual to exercise any or all of these modulatory processes to such a degree that the inability causes impairment. Consistent with such line of thinking, Cole et al. (2004) underscore that it is essential to ED that it results in suboptimal functioning. Specifically then, we propose the following operational definition of ED.

> **Emotion dysregulation** is an individual's inability to exercise any or all aspects of the modulatory processes involved in emotion regulation, to such a degree that the inability results in the individual functioning meaningfully below his or her baseline.

Figure 1 represents this process. The lines portray a physiological, experiential, or behavioral response. We suspect that there is considerable interindividual variability in the manifestations of ED and part of this variability is likely to be differential responding across these three ways of reacting to emotional stimuli. The solid line corresponds to a well-regulated individual who, in response to an emotional stimulus, escalates, but not to the point of impairment. The well-regulated individual then returns to baseline, where the return to baseline phase is slower than the escalation phase but quicker than that of the individuals with ED. In the case of the individual labeled ED case #1, the person escalates with a speed comparable to the well-regulated person but does so to a degree that falls in the impaired range. In addition, relative to the well-regulated person, ED case #1 exhibits a slow return to baseline. As such, the ED of case #1 mainly manifests in emotional intensity that is above the threshold for impairment and is characterized by slow return to baseline. The person labeled ED case #2 escalates more quickly than the well-regulated individual or ED case #1 and does so to a degree

that falls in the impaired range, even more so than ED case #1. However, this person returns to baseline at a rate similar to the well-regulated individual. As such, the ED of case #2 mainly manifests in emotional intensity but not so much in slow return to baseline. The third case, ED #3, is a combination of cases 1 and 2, where the person both escalates more quickly than the well-regulated individual, does so to a degree that results in considerable impairment, and exhibits slow return to baseline. As such, this person's ED will be characterized both by high intensity and by slow return to baseline.

Of note, although we believe that it is important to consider the physiological, experiential, and behavioral aspects of ED, as noted above, our experience suggests that these three systems may not correspond to each other in terms of relative intensity or temporal features. It is further likely the case that the three ED patterns vary not only across individuals but also within an individual across situations and development. Even the individual's baseline is subject to change over time (see Fruzzetti et al. 2005 for review). For example, there may be situations that do not elicit, within the same individual, an emotionally dysregulated response, whereas others may elicit a relatively quick escalation that is in the impaired range but a relatively timely return to baseline. Similarly, it may be that at earlier stages of development an individual both quickly escalates and exhibits a slow return to baseline, but, over development, they come to learn skills to modulate the speed with which and degree to which they escalate (therefore their escalation is neither quick nor in the impaired range) but do not come to learn skills to modulate the speed with which they return to baseline (and therefore continue exhibiting slow return to baseline).

In addition, *the basis of comparison* for the regulatory processes (arousal and return to baseline) is the individual's own level of functioning as opposed to some population value. Thus, the threshold for impairment in Fig. 1 is relative to the individual's own, general level of functioning. Thus, for purposes of comparison, an individual's baseline being "low" or "high" relative to others is irrelevant to ED (but is certainly relevant from the perspective of comparing the individual's emotion intensity and duration to others' responses). Of relevance to the definition we are proposing is how quickly and the extent to which one deviates from his/her baseline and the speed with which they are able to return to it. Although in Fig. 1 we depict the baseline for each case as being equivalent, we do so for purposes of illustration and not to indicate that individuals' baselines are the same.

It is important to underscore that neither the definition offered by Gottman and Katz (1989) nor our definition is *exclusive to negative emotions*. This is a crucial consideration as many clinical characterizations of individuals with
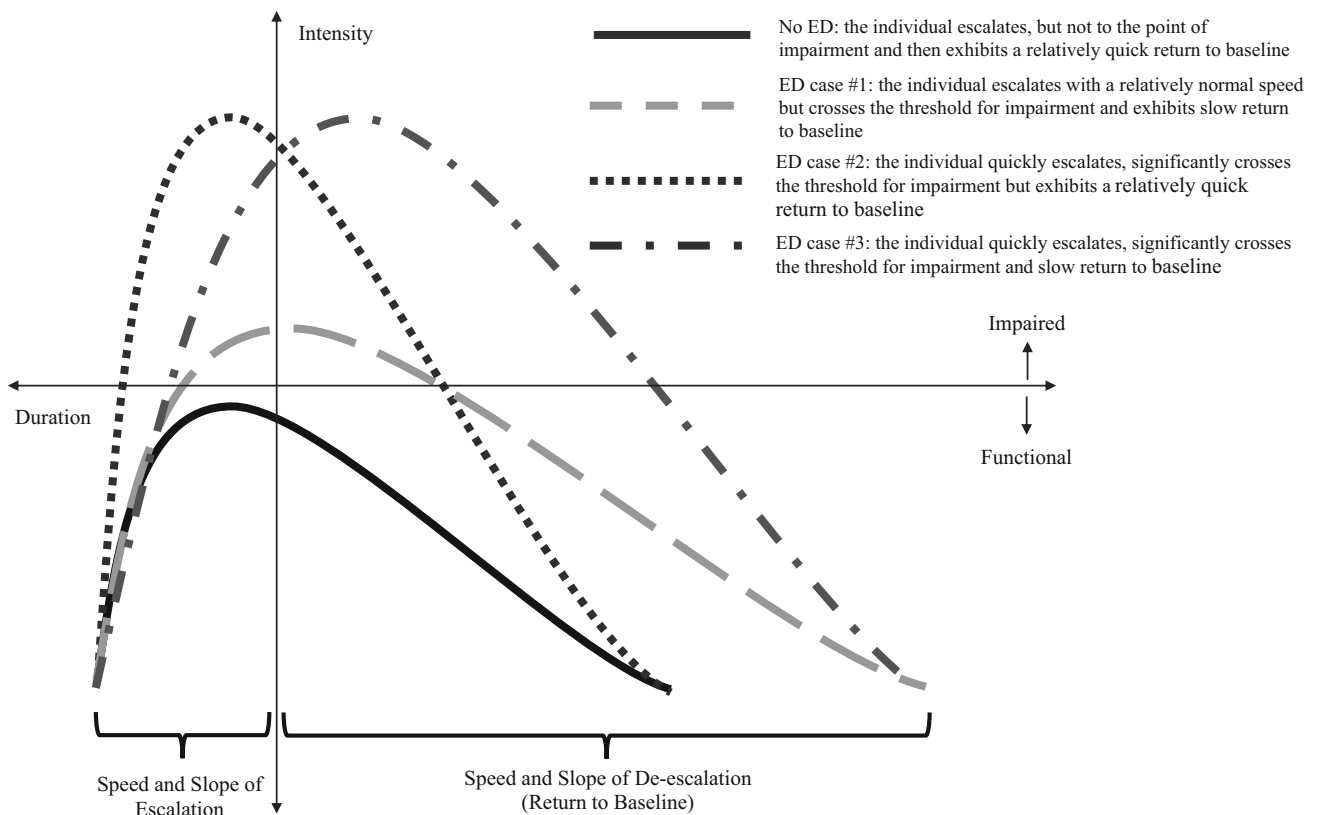
Fig. 1 Three examples of ED relative to an emotionally regulated case

ADHD who exhibit ED are predominantly focused on dysregulation of negative emotions. ED is most often described as manifesting in "low frustration tolerance, impatience, quickness to anger" (Barkley 2010; p. 5). However, as in Barkley's (2010) description of ED, individuals with ADHD may also experience impairments in their ability to regulate positive emotions. Indeed, the findings of Sjöwall et al. (2013) indicate that although among youth with ADHD, anger was the most commonly dysregulated emotion (61 % of boys and 65 % of girls), many children also exhibited dysregulation of sadness (61 % of boys and 50 % of girls), happiness (52 % of boys and 48 % of girls), and fear (34 % of boys and 42 % of girls). Similarly, although not specific to emotion regulation, the findings of Braaten and Rosen (2000) provide further support to the notion that youth with ADHD exhibit difficulties not only with negative but also with positive emotion-related processes. Specifically, Braaten and Rosen (2000) found that relative to children without ADHD, children with the disorder had difficulties with empathic responding to both negative and positive emotions exhibited by another person. We thus propose that some youth with ADHD experience difficulties with managing positive emotions, and this is why they are often described as boisterous, exuberant, or rambunctious. In turn, difficulties with regulating positive emotions can, similar to difficulties with regulating negative emotions, impede the ability of youth with ADHD to respond to their environment in a flexible or socially adaptive manner.

Of note, regarding the literature on the association between ADHD and ED, it is important to distinguish the definition(s) we cite and propose above from some others that have been used. Specifically, Banaschewski et al. (2012), Galanter et al. (2003), and Waxmonsky et al. (2008) reported findings on children with ADHD who exhibit emotional problems. These groups indexed ED via emotional lability (Banaschewski et al. 2012) or via symptoms of mania and severe mood dysregulation (SMD) (Galanter et al. 2003; Waxmonsky et al. 2008) to identify a subgroup of children with ADHD. The identified subgroups included children who exhibited overly frequent and excessive emotional displays of mood (emotional lability) or persistently abnormal mood, such as extended periods of time characterized by exuberance (symptoms of mania and SMD). Although related to ED and certainly representative of children who have emotional problems, the definitions adopted by these authors identify groups of children who may not meet criteria for the definition of ED we propose.

As a result, the findings obtained in these studies may not apply to the group of children and adolescents with ADHD that we are defining as exhibiting ED.

Contextual Issues Related to Definition

The definition of ED that we propose above is the focus of this review and pertains to physiological, experiential, and behavioral responses to an emotionally arousing stimulus. There are many factors and contextual considerations that influence what takes place before and after the point of arousal and these are important. However, these are not the focus of this review. Among others, these include psychopathology (other than ADHD), the neural bases of emotional behavior and ED, and behaviors and events that precede the interaction with arousing stimuli.

Based on the definition we propose, ED is a characteristic that is exhibited by individuals without and with a psychiatric condition. ED *can, but does not always*, lead to pathological mood states (e.g., Critchley 2003). Further, ED is a transdiagnostic characteristic and aspects of it are observable in the context of many disorders. For example, poor emotion understanding is associated with generalized anxiety disorder (GAD, e.g., Mennin et al. 2007; Turk et al. 2005), social anxiety disorder (SAD, e.g., Salovey et al. 2002; Turk et al. 2005), and depression (e.g., Salovey et al. 2002; Wise et al. 1995). Other aspects of ED differentiate disorders from one another. For example, chronic irritability predicts major depressive disorder (MDD), dysthymia, and GAD but not BD (Stringaris et al. 2009). Similarly, heightened emotion intensity differentiates GAD from SAD. Those with GAD exhibit heightened intensity (Mennin et al. 2007) more so than those with SAD (Turk et al. 2005) or with eating disorders (Fresco et al. 2002). Similarly, negative reactivity to emotions[3] is associated with both anxiety and depression; but whereas anxiety is more strongly associated with a lack of acceptance of emotions, depression is more strongly associated with expectations of prolonged mood duration (Leahy 2002). It is clear from these data that although ED is associated with many disorders, it manifests differently across them. The focus of this review are manifestations of ED associated with ADHD.

There is also literature on the neural bases of ED. Investigators have worked to establish whether ED reflects abnormal reactivity (reactive self-regulation), deficits in regulation (conscious and effortful control) (Derryberry and Rothbart 1997), or both. Regarding ADHD, the current leading perspective on this topic is that regulation problems (abnormal regulation) occur in most children with ADHD

and that there is a subgroup characterized by negative and positive approach problems (abnormal reactivity) (Nigg et al. 2004). Specifically, the findings of studies conducted with youth with ADHD indicate that they exhibit deficits in approach such that they make errors in their predictions about the environment and the predictions they make prioritize immediate reward at the expense of potentially greater but delayed reward (see Luman et al. 2005 for review). However, data on the association between ADHD and personality traits (i.e., neuroticism, agreeableness and extraversion) indicate that differences in these traits, and therefore in the reactivity of the neural systems that underlie them, are not specific to ADHD but are associated with comorbid psychopathologies (see Nigg 2006 for review). Conversely, findings indicating an association between low conscientiousness and ADHD/ADHD symptoms (Braaten and Rosen 1997; Ranseen et al. 1998) including ones that suggest that this effect is unique to inattentive symptoms (Nigg et al. 2002b) and is independent of co-occurring delinquent and antisocial behavior (Nigg et al. 2002a), lend support to the hypothesis that problems in regulation are associated with ADHD and are not explained by comorbid conditions.

Finally, there are various steps involved in emotion processing and these involve emotion recognition and regulation. Emotion recognition, which involves attending to and correctly identifying emotions in the self and others (Denham 1998), and emotion regulation are separate but related constructs. Emotion recognition may be conceptualized as a precondition for emotion regulation or as part of the regulation process. Regarding empirical findings, results are mixed on the association between emotion recognition and ADHD. Some data indicate that children with ADHD make more errors in emotion recognition than children without ADHD (e.g., Kats-Gold et al. 2007; Singh et al. 1998). Other researchers could not replicate these findings (e.g., Shapiro et al. 1993). Thus, although it may be that deficits in emotion recognition contribute to the more distal outcome of ED, the literature on the association between emotion recognition deficits and ADHD is inconclusive.

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. However, to the best of our knowledge,

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[3] Discomfort with one's own emotions and negative beliefs about the effects and after-effects of those emotions.

these processes are untested with youth with ADHD to date. As such, we will not consider them in further detail. In addition, our focus herein and therefore in our definitions is on those aspects of emotion regulation that pertain to steps in the regulatory process that take place *after the point of arousal*.

Validity of ED

Once defined, it is important to determine whether ED is associated with theoretically relevant constructs and not associated with theoretically irrelevant constructs. There is empirical evidence for both the convergent and divergent validity of ED.

Convergent Validity

In a community sample of 428 adolescents,[4] Weinberg and Klonsky ([2009](#)) found that ED correlated with theoretically relevant psychological problems, such as anxiety, depression, eating disorders, suicidal ideation, and alcohol and substance abuse. Vasilev et al. ([2009](#)) also examined the relationship between adolescents' scores on a rating scale measure of ED (Difficulties in Emotion Regulation Scale [DERS]) and on a physiological index of ED, respiratory sinus arrhythmia. Respiratory sinus arrhythmia was measured during a resting baseline and an emotion induction condition[5] on three occasions across 3 years [at ages 8–12 (year 1) and follow-up at years 2 and 3]. The DERS was administered during the third year. Respiratory sinus arrhythmia across all three measurements was associated with ED measured during the third year. These findings indicate that as adolescents develop a more adaptive physiological response to emotional arousal, they also experience less ED. Finally, similar to the data obtained by Weinberg and Klonsky ([2009](#)), Vasilev and colleagues found that ED was correlated with theoretically relevant psychological problems, such as externalizing behaviors and anxiety and depression symptoms.[6] Taken together,

these findings indicate that ED, measured via self-report on the DERS, is associated with theoretically relevant psychological problems and with a physiological index of ED, thereby supporting its convergent validity.

Discriminant Validity

It may be more challenging to establish the discriminant validity of ED as there is overlap between some manifestations of ED and the symptoms of some disorders. Nevertheless, it is important to differentiate ED from other conditions so when completing diagnostic evaluations of youth with ADHD, clinicians and researchers are able to distinguish between a presentation of ADHD and associated ED from a presentation of ADHD and a comorbid condition that may better account for the behaviors that resemble ED. Relatedly, establishing the discriminant validity of ED is important if we wish to counter the argument that ED is "nothing but old wine in new bottles" (i.e., ED is a new name for conditions that are frequently comorbid with ADHD such as ODD or BD).

ED Versus Bipolar Disorder, Depression, Dysthymia, and Anxiety

As already noted, ED may occur in the context of a disorder, but such occurrence is not evidence for ED being equivalent with that disorder. Indeed, ED occurs in the context of BD, MDD, dysthymia, and anxiety disorders. However, ED *manifests differently across these disorders*, indicating that it is transdiagnostic. By definition, a transdiagnostic characteristic is not a diagnosis. Therefore, ED is not the same as any of these diagnoses. Indeed, prior findings indicate that children with ADHD exhibit less emotional variability, stability, and more predictability than children with BD and that children with ADHD exhibit chronic patterns of ED, whereas those with BD exhibit episodic variation in ED (Rosen and Epstein [2010](#); Rosen and Factor [2012](#); Rosen et al. [2013](#)). These data indicate there is discriminant validity between the association between ED, associated with ADHD, and BD. In addition, among youth with ADHD, ED and depression are correlated (e.g., Bunford et al. [2015b](#)). However, the size of the correlation coefficients (e.g., rs ranging from .03 to .46) indicates that ED and depression are distinct in their association with ADHD. Although we are unaware of comparable data on the association between ED and anxiety disorders *among youth with ADHD*, various aspects of ED have been found to correlate with generalized and

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[4] The sample was comprised of youth with depression, conduct problems, comorbid depression/conduct problems, or no psychiatric condition. Participants were between the ages of 13–17 years and were 61 % female, 53 % Caucasian, 19 % Hispanic, 15 % Asian, 11 % African American, and 3 % mixed racial heritage. ED was measured via self-report on the Difficulties in Emotion Regulation Scale (DERS). Psychological problems were measured via self-report on the Patient Health Questionnaire-Adolescent (PHQ-A).

[5] Respiratory sinus arrhythmia was measured during a 5-min resting baseline, followed by a 3-min video clip from the movie The Champ, in which a young child witnesses and reacts to the death of his father. This film clip has been demonstrated to evoke sadness (see Gross and Levenson [1995](#)) and to result in physiological reactivity—including changes in RSA—that are consistent with individual differences in ER abilities.

[6] The former were measured via self-report on the Youth Self-Report (Achenbach [1991](#)), and the later were measured via self-report on the Children's Depression Inventory (Kovacs [2004](#)).

social anxiety symptoms[7] (Mennin et al. 2007). The magnitude of the associations indicates discriminant validity between ED and generalized and between ED and social anxiety. Taken together, these data indicate that ED is not another name for a mood or anxiety disorder comorbid to ADHD, but is a transdiagnostic characteristic with manifestations that vary across diagnoses.

In addition, there are manifestations of ED *that distinguish* various disorders from one another. If a characteristic distinguishes two things from one another, it cannot be identical to either of those things. Empirical evidence on specific manifestations of ED distinguishing among anxiety disorders and between anxiety and mood disorders supports this point. For example, heightened emotion intensity and maladaptive emotion management are positively associated with GAD and negatively associated with SAD, whereas poor emotion understanding and negative reactivity are positively associated with SAD and MDD but not associated with GAD (Mennin et al. 2007). Unlike when associated with these disorders, ED associated with BD involves positive rumination (i.e., dwelling on the causes, consequences, and content of positive emotions) and difficulty down-regulating positive emotions (see Gruber 2011 for review). Thus, although ED is associated with anxiety disorders, MDD, and BD, its various manifestations differentiate these disorders from one another, indicating that ED is a characteristics that can be both common to—and manifest differently across—psychopathologies (and, as such, it cannot be equivalent to those).

ED Versus ODD

Individuals, including those with ADHD, can exhibit ED in the absence of attempts to deliberately annoy others, defiance, refusal to comply with rules, or even blaming others for an emotionally arousing stimulus (i.e., symptoms of ODD). Some findings lend support to ED being distinct from ODD in its association with ADHD. For example, our prior work indicates that, among youth with ADHD, ED and ODD predict different aspects of social impairment. First, we found that three aspects of ED: (1) emotional inflexibility and slow return to emotional baseline; (2) low threshold for emotional excitability and impatience; and (3) behavioral dyscontrol in response to negative emotions, differentiate youth with ADHD from a community sample of youth (Bunford et al. 2014). In our sample of adolescents with ADHD, we found these aspects of ED to be

associated with social impairment above and beyond (the effects of) ODD. Our findings further indicated that other aspects of ED, such as the extent to which youth experience difficulty exhibiting socially appropriate emotional responses, such as empathy and friendliness, are associated with ODD and these aspects of ED do not predict social impairment above and beyond ODD (Bunford et al. 2014). These data indicate that, among youth with ADHD, some aspects of ED do not and some do overlap with ODD. Finally, although ED and ODD were correlated in our sample, the correlation coefficients were actually quite small (e.g., rs ranging from .005 to .149), further indicating that ED and ODD are distinct. The data we reviewed lend support to the discriminant validity of ED from ODD.

ED Versus Impulsivity or Disinhibition

Though ED may underlie some impulsive behaviors (see Gratz and Tull 2010 for review), it is not equivalent to impulsivity or disinhibition[8] (a disposition or tendency "to act without adequate forethought as to the consequences of actions," Weiss et al. 2012; p. 456). In fact, although ED and impulsivity are correlated, the coefficient is not so large as to indicate isomorphism (e.g., $r = .31$; Weiss et al. 2012). Impulsive behaviors have been conceptualized as behavioral attempts to alleviate negative emotions. Thus, engaging in impulsive behaviors can be an emotion regulation strategy (that is often maladaptive) (Verdejo-Garcia et al. 2007; Whiteside and Lynam 2001).

Not only can ED underlie impulsive behaviors but impulsive behaviors may also contribute to ED. Nevertheless, even when impulsive behaviors contribute to ED, some manifestations of ED are distinct from impulsivity. As an example, ED measured on the DERS has been found to mediate the association between post-traumatic stress disorder (PTSD) and impulsivity (Weiss et al. 2012). Importantly, given that there is overlap between one dimension of ED—behavioral dyscontrol in the presence of strong emotion indexed on the DERS Impulse subscale—and impulsive behavior (which was the dependent variable in this study), Weiss and colleagues excluded the DERS Impulse subscale from the total DERS score in their analyses. Findings with the DERS Impulse items removed

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[7] For example, heightened intensity of emotions and generalized anxiety symptoms $r = .27$ and social anxiety symptoms $r = -.07$; poor understanding of emotions and generalized anxiety symptoms $r = .17$ and social anxiety symptoms $r = .32$; negative reactivity to emotions and generalized anxiety symptoms $r = .31$ and social anxiety symptoms $r = .37$ (Mennin et al. 2007).

[8] According to Barkley (1997), "circumstances or tasks that involve temporal delays, conflicts in temporally related consequences, or the generation of novel responses" are the ones that most heavily tax *the type of behavioral inhibition relevant to ADHD.* "Tasks requiring resistance to temptation or deferred gratification are of this sort. *Among the several dimensions of impulsivity* discovered in past research (behavioral and cognitive-motor, typically) … *it is that dimension reflected in deferred gratification and resistance to temptation, or what others have also called 'behavioral inhibition', that is associated with the inhibitory processes*" implicated in ADHD (p. 68).

indicated that PTSD had an indirect effect on impulsive behaviors through ED and that its direct effect on impulsive behaviors was not significant after controlling for ED. Thus, these results indicate that the association between ED and impulsive behaviors, as well as its mediating role in the association between PTSD and impulsive behaviors, is not solely driven by the dimension of ED that is related to behavioral dyscontrol in the presence of strong emotions. Thus, although one manifestation of ED may be impulsive behavior in response to strong emotion, there are other aspects of ED that do not overlap with impulsivity. As such, ED and impulsivity are distinct constructs.

Subtype Differences in the Association Between ADHD and ED

According to some theoretical conceptualizations of ED, ED may vary as a function of ADHD subtype. For example, according to Barkley's (1997) neuropsychological model of ADHD, all individuals with ADHD exhibit a primary deficit in inhibition. Those with the hyperactive/impulsive subtype also exhibit secondary deficits in the self-regulation of affect, motivation, and arousal, and those with the inattentive subtype exhibit secondary deficits in working memory. Similarly, Sonuga-Barke and colleagues argue that hyperactivity/impulsivity symptoms reflect deficits in "hot" executive functions (consistent with ED), whereas inattention symptoms reflect deficits in "cool" functions (see Bunford et al. 2015a for review). The implication of these conceptualizations is that the association between ADHD and ED is relevant for the hyperactive/impulsive and combined subtypes but not the inattentive subtype.

Although some empirical findings indicate that ED does vary as a function of subtypes, others indicate that it does not. There may be third variables (i.e., ones in addition to ADHD and ED), such as age and measurement modality, that explain the discrepant findings across studies. Although Maedgen and Carlson (2000) found that children with ADHD-C but not children with ADHD-I exhibit ED, our group (Bunford et al. 2014) found no differences across subtypes in ED. The findings of Maedgen and Carlson (2000) might be different from ours because of participants' age. Maedgen and Carlson's participants were between 8 and 11 years of age, whereas our participants were between 12 and 16 years of age.[9] Given that changes

in context, expectations, and maturation are associated with differences in the manifestation of ADHD symptoms in childhood versus adolescence (Langberg et al. 2008; Wolraich et al. 2005), it may be that ED also manifests differently among children and adolescents with ADHD. Another reason for the discrepant findings regarding the relationship between ADHD subtypes and ED may be due to different situations eliciting ED in different subtypes. Specifically, the laboratory task employed by Maedgen and Carlson might elicit ED, but not in a manner that is representative of the multiple contexts of a youth's day. When a greater number of situations are sampled, such as with a rating scale (which is how we measured ED), ED may be detectable in more than one subtype. It may also be that although there may be distinct etiological contributions to—and behavioral manifestation of—ED across subtypes,[10] the phenomenological experience of ED captured by a rating scale is the same. These are testable hypotheses, and the absence of consistently replicated subtype differences in ED indicates the need for further research.

What Portion of Youth with ADHD Experience Emotion Dysregulation?

ADHD-related impairments vary across individuals, and similarly, it seems likely that not all youth with ADHD will exhibit ED. We know of only one study wherein data were specifically reported on the prevalence of ED among youth with ADHD. Based on data obtained from 182 young adolescents (ages 12–16 years; 75 % boys) on the DERS and the Emotion Regulation Index for Children and Adolescents (ERICA), Bunford et al. (2014) reported that boys with ADHD differed from a community sample of youth on six of nine subscales across these two measures and girls with ADHD differed on five. We compared data obtained by Bunford et al. (2014) to percentiles provided

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Footnote 9 continued

between-group comparisons yielded statistically significant differences, indicating that effect sizes may have been substantial. We thus calculated effect sizes (Cohen's *d*) for both the data obtained by Maedgen and Carlson and our own data. These range from .44 to 1.1 in the Maedgen and Carlson study and from .02 to .32 in the Bunford et al. (2014) study. Thus, although Maedgen and Carlson obtained medium to large effect differences with a sample that was ∼ 1/4th of ours, we obtained small effect differences only. This indicates that our not having found group differences may not be a function of the size of our sample but, rather, reflects a true absence of a difference.

[10] Nigg (2010; p. 25) argues that ADHD is a combination of problems in both bottom-up (e.g., emotion generation) and top-down (e.g., emotion control) control systems […] and that "what psychopathologists call attention problems reflects difficulty in regulation, constraint, and effortful control, whereas impulsivity and perhaps hyperactivity are related to breakdown in incentive response systems".

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[9] Due to the possibility that with small sample sizes there would be power limitations to detecting such small effect sizes in subsample comparisons, we revisited Maedgen and Carlson's data. In their study, Maedgen and Carlson found a statistically significant difference across subtypes of ADHD. Of note, the sample size in that study was smaller (Maedgen and Carlson 2000; ADHD-C = 16, ADHD-I = 14) than the size of our (Bunford et al. 2014) sample. Yet,

Table 1 Self-rated emotion dysregulation of young adolescents with ADHD compared to community sample percentiles by sex

	% of sample with ADHD at or below community sample percentiles		
	25th	10th	1st
ERICA subscales			
Females			
Self-awareness	45	27	0
Situational responsiveness	59	32	0
Emotional control	41	30	5
Males			
Self-awareness	68	41	4
Situational responsiveness	51	34	.7
Emotional control	36	14	4

Total *n* for females with ADHD is 44 and for males with ADHD is 138

ERICA Emotion Regulation Index for Children and Adolescents

by MacDermott (2011) on the ERICA to determine the relative proportions of the samples placed at the 25th, 10th, and 1st percentiles (see Table 1). The findings are reported for males and females and document that far more youth with ADHD are in those (impaired) ranges than were in MacDermott's community sample. In fact, more than twice as many young adolescents with ADHD are under the 25th percentile as in the community sample for half of the subscale/sex pairings. The percentages also reveal that ED may be more common for males than females with ADHD, though both sexes are more likely to report ED than the youth in the community sample.

How is Emotion Dysregulation Measured?

Although historically it has been the case that empirical attention was devoted to the observable symptoms of ADHD (see Barkley 2010 for review), investigators recently validated measures of ED. Because the disorder of focus in this paper is ADHD, the ensuing discussion of the measurement of ED will be limited to methods that have been used to measure ED, when associated with this disorder. In line with the Research Domain Criteria (RDoC) project put forth by the National Institute of Mental Health, we review these measurement techniques to identify the strengths and weaknesses of each. The units of analysis employed by the RDoC project are as follows: genes, molecules, cells, circuits, physiology, behavior, and self-report (Morris and Cuthbert 2012). For purposes of parsimony, we will focus our review on three units that are captured by our definition: physiology, behavior, and self-report. We organize this section in line with the RDoC definitions of these units of analysis. We conclude this section by reviewing

cognitive emotion regulatory strategies and the measurement of such strategies. We present such reviews separately because cognition represents an RDoC domain of its own. In this domain, cognition can be measured on various units of analysis, including behavior and self-report.

Physiology

Some changes in physiology correspond to the phenomenological experience of emotions (Gross and Levenson 1995). The autonomic nervous system (ANS) governs these physiological changes and is comprised of the sympathetic (SNS) and the parasympathetic (PNS) nervous systems. The SNS governs arousal by preparing the body for action (e.g., muscle tension, increased blood pressure, and heart rate) (Porges 2001). The PNS governs recovery and relaxation by constricting the pupils, dilating blood vessels, slowing heart rate, and stimulating digestion. The SNS and PNS function reciprocally; when the activity of the former is increased, that of the latter is decreased (Beauchaine 2001). SNS activity is associated with emotions reflecting arousal (e.g., anger, excitement, fear; McCraty et al. 1995; Nakahara et al. 2010), whereas PNS activity is associated with emotions reflecting relaxation (e.g., contentment, peacefulness; Hjelland et al. 2007). ED occurs when the SNS is excessively active and/or the PNS is inadequately active (Appelhans and Luecken 2006).

There is indication of abnormalities in both SNS and PNS functioning among youth with externalizing problems, including ADHD. Although findings of one study (Musser et al. 2011) are not indicative of SNS abnormalities among children with ADHD, others indicate that

externalizing problems are related to reduced SNS activity in the presence of rewards (Beauchaine et al. 2007; Calkins 1997; Crowell et al. 2006).[11] In addition, inflexible PNS activity during baseline measurements as well as abnormal PNS activity during reward-based (youth with externalizing problems: Beauchaine et al. 2007; Calkins 1997) and emotion regulation (youth with ADHD: Musser et al. 2011) tasks have been documented.

Psychophysiological measures of ED allow for measurement precision and stimulus control. However, psychophysiological measures are with poor signal-to-noise ratio; the ratio of useful information to irrelevant data obtained via these techniques is low (Nigg 2010). This may be because although physiological arousal may index emotional arousal and ANS abnormalities may index ED, the emotion associated with arousal or is dysregulated cannot be specified by psychophysiological measures. What are observed to be identical changes on psychophysiological measures can indicate many different emotions, such as excitement or frustration. Similarly, abnormalities on psychophysiological measures can indicate dysregulation of a variety of emotions. The degree to which these indices reflect specific emotions is a function of the extent to which an experiment(al task) is valid. For example, if a task is designed to elicit frustration, the assumption is that it will elicit frustration in all individuals. Finally, even if an experiment(al task) is internally valid, findings obtained in the laboratory may not always translate well to the real world (Biederman 1972; Levitt and List 2007) and are relatively less useful for measuring treatment response (e.g., Nigg et al. 1996). One alternative to physiological measures are behavioral ones.

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[11] Note that findings on PNS abnormalities among youth with externalizing problems are consistent across studies but those on SNS abnormalities are not. One explanation for these mixed results pertains to the type of experimental task employed. For example, Beauchaine et al. (2007) and Calkins (1997) used reward-based tasks, which engage the SNS more so than the PNS (Musser et al. 2011). Conversely, Musser and colleagues focused specifically on emotion regulation (as opposed to an association between changes in ANS functioning at baseline and externalizing behavior) and employed a negative and positive mood induction and suppression paradigm. It might be the case that youth with ADHD exhibit different PNS and SNS activity than typically developing peers during a baseline condition but demonstrate only PNS abnormalities during an emotion regulation task. Finally, Musser and colleagues' sample included children with ADHD, whereas a broadly conceptualized externalizing sample was included in Beauchaine et al. (2007), Calkins (1997), and Crowell et al. (2006). This is noteworthy because, despite the common behavioral co-occurrence, it is not clear that ADHD and externalizing problems are the same in terms of ANS abnormalities (e.g., Musser et al. 2011).

Behavior

Observation During Laboratory Tasks

In observational studies of ED, ED is usually measured in a controlled and standardized context (e.g., Maedgen and Carlson 2000; Melnick and Hinshaw 2000). Examples of such context include experimental tasks, such as a disappointing task (Maedgen and Carlson 2000) or a family frustration task (i.e., build a Lego™ model with one of the necessary pieces missing, unbeknownst to the family) (Melnick and Hinshaw 2000). Data collection in these types of designs involves behavioral coding. Examples of behaviors that may be conceptualized as manifestations of ED are "maintaining interest in the task, continuing to apply problem-solving efforts, and expressing emotion in ways that were not overly disruptive to his involvement in the task or to his relationship with his parent(s)" (Melnick and Hinshaw 2000; p. 77). More specific indices of ED may include emotion ventilation as indicated by the child exhibiting emotions through facial, gestural, or vocal medium. Other specific indices may pertain to various aspects of ED, such as engagement in goal-directed behavior (e.g., child generated an alternative idea to build the model/child refuses to continue), or to emotion regulatory skills (e.g., the child reinterprets the situation to frame it in a positive light [as indicated by, for example, the child making statements such as "Even though I can't finish the model, I can still have fun" or making statements or behaving in a way that indicates acceptance of the conditions of the task, for example, by shrugging his shoulders and saying "Its okay."] or the child focuses on the negative or uncontrollable aspects of the task [as indicated by, for example, blaming others or complaining that he won't win the prize]) (Melnick and Hinshaw 2000).

Observational methods in controlled settings allow for stimulus control and have contributed to our understanding of ED. Nevertheless, there are limitations to this method. First, the association between observable behaviors and underlying emotions is complex. Any observable, behavioral manifestation of an emotion or of ED may be indicative of a variety of different emotions or a variety of difficulties with emotion regulation. Thus, the specific emotion or regulatory problem contributing to the observable behavior may be difficult to distinguish. Relatedly, measurement precision may be difficult to achieve, depending on the complexity of the observed behaviors. For example, observers in Melnick and Hinshaw (2000) coded child social behaviors presumably associated with ED in summer camps as well as child emotion regulation during a pre-camp assessment. In the assessment, boys and their families participated in a task wherein the boy was offered a prize to successfully build a Lego™ model (two

necessary pieces of which had been removed by staff). Observers made ratings of child emotion regulation on a four-point rating of the degree to which boys maintained interest in the task, exhibited behaviors consistent with problem-solving, and expressed emotion in ways that were not disruptive to their involvement in the task or relationship with parent(s). In addition, observers coded child behavior corresponding to specific emotion regulation categories (see Melnick and Hinshaw 2000, for the conceptual basis and further detail on the behavioral coding system used. Inter-rater reliability was fairly low (.63 for non-compliance and .50 for aggression), possibly due to limitations of live observation. In addition, although experimental tasks may resemble real-world situations, participants are usually aware of being in a contrived setting and thus their emotional responses may be dampened relative to the ones they exhibit in their daily lives. Finally, as already noted, observational methods allow for stimulus control. However, stimulus control is of value only if the experimental manipulation is similarly effective with all participants. In Melnick and Hinshaw's study, for example, no differences in ED were observed between boys with ADHD + low aggression and boys without ADHD.[12] This null finding may be a result of ineffective experimental manipulation. The low-aggressive boys tended to have ADHD-I and, as such, may have been less attentive to details of the task than the boys without ADHD, thus less provoked by it. As with Melnick and Hinshaw's study, it is not always the case that a well-designed manipulation elicits the desired response in all participants, precluding generalizable conclusions.

Neuropsychological Indices

The absence of theoretical clarity on the construct of ED is accompanied by the absence of neuropsychological measures specific to ED. According to Barkley's comprehensive neuropsychological model of ADHD (Barkley 1997, 2010), self-regulation involves an interplay among different executive functions. In self-regulation, once a prepotent response is inhibited (inhibition), the individual holds the event in mind to control responses (working memory), engages in self-talk to exert control via language over behavior (verbal working memory), regulates arousal to an optimal level for the task at-hand (self-regulation of affect, motivation, and arousal), and, finally, reconstructs the event to obtain new messages (reconstruction). In this hierarchical model, inhibition is primary to other executive functions. Namely, because intact inhibition allows for a delay during which

other, secondary executive functions may occur, dysfunctional inhibition precedes malfunctioning in other areas, including ED. Relatedly, according to Banaschewski et al. (2012), the association between ADHD and emotional lability, which is a manifestation of ED, could arise from abnormalities in neurobiological processes that influence both (ADHD and ED) sets of symptoms. These neurobiological processes are reflected in neuropsychological dysfunctions such as executive deficits in inhibitory control and working memory, reduced processing efficiency and speed (variable and slow reaction times), delay aversion, temporal discounting (or preference for smaller but immediate rewards), and psychophysiological dysregulation during periods of over- or underactivation (Willcutt et al. 2008) that, albeit not specific to ADHD (Banaschewski et al. 2005), might explain the association between ADHD and emotional lability (see Banaschewski et al. 2012 for review).[13] Nevertheless, although the importance of identifying neuropsychological deficits in ADHD beyond behavioral descriptors has been underscored (e.g., Nigg 2005), authors of empirical studies have primarily focused on "cold" executive functions (e.g., cognitive flexibility, planning, and working memory), leaving a number of questions about "hot" executive functions (i.e., executive functions associated with high affective and motivational involvement), such as ED, unaddressed. For example, it is currently unclear whether the primary deficit in the frontolimbic system in ADHD is bottom-up (e.g., associated primarily with the amygdala, hippocampus and ventral striatum) and thus constitutes a "lower" level dysfunction, or is top-down (e.g., associated with the lateral prefrontal cortex, medial prefrontal cortex, and anterior cingulate cortex) and thus constitutes a "higher" level processing or regulatory problem (see Barkley 2010; Banaschewski et al. 2012 for reviews). In addition, in the available literature "hot" executive functions are indexed by measures of disinhibition or impulsivity (e.g., Banaschewski et al. 2012; Mulder et al. 2008), which are not specific to ED. Thus, there is a need for further parsing of the "hot" executive deficits in ADHD. Until then, ED, when associated with ADHD, cannot be parsed apart from other "hot" executive deficits on neuropsychological measures.

Self-Report

Rating Scales

A number of rating scale measures are available for measuring ED in youth and some examples are the parent-report

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[12] But boys with ADHD + high aggression were different in terms of their ED from boys with ADHD + low aggression and from boys without ADHD.

[13] Of note, the empirical findings of Banaschewski et al. (2012) did not support the notion that performance on measures of these functions explains the association of ADHD and emotional lability.

Emotion Regulation Checklist (ERC; Shields and Cicchetti 1997); the self-report Emotion Regulation Index for Children and Adolescents (ERICA, MacDermott et al. 2010); the Emotion Regulation Questionnaire (ERQ; Gross and John 2003); and the Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer 2004).[14] Many investigators measure ED among youth with ADHD using rating scales (e.g., Bunford et al. 2014, 2015b; Seymour et al. 2012, 2014). Rating scales are appropriate for sampling a large number of situations (as opposed to a single experimental task) and can thus be representative of the multiple contexts of an individual's day. In addition, given the largely internal and subjective nature of emotion regulation, self-report rating scales have advantages for measuring ED (Rohrbeck et al. 1991; Soto et al. 2008; Walden et al. 2003).

Similar to psychophysiological and observational techniques, however, rating scale measures have limitations. For example, rating scales rely on subjective descriptions of multifaceted, observable behavior, at the core of which more specific processes may be at play. Rating scales do not provide information on these core or more specific processes (e.g., physiological arousal). In addition, many of these rating scales are specific to negative emotions. For example, the majority of the DERS items begin with "When I am distressed" or "When I am upset." Further, the assumption underlying rating scales is that any given construct equals the sum of its "symptoms," which, in turn, are adequately represented by the numbers raters associate with behaviors represented on the items (Bech 2006). Furthermore, on ratings scales, each "symptom" (i.e., items) is considered equivalent with regard to its contribution to ED (i.e., items are not weighted). This may not accurately represent the phenomenological experience of ED. Another underlying assumption of rating scale measurement and data interpretation is that changes in the numbers raters associate with behaviors reflect changes in clinical reality. Finally, rating scales may be confounded by rater bias. In spite of these limitations, there are advantages related to convenience of administration and the option to compare individual scores to norms (e.g., age- or sex-based norms).

Ecological Momentary Assessment

Ecological momentary assessment (EMA) allows for assessment of the temporal features of ED. These include variability (the degree to which emotional states vary around a set point, which reflects an individual's typical or trait emotional state, regardless of valence), stability/instability (the extent to which individuals consistently maintain emotional states over time[15]), predictability (the degree to which the individual's pattern of emotional arousals are structured over time, e.g., in predictable sequences or unpredictable "storms"), and episodicity/chronicity (individuals with chronic arousal exhibit arousal around a fixed emotional set point, but those with episodic arousal exhibit changes in the set point itself). EMA allows for the measurement of temporal patterns of ED in that it was developed to collect real-time data in individuals' daily lives. For the EMA method, individuals typically use a personal digital assistant (PDA), onto which rating scales are loaded. The PDA is set to signal at various times at the researchers' choosing.

In a pilot study aimed to evaluate the feasibility of EMA technology, Rosen and Epstein (2010) collected data on the ED of a child with ADHD and a child with pediatric BD. Parents used a PDA, set to signal three times a day for 28 days, for parents to report on their child's current mood, irritability, and affect. The parent of the child with ADHD (9 years old) completed 96.3 % of ratings, and the parent of the child with pediatric BD (8 years old) completed 86.6 %. The child with ADHD exhibited less variability, stability, and more predictability than the child with BD. In addition, the child with ADHD exhibited chronic patterns of ED, whereas the child with BD exhibited episodic variation in ED. In their follow-up studies, Rosen et al. (2012, 2013) replicated these methods and extended these findings. In one study, EMA-based data collection was tested not only with 27 parents of children with ADHD (ages 8–11 and 8–12 years) but also with the children themselves (Rosen and Factor 2012). All parents and 22 children completed at least 65 % of all ratings. In a second study, however (Rosen et al. 2013), although support was obtained for the feasibility and validity of the parent EMA protocol, results did not support the validity of the child protocol. Children were less likely to complete ratings when emotionally distressed and demonstrated substantial response bias. These findings suggest that it is feasible for parents to complete EMA ratings on their children and complete 65 % or more of such ratings. It will be important to determine how many assessment points are necessary for obtaining a valid index of ED over a given period of time as well as the utility and validity of EMA protocols with young adolescents and adolescents.

Cognition

Certain cognitive strategies have been identified as adaptive, and these include acceptance, concentration, distraction, problem-solving, reappraisal, response modulation,

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[14] Although this is not an exhaustive list of available measures, it is a list of commonly used measures for which there is considerable psychometric data available.

[15] A child with depression may demonstrate stable but intensely negative emotional states.

rumination, and suppression. Some of these, such as acceptance, distraction, problem-solving, and reappraisal are more effective than others in regulating emotions (Aldao et al. 2010; Webb et al. 2012). Yet others, such as rumination and suppression, are associated with increased psychopathology (Aldao et al. 2010). Of import, findings indicate that, overall, cognitive emotion regulation strategies are less effective than behavioral ones (Augustine and Hemenover 2009). It is also important to note that the effectiveness of cognitive strategies has not been examined with youth with ADHD or with ADHD and ED. However, given that cognitive treatment techniques have been consistently shown to be less effective than behavioral or organizational ones with youth with ADHD (Pelham and Sams 1992), it is likely that cognitive emotion regulation strategies will also be less effective than behavioral ones in improving the ability of youth with ADHD to regulate their emotions. For example, it might be difficult to train youth with ADHD and ED to exercise cognitive emotion regulation strategies, especially in light of the executive deficits associated with ADHD.

Cognitive measures of emotion regulation include behavioral (i.e., neuropsychological) and self-report measures. Recognition of emotional faces and responses to such faces on neuropsychological tasks designed to measure attentional bias might be an index of thought suppression. Most cognitive measures of the subjective experience of behavioral responses to emotions involve self-report. We are unaware of any studies on cognitive emotion regulation strategies conducted with youth with ADHD. As mentioned above, this may be due, in part, to findings indicating that cognitive therapies are ineffective with youth with ADHD. Nevertheless, given the potentially adaptive role of cognitive emotion regulation strategies, studies identifying measures of these strategies in any youth with ED, including youth with ADHD, are needed.

Each of the reviewed measurement techniques has advantages and disadvantages, with physiological measures allowing for stimulus control and measurement precision, observational techniques allowing for stimulus control, rating scales revealing information about the subjective and real-world manifestations of ED, and EMA protocols allowing for measurement of temporal features of ED and circumventing recall bias. In line with evidence-based assessment guidelines underscoring the importance of multi-source, multi-informant measurement (Mash and Hunsley 2005), the use of objective assessment techniques that allow for measurement precision and stimulus control, combined with ecologically valid observation, rating scale, or EMA measures may comprise an optimal battery to measure emotion regulation in future studies. Regarding the utility of these measures across the developmental spectrum, we have no reason to believe that physiological, observational, or neuropsychological measures would not be equally valuable across development. Regarding

rating scale measures and EMA, it stands to reason that self-report on both types of measures becomes increasingly more appropriate over development and parent-report becomes increasingly less valuable. This recommendation is based on data indicating that although young children exhibit a response bias in their self-ratings of ED, emotion regulation is largely internal and subjective. Thus, as individuals mature and become more accurate in their self-appraisals, others may become less accurate.

Impairments Associated with ADHD and Emotion Dysregulation

There are a variety of ADHD-related impairments that are associated both with ADHD and with ED. Some of these are social (e.g., aggression and prosocial behaviors), and others are contexts for social functioning (e.g., peer, family, and romantic relationships). Other ADHD-related impairments, such as risky behaviors, are also associated with ED. Without being conclusive, we will next argue that many characteristics that can be debilitating to individuals are associated with both ADHD and ED, and there may be some overlap in such associations. Specifically, although both ADHD and ED are associated with negative outcomes such as aggression, family and romantic relationship difficulties, substance abuse, and risky sexual behaviors and there is literature independently connecting ADHD and ED to these outcomes, there is little information on the *combined contributions of ADHD and ED to risk* with the exception of some findings indicating that among youth with ADHD, ED is associated with impairments in peer relationships (Maedgen and Carlson 2000; Melnick and Hinshaw 2000) and prosocial behaviors (Bunford et al. 2014, 2015b).

ADHD, ED, and Social Behaviors

Many of the behaviors that are associated with ED and contribute to impairment occur in social contexts. These include aggression, prosocial behaviors, family conflict, and difficulties in romantic relationships.

ADHD and ED are Each Associated with Verbal and Physical Aggression

There is considerable literature on the association between ADHD and aggression, and we will review only a few findings on this association so as to provide examples. For example, girls with ADHD are at higher risk than girls without ADHD in adolescence for overt (Hinshaw et al. 2006) and relational aggression (Zalecki and Hinshaw 2004). The findings of longitudinal studies indicate that,

among children with ADHD, an early and persistent tendency to engage in physical fights is a strong predictor of adult violent behavior (e.g., Loeber et al. 1993; Loney et al. 1981; Weiss et al. 1985) and characterological disturbance (e.g., Antisocial Personality Disorder). Finally, young adults who were diagnosed with ADHD and ODD in childhood report more verbal aggression than typically developing peers. Importantly, when comparing typical peers to peers with ADHD only, peers with ADHD and ODD, and peers with ADHD and CD, the persistence of ADHD into adolescence accounts for the greatest differences across groups in *verbal* aggression in adulthood (Harty et al. 2009).

Theory and empirical findings indicate that ED also contributes to the emergence and maintenance of aggressive behavior. For example, Lemerise and Arsenio (2000) argue that children who are prone to experience strong emotions might become too overwhelmed, in the face of strong emotions, to consider non-aggressive responses to social conflict. Empirical findings indicate that children with ED are more likely to use aggressive tactics to resolve peer conflict than children with well-developed emotion regulation skills by the time they reach adolescence (Calkins et al. 1999) and adulthood (Cupach and Olson 2006). Difficulties with regulating anger, specifically, are also related to aggression (Furlong and Smith 1994), partly because some individuals, when they experience anger, use aggression to regulate the anger (Bushman et al. 2001). Finally, a low threshold for negative emotions not only precipitates but also heightens aggressive behavior (Berkowitz 1999).

Aggression may be a particularly impairing outcome of ADHD and of ED. Arrests, discipline problems, school expulsion, and social rejection are likely outcomes for aggressive youth. Furthermore, aggression puts both the aggressor and the target at risk for serious bodily harm. Thus, identifying the combined and unique contributions of ADHD and ED to aggressive behavior is critically important to inform interventions for this dangerous set of behaviors.

The Association Between ADHD and ED is Related to Impairments in Peer Relationships and Prosocial Behaviors

The authors of two studies reported that there is an association between performance on laboratory tasks designed to elicit ED and social impairment among children with ADHD (Maedgen and Carlson 2000; Melnick and Hinshaw 2000). Participants in both studies were elementary-school-aged children with and without ADHD. Indices of social functioning associated with ED included parent and teacher ratings of social status (i.e., parents and teachers estimated the proportion of each child's peers who like, dislike, and

ignore the child) and peer ratings (each boy was asked to nominate three boys with whom he most wanted to be friends and with whom he least wanted to be friends). Maedgen and Carlson (2000) found that children with ADHD exhibited ED characterized by high emotion intensity and high levels of behavioral displays of both negative and positive emotions and that ED predicted peer ratings. The findings of Melnick and Hinshaw (2000) indicate that two specific emotion regulation strategies displayed during the laboratory task (emotional accommodation[16] and negative responses[17]) predicted[18] parent and teacher ratings of social preference. These data indicate that ED is associated with impairment in peer relationships among children with ADHD.

Our group reported that ED, measured by rating scales, was associated with impairment in prosocial behaviors among young adolescents with ADHD. The results of our first study (Bunford et al. 2014) indicated that three aspects of ED: inflexibility/slow return to baseline, low threshold for emotional excitability/impatience, and behavioral dyscontrol in response to strong emotions predicted parent- and self-rated impairment in prosocial behaviors, above and beyond ODD. In our second study (Bunford et al. 2015b), we examined whether ED mediates the negative association between ADHD and parent- and self-rated social skills and whether this mediational process is moderated by depression. Results indicated that, controlling for ODD, the negative association between ADHD and social skills was mediated by inflexibility/slow return to baseline as well as by low threshold for emotional excitability/impatience. Further, this indirect effect was relevant for youth with non-clinical and subclinical levels of depression but not for those with clinical levels of depression. These data indicate that ED is associated with impairment in prosocial behaviors among adolescents with ADHD.

ADHD and ED are Each Associated with Family Conflict

Investigators documented more stressful and conflicted family environments, poorer parenting practices, and less authoritative parenting beliefs among parents of children with ADHD compared to parents of children without ADHD

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[16] "Child cognitively reinterprets the situation to find a tenable way, or sees a bright side, for example, "Even though I can't finish, the model, I can still have fun." Alternatively, he makes verbal statements or behaves in a way that indicates acceptance of the given conditions of the task, for example, shrugs shoulders and says 'its okay'" (Melnick and Hinshaw 2000; p. 77).

[17] "Child makes statements or expressions focusing on the negative, threatening, or uncontrollable aspects of the task, for example, blames others or complains he won't win the prize" (Melnick and Hinshaw 2000; p. 78).

[18] Marginally significant finding.

(see Johnston and Mash 2001 for review). Regarding triadic mother–father–child interactions, investigators documented more aversive and demanding interactions in the families of sons with ADHD compared to families of typically developing sons (Buhrmester et al. 1992). Finally, parents of children with ADHD report less marital satisfaction, more conflict, and more stress than comparison parents (see Johnston and Mash 2001 for review).

ED is also considered to be both a predictor and an outcome of interparental conflict (e.g., Crockenberg et al. 2007; Maughan and Cicchetti 2002; Schulz et al. 2005), and it has been suggested that negative emotionality is a cause of family perturbations, including poor parenting practices and child maladjustment (Chang et al. 2003). For example, Kobak et al. (1993) found that during a mother-teen problem-solving task, child ED was associated with caregiver-child interaction such that teens with secure attachment and less dysfunctional anger used problem-solving skills characterized by less avoidance than teens with insecure attachment and more dysfunctional anger. In turn, the mothers of teens with insecure attachment and dysfunctional anger used problem-solving skills characterized by dominance and dysfunctional anger. Thus, there is evidence that child and parental ED may contribute to family conflict.

Consistent with impairment in peer relationships and prosocial behaviors, family conflict is another example of the contribution of ADHD and ED to social impairment. The family is perhaps one of the most constant and demanding social settings, and it thus may be the context most likely to be impacted by the social problems associated with ADHD and with ED.

ADHD and ED are Each Associated with Romantic Difficulties

Individuals with ADHD experience a wide range of romantic difficulties. In late adolescence and young adulthood, girls with ADHD are involved in fewer romantic relationships (Babinski et al. 2010), and when they are involved in relationships, they exhibit "underdeveloped interpersonal sensitivity skills and awareness of relationship dynamics" (Waite 2007; p. 185). Compared to those without ADHD, men and women with ADHD report being less satisfied in their romantic relationships as well as discord in such relationships (e.g., Babinski et al. 2010; Barkley et al. 2008), including intimate partner violence (Wymbs et al. 2012, in press). Finally, when married, individuals with ADHD are more likely to divorce than individuals without ADHD (e.g., Biederman et al. 2006; Fargason and Ford 1994; Kessler et al. 2006; Murphy and Barkley 1996).

Similar problems also exist for individuals who exhibit ED. Maladaptive coping with emotional reactions including reactive and suppressive styles of coping are associated with interpersonal problems (Wei et al. 2003). Specifically, emotional reactivity and emotional cutoff are associated with decreased romantic relationship satisfaction (Skowron 2000; Skowron and Friedlander 1998); emotional reactivity and emotional cutoff are associated with attachment anxiety (fear of rejection and abandonment), and emotional cutoff is associated with attachment avoidance (fear of intimacy and discomfort with closeness and dependence) (Wei et al. 2005). Other findings indicate that ED is a mechanism that contributes to the continuity of romantic relationship conflict across generations. In one study, parents' ED was directly associated with sons' ED, which in turn was associated with the sons' later romantic conflict (Kim et al. 2009).

The literature on the association between ADHD and romantic difficulties and the literature on the association between ED and romantic difficulties indicate that some of the reasons for romantic difficulties may differ between those with ADHD and those with ED. For example, attachment anxiety and avoidance seem clinically incongruent with ADHD. Thus, as we have argued hitherto in this review, there may be some aspects of ED that are more and some that are less likely to be associated with ADHD. In particular, suppressive styles of coping with emotions may lead to impairment, but may be less relevant for individuals with ADHD than reactive styles of coping with emotions (e.g., ADHD is associated with intimate partner violence). Another aspect of ED, uninhibited expression of negative and positive emotions, is also consistent with models of ADHD that emphasize deficits in the inhibition of behavior (e.g., Barkley 1997). These findings related to romantic difficulties experienced by adolescents and adults have implications for improving our understanding of how children and young adolescents develop an understanding of romantic relationships and how they may learn from their early "dating" experiences. If we are able to effectively modify some of this early learning about romantic relationships with children with ADHD and ED, we may be able to alter the developmental trajectories of these youth to avoid the negative outcomes described above.

ADHD, ED, and Risky Behaviors

In addition to impairments in the social behaviors and situations described above, ADHD and ED are associated with risky behaviors such as substance use and risky sex. These are similar to the areas of impairment described above in that they usually occur in a social context.

ADHD and ED are Each Associated with Substance Misuse

There is a high incidence of alcohol and other substance use among children and adolescents with ADHD (Barkley et al. 2006; Molina et al. 1999, 2007). Relative to typical

peers, adolescents with ADHD report more drunken episodes and more frequent drinking and have three times as high of a lifetime use of illicit substances (Molina and Pelham 2003). Finally, not only does alcohol and other substance use occur more frequently among youth with ADHD than youth without, but ADHD is also associated with a longer maintenance of addictions (Wilens et al. 1998).

Empirical evidence indicates that ED is also associated with substance abuse (Finn et al. 2000; Martin et al. 2000; Tarter et al. 1995). Kassel et al. (2000) investigated the relationship between mood regulation expectancies (i.e., the belief that some behavior or cognition will alleviate a state of distress)[19] and problem drinking. Negative mood regulation expectancies accounted for a significant amount of variance in problem drinking, above and beyond the effects of age and gender, alcohol consumption, coping styles, emotional distress, and drinking motives. Further, among adolescent boys, ED[20] is negatively associated with gateway drug use (Farrell and Danish 1993) and among adults it accounts for 8 % of the variance in alcohol abuse, above and beyond age and sex (Bradley et al. 2011).

Although there is no evidence to support this, it is reasonable to suspect that the combination of ADHD and ED may interact in a way that increases risk beyond the sum of that conferred by each uniquely. Yet, even without an interaction and considering the possibility that some of the risk for substance use may be shared (and thus not cumulative), evidence suggests that individuals with ADHD and with ED are at substantial risk for substance abuse.

ADHD and ED are Each Associated with Risky Sexual Behaviors

Additional adverse outcomes associated with ADHD include poor sexual health among adolescents (Monuteaux et al. 2007) and adults (Flory et al. 2006; Winters et al. 2009). In adulthood, ADHD symptoms among women are associated with a tendency to engage in a variety of risky sexual behaviors (Hosain et al. 2012). Among men, childhood ADHD predicts earlier initiation of sexual activity and more sexual partners, casual sex, and unplanned partner pregnancies[21] (Flory et al. 2006). Finally, findings with men and

women indicate that ADHD is associated with an early sexual debut and failure to use condoms (Barkley et al. 2008; Brown et al. 2012; Galéra et al. 2010).

Difficulty regulating sadness and anger (Hessler and Katz 2010), and avoidance of negative emotions in middle childhood and adolescence are also associated with more sexual partners and risky sexual behavior in adulthood (Cooper et al. 1998). ED in adulthood is associated with lifetime number of sexual partners and frequency of risky sex with a stranger (Raffaelli and Crockett 2003). Further, ED mediates the association between risky sexual behavior including with a dating partner or with a stranger (e.g., failure to use condoms, or having sex with someone under the influence of alcohol/drugs), and sexual revictimization among adult victims of child sexual and physical abuse (Messman-Moore et al. 2010).

Characteristics of ADHD and of ED indicate that the likelihood of risky sex may be especially pronounced for individuals with both ADHD and ED. The demands of responsible sexual activity require the regulation of emotions, which may manifest as patience, delay of gratification, and pacing when faced with a sexual opportunity. Aspects of ADHD that manifest in impatience and temporal discounting seem to be the behaviors that are compromised by ED.

Etiology

Genetic Effects on the Development of ED

The findings of family studies indicate that familial factors may account for the covariation of ADHD and ED (e.g., Biederman et al. 2012; Surman et al. 2011). Specifically, some research indicates that ED is heritable and co-segregates in families of youth with ADHD. For example, Surman et al. (2011), who adopted a definition of ED similar to ours, aimed to clarify the co-occurrence of ADHD and ED in a family study. For all participants, the presence of DSM-IV disorders was evaluated and ED was measured via the self-report Current Behavior Scale.[22] Findings indicated that siblings of those with ADHD were at elevated risk of having the disorder, irrespective of ED. The risk of having ED[23] superimposed on ADHD was elevated among siblings of ADHD plus ED probands but not in siblings of ADHD only probands. Because ADHD and ED co-segregated in siblings,

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[19] Those who hold high levels of negative mood regulation expectancies believe that their coping efforts will improve affect, whereas those with low negative mood regulation expectancies believe that their efforts will have little effect on their on their feelings of distress.

[20] Defined here as emotional restraint, which is a way of managing negative emotions by suppression.

[21] Although childhood conduct problems did contribute significantly to risky sexual behaviors among participants with ADHD, there was also an independent contribution of ADHD.

[22] The eight-item ED subscale of this measure demonstrated both excellent internal consistency and external validity, as indicated by significant correlations between scores on the subscale and impairment on measures assessing quality of life and social functioning.

[23] Participants in this study were conceptualized as exhibiting ED if their self-ratings on the ED subscale were at least as impaired as the worst 5 % of ratings among individuals without ADHD.

and because the risk of having any DSM-IV disorder other than ADHD was similar in siblings of the proband groups with ADHD, Surman et al. (2011) concluded that (1) the pattern of inheritance of ADHD with ED indicates that ED may be a familial subtype of ADHD and (2) ED is not an expression of other Axis I disorders or of environmental factors. Conversely, the findings of other familial research (Sobanski et al. 2010) indicate that although there is a familial risk for ED, there is no co-segregation with ADHD symptoms among siblings of ADHD probands.

Merwood et al. (2014) examined the extent to which common etiological influences account for the association between symptoms of ADHD and ED in a community sample of twins.[24] The findings of this study indicated that phenotypic covariation between symptoms of ADHD and ED was primarily due to common genetic influences. In addition, because a common pathway model was the best empirical fit to the data, these authors concluded that symptoms of ADHD and ED correspond to one heritable latent factor. However, Merwood and colleagues also identified unique non-additive genetic and non-shared environmental influences for symptoms of ADHD and ED, indicating that the etiological overlap across the two is not absolute.

One implication of these findings is that symptoms of ADHD and ED may arise as a result of a common etiology and that ED may be a component of the broader ADHD construct. However, many behavioral and cognitive traits share genetic risk with ADHD (e.g., autism or dyslexia), and these are not components of a broader ADHD construct (see Merwood et al. 2014, for review). Furthermore, as we discuss consistently throughout this paper, ED can occur in the context of many disorders and is thus not specific to ADHD. So, an alternative explanation (alternative to ED being a component of the broader ADHD construct) is that the common genetic liability for ADHD and ED might better reflect "a latent construct that cuts across a range of disorders associated with emotional symptoms" (Merwood et al. 2014; p. 217).

However, the results across these studies are neither consistent nor conclusive. Some reasons for these inconsistent findings may be related to study methodology, including sample characteristics. First, Merwood et al. (2014) found an age effect; ED was more strongly related to the latent ADHD factor in older than in younger twins, indicating that there is greater sharing of genetic influences between ADHD symptoms and ED in older youth. These findings may be due to ED in childhood being qualitatively different from ED in adolescence (in that in childhood it could arise for a number of reasons besides

ADHD). However, as the heterogeneous symptoms of ADHD "taper off during development, what is left might be a chronic state of emotional lability that is more strongly related to ADHD symptoms at an etiological level" (Merwood et al. 2014; p. 217). The results and hypothesis of Merwood et al. (2014) may explain why Sobanski et al. (2010), who had a relatively younger sample (5–17 years), did not replicate the co-segregation findings of Surman et al. (2011), whose participants were men and women between the ages of 18 and 55 years. Other methodological issues related to participant recruitment (e.g., participants were ascertained from specialist clinics by Sobanski et al. and Surman et al. but were recruited from the community by Merwood et al.) or to measurement (e.g., Sobanski et al. measured ED on the Conner's Global Index: Emotional Lability subscale, Surman et al. on the Current Behavior Scale and Merwood et al. on the Conner's 10-item Scale) may also account for the inconsistent findings across studies.

Environmental Effects on the Development and Maintenance of ED

Hitherto, we provided support for a direction of an effect from ED to other areas of impairment. However, conceptually, a case can also be made for an effect in the opposite direction. Specifically, characteristics of various social domains (e.g., family, parent–child, peer relationships) may contribute to the development and maintenance of ED among youth with ADHD. Although we are not aware of literature on this specific question that has been conducted with youth with ADHD, drawing on other literatures that speak to the effects of the social environment on ED may generate some testable hypotheses. In addition, research on characteristics of families of children with ADHD suggests that youth with ADHD may be particularly likely to experience the environmental effects that may exacerbate ED.

The role of the social environment and of a transactional process between the individual and his/her social environment has been underscored in the development and maintenance of ED in theoretical models of borderline personality disorder (BPD) (and, by extension, of ED, which is a core feature of BPD[25]). Although the ensuing discussion is primarily focused on parents as agents in youths' social environment, it stands to reason that the processes involved in the development of ED that are discussed next, such as emotional invalidation, may be applicable to other social agents (e.g., siblings, peers, teachers) in the lives of youth with ADHD.

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[24] ADHD symptoms were measured on a modified version of the DuPaul Rating Scale. Emotional lability was measured on the parent-rated Conner's 10-item scale and indexed by four items "demands must be met immediately—easily frustrated," "cries often and easily," "mood changes quickly and drastically," and "temper outbursts, explosive, and unpredictable behavior".

[25] According to Linehan (1993), chronic and pervasive emotion dysregulation is considered the core feature and core difficulty in BPD and related disorders rather than a "symptom" of the disorder.

According to Linehan's (1993) theory of BPD, many individuals who develop BPD are, at some point or throughout development, surrounded by an emotionally invalidating environment. In an emotionally invalidating environment, the individual's communication about his/her emotions is met by erratic, extreme, or inappropriate responses by others. Combined with biological predispositions, individuals exposed to invalidating environments develop an emotional vulnerability that results in heightened sensitivity to emotional stimuli, a style of experiencing emotions as extremely intense, and slow return to emotional baseline.

There are various family interactions or processes that may be conceptualized as invalidating, and these are characterized by the presence of interactions that are critical, conflictual, and negative, and the absence of interactions that are empathic and supportive (see Fruzzetti et al. 2005 for review). Of import, invalidating does not indicate "bad." Rather, it indicates that the demands or responses of others (e.g., parents) are inaccurate and/or judgmental related to the individual's expressions of emotions and thoughts. For example, a child learns to label her or his experiences as cold or hot when others consistently notice the environmental conditions corresponding to the child's behavior (shivering, sweating) and apply an accurate label. This way, the child learns to scan the environment for cues (e.g., temperature) that, in combination with her or his private experience (e.g., feeling cold), inform the label and the explanation for the phenomenon. Analogous processes occur with emotions. If a child were hit by an older sibling and cried, looked down quietly with eyes closed, a normative label would likely be "sad." In an invalidating environment, the more accurate label would less likely be applied, and the person teaching the labeling would base the label on cues that are outside the child (e.g., on how the caregiver feels).[26] So a parent may tell the child to not feel sad, but instead he should stand up for himself and be angry at his brother. This correction is based on the parent's expectations and desires and ignores the child's actual emotional response. This may lead to confusion in the child between his actual emotions and how "he should be feeling." Consequently, the child who is in an invalidating environment will be less able to integrate environmental events and private experiences into the label and explanation for his/her emotions. The inaccuracy of such labels (whether due to parental preoccupation with other stimuli or inaccurate expression by the child) reduces the

likelihood that good coping responses will be learned to manage or regulate emotions and results in "mismatched" responses that invalidate the child's actual emotional experience. A child who consistently experiences invalidating responses to his emotions coupled with a predisposition to ED may be at heightened risk for impairment due to ED. ADHD may constitute that predisposition and so an invalidating environment may be particularly impactful to youth with ADHD developing effective emotion regulation strategies.

Thus, Linehan's (1993) model and its extension by Fruzzetti et al. (2005) provide a framework in which impairment in social settings may contribute to ED for children with and without ADHD. In addition to the vulnerability predisposed by having ADHD, the family environments of children with ADHD may be particularly likely to provide invalidating feedback about the children's emotions. Evidence indicates that relative to the families of children without ADHD, the families of children with ADHD are characterized by conflicted and stressful family environments, poor parenting practices, more aversive and demanding parent–child interactions, and less authoritative parenting beliefs. In addition, the parents of children with ADHD report more conflict, less marital satisfaction, and more stress than comparison parents (see Johnston and Mash 2001 for review). Parents who are in conflicted relationships with other family members and stressed may be more likely to invalidate, either intentionally or unintentionally, than parents without these conflicts or stressors. The combination of parent and child behavior may lead to a counterproductive and potentially damaging cycle of deterioration. Children with ADHD and ED may exhibit dysregulated behaviors, and parents may respond in increasingly more negative ways toward them, often in invalidating ways that propagate emotional cascades (i.e., wherein rumination on negative emotions increases emotional intensity, and this increase in emotional intensity results in increased rumination and consequently an amplified behavioral response to emotional stimuli) (Fruzzetti et al. 2005). Although to our knowledge there is no research available on the degree to which these family characteristics are related to the types of invalidating responses and environments discussed above, this is likely a fertile topic for future researchers of ADHD and ED and one that may have implications for prevention and treatment.

Finally, as noted above, the role of the emotionally invalidating environment in the development and maintenance of ED was first posited in relation to BPD. Similarities between BPD and ADHD lend further support to the applicability of the emotional invalidation hypothesis of the development and maintenance of ED among youth with ADHD. Specifically, a number of authors have made note of similarities between BPD and ADHD, including with regard to purported etiology, neuroanatomical and

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[26] For more a more detailed discussion on more specific invalidating processes [i.e., invalidation of emotions, thoughts, wants, and other internal or private behaviors; invalidation of overt or public behavior; minimizing difficulties, invalidation of a sense of self and self-initiated behavior] and the effects of chronic and pervasive invalidation developmentally, see Fruzzetti et al. (2005).

neurophysiological concomitants, and personality traits, as well as overlapping features such as impulsivity and behavioral and emotional dysregulation (see Nigg 2005 for a review). Other data indicate that adults with BPD report having had more ADHD symptoms in childhood than adults with other personality disorders and that although deficiencies in inhibition are purportedly due to executive deficits in ADHD but due to problems with the septal–hippocampal system in BPD, it is evident that disinhibition is associated with both disorders. As we note above, an important area of research will be to understand whether the ED associated with ADHD is a result of deficits in conscious and effortful control that are otherwise associated with the disorder or of deficits in reactivity, similar to BPD, or both.

Is Emotion Dysregulation Malleable?

Currently, there are no treatment studies conducted with youth with ADHD wherein ED was examined as an outcome variable. However, some studies include participants with anger management problems, emotional lability, SMD, and other emotional problems. Some portion of the participants in these studies could meet our definition of ED. In the following sections, we explore interventions targeting ED among non-ADHD and ADHD populations.

Interventions Targeting ED with Non-ADHD Populations

Treatments have been designed to target ED in populations other than individuals with ADHD. Although empirical support for these interventions is mixed, it is possible that some findings generalize to youth with ADHD.

Parent Management Training

In the context of parent management training (PMT), parents learn to use discipline strategies consistently and effectively to manage children's disruptive behavior. Scott and O'Connor (2012) examined whether children with characteristics related to ED exhibit differential treatment response to PMT. The sample was comprised of 112, 5- to 6-year-old children, whose parents were randomly assigned either to receive PMT or to a control condition. All children met diagnostic criteria for ODD and were divided into an Emotionally Dysregulated type and a Headstrong type. Findings indicated that the Emotionally Dysregulated children were more responsive to improvements in parental care than the Headstrong children. It is important to note that children with the Emotionally Dysregulated type of ODD are different from youth with ADHD and ED. Specifically, the Emotionally Dysregulated type in Scott

and O'Connor's study was comparable to the emotional symptoms of ODD, while the Headstrong subgroup was comparable to some ADHD and non-aggressive conduct symptoms. Additionally, Scott and O'Connor (2012) did not directly measure ED. For these reasons, although these data are encouraging with regard to there being potential benefits to screening children with ADHD on ED prior to allocating parenting interventions (so as to identify a subgroup who may be particularly responsive to such interventions), it is questionable whether or not the results of this study generalize to youth with ADHD and ED.

Other Parenting Interventions

Other parenting interventions have been designed to target ODD symptoms in infants and children with negative emotionality. Dunsmore et al. (2015) found that child emotional lability/negativity moderated the effects of a 12-week maternal emotion coaching program on child ODD symptoms post-treatment. Children high on emotional lability/negativity exhibited greater benefits. In another study, Cassidy, Woodhouse, Sherman, Stupica, and Lejuez (2011) found that infants with negative reactivity benefited most from a parenting intervention aimed at improving infant attachment security. Although these results indicate that there may be increased benefits of parenting interventions for children with ODD and emotional lability/negativity and infants with negative reactivity, ED was not measured or directly targeted in these interventions. As such, it is unclear whether the enhanced effects of parenting interventions would generalize to youth with ED, let alone youth with ADHD and ED.

Dialectical Behavior Therapy

Several interventions directly target ED. Dialectical behavior therapy (DBT) is a comprehensive treatment for ED that has beneficial effects for adults and youth with a wide range of psychopathologies and problems. Although we are unaware of any research on DBT delivered to youth with ADHD, researchers have tested the effects of DBT with similar populations: youth with aggression (e.g., Apsche et al. 2006) and ODD (e.g., Nelson-Gray et al. 2006) as well as juvenile offenders (e.g., Trupin et al. 2002) including ones who were incarcerated (Shelton et al. 2011). However, ED was not measured in these studies, making it difficult to determine the effectiveness of DBT on the ED of participating youth. Nelson-Gray et al. (2006) did measure the effects of DBT[27]

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[27] Thirty-two adolescents completed a16-week group DBT skills training program and pre- and post-treatment measures. All components of the core mindfulness, interpersonal effectiveness, emotion regulation, and distress tolerance modules from Linehan (1993) DBT

on outcomes theoretically related to ED and found that the treatment was effective in reducing parent-rated ODD symptoms and externalizing behaviors and in increasing parent-rated interpersonal strength. Participating teens also reported reductions in externalizing and internalizing symptoms including in depression, and reliable change indices indicated that more participants were in the improved category than in the deteriorated category on measures of interest, underscoring that DBT is a promising intervention for adolescents with ODD. Further, as there appears to be a direct link between externalizing behaviors and ED (e.g., Snyder et al. 1997), an intervention that targets ED may be appropriate not only for youth with ODD but for youth with externalizing problems generally.

Mindfulness Meditation

Mindfulness meditation (MM) also directly targets ED. MM as an independent practice involves intentionally shifting one's attention toward one's thoughts, feelings, and bodily states (while adopting an observant and nonjudgmental stance) (Bishop et al. 2004). There has been an increase in attention to MM as an intervention for a range of childhood and adolescent problems, including anxiety (e.g., Britton et al. 2014; Liehr and Diaz 2010; Semple et al. 2005), depression (e.g., Ames et al. 2014; Raes et al. 2013), and sleep problems (e.g., Bei et al. 2013). Although the authors of these studies did not examine the effects of MM on ED, some did include measures of emotion. For example, Britton et al. (2014) conducted a randomized pilot trial comparing the effects of MM to an alternative experiential control group and examined changes in anxiety and negative and positive emotionality and found that children in both groups improved on these outcomes. Other findings indicate that MM is related to improvements in emotional control (Tacon et al. 2003) and decreased emotional reactivity (Linehan et al. 2007). Although broad measures of ED were not included in these studies, MM appears to be associated with improvements in some aspects of emotional functioning and regulation.

Contextual Emotion Regulation Therapy

Kovacs (2009) developed contextual emotion regulation therapy (CERT)[28] for childhood depression. In CERT, therapists work with children and parents to identify factors

that "up-regulate" (or intensify) or "down-regulate" (or de-intensify) dysphoric mood. Data from pilot trials on the effects of CERT indicate that youth exhibited improvements in their ability to regulate dysphoric mood (Kovacs and Lopez-Duran 2012). However, in the absence of empirically validated indices of what is developmentally normative, CERT therapists rely on qualitative information obtained from parents and children and on clinical experience, so as to estimate the degree to which each child exhibits improvements in his/her ability to regulate dysphoric mood (Kovacs and Lopez-Duran 2012).

Interventions Targeting ED with ADHD Populations

Social Skills Training

Some social skills training (SST) programs target cognitive–behavioral and emotional (e.g., recognizing and managing emotions) contributors to social functioning (Miranda and Presentacion 2000; Pfiffner and McBurnett 1997; Tutty et al. 2003). Findings indicate that SST has been minimally effective (e.g., Hoza 2007) or ineffective (Pfiffner and McBurnett 1997) for children with ADHD, and there have been no randomized trials with adolescents with ADHD (Storebø et al. 2011). One explanation for these findings may be that cognitive techniques, which have not fared well with youth with ADHD, are emphasized in SST (Pelham and Sams 1992).

Anger Management

The goal of anger management training (AMT) programs is to decrease aggression by increasing youths' ability to manage anger. In theory, because an aversive stimulus can elicit anger (*vis-à-vis* physiological arousal or cognitive distortions), which then elicits aggression, managing physiological arousal and restructuring cognitive distortions may prevent aggression. Thus, AMT programs involve education about internal and external anger cues and non-aggressive problem-solving (Feindler and Ecton 1986). The authors of a few studies have examined the efficacy of AMT with youth with ADHD. AMT combined with medication and behavioral interventions (see Hinshaw and Melnick 1992 for review) and with self-control training (Miranda and Presentacion 2000) extends treatment gains. However, ED is not comprehensively targeted in AMT, albeit regulation of one emotion, anger, is addressed. As we note above, anger is but one of the many emotions that some youth with ADHD are unable to regulate. Nevertheless, AMT programs are similar to other treatments targeting ED (e.g., DBT), and aggression

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Footnote 27 continued

manual were taught with age-appropriate modifications (Nelson-Gray et al. 2006).

[28] In CERT, clinicians are able to "match" the intervention to children's emotion regulatory needs and symptoms. Therapists work with children to complete in-session activities and with parents to teach them how to coach the child during the week. Outside of sessions, children complete "homework" assignments with guidance

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Footnote 28 continued

and support from their parents. CERT involves 22 sessions occurring over 6 months with 6- to 12-month follow-up after treatment ends.

is an important consequence of ED that meaningfully impacts the social functioning of youth with ADHD.

Novel Group Therapy with Emotion Regulation

Some authors have tested the effects of interventions on problems redolent to ED among individuals with ADHD. However, in these studies, proxies for ED were measured (e.g., mania, SMD) and ED, as defined in this paper, was not. Thus, the findings we review next may apply to the group of youth we are defining as having ADHD and ED only to a limited extent.

Waxmonsky et al. (2013) developed a group therapy for children with ADHD and SMD wherein elements of cognitive–behavioral therapy, emotion regulation techniques, and parent training are combined. In a pilot trial, youth exhibited improvements in self-rated depression and parent-rated mania (on the Young Mania Rating Scale; Fristad et al. 1992) (Waxmonsky et al. 2013). Although all participants in this study had ADHD and SMD, the authors did not measure ED (defined in terms of intensity, duration, and impairment).

Mindfulness Meditation

In a recent review of the effects of MM on the functioning of youth with ADHD, Cassone (2015) concluded that mindfulness approaches are associated with improvements in various outcomes. Specifically, mindfulness approaches have been found to be associated with improvements in attention (e.g., Haydicky et al. 2015), ADHD symptoms (e.g., van der Oord et al. 2012; Zylowska et al. 2008), and anxiety and depression (Zylowska et al. 2008) as well as with reductions in behavior problems (e.g., van de Weijer-Bergsma et al. 2011) and peer relationship problems (Haydicky et al. 2015) among youth with ADHD. ED was not measured in these studies, and participants were not selected for ED. Thus, the effect of MM on individuals with ADHD and ED remains unclear.

Dialectical Behavior Therapy Skills

Some authors examined the effects of DBT skills on the functioning of adults with ADHD. Skills from the emotion regulation module were included in a larger intervention for adults with ADHD (Philipsen et al. 2007) and were among the top three skill areas (along with mindfulness and behavior analysis) in participant-rated effectiveness (Fleming and McMahon 2012). DBT skills[29] were also

delivered to eight adults with ADHD in a study by Hesslinger et al. (2002), who tested the feasibility of DBT against a waitlist control condition. All participants exhibited improvements in self-rated ADHD and depressive symptoms. Although ED was not measured it this study, results supported the feasibility of a DBT program for adults with ADHD (Hesslinger et al. 2002).

In a pilot randomized trial evaluating DBT group skills training adapted for college students with ADHD, 33 students with ADHD were assigned to receive either 8 weeks of DBT group skills training[30] or handouts[31] (Fleming et al. 2014). Participants receiving DBT exhibited greater treatment response rates (59–65 vs. 19–25 %) and clinical recovery rates (53–59 vs. 6–13 %) as indicated by improvements on ADHD symptoms and in quality of life. Although ED was not measured in this study, these findings indicate that DBT group skills training may be efficacious, acceptable, and feasible for college students with ADHD (Fleming et al. 2014).

Multimodal Inpatient Treatment

Some findings indicate that characteristics related to ED may moderate the response of youth with ADHD and comorbidities to a multimodal inpatient treatment program comprised of cognitive–behavioral therapy, family therapy, gym, parent training, recreation, school work, and social skills training. Specifically, among 47 boys, those with ADHD, CD, and depression, higher heart rate variability (which has been associated with lower ED) was associated with better treatment response; among youth with ADHD and CD (but no depression), higher heart rate variability was not associated with an enhanced treatment response (and this group responded less well to the intervention). Beauchaine et al. (2000) argued that better emotion regulation skills may be associated with an enhanced treatment response among youth with ADHD, CD, and depression because these youth may be

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Footnote 29 continued

functional behavior analysis, impulse control, emotion regulation, and stress management.

[30] Consisting of a 15-minute individual pre-group motivation-enhancing meeting, eight weekly 90-minute group skills training sessions and seven weekly 10- to 15-minute individual coaching phone calls focused on skills generalization. A 90-minute group booster session was held during the first week of the follow-up quarter. DBT groups skills training included psychoeducation and skills trainings in goal setting, daily planner use, task prioritization and chunking, environment restructuring, using social support, managing sleep, eating, and exercise habits, mindfulness, emotion regulation such as opposite action, planning for high-demand periods, and planning for skill maintenance.

[31] Students in the handouts condition were provided with a self-help booklet that contained information on psychoeducation about ADHD, organization, planning, time management, environment restructuring, and stress management.

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[29] In Hesslinger et al. (2002), all participants were selected on the basis of ADHD-status, but ED was not measured. The program consisted of a 13-week group psychoeducation and skills program delivered for 2 h a week. DBT was modified for adults with ADHD to include psychoeducation on the neurobiology of ADHD, medications for ADHD, dependency, self-respect, and the role of ADHD symptoms in relationships as well as skills training in mindfulness,

Table 2 Summary of research questions and findings

Research question	Finding(s)	
What is ED and how do we define it when it is associated with ADHD?	*Emotion regulation* is an individual's ability to modulate (1) the speed with which and degree to which the physiological, experiential, and behavioral expression of an emotion escalates, (2) the intensity of the physiological, experiential, and behavioral expression of an emotion, and (3) the speed with which and degree to which physiological, experiential, and behavioral expression of an emotion de-escalates in a manner congruent with an optimal level of functioning	
	Emotion dysregulation is an individual's inability to exercise any or all aspects of the modulatory processes involved in emotion regulation, to such a degree that the inability results in the individual functioning meaningfully below his or her baseline	
What portion of youth with ADHD experience ED?	See Table 1	
How is ED measured?[a]	*Physiology*—psychophysiological measurements of ANS activity	*Advantages*: measurement precision and stimulus control
		Disadvantages:
		poor signal-to-noise ratio (specific emotion or regulatory problem corresponding to ANS activity may be difficult to distinguish)
		reliance on validity of experimental task for validity of measurement
		many experimental measurements do not translate well to the real world
		many experimental measurements have less utility for measuring treatment response
	Behavior—observation	*Advantages*: stimulus control
		Disadvantages:
		specific emotion or regulatory problem contributing to observed behavior may be difficult to distinguish
		reliance on validity of experimental task for validity of measurement
		many experimental measurements do not translate well to the real world
		many experimental measurements have less utility for measuring treatment response
		measurement precision may be difficult to achieve
	Behavior—performance on neuropsychological tasks	Although most explanatory models of ADHD attribute impairments in neuropsychological functions to symptom expression and ED, there is a relative absence of neuropsychological measures specific to ED
		Given the importance of neuropsychological deficits associated with ADHD and with ED, research is needed to identify neuropsychological measures of ED that are appropriate for use with youth with ADHD
	Self-report—rating scales	*Advantages*: appropriate for sampling a large number of situations and are thus representative of the multiple contexts of an individual's day; appropriate for distinguishing among specific emotions or regulatory problems; are reflective of the subjective experience of emotion and emotion regulation; are convenient to administer; and allow for norms-based comparison
		Disadvantages:
		rely on subjective descriptions of multifaceted, observable behavior, at the core of which more specific processes may be at play
		most are specific to negative emotions
		assumption that a construct equals the sum of its "symptoms" and that these (the "symptoms") are adequately represented by the numbers raters associate with behaviors represented on items
		assumption that changes in the numbers raters associate with behaviors reflect changes in clinical reality
		rater bias

Table 2 continued

Research question	Finding(s)	
	Self-report—ecological momentary assessment	*Advantages*: appropriate for sampling a large number of situations and are thus representative of the multiple contexts of an individual's day; allows for the assessment of temporal features of ED; and allows for real-time measurement of ED
		Disadvantages:
		Children are less likely to complete ratings when emotionally distressed
		Children demonstrate response bias
	Cognition	Cognitive emotion regulation strategies are less effective than behavioral ones; cognitive treatment techniques are less effective than behavioral or organizational ones with youth with ADHD, thereby making it likely that cognitive emotion regulation treatment strategies will also be less effective than behavioral ones in improving the youths' ability to regulate emotions
		Given the potentially adaptive role of cognitive emotion regulation strategies, research is needed to identify measures of cognitive strategies that are appropriate for use with youth with ADHD
Is ED associated with social impairment and risky behaviors among individuals with ADHD?	Among individuals with ADHD, ED is associated with impaired peer relations and prosocial behaviors above and beyond symptoms of ADHD and ODD	
	ADHD and ED are each associated with substance use and risky sex as well as with aggression, family relation impairment, or romantic relation impairment	
	Research is needed on the combined contributions of ADHD and ED to substance use and risky sex and to aggression, family relation impairment, or romantic relation impairment	
What characteristics contribute to the development and maintenance of ED?	Heritability and co-segregation	
	Some findings indicate that ED is heritable and co-segregates in families of youth with ADHD	
	Other findings indicate that although there is a familial risk for ED, there is no co-segregation with ADHD symptoms among siblings of ADHD probands	
	Environmental effects	
	No empirical data research is needed	
	Theoretical support for the role of an emotionally invalidating environment in the development and maintenance of ED among youth with ADHD	
Is ED malleable?	No treatment studies conducted with youth with ADHD with ED as an outcome variable	
	Treatment studies with non-ADHD populations	
	PMT[b]/other parenting: ED is not directly targeted or measured	
	DBT[c]: ED is directly targeted but not typically measured in studies conducted with youth with presentations related or similar to ADHD (e.g., aggression, ODD)	
	MM[d]: ED is directly targeted and although ED is not directly measured in the reviewed studies, MM is associated with improvements in negative and positive emotionality, emotional control, and emotional reactivity	
	CERT[e]: dysregulation of dysphoria is directly targeted and measured; empirical findings are encouraging	
	Treatment studies with ADHD populations	
	Social skills training: minimally effective for youth with ADHD and no randomized trials with adolescents	
	AMT[f]: combined with medication and behavioral interventions and with self-control training extends treatment gains. ED is not comprehensively targeted, albeit regulation of anger is	
	Novel group therapy with emotion regulation: in studies wherein effects were assessed, proxies for ED were used (e.g., mania, severe mood dysregulation); youth exhibited improvements in self-rated depression and parent-rated mania	
	MM: mindfulness approaches are associated with improvements in attention, ADHD symptoms, and anxiety and depression as well as with reductions in behavior problems and peer relationship problems. Across the reviewed studies, ED is not directly measured	
	DBT: three studies on the effects of DBT for adults with ADHD, which is effective as rated by participants, associated with improvements in ADHD and depressive symptoms, and with quality of life. Across the reviewed studies, ED is not directly measured	

Table 2 continued

Research question	Finding(s)
	Multimodal inpatient treatment: Among boys with ADHD, CD and depression (but not among boys with ADHD and CD only), higher heart rate variability (lower ED) is associated with better treatment response. ED was not directly measured

[a] Limiting our review of the measurement of ED will be limited to methods that have been used to measure ED, when associated with ADHD

[b] Parent management training

[c] Dialectical behavior therapy

[d] Mindfulness mediation

[e] Contextual emotion regulation therapy

[f] Anger management training

characterized by a range of emotional responsiveness that is not characteristic of youth with ADHD and CD alone (Beauchaine et al. 2000).

In sum, the results of intervention studies for non-ADHD and ADHD populations suggest that treatments that purportedly improve ED are being developed and tested. Results generally indicate that these treatments are acceptable and feasible and are associated with changes in ADHD symptoms and, in some cases, depression. The findings of some of these studies indicate that characteristics related to or aspects of ED predict a better (e.g., Cassidy et al. 2011; Dunsmore et al. 2015; Scott and O'Connor 2012) and worse (e.g., Beauchaine et al. 2000) treatment response. These mixed findings are likely a reflection of variations in diagnoses (e.g., ADHD, ODD, CD comorbidities and trimorbidities), comorbid symptoms (e.g., depression), individual characteristics (e.g., age), settings (e.g., outpatient and inpatient), and treatment modalities (e.g., parent training with parents or anger management training with youth). Perhaps most importantly, however, ED was either not specifically or not comprehensively measured in any of these studies, preventing us from knowing whether or not ED, associated with ADHD, is a characteristic that is malleable and is thus going to be a useful treatment target.

Discussion

Children, adolescents, and adults with ADHD experience impairment in a number of domains of functioning, including social impairment as well as risky behaviors, and their response to interventions targeting such impairments is often limited. We have argued that it may be helpful to examine characteristics that are associated with these domains of impairment and may be associated with treatment response among some youth with ADHD. We have further argued that ED may be one such characteristic. However, prior to stating far-reaching conclusions with regard to incorporating a focus on ED into current interventions targeting these ADHD-related impairments, it was important that we examine some relevant issues, such as the definition of ED, when associated with ADHD; what portion of youth with

ADHD experience ED; ways of measuring ED; whether or not ED is associated with social impairment and risky behaviors among individuals with ADHD; what characteristics contribute to the development and maintenance of ED; as well as whether or not ED is malleable (see Table 2 for a list of our research questions and summary of our findings).

Summary and Conclusions

Based on prior theory and literature, we defined emotion regulation in this paper as an individual's ability to modulate (1) the speed with which and degree to which the physiological, experiential, and behavioral expression of an emotion escalates, (2) the intensity of the physiological, experiential, and behavioral expression of an emotion, and (3) the speed with which and degree to which physiological, experiential, and behavioral expression of an emotion de-escalates in a manner congruent with an optimal level of functioning. We defined ED as an individual's inability to exercise any or all aspects of the modulatory processes involved in regulating positive and negative emotions, to such a degree that the inability results in the individual functioning meaningfully below his or her baseline. Our review of the literature indicates that there is some empirical evidence for the second and third aspects of this definition (e.g., Bunford et al. 2014, 2015b) but not for yet for the first. Thus, authors of future studies may wish to collect data on whether or not youth with ADHD exhibit ED characterized by a speed of escalation and degree of escalation of emotion expression that results in the youth functioning meaningfully below his or her baseline. In addition, further evidence is needed to confirm our findings indicating that youth with ADHD experience emotions with intensity that results in impairment as well as that youth with ADHD exhibit slow return to emotional baseline. In addition, it may be important for the authors of future empirical studies to consider steps that precede the point of arousal, such as Gross' (1998) steps of situation selection and modification as these have not been studied with youth with ADHD.

We have very limited information on what portion of youth with ADHD experience ED. Based on the findings

described earlier and reported in Table 1, according to self-report on the ERICA, ED is more common in males with ADHD than females with ADHD and is more common in youth with ADHD than youth without the disorder. Depending on the preferred cutoff for determining ED, these findings suggest that approximately one-third (cutoff of 10th percentile) to approximately one-half or more (cutoff of 25th percentile) of young adolescents with ADHD would be considered to exhibit ED. As a result, ED is a common problem for young adolescents with ADHD and should be considered when measuring outcomes and developing treatments for this population.

We hope to have convinced the reader that ED, when associated with ADHD, is distinct from impulsivity/disinhibition as well as from various conditions that are often co-morbid with ADHD (e.g., BD, mood and anxiety disorders, or ODD). We argued that some individuals may engage in impulsive behaviors as an emotion regulation strategy and also that there are aspects of ED that involve behavioral dyscontrol in the presence of strong emotions. However, there are aspects of ED that are independent of impulsivity. Similarly, we also noted that ED is associated with—and occurs in the context of—a variety of disorders that are often comorbid with ADHD. However, because ED manifests differently across these disorders and because it helps distinguish among some of these disorders, it is not equivalent to any of them. In addition, when data were available, we reported correlation coefficients, indicating that ED is distinct from depression, ODD, or impulsivity.

Our review indicates that there are various ways to measure ED, including via observation, rating scales, psychophysiological measures, and ecological momentary assessment. Each of these measurement modalities has advantages and disadvantages, underscoring the importance of multi-method measurement. Our review further indicates that ADHD and ED are each associated with a variety of negative outcomes; however, we are unsure about the degree to which the contributions of ADHD and ED overlap. Relatedly, a handful of studies indicate that ED is associated with social impairment among youth with ADHD. Finally, although there is reason to believe that ED is malleable, at least in the context of disorders other than ADHD, ED is not specifically measured in most treatment outcome studies. In addition, ED is not measured in any of the treatment outcome studies wherein the effects of interventions aimed to target ED among individuals with ADHD were tested.

Future Directions

It is important to note that for the present review, we primarily draw on literature focused on the regulation of negative emotions, such as anger or frustration. Although

we cannot underscore enough that there is reason to believe that the dysregulation of positive emotions is just as important and impairing for youth with ADHD as the dysregulation of negative emotions, we are constrained in our approach by the available literature. Specifically, the majority of available studies conducted with youth with ADHD either do not differentiate among the various emotions that are dysregulated (e.g., Bunford et al. 2014, 2015b; Seymour et al. 2012, 2014) or differentiate generally between positive and negative valence but not specifically among the emotions that comprise these categories (e.g., Maedgen and Carlson 2000; Musser et al. 2011). Nevertheless, the findings of one study conducted with children with ADHD indicate that anger, sadness, and happiness are perhaps the most commonly dysregulated emotions in this population (e.g., Sjöwall et al. 2013). Thus, we recommend that the authors of future studies study the association between ADHD and ED by examining the dysregulation of specific emotions as well as the role such dysregulation plays in ADHD-related impairments such as social impairment and risky behaviors.

Given the paucity of research in this area, it will be important for investigators to collect information on the prevalence of ED among youth with ADHD. Research examining prevalence can expand upon the data we reported in this manuscript to examine differences across ages, variations in manifestations, and etiological factors that may be associated with the development and maintenance of ED. In addition, data are needed on the degree to which ADHD and ED jointly or uniquely contribute to negative outcomes. Relatedly, although some research indicates there is an association between ED and social impairment among youth with ADHD, more studies are needed to replicate and expand upon these findings. Finally, although there is reason to believe that there is an association between ED and academic impairment among individuals with ADHD (Barkley and Fischer 2010),[32] there is even more of a paucity of research (relative to the body of work on prevalence, negative outcomes and social impairment) on the association among these variables.

Should the findings of future studies confirm our hypothesis on the importance of ED for ADHD-related impairments among youth, investigators of intervention

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[32] Barkley and Fischer (2010) found that, among adults with ADHD (assessed for the association between emotional impulsivity and educational outcomes at age 27 years), emotional impulsivity predicted having completed less education as well as more school expulsions and suspensions, above and beyond ADHD symptoms. Emotional impulsivity was further negatively associated with graduation from high school and from college, above and beyond ADHD symptoms. Of note, only emotional impulsivity (and not ADHD symptoms) predicted school expulsions and suspensions and only emotional impulsivity was negatively related to graduation from high school.

studies should determine the degree to which ED (conceptualized in a manner congruent with our definition as opposed to using a proxy for ED such as mania or SMD) differentiates youth who respond to interventions from those who do not. If the evidence indicates that ED meaningfully contributes to treatment non-response among youth with ADHD, researchers of translational work may map the manifestations of ED, as those occur in association with ADHD, onto treatment techniques that target such manifestations. Once identified, these treatment techniques should be incorporated into current interventions, with the aim of increasing treatment response and reducing the prevalence and chronicity of social impairment and risky behaviors among youth with ADHD.

References

Achenbach, T. M. (1991). *Integrative guide for the 1991 CBCL/4-18, YSR, and TRF profiles*. Burlington, VT: University of Vermont, Department of Psychiatry.

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*, 217–237.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)*. Washington, DC: American Psychiatric Publishing.

Ames, C., Richardson, J., Payne, S., Smith, P., & Leigh, E. (2014). Innovations in practice: Mindfulness-based cognitive therapy for depression in adolescents. *Child and Adolescent Mental Health, 19*(1), 74–78.

Appelhans, B. M., & Luecken, L. J. (2006). Heart rate variability as an index of regulated emotional responding. *Review of General Psychology, 10*(3), 229–240.

Apsche, J. A., Bass, C. K., & Houston, M. (2006). A one year study of adolescent males with aggression and problems of conduct and personality: A comparison of MDT and DBT. *International Journal of Behavioral and Consultation Therapy, 2*, 544–552.

Augustine, A. A., & Hemenover, S. H. (2009). On the relative effectiveness of affect regulation strategies: A meta-analysis. *Cognition and Emotion, 23*, 1181–1220.

Babinski, D. E., Pelham, W. E., Molina, B. S., Gnagy, E. M., Waschbusch, D. A., Yu, J., et al. (2010). Late adolescent and young adult outcomes of girls diagnosed with ADHD in childhood: An exploratory investigation. *Journal of Attention Disorders, 15*, 204–214.

Banaschewski, T., Hollis, C., Oosterlaan, J., Roeyers, H., Rubia, K., Willcutt, E., & Taylor, E. (2005). Towards an understanding of unique and shared pathways in the psychopathophysiology of ADHD. *Developmental Science, 8*, 132–140.

Banaschewski, T., Jennen-Steinmetz, C., Brandeis, D., Buitelaar, J. K., Kuntsi, J., Poustka, L., et al. (2012). Neuropsychological correlates of emotional lability in children with ADHD. *Journal of Child Psychology and Psychiatry, 53*(11), 1139–1148.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin, 121*, 65–94.

Barkley, R. A. (2010). Deficient emotional self-regulation: A core component of attention-deficit/hyperactivity disorder. *Journal of ADHD and Related Disorders, 1*, 5–37.

Barkley, R., Anastopoulos, A. D., Guevremont, D. C., & Fletcher, K. E. (1992). Adolescents with attention deficit hyperactivity disorder: Mother–adolescent interactions, family beliefs and conflicts, and maternal psychopathology. *Journal of Abnormal Child Psychology, 20*, 263–288.

Barkley, R. A., & Fischer, M. (2010). The unique contribution of emotional impulsiveness to impairment in major life activities in hyperactive children as adults. *Journal of the American Academy of Child and Adolescent Psychiatry, 49*(5), 503–513.

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2006). Young adult outcome of hyperactive children: Adaptive functioning in major life activities. *Journal of the American Academy of Child and Adolescent Psychiatry, 45*, 192–202.

Barkley, R. A., Murphy, K. R., & Fischer, M. (2008). *ADHD in adults: What the science tells us*. New York, NY: Guilford Press.

Beauchaine, T. P. (2001). Vagal tone, development, and Gray's motivational theory: Toward an integrated model of autonomic nervous system functioning in psychopathology. *Development and Psychopathology, 13*, 183–214.

Beauchaine, T. P., Gartner, J., & Hagen, B. (2000). Comorbid depression and heart rate variability as predictors of aggressive and hyperactive symptom responsiveness during inpatient treatment of conduct-disordered, ADHD boys. *Aggressive Behavior, 26*(6), 425–441.

Beauchaine, T. P., Gatzke-Kopp, L., & Mead, H. K. (2007). Polyvagal theory and developmental psychopathology: Emotion dysregulation and conduct problems from preschool to adolescence. *Biological Psychology, 74*, 174–184.

Bech, P. (2006). Rating scales in depression: Limitations and pitfalls. *Dialogues in Clinical Neuroscience, 8*(2), 207–215.

Bei, B., Byrne, M., Ivens, C., Waloszek, J., Woods, M., Dudgeon, P., et al. (2013). Pilot study of a mindfulness-based, multi-component, in-school group sleep intervention in adolescent girls. *Early Intervention in Psychiatry, 7*(2), 213–220.

Berkowitz, L. (1999). Anger. In T. Dagleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 411–428). Chichester: Wiley.

Biederman, I. (1972). Perceiving real-world scenes. *Science, 177*, 77–80.

Biederman, J., Faraone, S. V., Spencer, T. J., Mick, E., Monuteaux, M. C., & Aleardi, M. (2006). Functional impairments in adults with self-reports of diagnosed ADHD: A controlled study of 1001 adults in the community. *Journal of Clinical Psychiatry, 67*, 524–540.

Biederman, J., Newcorn, J., & Sprich, S. (1991). Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *The American Journal of Psychiatry, 148*, 564–577.

Biederman, J., Spencer, T., Lomedico, A., Day, H., Petty, C. R., & Faraone, S. V. (2012). Deficient emotional self-regulation and pediatric attention deficit hyperactivity disorder: A family risk analysis. *Psychological Medicine, 42*(03), 639–646.

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., et al. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230–241.

Bonanno, G. A. (2001). Emotion self-regulation. In T. J. Mayne & G. A. Bonanno (Eds.), *Emotions* (pp. 251–285). New York, NY: Guilford Press.

Braaten, E. B., & Rosen, L. A. (1997). Emotional reactions in adults with symptoms of attention deficit hyperactivity disorder. *Personality and Individual Differences, 22*(3), 355–361.

Braaten, E. B., & Rosen, L. A. (2000). Self-regulation of affect in attention deficit-hyperactivity disorder (ADHD) and non-ADHD boys: Differences in empathic responding. *Journal of Consulting and Clinical Psychology, 68*(2), 313–321.

Bradley, B., DeFife, J. A., Guarnaccia, C., Phifer, J., Fani, N., Ressler, K. J., & Westen, D. (2011). Emotion dysregulation and negative affect: Association with psychiatric symptoms. *Journal of Clinical Psychiatry, 72*(5), 685–691.

Britton, W., Lepp, N., Niles, H., Rocha, T., Fisher, N., & Gold, J. (2014). A randomized controlled pilot trial of classroom-based mindfulness meditation compared to an active control condition in sixth-grade children. *Journal of School Psychology, 52*(3), 263–278.

Brown, L. K., Hadley, W., & Stewart, A. (2012). Psychiatric disorders and sexual risk among adolescents in mental health treatment. *Journal of Consulting and Clinical Psychology, 78*, 590–597.

Buhrmester, D., Camparo, L., Christensen, A., Gonzalez, L. S., & Hinshaw, S. P. (1992). Mothers and fathers interacting in dyads and triads with normal and hyperactive sons. *Developmental Psychology, 28*(3), 500.

Bunford, N., Brandt, N., Golden, K., Dykstra, J., Owens, J. S., & Suhr, J. A. (2015a). Attention-deficit/hyperactivity disorder symptoms mediate the association between neuropsychological and social impairment among children. *Journal of Abnormal Child Psychology, 43*, 133–147.

Bunford, N., Evans, S. W., Becker, S. A., & Langberg, J. M. (2015b). Attention-deficit/hyperactivity disorder and social skills in youth: A moderated mediation model of emotion dysregulation and depression. *Journal of Abnormal Child Psychology, 43*, 283–296.

Bunford, N., Evans, S. W., & Langberg, J. M. (2014). Emotion dysregulation is associated with social impairment among young adolescents with attention-deficit/hyperactivity disorder. *Journal of Attention Disorders*. doi:10.1177/1087054714527793.

Bunford, N., Evans, S. W., Zoccola, P. M. & Rybak, T. (2013). *Validating a frustration task to assess emotion dysregulation in adolescents with ADHD*. Poster presented at the semi-annual meeting of the International Society for Research on Child and Adolescent Psychopathology, Leuven, Belgium.

Bushman, B. J., Baumeister, R. F., & Phillips, C. M. (2001). Do people aggress to improve their mood? Catharsis beliefs, affect regulation opportunity, and aggressive responding. *Journal of Personality and Social Psychology, 81*(1), 17–32.

Calkins, S. D. (1997). Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. *Developmental Psychobiology, 31*(2), 125–135.

Calkins, S. D., Gill, K. L., Johnson, M. C., & Smith, C. L. (1999). Emotional reactivity and emotional regulation strategies as predictors of social behavior with peers during toddlerhood. *Social Development, 8*(3), 310–334.

Cassidy, J., Woodhouse, S. S., Sherman, L. J., Stupica, B., & Lejuez, C. W. (2011). Enhancing infant attachment security: An examination of treatment efficacy and differential susceptibility. *Development and Psychopathology, 23*, 131–148.

Cassone, A. R. (2015). Mindfulness training as an adjunct to evidence-based treatment for ADHD within families. *Journal of Attention Disorders, 19*, 147–157.

Chang, L., Schwartz, D., Dodge, K. A., & McBride-Chang, C. (2003). Harsh parenting in relation to child emotion regulation and aggression. *Journal of Family Psychology, 17*(4), 598–606.

Cicchetti, D., Ackerman, B. P., & Izard, C. E. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology, 7*, 1–10.

Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development, 75*, 317–333.

Cooper, M. L., Shapiro, C. M., & Powers, A. M. (1998). Motivations for sex and risky sexual behavior among adolescents and young adults: a functional perspective. *Journal of Personality and Social Psychology, 75*(6), 1528–1558.

Critchley, H. (2003). Emotion and its disorders: Imaging in clinical neuroscience. *British Medical Bulletin, 65*(1), 35–47.

Crockenberg, S. C., Leerkes, E. M., & Lekka, S. K. (2007). Pathways from marital aggression to infant emotion regulation: The development of withdrawal in infancy. *Infant Behavior and Development, 30*(1), 97–113.

Crowell, S. E., Beauchaine, T. P., Gatzke-Kopp, L., Sylvers, P., Mead, H., & Chipman-Chacon, J. (2006). Autonomic correlates of attention-deficit/hyperactivity disorder and oppositional defiant disorder in preschool children. *Journal of Abnormal Psychology, 115*(1), 174–178.

Cupach, W., & Olson, L. (2006). Emotion regulation theory: A lens for viewing family conflict and violence. In D. Braithwaite & L. Baxter (Eds.), *Engaging theories in family communication: Multiple perspectives* (pp. 213–229). Thousand Oaks, CA: SAGE Publications Inc.

Dan-Glauser, E., & Gross, J. (2011). The temporal dynamics of two response-focused forms of emotion regulation: Experiential, expressive, and autonomic consequences. *Psychophysiology, 48*, 1309–1322.

Denham, S. A. (1998). *Emotional development in young children*. New York, NY: Guilford Press.

Derryberry, D., & Rothbart, M. K. (1997). Reactive and effortful processes in the organization of temperament. *Development and Psychopathology, 9*(04), 633–652.

Dunsmore, J. C., Booker, J. A., Ollendick, T. H., & Greene, R. W. (2015). Emotion socialization in the context of risk and psychopathology: Maternal emotion coaching predicts better treatment outcomes for emotionally labile children with oppositional defiant disorder. *Social Development*. doi:10.1111/sode.12109.

Evans, S. W., Owens, J. S., & Bunford, N. (2014). Evidence-based psychosocial treatments for children and adolescents with attention-deficit/hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology, 43*, 527–551.

Fargason, R. E., & Ford, C. V. (1994). Attention deficit hyperactivity disorder in adults: Diagnosis, treatment, and prognosis. *Southern Medical Journal, 87*, 302–309.

Farrell, A. D., & Danish, S. J. (1993). Peer drug associations and emotional restraint: Causes or consequences of adolescents' drug use? *Journal of Consulting and Clinical Psychology, 61*(2), 327–334.

Feindler, E. L., & Ecton, R. B. (1986). *Adolescent anger control: Cognitive-behavioral techniques*. Elmsford, NY: Pergamon Press.

Finn, P. R., Sharkansky, E. J., Brandt, K. M., & Turcotte, N. (2000). The effects of familial risk, personality, and expectancies on alcohol use and abuse. *Journal of Abnormal Psychology, 109*, 122–133.

Fleming, A., & McMahon, R. (2012). Developmental context and treatment principles for ADHD among college students. *Clinical Child Family Psychology Review, 15*, 303–329.

Fleming, A., McMahon, R., Moran, L., Peterson, A., & Dreessen, A. (2014). Pilot randomized controlled trial of dialectical behavior therapy group skills training for ADHD. *Journal of Attention Disorders*. doi:10.1177/1087054714535951.

Flory, K., Molina, B. S., Pelham, W. E, Jr, Gnagy, E., & Smith, B. (2006). Childhood ADHD predicts risky sexual behavior in young adulthood. *Journal of Clinical Child and Adolescent Psychology, 35*(4), 571–577.

Fresco, D. M., Wolfson, S. L., Crowther, J. H., & Docherty, N. M. (2002). *Distinct and overlapping patterns of emotion regulation in the comorbidity of generalized anxiety disorder and the eating disorders.* Poster presented at the Annual Meeting of the Society for Research in Psychopathology, San Francisco, California.

Fristad, M. A., Weller, E. B., & Weller, R. A. (1992). The Mania Rating Scale: can it be used in children? A preliminary report. *Journal of the American Academy of Child & Adolescent Psychiatry, 31*(2), 252–257.

Froehlich, T. E., Lanphear, B. P., Epstein, J. N., Barbaresi, W. J., Katusic, S. K., & Kahn, R. S. (2007). Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. *Archives of Pediatric Adolescent Medicine, 161*, 857–864.

Fruzzetti, A. E., Shenk, C., & Hoffman, P. D. (2005). Family interaction and the development of borderline personality disorder: A transactional model. *Development and Psychopathology, 17*(04), 1007–1030.

Furlong, M. J., & Smith, D. C. (1994). *Anger, hostility, and aggression: Assessment, prevention, and intervention strategies for youth.* Brandon, VT: Clinical Psychology Publishing Company Inc.

Galanter, C. A., Carlson, G. A., Jensen, P. S., Greenhill, L. L., Davies, M., Li, W., & Swanson, J. M. (2003). Response to methylphenidate in children with attention-deficit/hyperactivity disorder and manic symptoms in the multimodal treatment study of children with ADHD titration trial. *Journal of Child and Adolescent Psychopharmacology, 13*, 123–136.

Galéra, C., Messiah, A., Melchior, M., Chastang, J. F., Encrenaz, G., Lagarde, E., et al. (2010). Disruptive behaviors and early sexual intercourse: The GAZEL youth study. *Psychiatry Research, 177*(3), 361–363.

Goldsmith, H., & Davidson, R. J. (2004). Disambiguating the components of emotion regulation. *Child Development, 75*, 361–365.

Gottman, J. M., & Katz, L. F. (1989). Effects of marital discord on young children's peer interaction and health. *Developmental Psychology, 25*, 373–381.

Gratz, K. L., & Roemer, L. (2004). Multidimensional assessment of emotion regulation and dysregulation: Development, factor structure, and initial validation of the difficulties in emotion regulation scale. *Journal of Psychopathology and Behavioral Assessment, 26*(1), 41–54.

Gratz, K. L., & Tull, M. T. (2010). The relationship between emotion dysregulation and deliberate self-harm among inpatient substance users. *Cognitive Therapy and Research, 34*, 544–553.

Gross, J. J. (1998). The emerging field of emotion regulation: an integrative review. *Review of General Psychology, 2*(3), 271–299.

Gross, J. J. (1999). Emotion regulation: Past, present, and future. *Cognition and Emotion, 13*, 551–573.

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

Gross, J. J., & Levenson, R. W. (1995). Emotion elicitation using films. *Cognition and Emotion, 9*(1), 87–108.

Gruber, J. (2011). Can feeling too good be bad? Positive emotion persistence (PEP) in bipolar disorder. *Current Directions in Psychological Science, 20*(4), 217–221.

Harty, S. C., Miller, C. J., Newcorn, J. H., & Halperin, J. M. (2009). Adolescents with childhood ADHD and comorbid disruptive behavior disorders: Aggression, anger, and hostility. *Child Psychiatry and Human Development, 40*(1), 85–97.

Haydicky, J., Shecter, C., Wiener, J., & Ducharme, J. M. (2015). Evaluation of MBCT for adolescents with ADHD and their parents: Impact on individual and family functioning. *Journal of Child and Family Studies, 24*(1), 76–94.

Henker, B., & Whalen, C. K. (1989). Hyperactivity and attention deficits. *American Psychologist, 44*, 216–223.

Hessler, D. M., & Katz, L. F. (2010). Brief report: Associations between emotional competence and adolescent risky behavior. *Journal of Adolescence, 33*(1), 241–246.

Hesslinger, B., Tebartz van Elst, L., Nyberg, E., Dykierek, P., Richter, H., Berner, M., & Ebert, D. (2002). Psychotherapy of attention deficit hyperactivity disorder in adults: A pilot study using a structured skills training program. *European Archives of Psychiatry and Clinical Neuroscience, 252*, 177–184.

Hinshaw, S. P., & Melnick, S. (1992). Self-management therapies and attention deficit/hyperactivity disorder. *Behavior Modification, 16*, 253–273.

Hinshaw, S. P., Owens, E. B., Sami, N., & Fargeon, S. (2006). Prospective follow-up of girls with attention-deficit/hyperactivity disorder into adolescence: Evidence for continuing cross-domain impairment. *Journal of Consulting and Clinical Psychology, 74*(3), 489.

Hjelland, I. E., Svebak, S., Berstad, A., Flatabø, G., & Hausken, T. (2007). Breathing exercises with vagal biofeedback may benefit patients with functional dyspepsia. *Scandinavian Journal of Gastroenterology, 42*(9), 1054–1062.

Hosain, G. M., Berenson, A. B., Tennen, H., Bauer, L. O., & Wu, Z. H. (2012). Attention deficit hyperactivity symptoms and risky sexual behavior in young adult women. *Journal of Women's Health, 21*(4), 463–468.

Hoy, E., Weiss, G., Minde, K., & Cohen, N. (1978). The hyperactive child at adolescence: Emotional, social, and cognitive functioning. *Journal of Abnormal Child Psychology, 6*, 311–324.

Hoza, B. (2007). Peer functioning in children with ADHD. *Ambulatory Pediatrics, 7*(1 Suppl.), 101–106.

Johnston, C., & Mash, E. J. (2001). Families of children with attention-deficit/hyperactivity disorder: Review and recommendations for future research. *Clinical Child and Family Psychology Review, 4*(3), 183–207.

Kassel, J. D., Jackson, S. I., & Unrod, M. (2000). Generalized expectancies for negative mood regulation and problem drinking among college students. *Journal of Studies on Alcohol, 61*(2), 332–340.

Kats-Gold, I., Besser, A., & Priel, B. (2007). The role of simple emotion recognition skills among school aged boys at risk of ADHD. *Journal of Abnormal Child Psychology, 35*, 363–378.

Kessler, R., Adler, L., Barkley, R., Biederman, J., Conners, C., Demler, O., et al. (2006). The prevalence and correlates of adult ADHD in the United States: Results from the National Comorbidity Survey Replication. *American Journal of Psychiatry, 163*(4), 716–723.

Kim, H. K., Pears, K. C., Capaldi, D. M., & Owen, L. D. (2009). Emotion dysregulation in the intergenerational transmission of romantic relationship conflict. *Journal of Family Psychology, 23*(4), 585–595.

Kobak, R. R., Cole, H. E., Ferenz-Gillies, R., Fleming, W. S., & Gamble, W. (1993). Attachment and emotion regulation during mother-teen problem solving: A control theory analysis. *Child Development, 64*, 231–245.

Kovacs, M. (2004). *Children's depression inventory (CDI).* Toronto: Multi-Health Systems Inc.

Kovacs, M. (2009). *Manual of contextual emotion regulation therapy for depression in childhood.* New York, NY: Guilford Press.

Kovacs, M., & Lopez-Duran, N. (2012). Contextual emotion regulation therapy: A developmentally based intervention for pediatric depression. *Child and Adolescent Psychiatric Clinics of North America, 21*(2), 327–343.

Kowatch, R. A., Youngstrom, E. A., Danielyan, A., & Findling, R. L. (2005). Review and meta-analysis of the phenomenology and clinical characteristics of mania in children and adolescents. *Bipolar Disorders, 7*, 483–496.

Landau, S., & Moore, L. A. (1991). Social skill deficits in children with attention-deficit hyperactivity disorder. *School Psychology Review, 20*, 235–251.

Langberg, J. M., Epstein, J. N., Altaye, M., Molina, B. S., Arnold, L. E., & Vitiello, B. (2008). The transition to middle school is associated with changes in the developmental trajectory of ADHD symptomatology in young adolescents with ADHD. *Journal of Clinical Child & Adolescent Psychology, 37*(3), 651–663.

Leahy, R. L. (2002). A model of emotional schemas. *Cognitive and Behavioral Practice, 9*(3), 177–190.

Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child Development, 71*(1), 107–118.

Levitt, S. D., & List, J. A. (2007). What do laboratory experiments measuring social preferences reveal about the real world? *The Journal of Economic Perspectives, 21*(2), 153–174.

Lewis, M. D., & Stieben, J. (2004). Emotion regulation in the brain: Conceptual issues and directions for developmental research. *Child Development, 75*, 371–376.

Liehr, P., & Diaz, N. (2010). A pilot study examining the effect of mindfulness on depression and anxiety for minority children. *Archives of Psychiatric Nursing, 24*(1), 69–71.

Linehan, M. M. (1993). *Cognitive-behavioral treatment of borderline personality disorder*. New York, NY: Guilford Press.

Linehan, M. M., Bohus, M., & Lynch, T. R. (2007). Dialectical behavior therapy for pervasive emotion dysregulation: Theoretical and practical underpinnings. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 581–605). New York, NY: Guilford Press.

Loeber, R., Wung, P., Keenan, K., Giroux, B., Stouthamer-Loeber, M., Van Kammen, W. B., & Maugham, B. (1993). Developmental pathways in disruptive child behavior. *Development and Psychopathology, 5*(1–2), 103–133.

Loney, J., Kramer, J., & Milich, R. (1981). The hyperkinetic child grows up: Predictors of symptoms, delinquency, and achievement at follow-up. In K. Gadow & J. Loney (Eds.), *Psychosocial aspects of drug treatment for hyperactivity* (pp. 381–415). Boulder, CO: Westview Press.

Luman, M., Oosterlaan, J., & Sergeant, J. A. (2005). The impact of reinforcement contingencies on AD/HD: A review and theoretical appraisal. *Clinical Psychology Review, 25*(2), 183–213.

MacDermott, S. T. (2011). *The development and psychometric evaluation of two measures of emotion regulation for use with older children and adolescents.* (Unpublished doctoral dissertation. Monash University, Melbourne, Australia.

MacDermott, S. T., Gullone, E., Allen, J. S., King, N. J., & Tonge, B. (2010). The emotion regulation index for children and adolescents (ERICA): a psychometric investigation. *Journal of Psychopathology and Behavioral Assessment, 32*(3), 301–314.

Maedgen, J. W., & Carlson, C. L. (2000). Social functioning and emotional regulation in the attention deficit hyperactivity disorder subtypes. *Journal of Clinical Child Psychology, 29*, 30–42.

Martin, C. S., Lynch, K. G., Pollock, N. K., & Clark, D. B. (2000). Gender differences and similarities in the personality correlates of adolescent alcohol problems. *Psychology of Addictive Behaviors, 14*, 121–133.

Mash, E. J., & Hunsley, J. (2005). Evidence-based assessment of child and adolescent disorders: Issues and challenges. *Journal of Clinical Child and Adolescent Psychology, 34*(3), 362–379.

Maughan, A., & Cicchetti, D. (2002). Impact of child maltreatment and interadult violence on children's emotion regulation abilities and socioemotional adjustment. *Child Development, 73*(5), 1525–1542.

McCraty, R., Atkinson, M., Tiller, W. A., Rein, G., & Watkins, A. D. (1995). The effects of emotions on short-term power spectrum analysis of heart rate variability. *The American Journal of Cardiology, 76*(14), 1089–1093.

Melnick, S. M., & Hinshaw, S. P. (2000). Emotion regulation and parenting in AD/HD and comparison boys: Linkages with social behaviors and peer preference. *Journal of Abnormal Child Psychology, 28*, 73–86.

Mennin, D. S., Holaway, R. M., Fresco, D. M., Moore, M. T., & Heimberg, R. G. (2007). Delineating components of emotion and its dysregulation in anxiety and mood psychopathology. *Behavior Therapy, 38*(3), 284–302.

Merwood, A., Chen, W., Rijsdijk, F., Skirrow, C., Larsson, H., Thapar, A., et al. (2014). Genetic associations between the symptoms of attention-deficit/hyperactivity disorder and emotional lability in child and adolescent twins. *Journal of the American Academy of Child and Adolescent Psychiatry, 53*(2), 209–220.

Messman-Moore, T. L., Walsh, K. L., & DiLillo, D. (2010). Emotion dysregulation and risky sexual behavior in revictimization. *Child Abuse and Neglect, 34*(12), 967–976.

Miller, A. L., Rathus, J. H., & Linehan, M. M. (2007). *Dialectical behavior therapy with suicidal adolescents*. New York, NY: Guilford Press.

Miranda, A., & Presentacion, M. (2000). Efficacy of cognitive-behavioral therapy in the treatment of children with ADHD with and without aggressiveness. *Psychology in the Schools, 37*(2), 169–182.

Molina, B. S., Flory, K., Hinshaw, S. P., Greiner, A. R., Arnold, L. E., Swanson, J. M., et al. (2007). Delinquent behavior and emerging substance use in the MTA at 36 months: prevalence, course, and treatment effects. *Journal of the American Academy of Child and Adolescent Psychiatry, 46*(8), 1028–1040.

Molina, B. S., & Pelham, W. E. (2003). Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. *Journal of Abnormal Psychology, 112*, 497–507.

Molina, B. S., Smith, B. H., & Pelham, W. E. (1999). Interactive effects of attention deficit hyperactivity disorder and conduct disorder on early adolescent substance use. *Psychology of Addictive Behaviors, 13*, 348–358.

Monuteaux, M. C., Faraone, S. V., Gross, L. M., & Biederman, J. (2007). Predictors, clinical characteristics, and outcome of conduct disorder in girls with attention-deficit/hyperactivity disorder: a longitudinal study. *Psychological Medicine: A Journal of Research in Psychiatry and the Allied Sciences, 37*(12), 1731–1741.

Morris, S. E., & Cuthbert, B. N. (2012). Research Domain Criteria: cognitive systems, neural circuits, and dimensions of behavior. *Dialogues in Clinical Neuroscience, 14*(1), 29–37.

Mulder, M. J., Baeyens, D., Davidson, M. C., Casey, B. J., Van Den Ban, E. V., Van Engeland, H., & Durston, S. (2008). Familial vulnerability to ADHD affects activity in the cerebellum in addition to the prefrontal systems. *Journal of the American Academy of Child and Adolescent Psychiatry, 47*(1), 68–75.

Murphy, K., & Barkley, R. A. (1996). Prevalence of DSM-IV symptoms of ADHD in adult licensed drivers: Implications for clinical diagnosis. *Journal of Attention Disorders, 1*(3), 147–161.

Musser, E. D., Backs, R. W., Schmitt, C. F., Ablow, J. C., Measelle, J. R., & Nigg, J. T. (2011). Emotion regulation via the autonomic nervous system in children with attention-deficit/hyperactivity disorder (ADHD). *Journal of Abnormal Child Psychology, 39*, 841–852.

Nakahara, H., Furuya, S., Francis, P. R., & Kinoshita, H. (2010). Psychophysiological responses to expressive piano performance. *International Journal of Psychophysiology, 75*(3), 268–276.

Nelson-Gray, R., Keane, S., Hurst, R., Mitchell, J., Warburton, J., Chok, J., & Cobb, A. (2006). A modified DBT skills training for oppositional defiant adolescents: Promising preliminary findings. *Behavior Research and Therapy, 44*, 1811–1820.

Nigg, J. T. (2005). Neuropsychologic theory and findings in attention-deficit/hyperactivity disorder: the state of the field and salient challenges for the coming decade. *Biological Psychiatry, 57*(11), 1424–1435.

Nigg, J. T. (2006). Temperament and developmental psychopathology. *Journal of Child Psychology and Psychiatry, 47*(3–4), 395–422.

Nigg, J. T. (2010). Attention-deficit/hyperactivity disorder endophenotypes, structure, and etiological pathways. *Current Directions in Psychological Science, 19*, 24–29.

Nigg, J. T., Blaskey, L. G., Huang-Pollock, C. L., & Rappley, M. D. (2002a). Neuropsychological executive functions and DSM-IV ADHD subtypes. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(1), 59–66.

Nigg, J. T., Goldsmith, H. H., & Sachek, J. (2004). Temperament and attention deficit hyperactivity disorder: The development of a multiple pathway model. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 42–53.

Nigg, J. T., Hinshaw, S. P., & Halperin, J. M. (1996). Continuous performance test in boys with attention deficit hyperactivity disorder: Methylphenidate dose response and relations with observed behaviors. *Journal of Clinical Child Psychology, 25*, 330–340.

Nigg, J. T., John, O. P., Blaskey, L. G., Huang-Pollock, C. L., Willcutt, E. G., Hinshaw, S. P., & Pennington, B. (2002b). Big five dimensions and ADHD symptoms: Links between personality traits and clinical symptoms. *Journal of Personality and Social Psychology, 83*(2), 451–469.

Pelham, W. E., & Sams, S. E. (1992). Behavior modification. *Child and Adolescent Psychiatric Clinics of North America, 1*, 255.

Pfiffner, L. J., & McBurnett, K. (1997). Social skills training with parent generalization: Treatment effects for children with attention deficit disorder. *Journal of Consulting and Clinical Psychology, 65*, 749–757.

Philipsen, A., Richter, H., Peters, J., Alm, B., Sobanski, E., Colla, M., et al. (2007). Structured group psychotherapy in adults with attention deficit hyperactivity disorder: Results of an open multicentre study. *The Journal of Nervous and Mental Disease, 195*, 1013–1019.

Porges, S. W. (2001). The polyvagal theory: Phylogenetic substrates of a social nervous system. *International Journal of Psychophysiology, 42*, 123–146.

Raes, F., Griffith, J., Gucht, K., & Williams, J. (2013). School-based prevention and reduction of depression in adolescents: A cluster-randomized controlled trial of a mindfulness group program. *Mindfulness, 5*, 477–486.

Raffaelli, M., & Crockett, L. J. (2003). Sexual risk taking in adolescence: the role of self-regulation and attraction to risk. *Developmental Psychology, 39*(6), 1036.

Ranseen, J. D., Campbell, D. A., & Baer, R. A. (1998). NEO PI-R profiles of adults with attention deficit disorder. *Assessment, 5*(1), 19–24.

Rohrbeck, C. A., Azar, S. T., & Wagner, P. E. (1991). Child self-control rating scale: Validation of a child self-report measure. *Journal of Clinical Child Psychology, 20*, 179–183.

Rosen, P. J., & Epstein, J. N. (2010). A pilot study of ecological momentary assessment of emotion dysregulation in children. *Journal of ADHD and Related Disorders, 1*(4), 39–52.

Rosen, P. J., Epstein, J. N., & Van Orden, G. (2013). I know it when I quantify it: Ecological momentary assessment and recurrence quantification analysis of emotion dysregulation in children with ADHD. *ADHD: Attention Deficit Hyperactivity Disorders, 5*, 283–294.

Rosen, P. J., & Factor, P. I. (2012). Emotional impulsivity and emotional and behavioral difficulties among children with ADHD: An ecological momentary assessment study. *Journal of Attention Disorders*. doi:10.1177/1087054712463064.

Salovey, P., Stroud, L. R., Woolery, A., & Epel, E. S. (2002). Perceived emotional intelligence, stress reactivity, and symptom reports: Further explorations using the trait meta-mood scale. *Psychology and Health, 17*(5), 611–627.

Schulz, M. S., Waldinger, R. J., Hauser, S. T., & Allen, J. P. (2005). Adolescents' behavior in the presence of interparental hostility: Developmental and emotion regulatory influences. *Development and Psychopathology, 17*(2), 489–507.

Scott, S., & O'Connor, T. (2012). An experimental test of differential susceptibility to parenting among emotionally dysregulated children in a randomized controlled trial for oppositional behavior. *Journal of Child Psychology and Psychiatry, 53*(11), 1184–1193.

Semple, R., Reid, E., & Miller, L. (2005). Treating anxiety with mindfulness: An open trial of mindfulness training for anxious children. *Journal of Cognitive Psychotherapy: An International Quarterly, 19*(4), 379–392.

Seymour, K., Chronis-Tuscano, A., Halldorsdottir, T., Stupica, B., Owens, K., & Sacks, T. (2012). Emotion regulation mediates the relationship between ADHD and depressive symptoms in youth. *Journal of Abnormal Child Psychology, 40*, 595–606.

Seymour, K. E., Chronis-Tuscano, A., Iwamoto, D. K., Kurdziel, G., & MacPherson, L. (2014). Emotion regulation mediates the association between ADHD and depressive symptoms in a community sample of youth. *Journal of Abnormal Child Psychology, 42*(4), 611–621.

Shapiro, E. G., Hughes, S. J., August, G. J., & Bloomquist, M. L. (1993). Processing of emotional information in children with attention-deficit hyperactivity disorder. *Developmental Neuropsychology, 9*(3–4), 207–224.

Shelton, D., Kesten, K., Zhang, W., & Trestman, R. (2011). Impact of a dialectic behavior therapy-corrections modified (DBT-CM) upon behaviorally challenged incarcerated male adolescents. *Journal of Child and Adolescent Psychiatric Nursing, 24*(2), 105–113.

Shields, A. M., & Cicchetti, D. (1997). Emotion regulation and autonomy: The development and validation of two new criterion Q-sort scales. *Developmental Psychology, 33*, 906–916.

Singh, S. D., Ellis, C. R., Winton, A. S., Singh, N. N., Leung, J. P., & Oswald, D. P. (1998). Recognition of facial expressions of emotion by children with attention-deficit hyperactivity disorder. *Behavior Modification, 22*(2), 128–142.

Sjöwall, D., Roth, L., Lindqvist, S., & Thorell, L. B. (2013). Multiple deficits in ADHD: Executive dysfunction, delay aversion, reaction time variability, and emotional deficits. *Journal of Child Psychology and Psychiatry, 54*(6), 619–627.

Skowron, E. A. (2000). The role of differentiation of self in marital adjustment. *Journal of Counseling Psychology, 47*, 229–237.

Skowron, E. A., & Friedlander, M. L. (1998). The differentiation of self inventory: Development and initial validation. *Journal of Counseling Psychology, 45*, 235–246.

Snyder, J., Schrepferman, L., & St. Peter, C. (1997). Origins of antisocial behavior: Negative reinforcement and affect dysregulation of behavior as socialization mechanisms in family interaction. *Behavior Modification, 21*, 187–215.

Sobanski, E., Banaschewski, T., Asherson, P., Buitelaar, J., Chen, W., Franke, B., et al. (2010). Emotional lability in children and adolescents with attention deficit/hyperactivity disorder (ADHD): clinical correlates and familial prevalence. *Journal of Child Psychology and Psychiatry, 51*(8), 915–923.

Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2008). The developmental psychometrics of big five self-reports: Acquiescence, factor structure, coherence, and differentiation from ages 10 to 20. *Journal of Personality and Social Psychology, 94*, 718–737.

Storebø, O. J., Skoog, M., Damm, D., Thomsen, P. H., Simonsen, E., & Gluud, C. (2011). Social skills training for attention deficit hyperactivity disorder (ADHD) in children aged 5 to 18 years. *Cochrane Database Systematic Reviews.* doi:10.1002/14651858. CD008223.pub2.

Stringaris, A., Cohen, P., Pine, D., & Leibenluft, E. (2009). Adult outcomes of youth irritability: a 20-year prospective community-based study. *American Journal of Psychiatry, 166*(9), 1048–1054.

Surman, C. B., Biederman, J., Spencer, T., Yorks, D., Miller, C. A., Petty, C. R., & Faraone, S. V. (2011). Deficient emotional self-regulation and adult attention deficit hyperactivity disorder: A family risk analysis. *American Journal of Psychiatry, 168*(6), 617–623.

Tacon, A. M., McComb, J., Caldera, Y., & Randolph, P. (2003). Mindfulness meditation, anxiety reduction, and heart disease: a pilot study. *Family & Community Health, 26*, 25–33.

Tarter, R., Blackson, T., Brigham, J., Moss, H., & Caprara, G. (1995). Precursors and correlates of irritability: A two year follow-up of boys at risk for substance abuse. *Drug and Alcohol Dependence, 39*, 253–261.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2–3, Serial No. 240), 25–52.

Trupin, E. W., Stewart, D. G., Beach, B., & Boesky, L. (2002). Effectiveness of dialectical behaviour therapy program for incarcerated female juvenile offenders. *Child and Adolescent Mental Health, 7*, 121–127.

Turk, C. L., Heimberg, R. G., Luterek, J. A., Mennin, D. S., & Fresco, D. M. (2005). Emotion dysregulation in generalized anxiety disorder: A comparison with social anxiety disorder. *Cognitive Therapy and Research, 29*(1), 89–106.

Tutty, S., Gephart, H., & Wurzbacher, K. (2003). Enhancing behavioral and social skill functioning in children newly diagnosed with attention-deficit hyperactivity disorder in a pediatric setting. *Journal of Developmental and Behavioral Pediatrics, 24*, 51–57.

van de Weijer-Bergsma, E., Formsma, A. R., de Bruin, E. I., & Bögels, S. M. (2011). The effectiveness of mindfulness training on behavioral problems and attentional functioning in adolescents with ADHD. *Journal of Child and Family Studies, 21*(5), 775–787.

Van der Oord, S., Bögels, S. M., & Peijnenburg, D. (2012). The effectiveness of mindfulness training for children with ADHD and mindful parenting for their parents. *Journal of child and family studies, 21*(1), 139–147.

Vasilev, C. A., Crowell, S. E., Beauchaine, T. P., Mead, H. K., & Gatzke-Kopp, L. M. (2009). Correspondence between physiological and self-report measures of emotion dysregulation: A longitudinal investigation of youth with and without psychopathology. *Journal of Child Psychology and Psychiatry, 50*, 1357–1364.

Verdejo-García, A., Bechara, A., Recknor, E. C., & Pérez-García, M. (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence, 91*(2), 213–219.

Waite, R. (2007). Women and attention deficit disorders: A great burden overlooked. *Journal of the American Academy of Nurse Practitioners, 19*(3), 116–125.

Walden, T. A., Harris, V. S., & Catron, T. F. (2003). How I feel: A self-report measure of emotional arousal and regulation for children. *Psychological Assessment, 15*(3), 399–412.

Waxmonsky, J., Pelham, W. E., Gnagy, E., Cummings, M. R., O'Connor, B., Majumdar, A., et al. (2008). The efficacy and tolerability of methylphenidate and behavior modification in children with attention-deficit/hyperactivity disorder and severe mood dysregulation. *Journal of Child and Adolescent Psychopharmacology, 18*(6), 573–588.

Waxmonsky, J. G., Wymbs, F. A., Pariseau, M. E., Belin, P. J., Waschbusch, D. A., Babocsai, L., et al. (2013). A novel group therapy for children with ADHD and severe mood dysregulation. *Journal of Attention Disorders.* doi:10.1177/1087054711433423.

Webb, T., Miles, E., & Sheeran, P. (2012). Dealing with feeling: Meta-analysis of the effectiveness of strategies derived from process model of emotion regulation. *Psychological Bulletin, 138*(4), 775–808.

Wei, M., Heppner, P. P., & Mallinckrodt, B. (2003). Perceived coping as a mediator between attachment and psychological distress: A structural equation modeling approach. *Journal of Counseling Psychology, 50*, 438–447.

Wei, M., Vogel, D. L., Ku, T. Y., & Zakalik, R. A. (2005). Adult attachment, affect regulation, negative mood, and interpersonal problems: The mediating roles of emotional reactivity and emotional cutoff. *Journal of Counseling Psychology, 52*(1), 14–24.

Weinberg, A., & Klonsky, E. D. (2009). Measurement of emotion dysregulation in adolescents. *Psychological Assessment, 21*, 616–621.

Weiss, G., Hechtman, L., Milroy, T., & Perlman, T. (1985). Psychiatric status of hyperactives as adults: A controlled prospective 15-year follow-up of 63 hyperactive children. *Journal of the American Academy of Child Psychiatry, 24*(2), 211–220.

Weiss, N. H., Tull, M. T., Viana, A. G., Anestis, M. D., & Gratz, K. L. (2012). Impulsive behaviors as an emotion regulation strategy: Examining associations between PTSD, emotion dysregulation, and impulsive behaviors among substance dependent inpatients. *Journal of Anxiety Disorders, 26*(3), 453–458.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*, 669–689.

Wilens, T. E., Biederman, J., Brown, S., Tanguay, S., Monuteaux, M. C., Blake, C., & Spencer, T. J. (2002). Psychiatric comorbidity and functioning in clinically referred preschool children and school-age youths with ADHD. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*(3), 262–268.

Wilens, T. E., Biederman, J., & Mick, E. (1998). Does ADHD affect the course of substance abuse?: Findings from a sample of adults with and without ADHD. *The American Journal on Addictions, 7*(2), 156–163.

Willcutt, E., Sonuga-Barke, E., Nigg, J., & Sergeant, J. (2008). Recent developments in neuropsychological models of childhood psychiatric disorders. *Biological Child Psychiatry, 24*, 195–226.

Winters, K. C., Botzet, A. M., Fahnhorst, T., Baumel, L., & Lee, S. (2009). Impulsivity and its relationship to risky sexual behaviors and drug use. *Journal of Child & Adolescent Substance Use, 18*(1), 43–56.

Wise, T. N., Mann, L. S., & Randell, P. (1995). The stability of alexithymia in depressed patients. *Psychopathology, 28*(4), 173–176.

Wolraich, M. L., Wibbelsman, C. J., Brown, T. E., Evans, S. W., Gotlieb, E. M., Knight, J. R., et al. (2005). Attention-deficit/ hyperactivity disorder among adolescents: a review of the diagnosis, treatment, and clinical implications. *Pediatrics, 115*(6), 1734–1746.

Wymbs, B. T., Dawson, A. E., Suhr, J. A., Bunford, N., & Gidycz, C. A. (in press). ADHD symptoms as risk factors for intimate partner violence perpetration and victimization among men and women in college. *Journal of Interpersonal Violence.* doi:10. 1177/0886260515586371.

Wymbs, B. T., Molina, B., Pelham, W., Cheong, J., Gnagy, E., Belendiuk, K., et al. (2012). Risk of intimate partner violence among young adult males with childhood ADHD. *Journal of Attention Disorders*. doi:10.1177/1087054710389987.

Zalecki, C. A., & Hinshaw, S. P. (2004). Overt and relational aggression in girls with attention deficit hyperactivity disorder. *Journal of Clinical Child and Adolescent Psychology, 33*(1), 125–137.

Zylowska, L., Ackerman, D. L., Yang, M. H., Futrell, J. L., Horton, N. L., Hale, T. S., et al. (2008). Mindfulness meditation training in adults and adolescents with ADHD: A feasibility study. *Journal of Attention Disorders, 11*, 737–746.