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Adult ADHD, Emotion Dysregulation, and Functional Outcomes: Examining the Role of Emotion Regulation Strategies

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Abstract

Emotion dysregulation is associated with Attention-Deficit/Hyperactivity Disorder (ADHD) and may contribute to the functional impairment experienced by people with this disorder. The present study addressed the following questions: 1) Does emotion dysregulation mediate the relationship between ADHD and key domains of functioning in adults with ADHD?, and, 2) If so, which emotion regulation *strategies* might further explain this relationship? 159 participants (59 ADHD, 100 non-ADHD) were recruited through Amazon's Mechanical Turk. Participants completed a variety of online self-report measures assessing ADHD symptoms, emotion regulation deficits and strategies, symptoms of depression and anxiety, relationship satisfaction, and overall functional impairment. Deficits in emotion regulation mediated the relationship between ADHD and internalizing symptoms, relationship satisfaction, and overall functional impairment. In exploratory analyses, avoidance mediated the relationship between ADHD and deficits in emotion regulation, but reappraisal and suppression did not. Serial mediation analyses indicated that the indirect effects of avoidance alone, apart from deficits in emotion regulation, partially explained the relationship between ADHD and nearly all outcomes. These results are consistent with past literature indicating that emotion regulation problems help explain the presence of depressive symptoms and romantic relationship impairment in adults with ADHD, and add that anxiety symptoms, poorer friendship quality, and greater functional impairment also may be influenced by emotion regulation problems. This study also identifies a specific emotion regulation strategy – avoidance – as a potential contributor to these outcomes. Future work should investigate contexts in which avoidant coping is most problematic so that interventions can be adapted accordingly.

Keywords ADHD · Attention-deficit/hyperactivity disorder · Emotion regulation · Emotion regulation strategies · Avoidance · Reappraisal · Suppression · Functional impairment · Relationship satisfaction · Depression · Anxiety · Adult ADHD · Mechanical Turk

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by impairing levels of inattention, distractibility, and hyperactivity that affects approximately 4.4% of adults in the United States (Kessler et al. 2006). ADHD affects a broad range of outcomes in school, work, social life, home life, driving, romantic relationships and financial management (Barkley et al. 2008; Bruner et al. 2015; Marsh et al. 2015) and, for some clients, may be more impairing than other outpatient psychiatric disorders such as anxiety and depression (2008). Researchers and clinicians have noted emotion dysregulation difficulties in the ADHD population (e.g., Bunford et al. 2015; Martel 2009; Shaw et al. 2014), but less is known about the role that emotion dysregulation plays in the relationship between ADHD and associated impairments. The current study poses two questions: 1) Does emotion regulation mediate the relationship between ADHD symptoms and outcomes such as anxiety and depression symptoms, relationship impairment, and broader functional impairment in adults? 2) If so, which specific emotion regulation strategies (avoidance, suppression, or reappraisal) may further explain this relationship?

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ADHD and Emotion Dysregulation

Evidence of emotional problems in the ADHD population has long been documented. Early conceptualizations of ADHD as "minimal brain dysfunction" included emotional symptoms as a central feature, and it was not until the publication of *DSM-III* that emotional symptoms were removed as a central feature and listed instead as an associated feature (Shaw et al. 2014). Since then, many authors have documented emotional symptoms in the ADHD population such as poorer performance on emotion recognition tasks (Da Fonseca et al. 2008; Yuill and Lyon 2007), elevated emotional lability (Banaschewski et al. 2012; Sobanski et al. 2010), and an increased risk for suicide attempts (Chronis-Tuscano et al. 2010). Some emotional problems in the ADHD population could be explained by the high rate of comorbidity of ADHD with other psychiatric disorders, since almost 40% of adults with ADHD have a comorbid mood disorder and nearly 50% have a comorbid anxiety disorder (Kessler et al. 2006).

However, the research indicates that emotional problems in the ADHD population cannot be attributed solely to the presence of comorbid disorders. Bunford and colleagues estimate that one-third to one-half of young adolescents with ADHD show features of emotion dysregulation, or the inability to modulate the escalation, de-escalation, or intensity of an expressed emotion (Bunford et al. 2015). A significant portion of a sample that excluded adults with comorbid conditions also showed impairing levels of emotion dysregulation (Reimherr et al. 2005), indicating that emotion regulation problems are persistent and cannot be fully accounted for by comorbidity. Other work has shown that emotional impulsiveness, emotional lability, and elevated levels of anger and hostility in the ADHD population are explained more by severity of ADHD symptoms than by the presence of comorbid psychiatric conditions (Harty et al. 2009; Skirrow and Asherson 2013). These findings, along with others, indicate that emotion dysregulation might be a central rather than associated feature of the disorder (Barkley 2015).

While comorbid conditions do not seem to entirely explain the presence of emotion dysregulation in adults with ADHD, emotion dysregulation likely makes this population more vulnerable to developing symptoms of depression and anxiety. A 2014 study found that in children with ADHD, the relationship between ADHD and depressive symptoms is mediated by deficits in emotion regulation (Seymour et al. 2014). The present study tests for replication of these findings in adults and explores emotion regulation strategies that might influence this relationship.

Less is known about whether emotion dysregulation predicts symptoms of anxiety in adults with ADHD, but the literature does indicate strong associations between ADHD symptoms, anxiety symptoms, and emotion regulation problems. Cognitive aspects of anxiety are so prevalent in adults with ADHD that they have been viewed by some as an inherent phenotypic expression of ADHD (Abramovitch and Schweiger 2009), and comorbid anxiety and ADHD is associated with more emotion regulation problems than ADHD or anxiety alone (Jarrett 2016). Given these findings, it seems possible that deficits in emotion regulation might explain the relationship between ADHD symptoms and anxiety symptoms.

In addition to predicting internalizing symptoms, emotion regulation problems also appear to contribute to some of the social impairments seen in ADHD populations. In a sample of young adolescents with ADHD, three specific facets of emotion dysregulation predicted social impairment: low threshold for emotional excitability, behavioral dyscontrol in the face of strong emotions, and inflexibility/slow return to baseline (Bunford et al. 2014). College students with elevated ADHD symptoms report more difficulty providing emotional support to friends and lower overall quality of friendships (McKee 2017), although no studies to our knowledge have directly tested emotion regulation as a mediator of the relationship between ADHD symptoms and friendship quality. Deficits in emotion regulation have, however, been shown to mediate the relationship between ADHD symptoms and romantic relationship quality in a sample of college students (Bruner et al. 2015). The present study will test for replication of these findings and will examine whether deficits in emotion regulation have similar effects on friendship quality. The role of specific emotion regulation strategies in explaining this relationship will also be explored.

Finally, this study examines deficits in emotion regulation as a mediator of the relationship between ADHD symptoms and overall functional impairment. In this study, functional impairment includes a broad range of psychosocial impairments in 15 domains: home life; work; social interactions with strangers and acquaintances; relationships with friends; chores and household tasks; community activities; educational activities; romantic relationships; sexual activities; management of finances; driving; organizing daily responsibilities; parenting; maintaining health; and daily care (Barkley 2011b). Previous work has shown that ADHD is associated with greater functional impairment even after taking into account the effect of comorbid psychiatric disorders (Sobanski et al. 2007), but it is not clear whether deficits in emotion regulation explain this relationship.

Emotion Regulation: Role of Strategies

To maximize the practical implications and future research directions that can be gleaned from research on deficits in emotion regulation, we also investigated the role of three specific emotion regulation strategies: avoidance (both experiential and cognitive-behavioral), suppression, and reappraisal. Experiential avoidance is defined by Bond et al. (2011) as "the attempt to alter the form, frequency, or situational

sensitivity of difficult private events (i.e., thoughts, feelings, and physiological sensations), even when doing so leads to actions that are inconsistent with one's values and goals" (p. 678). Ottenbreit and Dobson (2004) specify that avoidance includes both cognitive strategies (denying or minimizing a crisis and its effects) and behavioral strategies (seeking alternative rewards or escape when faced with a stressor), and they refer to both together as "cognitive-behavioral avoidance." Suppression, on the other hand, is a strategy that specifically involves inhibiting external expressions of internal emotions, such as facial expression (Gross and John 2003). Avoidance and suppression are known to increase vulnerability to psychopathology (Kashdan et al. 2006; Moore et al. 2008), but cognitive reappraisal is an adaptive strategy that involves construing a potentially emotion-eliciting situation in a way that changes its emotional impact (Gross and John 2003). These emotion regulation strategies have been extensively studied in anxious and depressed populations, but in ADHD populations, the literature is relatively scarce.

Some work has shown that adults with ADHD are more likely to endorse escape-avoidance coping strategies and positive reappraisal than non-ADHD controls (Young 2005). However, some clinicians have noted that adults with ADHD may avoid stressful situations in conjunction with an overly positive or optimistic appraisal (Knouse and Mitchell 2015), and if positive reappraisal is immediately followed by avoidant coping, it may not be as adaptive as it is in other populations. The ADHD population may also show unique physiological outcomes when suppressing emotions. In a 2011 study, Musser and colleagues found that children with ADHD had more stable patterns of elevated parasympathetic nervous system activity when suppressing negative and positive affect than non-ADHD counterparts (Musser et al. 2011). Less is known about suppression in adults with ADHD and whether any functional outcomes are associated with reliance on this emotion regulation strategy.

In summary, the current study addresses two research questions. First, do deficits in emotion regulation mediate the relationship between ADHD and key outcomes including depression and anxiety symptoms, relationship satisfaction, and broad functional impairment? We considered a range of outcomes in order to provide a comprehensive test of the role of emotion regulation deficits in the difficulties faced by adults with ADHD. Based on prior work, we predicted that deficits in emotion regulation would mediate the relationship between ADHD and each of these functional outcomes. Second, we explored which *specific* emotion regulation strategies—avoidance, suppression, or cognitive reappraisal—may link ADHD symptoms to emotion regulation deficits and then to outcomes by conducting serial mediation analyses (see Fig. 1 for an example). Of note, we did not make a priori predictions about which emotion regulation strategies would mediate these relationships due to the relative lack of prior research regarding these strategies in adults with ADHD upon which to base such predictions. Thus, these analyses should be considered exploratory, providing observations upon which to base future work in this research area.

Method

Participants

The study sample consisted of 159 Mechanical Turk workers who completed the study and passed screening on the infrequency scale (see Procedure). Of these, 59 participants met criteria for inclusion in the group of adults with ADHD and 100 were in the non-ADHD group (see criteria below). In the entire sample, 95 participants were female, 62 were male, and 2 identified as gender fluid or nonbinary. The ages of participants ranged from 18 to 61 years with a mean of 30.47 years ($SD = 9.2$). 129 participants identified as white, 9 as black or African-American, 17 as Asian or Pacific Islander, 4 as Native American and 6 identified as other. Note that participants were permitted to select more than one race. 16 participants identified as Hispanic or Latino. The ADHD group did not differ significantly from the non-ADHD group on age ($p = .53$), education ($p = .91$), or gender ($p = .09$), or whether they reported having an intimate partner ($p = .25$). (Note that only participants indicating that they had an intimate partner, $n = 106$, completed the Relationship Assessment Scale.) See Table 1 for additional between-groups comparisons.

To screen into the ADHD group, participants needed to: 1) endorse having been previously diagnosed with ADD or ADHD, 2) report current symptom severity exceeding the 93rd percentile for their age on the Barkley Adult ADHD Rating Scale (BAARS) Quick Screen and, 3) endorse symptom-related impairment in at least one domain on the BAARS Quick Screen. Inclusion in the non-ADHD group required that participants did not report a previous diagnosis of ADD or ADHD and that their current symptoms on the BAARS Quick Screen fell below the 93rd percentile.

Screening Materials

Barkley Adult ADHD Rating Scale Quick Screen (BAARS, 2011; Eight Items)

Current ADHD symptoms were assessed using the Barkley Adult ADHD Rating Scale (BAARS) Quick Screen, which asks participants to report the frequency of symptoms such as losing things necessary for tasks or activities or being easily distracted by extraneous stimuli or irrelevant thoughts on a Likert scale ranging from 1 to 4. A score of 1 indicates that the participant experiences the symptom "never or rarely" while a score of 4 indicates that they experience it "very

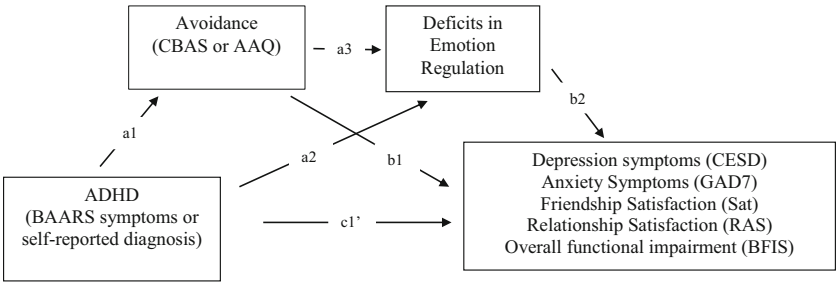

Fig. 1 A serial multiple mediation model with avoidance and deficits in emotion regulation as proposed mediators on the relationship between ADHD and impairment

often". Participants who endorsed having one or more symptoms often or very often were asked about the age at which those symptoms began and in which settings those symptoms cause impairment (i.e., school, home, work, or social relationships).

Table 1 ADHD group compared to non-ADHD group on demographic makeup, ADHD symptoms, emotion regulation strategies, deficits in emotion regulation, and various forms of impairment

	ADHD Group	Non-ADHD Group
Race		
White or Caucasian	53 (89.83%)	76 (76.0%)
Black or African American	2 (3.39%)	7 (7.0%)
Asian or Pacific Islander	4 (6.78%)	13 (13.0%)
Native American	2 (3.39%)	2 (2.0%)
Other	2 (3.39%)	4 (4.0%)
Ethnicity		
Hispanic/Latino	7 (11.86%)	9 (9.0%)
Education		
High school	4 (6.8%)	8 (8.0%)
Some college	19 (32.2%)	30 (30.0%)
Associates degree	7 (11.9%)	9 (9.0%)
Bachelor's degree	21 (35.6%)	41 (41.0%)
Master's degree	8 (13.6%)	11 (11.0%)
Doctoral/Medical/Law	0 (0%)	1 (1.0%)
Gender		
Male	19 (32.2%)	43 (43.0%)
Female	38 (64.4%)	57 (57.0%)
Non-binary	2 (3.4%)	0 (0%)
	M (*SD*)	*M* (*SD*)
Age	31.34 (10.12)	30.40 (8.55)
BAARS	2.62 (0.50)**	1.48 (0.39)**
DERS	2.82 (0.81)**	2.15 (0.67)**
ERQ-s	3.68 (1.38)	3.60 (1.34)
ERQ-r	4.80 (1.20)	5.02 (1.13)
CBAS	2.82 (0.94)**	1.99 (0.80)**
AAQ	3.87 (1.59)**	2.79 (1.53)**
CES-D	2.13 (0.77)**	1.67 (0.60)**
GAD-7	2.23 (0.77)**	1.68 (0.72)**
RAS	4.11 (0.98)	4.27 (0.76)
Sat	4.03 (0.90)	4.18 (0.73)
BFIS	4.66 (1.90)**	1.75 (1.86)**

**Difference between groups significant at the.01 level

Demographics Demographic items included age, gender, highest level of education, and relationship status.

ADHD Clinical History Participants selected "yes" or "no" when asked if they had ever been diagnosed with ADHD or ADD by a healthcare professional, and "yes" or "no" to whether or not they currently had a diagnosis. Participants needed to endorse a previous diagnosis of ADHD or ADD to be included in the ADHD group.

Full Survey Materials

Internal consistency for all measures listed below ranged from acceptable to excellent (Cronbach's α= .78–.97; see diagonal of Table 2).

Barkley Adult ADHD Rating Scale (BAARS-IV; Barkley 2011a; 30 Items) The BAARS is a self-report rating scale of current adult ADHD symptoms based on *DSM-IV* criteria that is also relatively consistent with *DSM-5* criteria. Participants rate the frequency with which they have experienced each ADHD symptom over the past 6 months on a 4-point scale from "Never or Rarely" to "Very Often." For items rated "Often" or "Very Often," participants report the age at which most of the symptoms began and indicate the domains in which the symptoms impair their functioning. The mean score for the inattentive and hyperactive-impulsive items was used as an index of current ADHD symptoms in our sample. In a normative sample of 1249 adults, BAARS scores showed good internal consistency (α = .78–.91) (Barkley 2011a). Test-retest reliability across 2–3 weeks in a subsample of 64 participants for the current symptoms scales ranged from r = .66 to.76. Evidence for validity of BAARS scores includes their relationship to functional impairment in a variety of domains.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004; 36 Items) The scale was designed to assess emotion dysregulation within the following dimensions of emotion regulation: (a) awareness and understanding of emotions, (b) acceptance of emotions, (c) the ability to engage in goal-directed behavior, and refrain from impulsive behavior when experiencing negative emotions, and (d) assess emotion

Table 2 Zero-order correlations among ADHD symptoms, emotion regulation strategies, deficits in emotion regulation, and various forms of impairment

	BAARS	DERS	ERQ-s	ERQ-r	CBAS	AAQ	CES-D	GAD-7	RAS	Sat	BFIS
BAARS	.97										
DERS	.63**	.96									
ERQ-s	.06	.18*	.78								
ERQ-r	−.14	−.35**	.03	.88							
CBAS	.36**	.75**	.26**	−.35**	.97						
AAQ	.53**	.75**	.20*	−.37**	.74**	.94					
CESD	.53**	.74**	.24**	−.42**	.75**	.79**	.94				
GAD-7	.56**	.68**	.13	−.39**	.68**	.75**	.84**	.91			
RAS	−.25**	−.35**	−.33**	.05	−.43**	−.42**	−.36**	−.33**	.91		
Sat	−.18**	−.32**	−.05	.24**	−.37**	−.33**	−.35**	−.33**	.32**	.83	
BFIS	.77**	.67**	.19*	−.24**	.72**	.65**	.70**	.67**	−.38**	−.31**	.97
Mean	1.9	2.40	3.63	4.94	2.30	3.19	1.84	1.88	4.22	4.12	2.83
SD	.70	.79	1.35	1.17	.94	1.63	.64	.78	.84	.80	2.35

BAARS = Barkley Adult ADHD Rating Scale; DERS = Deficits in Emotion Regulation Scale, ERQ-r = Emotion Regulation Questionnaire reappraisal subscale, ERQ-s = Emotion Regulation Questionnaire suppression subscale, CBAS=Cognitive Behavioral Avoidance Scale, AAQ = Acceptance and Action Questionnaire, CESD = Center for Epidemiological Studies Depression scale; GAD = Generalized Anxiety Disorder 7-item scale, RAS = Relationship Assessment Scale, Sat = Friendship satisfaction subscale on the NRI-RQV, BFIS = Barkley Functional Impairment Scale. Diagonal line contains internal reliability Cronbach's α

**. Correlation is significant at the 0.01 level (2-tailed)

*. Correlation is significant at the 0.05 level (2-tailed)

regulation strategies perceived as effective (Gratz and Roemer 2004). Participants report difficulties in emotion regulation that they experience in daily life and at moments when negative events happen. Each statement is rated on 5-point Likert scale, with 1 being "almost never" and 5 being "almost always". Items were averaged to create a mean score that was used in analyses. Internal consistency of the measure was evaluated using Cronbach's alpha and results indicated that DERS has high internal consistency, alpha = .93 (Gratz and Roemer 2004). Overall DERS scores had good test-retest reliability over a period ranging from four to 8 weeks ($p < .01$) (Gratz and Roemer 2004).

Emotion Regulation Questionnaire (ERQ; Gross and John 2003; 10 Items) This scale is a self-report measure that is designed to assess differences in the habitual use of two emotion regulation strategies: cognitive reappraisal and expressive suppression. Items assessing cognitive reappraisal included statements such as "When I want to feel more positive emotion, I change the way I'm thinking about the situation," and items assessing expressive suppression included statements such as "I control my emotions by not expressing them". Participants rate the items on a 7-point Likert-type scale ranging from "strongly disagree" to "strongly agree". Items were averaged to create a mean score for each subscale that was used in analyses. Cronbach's alpha reliabilities averaged.79 for reappraisal and.73 for suppression, and test-retest reliability across 3 months was.69 for both scales (Gross and John 2003).

Acceptance and Action Questionnaire (AAQ-II; Bond et al. 2011; 7 Items) This measure provides a one-factor measure of psychological flexibility, also known as experiential avoidance. Participants are asked how frequently statements such as "my painful experiences and memories make it difficult for me to live a life that I would value" and "worries get in the way of my success." Responses are scored on a 7-point scale ranging from "never true" to "always true". Items were averaged to create a mean score that was used in analyses. In a sample of 2816, 3- and 12- month re-test reliability was .81 and .79 and the mean alpha coefficient was .84 (Bond et al. 2011).

Cognitive-Behavioral Avoidance Scale (CBAS; Ottenbreit and Dobson 2004; 31 Items) This multi-dimensional self-report measure was designed to assess the construct of dispositional avoidance. Participants are asked to think about the extent to which statements such as "I quit activities that challenge me too much" and "I avoid social activities" apply to their lives. Responses are selected on a 5-point scale ranging from "not at all true for me" to "extremely true for me". The CBAS yields one overall avoidance score and the mean of these items was used in the analyses. The scale has demonstrated good internal consistency ($\alpha = .91$), test–retest reliability ($r = .92$), and reasonable convergent validity with other measures of coping styles ($r = .30–.63$). (Ottenbreit and Dobson 2004).

Barkley Functional Impairment Rating Scale (BFIS; Barkley 2011b; 15 Items) This scale is designed to assess psychosocial impairment in 15 domains: home life; work; social interactions with strangers and acquaintances; relationships with friends; chores and household tasks; community activities; educational activities; romantic relationships; sexual activities; management of finances; driving; organizing daily responsibilities; parenting; maintaining health (e.g., exercise, nutrition, preventative medical care); and daily care (e.g., dressing, bathing). Participants indicated on a 10-point likert scale that ranged from 0 (not at all) to 9 (severe) plus a "does not apply" option how much difficulty they have in each domain of functioning. Items were averaged to create a mean score that was used in analyses. In a large normative sample ($N > 1200$) the BFIS showed high internal consistency and test-retest reliability in both its full form and as a Quick Screen (Cronbach's $\alpha = .97$ and.92, $r = .72$ and.71) (Barkley 2011b).

The Network of Relationships—Relationship Quality Version (NRI-RQV; Buhrmester and Furman 2008; 30 Items) This scale measures five positive features and five negative features of close relationships. Items include questions such as "How often does this person praise you for the kind of person you are?" and "how often do you share secrets and private feelings with this person?" Answers are scored on a 5-point scale ranging from "never or hardly at all" to "always". In this study, we analyzed the satisfaction subscale for ratings of participants' relationships with their closest friend. Items from the satisfaction subscale were averaged to create a mean score that was used in analyses. A previous sample showed strong internal consistency for both closeness and discord subscales for close friendships (Cronbach's alpha = .95 and.84) (Buhrmester and Furman 2008).

Relationship Assessment Scale (RAS; Hendrick et al. 1998; Seven Items) The scale is a self-report measure that assesses romantic relationship satisfaction. Participants are asked general questions related to their relationship such as "how well does your partner meet your needs?" and "how good is your relationship compared to most?". Items are scored on a five-point Likert-type scale with a score of 1 indicating low satisfaction and a score of 5 indicating high satisfaction. Items were averaged to create a mean score that was used in analyses. The RAS shows moderate to high correlations with measures of marital satisfaction, good test-retest reliability, and similar psychometric properties across a wide variety of ethnicities and ages (Hendrick et al. 1998).

Center for Epidemiologic Studies Depression Scale (CES-D; Radloff 1977; 20 Items) This self-report measure was developed to assess symptoms of depression in the general population, and it asks participates to rate how frequently they thought or behaved in certain ways throughout the past week. Items include statements such as "I thought my life had been a failure" and "I had crying spells". Responses were selected on a 4-point scale that ranged from "rarely or none of the time (less than one day)" to "most of or all of the time (5-7 days)". Items were averaged to create a mean score that was used in analyses. This scale was initially tested in household interview survey and in psychiatric settings and showed similar reliability and validity across a number of demographic characteristics (Radloff 1977).

Generalized Anxiety Disorder Screener (GAD-7; Spitzer et al. 2006; 8 Items) This short self-report measure was developed to screen for symptoms of generalized anxiety disorder symptoms. It asks participants how often in the past 2 weeks they have been bothered by symptoms such as not being able to stop or control worrying. Participants can select responses on a 4-point scale ranging from "not at all" to "nearly every day". Items were averaged to create a mean score that was used in analyses.

Procedure

Recruitment and Screening Screening and recruitment was completed using Amazon's Mechanical Turk–an online crowdsourced worker pool that has recently been used by researchers in psychology. Interested workers completed the BAARS Quick Screen ($n = 2410$), which assesses current ADHD symptoms and related impairment. Participants also provided information on their age, education level and whether they had ever received a diagnosis of ADHD. Participants were paid $0.10 for completion of the screener. Researchers identified participants qualified for the ADHD group based on responses to the screener. For each participant in the ADHD group who was offered participation in the larger study, a control group participant was selected and offered participation on a one-to-one basis to match the ADHD participant on age and education level. Although we could not guarantee that people offered participation in the full study would ultimately participate, the goal of this matched recruitment procedure was to increase the likelihood that ADHD and control groups would be comparable in terms of age and gender. We identified the closest possible match for each participant that screened into the ADHD group. Education levels were matched exactly, while ages of control participants ranged up to 4 years older or younger than the ADHD counterpart.

Participants who completed the screener and met inclusion criteria for one of the two groups were invited to participate in the full study. Access to the full study was distributed through Mechanical Turk exclusively to these participants.

Online Survey Completion

Participants in the full study received a link to the Qualtrics online survey platform. Interested participants viewed a consent form and selected a statement verifying that they read and understood the information, were at least 18 years of age, and provided their consent to participate in the study. Compensation for this portion of the study was $3.00.

187 participants consented to participate in the main study. Four participants did not complete the study. In order to ensure that the data were of a high quality, an Infrequency Scale was included near the end of the survey. Participants who responded to more than 2 items in a way that indicated a highly unlikely response were removed from the data set. Twenty-four participants (12.8% of the initial sample) were removed before moving forward with data analysis, resulting in a final sample size of 159.

Plan of Analysis

Zero order correlations among ADHD symptoms, emotion regulation strategies, deficits in emotion regulation, and various forms of impairment are displayed in Table 2. Hayes PROCESS model 4 (Hayes 2013) was then used to test deficits in emotion regulation (DERS scores) as a mediator on the relationship between ADHD symptoms and each of five outcomes: anxiety symptoms, depression symptoms, friendship satisfaction, romantic relationship satisfaction, and overall functional impairment. Next, avoidance, reappraisal, and suppression were each tested as mediators of the relationship between ADHD symptoms and deficits in emotion regulation. Strategies that significantly mediated that relationship were then tested in a serial mediation model, Hayes' PROCESS model 6 (see Fig. 1 for an illustration). Consistent with our conceptualization of emotion regulation strategies (or lack thereof) linking ADHD symptoms to emotion regulation deficits, this model examined emotion regulation strategies and emotion regulation deficits as serial mediators of the relationship between ADHD and each functional outcome. Bias-corrected bootstrap confidence intervals were calculated for all indirect effects based on 5000 bootstrap samples.

We conducted secondary analyses in which ADHD diagnostic status, based on self-reported information, was substituted for ADHD symptoms as the predictor in each analysis and we reported instances in which findings differ from conclusions drawn with ADHD symptoms as the predictor. Although using symptoms as the predictor is preferred from the standpoint of statistical power and the nature of ADHD traits as continuous rather than dichotomous, we also wished to evaluate the extent to which our results generalized when diagnostic status was considered instead.

We hypothesized that the indirect effect of ADHD (X) on functional outcome variables (Y) through deficits in emotion regulation would be significant, predicting less desirable functional outcomes. Our tests of specific emotion regulation strategies were exploratory and we did not make specific predictions about which emotion regulation strategies would be most useful in explaining relationships among ADHD, emotion regulation, and functional outcomes.

Results

The Mediating Role of Deficits in Emotion Regulation

Simple mediation analyses showed that deficits in emotion regulation mediated the relationship between ADHD symptoms and all the outcomes of interest. (Note that all path parameters are unstandardized coefficients.) ADHD symptoms were associated with elevated deficits in emotion regulation ($a = .71$, $p < .01$) which in turn were associated with greater anxiety symptoms ($b = .54$, $p < .01$), greater depression symptoms ($b = .55$, $p < .01$), lower romantic relationship satisfaction ($b = -.35$, $p < .05$), lower friendship satisfaction ($b = -.35$, $p < .01$), and greater functional impairment ($b = .92$, $p < .01$). Using bootstrap analysis, significant indirect effects through emotion regulation were found when predicting depression ($ab = .38$, 95% *CI* .25 to .53), anxiety ($ab = .38$, 95% *CI* .28 to.50), friendship satisfaction ($ab = -.24$, 95% *CI* -.39 to −.10), romantic relationship satisfaction ($ab = -.28$, 95% *CI* -.54 to −.07) and functional impairment ($ab = .65$, 95% *CI* .40 to.96).

Role of Emotion Regulation Strategies

Looking more specifically at the relationship between ADHD symptoms and emotion regulation deficits with respect to the role of emotion regulation strategies, simple mediation analyses showed that ADHD symptoms indirectly influenced deficits in emotion regulation through their effect on avoidance. Specifically, participants with higher levels of ADHD symptoms reported higher levels of cognitive behavioral avoidance ($a = .84$, $p < .01$) and experiential avoidance ($a = 1.23$, $p < .01$), which were each associated with greater deficits in emotion regulation ($b = .49$, $p < .01$ and $b = .28$, $p < .01$). Using bootstrap analysis, significant indirect effects were found via cognitive behavioral avoidance ($ab = .41$, 95% *CI*.26 to .58) and experiential avoidance ($ab = .35$, 95% *CI* .23 to .49). Suppression and reappraisal, on the other hand, did not mediate the relationship between ADHD and deficits in emotion regulation. The confidence intervals for these indirect effects included zero (−.02 to.05 for suppression and − .004 to.10 for reappraisal), so these strategies were not considered in subsequent serial mediation models.

Emotion Regulation Strategies and Deficits in Emotion Regulation as Serial Mediators

Next, serial mediation analyses were used to test the strength of the role of avoidance strategies (experiential avoidance, cognitive-behavioral avoidance) in the relationship among ADHD symptoms, emotion regulation deficits, and outcome variables. Figure 1 shows the variables that were tested in the serial mediation models. Figures illustrating a subset of these models are displayed here and figures for all models are contained in the online Supplementary Materials.

A serial mediation analysis run with Hayes' PROCESS Model 6 showed that ADHD symptoms indirectly influenced depressive symptoms through their serial effects on cognitive behavioral avoidance and deficits in emotion regulation (*a1a3b2* = .14, 95% *CI* .06 to.24) (see Fig. 2)**.** Higher levels of ADHD symptoms were associated with greater cognitive behavioral avoidance (*a1* = .84, $p < .01$), which was associated with more deficits in emotion regulation (*a3* = .49, $p < .01$), which in turn were associated with higher levels of depressive symptoms (*b1* = .33 $p < .01$). Similarly, experiential avoidance predicted depression symptoms through a serial mediation pathway (*a1a3b2* = .09, 95% *CI* .04 to.17) (see Fig. 3).

Cognitive behavioral avoidance was also a significant serial mediator predicting anxiety symptoms (*a1a3b2* = .14, 95% *CI* .04 to .29) (see Fig. 4). Experiential avoidance was not significant in predicting anxiety symptoms through a serial mediation pathway (*a1a3b2* = .06, 95% *CI* -.008 to.16), although ADHD symptoms did influence anxiety symptoms through experiential avoidance alone (*a1a3* = .31, 95% *CI* .18 to.47).

A serial mediation pathway influencing relationship satisfaction through avoidance and deficits in emotion regulation was not supported, although ADHD symptoms did indirectly influence both friendship satisfaction and romantic relationship satisfaction through cognitive behavioral avoidance alone (*a1b1* = −.25, 95% *CI* -.40 to −.11; *a1b1* = −.32, 95% *CI* -.62 to −.12) (See Fig. 5). Experiential avoidance mediated the relationship between ADHD symptoms and romantic relationship satisfaction (*a1b1* = −.03, 95% *CI* -.50 to −.09) but not the relationship between ADHD symptoms and friendship satisfaction (*a1b1* = −.13, 95% *CI* -.30 to .001). ADHD symptoms did not have a significant indirect influence on functional impairment through avoidance and deficits in emotion regulation as serial mediators, but there were significant indirect effects through cognitive behavioral avoidance alone (*a1b1* = .93, 95% *CI* .62 to 1.31) and through experiential avoidance alone (*a1b1* = .46, 95% *CI* .16 to.81) (See Fig. 6).

Secondary Analysis: ADHD Diagnosis as Predictor

The pattern of results for all simple mediation analyses remained the same when ADHD diagnosis was used as the predictor instead of ADHD symptoms. There were only slight changes in the serial mediation patterns observed. The serial mediation pathway predicting anxiety symptoms via experiential avoidance and deficits in emotion regulation became significant when ADHD diagnosis was substituted for ADHD symptoms (*a1a3b2* = .-.09, 95% *CI* -.20 to −.02). Substituting diagnosis for symptoms also led to a significant indirect effect on functional impairment both with experiential avoidance (*a1a3b2* = −.29, 95% *CI* -.61 to −.11) and cognitive behavioral avoidance (*a1a3b2* = −.33, 95% *CI* -.63 to −.09) as serial mediators alongside deficits in emotion regulation. (Note that because ADHD diagnosis was coded as "1" while no diagnosis was coded as "2," the directions of these effects indicate that ADHD diagnoses were associated with greater functional impairment.)

Discussion

In line with our hypotheses, deficits in emotion regulation mediated the relationship between ADHD symptoms and diagnoses and a range of outcomes including internalizing symptoms, relationship satisfaction, and overall functional impairment. These findings are consistent with and add to the existing literature. Deficits in emotion regulation have been identified as a mediator on the relationship between ADHD and depression symptoms in children (Seymour et al. 2014), and our findings suggest similar patterns in adulthood. Similarly, our results are consistent with Bruner et al.'s (2015) findings that deficits in emotion regulation mediate the relationship between ADHD symptoms and romantic relationship quality in college students. Our study expands on these findings by demonstrating that the same pattern is seen in a sample with a broader age range, indicating that the problem is not limited to the unique developmental stage of emerging adulthood. Furthermore, our use of a friendship quality scale allowed us to see that problems with emotion regulation affect not only romantic relationships, but also social functioning more broadly. Lastly, although problems related to anxiety have been well documented in the ADHD population (Abramovitch and Schweiger 2009; Jarrett 2016), this study is the first to our knowledge to identify deficits in emotion regulation as a mediator of the relationship between ADHD symptoms and anxiety symptoms.

When examining the role of specific emotion regulation strategies, experiential avoidance and cognitive-behavioral avoidance—but not suppression or reappraisal—further explained the relationship between ADHD symptoms and emotion regulation deficits. Further examination of avoidance processes using serial mediation analysis revealed that avoidance and deficits in emotion regulation were serial mediators of the relationship between ADHD, emotion regulation deficits, and some outcomes. Specifically, this serial mediation pathway

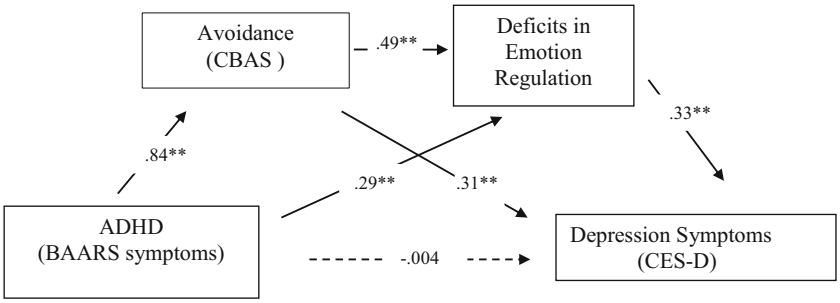

Fig. 2 A serial multiple mediation model with cognitive-behavioral avoidance and deficits in emotion regulation as serial mediators on the relationship between ADHD symptoms and depression symptoms. Indirect Effects: A →B →D – Value: .26 95% *CI* .18:.37. A →B →C →D – Value: .14 95% *CI* .06:.24. A →C →D – Value: .10 95% *CI* .03:.19. $^{**}p < .001$, $^{*}p < .05$

was most useful in predicting symptoms of depression. When predicting anxiety, experiential avoidance was a less consistent serial mediator than cognitive behavioral avoidance. Serial mediation pathways predicting relationship satisfaction and functional impairment were not supported, but there were significant indirect effects on these outcomes through avoidance alone. Notably, when substituting ADHD diagnosis for current symptoms the serial mediation pathways via both types of avoidance predicted depression, anxiety, and functional impairment.

Importantly, results of the serial mediation analyses indicated that the relationship between ADHD and nearly all measures of impairment could be at least partially explained through the indirect effects of avoidance alone, even apart from deficits in emotion regulation. While experiential avoidance did not mediate the relationship between ADHD and friendship satisfaction, the indirect effects of all *a1a3* pathways were significant for all other possible combinations of avoidance and outcome variables. Our results support the importance of avoidant coping and avoidance-oriented emotion regulation strategies in the relationship between ADHD and its functional impairments.

These results fit in well with past literature indicating that an overreliance on avoidant coping is a common problem in the adult ADHD population (Young 2005; Torrente et al. 2014) and that these coping styles may be directly influenced by core symptoms of ADHD. Specifically, symptoms of inattention are associated with a greater likelihood to dislike one's current activity and desire to be doing something else (Knouse et al. 2008) and impulsivity is a strong predictor of experiential avoidance in nonclinical undergraduate samples (Berghoff et al. 2012). Adults with ADHD experience greater discomfort than non-ADHD adults when completing tasks that require mental effort (Hsu et al. 2017), and this discomfort may also drive avoidant behaviors. Since the ADHD population struggles with delay-aversion, the immediate negative-reinforcement of avoiding unpleasant thoughts and feelings may be particularly powerful (Knouse and Mitchell 2015). This work replicates previous findings indicating that cognitive-behavioral avoidance accounts for significant variance in the relationship between ADHD symptoms and depressive symptoms (Knouse et al. 2013) and adds to previous work by testing a serial mediation pathway and demonstrating that cognitive-behavioral avoidance also appears to be helpful in explaining symptoms of anxiety.

Identifying unique features of avoidance in adults with ADHD will be necessary in order to develop effective treatments. Previous work notes that cognitions facilitating avoidance in the ADHD population often appear overly positive or optimistic, which may initially make it difficult to recognize them as problematic (Knouse and Mitchell 2015). Other authors observe that avoidance in adults with ADHD is sometimes driven by perfectionist thinking, as the need to be "perfectly ready" before beginning a difficult task rationalizes procrastination (Strohmeier et al. 2016). On the other hand, perfectionism and anxious coping may also be related to

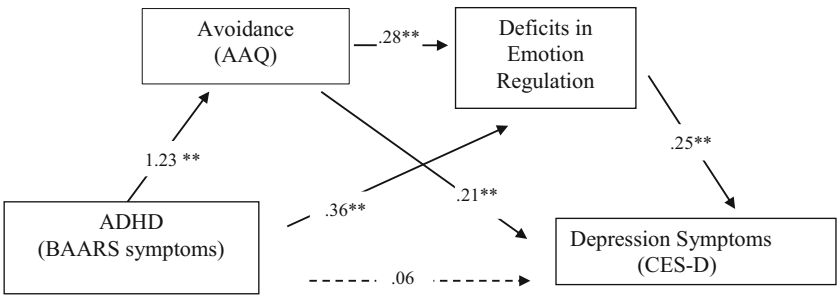

Fig. 3 A serial multiple mediation model with experiential avoidance and deficits in emotion regulation as serial mediators on the relationship between ADHD symptoms and depression symptoms. Indirect Effects: A →B →D – Value: .25 95% *CI* .16:.37. A →B →C →D – Value: .09 95% *CI* .04:.17. A →C →D – Value: .09 95% *CI* .04:.16. $^{**}p < .001$, $^{*}p < .05$

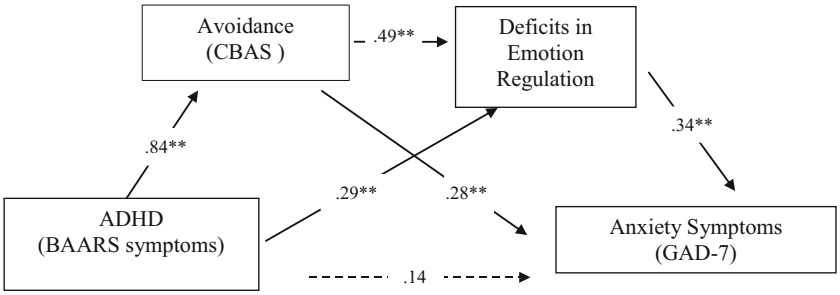

Fig. 4 A serial multiple mediation model with cognitive-behavioral avoidance and deficits in emotion regulation as serial mediators on the relationship between ADHD symptoms and anxiety symptoms. Indirect Effects: A →B →D – Value: .23 95% *CI* .10:.37. A →B →C →D – Value: .14 95% *CI* .04:.29. A →C →D – Value: .10 95% *CI* .03:.22. $^{**}p < .001$, $^{*}p < .05$

conscientious social skills (Becker et al. 2015), so more work is needed to clarify the contexts in which anxious coping is adaptive vs. maladaptive for people with ADHD.

This study had several relevant strengths. The use of an infrequency scale helped ensure that the data was of relatively high quality, and we took steps to account for the influence of potential confounding variables of age and education in our recruitment procedures. The study examined multiple areas of functional outcome relevant to adults with ADHD and is among the first to explore the relationship between ADHD and specific emotion regulation strategies in this population. Some key limitations should also be noted. Although testing mediation implies a causal relationship, the correlational nature of this study prohibits inferences about causation. It should also be noted that all measures were self-report, and bringing in other sources of data would paint a clearer picture of each participant's behavior. Future work using longitudinal designs will be necessary to understand the development of impairments in adults with ADHD over time, and the use of physiological measures and ecological momentary assessment methods could help give further insight into how adults with ADHD regulate their emotions in various situations. In addition, the serial mediation analyses examining emotion regulation strategies involved running a larger number of models to examine potential relationships with each functional outcome, which may increase the Type I error rate across these analyses, while the greater complexity of these serial models may have reduced our power to detect significant indirect effects within each model compared to the simple mediation analyses. Thus, as emphasized previously, the results of these serial mediation analyses should be considered exploratory. They should be interpreted with caution and the conclusions replicated and validated in additional samples and in future studies.

Understanding the specific emotion regulation strategies that contribute to impairment will enhance the effectiveness of interventions for adults with ADHD. Cognitive-behavioral therapy (CBT) has been shown to be useful in decreasing ADHD symptoms both in individual and group settings (Knouse et al. 2017), and a greater focus on decreasing avoidant coping may help improve the effect of CBT for adult ADHD on anxiety and depressive symptoms as well. Decreases in experiential avoidance appear to be a mechanism of change in group-based transdiagnostic CBT for anxiety disorders (Espejo et al. 2017), and using exposure techniques like those used by Espejo and colleagues may also decrease avoidant coping in adults with ADHD, especially among participants with comorbid anxiety disorders. CBT for depression may demonstrate better outcomes when it incorporates an emotion regulation skills training component (Berking et al. 2013), and adults with ADHD may benefit from a similar skills training module, especially if they have a comorbid mood disorder. More work will be necessary to develop treatments that effectively decrease depression symptoms, anxiety symptoms, relationship problems, and broad functional impairment for this population.

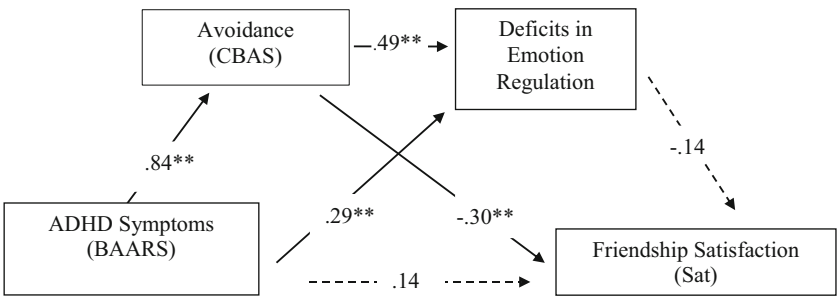

Fig. 5 A serial multiple mediation model with cognitive behavioral avoidance and deficits in emotion regulation as serial mediators on the relationship between ADHD symptoms and friendship satisfaction. Indirect Effects: A ➔ B ➔ D – Value: −.25 95% *CI* -.4:-.11. A ➔ B ➔ C ➔ D – Value: −.06 95% *CI* -.17:.04. A ➔ C ➔ D – Value: −.04 95% *CI* -.13:.02. $^{**}p < .001$, $^{*}p < .05$

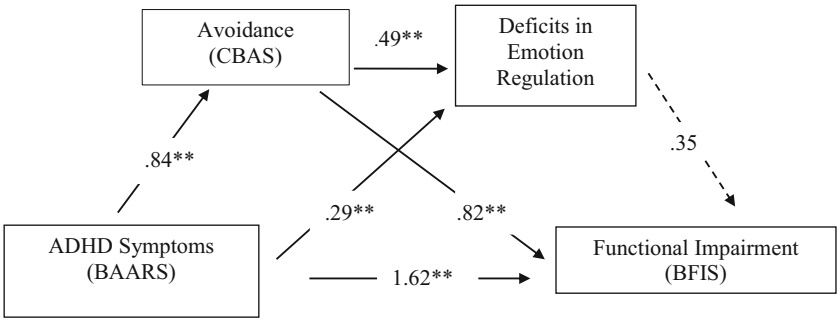

Fig. 6 A serial multiple mediation model with cognitive behavioral avoidance and deficits in emotion regulation as serial mediators on the relationship between ADHD symptoms and functional impairment. Indirect Effects: A ➔ B ➔ D – Value: .93 95% *CI* .62:1.31. A ➔ B ➔ C ➔ D – Value: .15 95% *CI* -.02:.35. A ➔ C ➔ D – Value: .10 95% *CI* -.01:.28. $^{**}p < .001$, $^{*}p < .05$

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Compliance with Ethical Standards

Conflict of Interest Elizabeth A. Bodalski, Laura E. Knouse, and Dmitry Kovalev declare no conflict of interest in publishing this work.

Experiment Participants All data collection procedures were approved by the Institutional Review Board at the University of Richmond and informed consent was obtained from all study participants.

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