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The Effects of Impulsivity on Emotion Regulation in College Students
with Symptoms of ADHD

A Thesis
Presented to
the Faculty of the Department of Psychology
University of South Carolina Aiken

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

By
Christine White
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Abstract

Introduction: Emotional regulation is essential for evaluating a situation, giving meaning to an experience in order to achieve a desired goal. Impulsivity has been thought of as engaging in behaviors without thinking and prematurely responding to stimuli that generate negative consequences. It has been suggested that impulsive behaviors may be a result of maladaptive strategies when regulating emotions. Research has shown adults with Attention-Deficit/Hyperactivity Disorder (ADHD), impulsivity, and emotional dysregulation have a variety of problems, such as missing nonverbal cues, interrupting conversations, not thinking before talking, being impatient, being hot-tempered, and being easily emotionally excitable. The present study used psychological self-report measures to better understand the interaction(s) between ADHD symptomology, emotional self-regulation and impulsive behaviors. **Method:** Participants completed the two subscales of the Barkley Adult ADHD Rating Scale-IV (BAARS-IV), the Difficulties in Emotion Regulation Scale (DERS), and the Impulsive Behaviors Scale (UPPS-P). Following the three measures, participants were asked to provide demographic information regarding age, gender, and history of ADHD. **Results:** It was determined that higher levels of behavioral impulsivity were related to lower levels of hyperactivity, while higher levels of emotion dysregulation were related to lower levels of impulsivity. In addition, high levels of emotion dysregulation were related to high levels of both inattention and hyperactivity. Finally, results showed that hyperactivity mediated the relationship between impulsivity and difficulties in emotion regulation. **Conclusion:** Although there were not a sufficient number of students with a history of ADHD to make statistical comparisons with those students without a history, there is evidence that problems with low frustration tolerance, irritability, and rapid mood changes are present in individuals with a continuum of ADHD symptoms. Results suggest there may be a

rather large number of college students with subthreshold ADHD symptoms and difficulties with emotional self-regulation and impulsivity.

Keywords: emotional self-regulation, behavioral impulsivity, ADHD symptomology, young adults

The Effect of Impulsivity on Emotional Regulation in College Students
with Symptoms of ADHD

Attention-Deficit/Hyperactivity Disorder is a chronic disorder characterized by a persistent pattern of inattention, hyperactivity and/or impulsivity that interferes with an individual's functioning or development according to the Diagnostic Statistical Manual – Fifth Edition (DSM-5). These three primary or core features of inattentive, hyperactive and/or impulsive symptoms occur in settings such as at home, school, or work, and negatively interferes with social, academic, or occupational functioning. Symptoms of hyperactivity include excessive motor activity, fidgeting, tapping, or talkativeness, while symptoms of impulsivity include interrupting others, difficulty waiting their turn, or blurting out answers to a question. Symptoms of inattention include failure to pay attention to details, difficulty remaining focused during tasks, not listening when spoken to directly, not following instructions, difficulty with organization, reluctance to engage in tasks that require sustained attention, losing things, being easily distractible, or forgetful of daily activities (DSM-5, American Psychiatric Association, 2013).

According to DSM-5, ADHD has three specifiers depending on presence of symptoms including combined presentation (symptoms of hyperactivity-impulsivity and inattention), predominantly inattentive, or predominantly hyperactive/impulsive (APA, 2013). More than two thirds to three fourths of individuals diagnosed with ADHD present with the combined type at some time in their adulthood (Barkley, 2011). The severity of ADHD can range from mild, where only a few symptoms are present and cause minor impairments, to severe. Individuals with severe ADHD present with more symptoms than are required for the diagnosis, which result in marked impairment in functioning in multiple settings (home, social, school or work

environments). ADHD is a neurodevelopmental disorder, where symptoms first appear in childhood prior to the age of 12 years. Some of the other disorders that commonly occur in individuals with ADHD include comorbid psychiatric disorders such as oppositional defiant disorder, intermittent explosive disorder, autism spectrum disorders, disruptive mood dysregulation, as well as anxiety, bipolar and depressive disorders. Associated features with the disorder include low frustration tolerance, irritability, and quick changes in mood (APA, 2013).

Prevalence Rates and Associated Problems

ADHD is one of the most common conditions with prevalence rates ranging from 6.0 to 9.5% of school-age children, 2-6% of teens and 1.5-2.0% of adults (Barkley, 2015). ADHD is a chronic disorder that persists in 50-80% of adolescents and 35-65% of adults first diagnosed in childhood (Barkley, 2015). In adulthood, ADHD is associated with low socio-economic status, lower academic and professional success, frequent job changes, unemployment, accidents, imprisonment, conflicts in relationships, substance abuse, and antisocial behaviors (Hirsch, Chavanon, Riechmann, & Christiansen, 2018). Martel (2009) found differences in presentation subtypes in adults where inattentive ADHD symptoms were related to high neuroticism, low openness, and low conscientiousness, while hyperactive-impulsive ADHD symptoms were related to high neuroticism, high extraversion, low agreeableness, and low conscientiousness.

When considering gender differences between males and females with ADHD, the published literature suggests that the prevalence of ADHD in males is 2-9 times higher than in females in clinical samples. When entering adulthood, the prevalence between men and women with ADHD becomes more equivalent, with men being two times more likely to have the disorder. It has been suggested that during childhood, there are many factors that contribute to the lack of diagnosis of ADHD in females. Some common factors that attribute to the lack of

diagnosis include differences in predominant symptoms and subtype, the presence of other comorbid disorders, the lack of referral by others for treatment, and the tendency for covert aggression to be more prominent in females and for physical aggression in females with ADHD to be less prominent (Quinn & Madhoo, 2014).

Research has found symptom differences in ADHD between males and females. Specifically, inattentiveness is generally more common than hyperactivity and impulsivity in females with the disorder. Females may have fewer symptoms than males, but they can be just as affected by the symptoms they do present with when compared to males. One symptom that shows more prominence in females with ADHD compared to males with ADHD is low self-esteem. In school aged females with the disorder, impaired executive function was shown to diminish self-esteem, which could result in lower peer acceptance. This can persist into adulthood as well, since it has been found that women with attention-deficit/hyperactivity disorder tend to struggle with negative self-image compared to their male counterparts with the disorder. This can result in impaired social behaviors and interpersonal relationships (Quinn & Madhoo, 2014).

Etiology and Physiological Factors

While the etiology is complex, research suggests that both genetic and environmental factors increase the risk for ADHD. Variations in the dopamine receptors that are important in the activation of frontal-striatal regions and rare chromosomal deletions or duplications are routinely reported in individuals with ADHD (Barkley, 2015; Tharpar et al., 2017). Research has also shown that up to 71-73% of the variance in the ADHD trait is attributed to genetic factors (Barkley, 2015). A family history of ADHD symptoms is among the most influential factors of the presence of ADHD in twin studies (50-95%) with an average of 70-80% across studies.

While other influences include low birth weight, complications during pregnancy and/or delivery, exposure to environmental toxins (lead, prenatal exposure to alcohol smoking), traumatic brain injury and autoimmune diseases have been found, genetic factors appear to play a substantial role in ADHD symptomology (Barkley, 2015; Hawi et al., 2015).

Neuroimaging research over the past two decades has shown maturational delays, structural differences in brain regions and abnormalities in functional networks in both adults and children with ADHD. Among the most salient findings come from longitudinal studies spanning 17 years. Shaw and colleagues reported that, when compared to healthy children, youths with ADHD have a 2-5 year maturational delay in gray matter and cortical thickness in 'executive' regions including frontal, parietal, and temporal cortices; with, smaller overall volumes in the basal ganglia (caudate) and cerebellum (Shaw, Eckstrand, & Sharp et al., 2007; Shaw et al., 2014). These brain regions mediate attention, impulsivity, cognitive and executive processes (planning, decision making), inhibition and regulation of emotions and behaviors (Shaw et al., 2014). Brain volume differences were greatest for children, correlated with symptom severity and persistent ADHD; while, increased maturation of prefrontal regions appeared in those children whose ADHD symptoms remitted over time (Friedman & Rapoport, 2015).

In a cross-sectional report of data from the International ENIGMA Working Group collaboration, MRI scans on 1713 individuals with ADHD (aged 4-63 years, median age = 14 years) were compared to 1529 controls (Hoogman et al., 2017). A meta-analysis of data collected across 23 research sites, which represents the largest data set on ADHD individuals, supported the maturation delay theory advanced by Shaw and colleagues (2014). Additionally, Hoogman et al. (2017) also found structural differences in subcortical regions including the amygdala and

hippocampus – the amygdala is associated with emotional regulation, whereas, the hippocampus may have a “role in the regulation of motivation and emotion” (p. 316).

Current research suggests that anomalies in specific brain regions, including the amygdala, ventral striatum, and orbitofrontal cortex, that process emotional stimuli are associated with difficulties in emotional regulation (Shaw et al., 2014). The next sections explore the relationship between emotion dysregulation, behavioral impulsivity and ADHD.

Emotion Dysregulation in ADHD

In addition to the three core features (hyperactivity, impulsivity and inattention), studies have shown that many individuals with ADHD have deficits in emotion regulation or the ability to regulate intense emotions (Barkley, 2015; Hoogman et al., 2017). Shaw et al. (2014) assert that, to date, research has not resolved the issue of whether ADHD and emotional dysregulation are separate dimensions, whether emotion dysregulation is a diagnostic feature of ADHD, or if both are present, they are distinct from either ADHD or emotion dysregulation. Shaw et al. (2014) define emotion regulation “as an individual’s ability to modify an emotional state so as to promote adaptive, goal-oriented behaviors” (p.277). Others suggest that emotional regulation includes the awareness, understanding, and acceptance of one’s emotions, an ability to use goal-directed behaviors, even when experiencing negative emotions, and an ability to recognize negative emotions as part of life (Flannery, Becker, & Luebbe, 2016).

Self-regulation refers to actions one takes to change behaviors in an effort to alter future outcomes or to achieve a goal (Barkley, 2011). Barkley (2011) states that executive functioning and self-regulation are interchangeable constructs that reflect the same underlying processes. Research has long recognized self-regulation difficulties in those with ADHD, and while not

unique to ADHD, early conceptualizations considered emotion dysregulation as core symptoms of ADHD (Barkley, 2011; Shaw et al., 2014).

Some researchers suggest that emotional dysregulation includes temper control, affective lability, and emotional over reactivity or stress intolerance (Corbisiero, 2013). Emotion regulation appears to be critical for managing current difficulties and for adapting to past and future affective reactions. Campos and colleagues (2004) define emotions as the process of identifying the importance of a physical and mental event, as the person determines the significance of the event and define emotional regulation as modifying any process of the production of emotion or its expression as behavior.

Although emotional dysregulation appears related to both internalizing and externalizing disorders, Macklem (2008) stated that ADHD is primarily a “disorder of self-regulation” (p.17). Poor cognitive control, deficient working memory and the inability to inhibit responses contribute to problems regulating emotions (Shaw et al., 2014). Emotional dysregulation is especially obvious during frustration-eliciting tasks and both affective and behavioral responses may be coded (Martel, 2009).

What is not clear in the literature are the exact mechanisms involved in these processes. Evidence supports both “bottom-up” processes where lower brain regions (i.e., amygdala, thalamus, ventral striatum and orbitofrontal cortex) orient the attentional system, recognize the importance (salience) of the stimuli, assess the presence of rewards, and “signal that control is needed”; while, “top-down” processes direct attention (toward or away from emotional stimuli) and exert appropriate effort to modify a response (Shaw et al., 2014, p. 5). Regions that connect lower brain processes to higher cortical regions necessary for effortful control over emotional reactions appear to be involved in emotional processing and control. Thus, the manifestations of

emotional dysregulation in ADHD may include low frustration tolerance, impatience, and quick to anger.

In summary, “bottom-up” processes help us read and assess the situation while “top-down” processes help us allocate attention and inhibitory resources needed to regulate our responses to emotionally charged stimuli. Effective regulations of emotions require that attentional systems detect relevant emotional stimuli and signal that control is needed, while frontal regions allocate resources to effectively manage strong emotional reactions. The authors suggest that individuals may vary in terms of the processes which are compromised such that, individuals with ADHD and emotional dysregulation may differ from those without emotional dysregulation (Shaw et al., 2014).

The Impact of Emotional Dysregulation on Functional Life Domains

Recent research confirms that emotional dysregulation is common in adults with ADHD and is associated with impairment in several major life activities (Corbisiero et al., 2017). Individuals with ADHD and emotion dysregulation show considerably more impairment in peer and family relationships, professional achievement, and academic performance than those with ADHD alone (Hirsch et al., 2018; Shaw et al., 2014). Problems with emotional regulation are associated with difficulties in the workplace. Furthermore, difficulties in emotional regulation affect both the severity and chronicity of ADHD through the lifespan, and emotion regulation problems in adults with ADHD have a greater adverse effect than hyperactivity and inattention do on well-being and on self-esteem (Shaw et al., 2014).

Emotional dysregulation is not unique to ADHD and is associated with symptoms of anxiety, intense discomfort, uncontrolled behavior, and withdrawal (Macklem, 2008). It is not clear whether emotion dysregulation is an underlying feature of all these disorders (i.e., conduct,

personality, mood, anxiety, eating and substance use) or whether these are comorbid disorders (Corbisiero et al., 2017). In a study of 213 adults with ADHD, Hirsch et al. (2018) found that ADHD core symptoms were distinct from positive and negative affect, and emotion regulation; however, negative affect and poor emotion regulation was indicative of adult ADHD.

Shaw et al. (2014) suggest that emotion regulation may improve when treated with some forms of psychotherapy (e.g., mindfulness and/or stress tolerance) and ADHD medications. Hirsch et al. (2018) also suggested that dialectic behavioral therapy might be useful for emotion regulation training in adults with ADHD. These authors outline steps for emotion regulation training: (1) identify specific emotions that need to be regulated; (2) select an emotional regulation strategy; (3) apply the strategy; and finally, (4) continuously monitor the strategy that was applied. Although common cognitive-behavioral treatments appear to have “limited impact on core symptoms of ADHD,” Shaw et al. (2014, p. 9) stated they may increase the ability to regulate emotions.

It seems reasonable to explore whether behavioral impulsivity and emotional dysregulation reflect different aspects of bottom-up and/or top-down processing. Bottom-up processing is more reactive and automatically initiates emotional reactions while top-down processing is more reflective, and facilitates inhibitory control (Peckham & Johnson, 2018). The literature has not fully investigated the degree to which emotion dysregulation leads to behavioral impulsivity, whether these are distinct difficulties, or whether ADHD presentation types differ on these processes. The next section briefly reviews these deficits and explores the overlap of the two processes.

When considering the link between ADHD and emotion regulation, the Difficulties in Emotion Regulation Scale has been a measure frequently used in research (Bardeen, Tull, Dixon-

Gordon, Stevens, & Gratz, 2015; Flannery, Becker, & Luebke, 2016; Gratz & Roemer, 2004; Mitchell, Robertson, Anastopolous, Nelson-Gray, & Kollins, 2012; Schreiber, Grant, & Odlaug, 2012). The DERS is used to find a score showing overall emotion dysregulation, where higher scores suggest greater emotion regulation difficulties. The DERS has been found to prove strong psychometric abilities and was also found to be related to youth ratings of problems with externalization and internalization (Seymour et al., 2012). It has been found that the DERS has high internal consistency ($\alpha = .93$), a high test-retest reliability (.88), and an adequate construct validity (.69) (Gratz & Roemer, 2004). The Difficulties in Emotion Regulation Scale was used in the present study to gauge participants' difficulties in the regulation of their emotions.

Behavioral Impulsivity and ADHD

The core symptom of impulsivity refers to acting without thinking and prematurely responding to events that tend to yield unfavorable and/or harmful consequences (APA, 2013; Schreiber, Grant, & Odlaug, 2012). Impulsive responses to strong emotions are a common feature of numerous forms of psychopathology (Peckham & Johnson, 2018), and may contribute to the use of maladaptive strategies when attempting to regulating emotions (Schreiber et al. 2012). In ADHD, impatience, low frustration tolerance, hot-temperedness, quickness to anger, irritability, and emotionally excitability are associated with behavioral impulsivity (Barkley & Fischer, 2010). So, do negatively charged emotions drive impulsive responding or are they so interrelated they cannot be distinguished?

Due to the increased interest in the link between emotions and behaviors, researchers have begun to explore ways to measure different aspects of impulsivity. Whiteside and Lynam (2001) developed the UPPS-P behavior scale using factor analytic methods exploring dimensions of impulsivity. The UPPS-P, a 59 item self-report scale for both adolescents and adults is

comprised of five subscales including negative urgency, positive urgency, (lack of) premeditation, (lack of) perseverance, and sensation seeking (Whiteside, Lynam, Miller, & Reynolds, 2005). The urgency subscale measures the tendency to act impulsively when faced with negative emotions, while premeditation assesses failures to reflect on the negative consequences of impulsive responding (Peckham & Johnson, 2018). The lack of perseverance subscale assesses the ability to focus and persevere on challenging/boring tasks, while sensation seeking assesses the extent to which one engages in behaviors that may be dangerous or harmful.

In a study of children aged 9 to 12 years of age, Peckham and Johnson (2018) found that underlying impulsivity traits measured by the UPPS-P clearly differentiated ADHD from non-ADHD children and were somewhat useful for classifying presentation types. Specifically, scores on premeditation and perseverance differentiated those with ADHD- combined type (ADHD/C, symptoms of hyperactivity-impulsivity and inattention) compared to those with ADHD predominantly inattentive (ADHD/I). In general, children with ADHD/C had higher levels of impulsivity than the ADHD/I group but the later students also had signs of impulsivity especially when persevering, focusing and completing tasks.

Relationship between Emotional Dysregulation and Behavioral Impulsivity

Emotional dysregulation explains impairments associated with ADHD, such as social rejection, conflicts in parent–child interactions, parenting stress, road rage, and increased interpersonal conflicts in the workplace that are not fully explained by inattention and/or hyperactivity/impulsivity (Barkley & Fischer, 2010). Barkley and Fischer (2010) found that emotional dysregulation contributed further behavioral impairments beyond core ADHD symptoms that interfere with family functioning, social interactions, dating relationships, money management, driving, and recreational activities. Overall, high rates of behavioral impulsivity

likely arise from ADHD and deficits in the “top down” inhibition and regulation of emotion (Barkley & Fischer, 2010).

Poor cognitive control over emotions, often displayed as a tendency to have impulsive thoughts and actions, occurs in situations when emotions are heightened (Johnson, Carver, & Joormann, 2013). Furthermore, poor response inhibition and deficits in working memory are common links to impulsivity (Peckham & Johnson, 2018). Working memory and response inhibition training have been effective in reducing emotion-related impulsivity. Training of working memory and response inhibition have also been shown to improve in emotion regulation (Peckham & Johnson, 2018).

Rationale for Current Study

While there is growing research exploring the relationship between ADHD, emotional dysregulation and behavioral impulsivity, it is not clear whether these problems are unique or part of the same integrated processes. That is, I was interested in exploring whether core symptoms of inattention and hyperactivity were related to impulsive behaviors and/or emotion dysregulation separately; or, does impulsivity lead to difficulties in emotional regulation apart from core symptoms of inattention and hyperactivity? This study addressed two major themes. First, I investigated the extent to which individuals with ADHD symptoms also displayed emotional dysregulation and impulsive behaviors. Second, the study explored the extent to which inattention and hyperactivity mediated the relationship between impulsive behaviors and difficulties in emotional regulation in college students. Students with and without a history of ADHD were included in an effort to determine whether emotional dysregulation and impulsive behaviors occur in the typically developing college students.

Subthreshold ADHD includes individuals who do not meet the full criteria for ADHD, as specified in the DSM-V (APA, 2013). Although individuals may not meet criteria for the disorder, those with subthreshold ADHD often report a chronic history of three or more inattentive symptoms or three or more hyperactive-impulsive symptoms, which can be described as a milder form of the disorder (Faraone et al., 2006; 2009). The authors found in their study that those with subthreshold ADHD were more impaired than groups without ADHD. The study also found that even mild symptoms of ADHD persist into adulthood and are present in individuals who have trouble regulating their emotion (Faraone et al., 2006). This study will assess the relationship between ADHD symptomology in adults, regardless of diagnosis, and difficulties in impulsivity and emotional self-regulation.

Identifying individuals with subthreshold symptoms of ADHD is consistent with researchers concerned about the categorical approach to the diagnosis of all mental health disorders (Insel et al. 2010). It has been suggested that adopting a dimensional approach could aid in identifying dimensions of both behavioral and emotional dysregulation in youth that are subsumed by categorically-defined diagnoses (Portugal et al., 2016). Given the high rates of comorbidity and overlapping symptoms among common disorders, it seems important to investigate the extent to which problems with low frustration tolerance, irritability, and rapid mood changes are present in individuals that are high on the continuum of ADHD symptoms but do not meet diagnostic criteria for the disorder. It is important to assess the extent to which these problems occur in a general population of college-age students; that is, a dimensional approach for identifying the specific nature of these psychological and behavioral constructs.

Within that context, the current study investigated the following research questions.

Research Questions

1. Are symptoms of inattention and hyperactivity as measured by the (BAARS-IV) related to impulsive behaviors as measured by the Impulsive Behavior Scale (UPPS-P) in college students?
2. Are symptoms of inattention and hyperactivity related to difficulties in emotional regulation (DERS)?
3. Are impulsive behaviors (UPPS-P) related to difficulties in emotional regulation (DERS) in college students?
4. Do levels of inattention and hyperactivity (BAARS-IV) mediate the relationship between impulsivity (UPPS-P) and difficulties in emotional regulation (DERS)?

Methods

Participants

Undergraduate students enrolled at a public university and enrolled in any psychology course offered in the spring 2019 semester were invited to participate in the study. The participants were recruited through the SONA system, which is a cloud-based participant pool software for universities. Participants received class credit for their involvement in the study. Based on literature review and statistical methodology, it was determined that 85 students would be needed to participate in the research. This was determined by finding the G*Power for a Linear multiple regression: fixed model, single regression coefficient with the effect size as 0.08,

95%, with 2 predictors Participants were required to be 18 years and older to be considered for the study.

There were 114 undergraduate students who participated in the study; where, 30.7% of the sample were freshman, 21.1% were sophomores, 27.2% were juniors, and 21.1% were seniors. The mean age was 21.36 years old with ages ranging from 18 years old to 64 years old. There were 88 females, 25 males, and 1 transgender male that participated in the study. Within the sample, 49.1% were Caucasian, 37.7% were African American, 7% were Hispanic/Latino, 1.8% were American Indian/Alaska Native, 0.9% preferred not to answer, and 3.5% marked “other”. See Table 1 for a summary of demographics. 13 students identified as having a history of ADHD, which represents approximately 9% of the sample. Of those, six students reported that they were currently taking ADHD medications (i.e., Adderall, Strattera, Vyvance, or Ritalin) while one student was prescribed an antidepressant.

Procedure

Participants were tested in groups of up to 10 in a room with individual computer stations to reduce distractions. Upon arrival, participants were greeted by the experimenter and were given the information letter informing participants about the nature of the study and the contact information of the researcher. The experimenter answered any questions that the participants had concerning the study. Participants were told they were free to leave at any point during the study without penalty. The experimenter opened the survey from a link on SurveyGizmo for participants to complete.

First, participants completed the counterbalanced assigned measures, two subscales of the Barkley Adult ADHD Rating Scale-IV (BAARS-IV), the Difficulties in Emotion Regulation Scale (DERS), and the Impulsive Behaviors Scale (UPPS-P). Following the three measures,

participants were asked to provide demographic information regarding age, gender, and history of ADHD. After all tasks were completed, participants were given a brief overview of the purpose of the experiment and were given an opportunity to ask any questions before leaving the lab. Students were also provided with campus and community resource information if any part of the experiment evoked emotions requiring mental health services, or if they wanted further testing for ADHD.

Measures

Subscales of the Barkley Adult ADHD Rating Scale (BAARS-IV) were utilized in this study. The BAARS-IV is a self-report measure that assesses current symptoms of ADHD, age of onset of the symptoms, and impairments associated with the symptoms. The BAARS-IV assesses major symptom clusters including inattention and hyperactivity (Barkley, 2011). Items on the inattention scale include failure to give close attention to details in work, difficulty sustaining attention in tasks, not listening when spoken to directly, not following through on instructions and/or failing to finish work (etc.). Hyperactive symptoms include feeling fidgety, restless, and always on the go (Barkley, 2011). Scores were calculated by adding the responses and higher scores suggest greater problems with hyperactivity or inattention. Possible scores for hyperactivity ranged from 0 to 4. Possible scores for inattention range from 0 to 9. The BAARS-IV has high levels of reliability (.92) and high validity (.67) (Barkley, 2011). See Appendix A for this measure.

The Difficulties in Emotion Regulation Scale (DERS) measures difficulties in emotion regulation (Gratz & Roemer, 2004). The DERS consists of 36 questions across six dimensions of emotion dysregulation, including lack of awareness of emotional responses, lack of clarity of emotional responses, nonacceptance of emotional responses, limited access to emotion regulation

strategies perceived as effective, difficulties controlling impulses when experiencing negative emotions, and difficulties engaging in goal-directed behaviors when experiencing negative emotions. The DERS has adequate levels of construct validity (.69) and high test-retest reliability (.88) (Gratz & Roemer, 2004). Scores were calculated by adding the responses and higher scores suggest greater problems with emotion regulation. Possible scores ranged from 36 to 142. See Appendix B for this measure.

The Urgency, Premeditation (lack of), Perseverance (lack of), Sensation Seeking, Positive Urgency, Impulsive Behavior Scale (UPPS-P) measures impulsive behaviors (Miller et al., 2010). It has statements that describe ways in which people act and think and requires that participants rate each statement on a scale from 1 to 4 on how much they agree with the statement. Participants choose 1 if they strongly agree with the statement and 4 if they strongly disagree. Scores are obtainable from each of five subscales and gives a total impulsivity score. The mean for the subscales is calculated for the items on each subscale, from 1 to 4, where 1 indicates that the participants did not indicate impulsive answers, and 4 indicating a high level of self-reported impulsivity. The five subscales include Negative Urgency, Lack of Premeditation, Lack of Perseverance, Sensation Seeking, and Positive Urgency. Urgency refers to the tendency to act impulsively especially when experiencing negative feelings. Lack of Premeditation refers to the tendency to fail to think and reflect on the consequences of an act before engaging in that act. Lack of Perseverance shows difficulties remaining focused on a task that may be long, boring, or difficult. Finally, Sensation Seeking encompasses the tendency to enjoy and pursue exciting activities and an openness to trying new experiences that may or may not be dangerous (Miller et al., 2010). Scores were calculated by adding the responses and higher scores suggest

greater problems with impulsivity. Scores were not looked at in the subscale level. Possible scores ranged from 90 to 178. See Appendix C for this measure.

Current Study

I scored participant answers on the Barkley Adult Attention-Deficit/Hyperactivity Disorder Rating Scale to determine whether they endorsed two core symptoms of ADHD, inattention and hyperactivity. The total number of symptoms endorsed on the inattention and hyperactivity subscales were calculated. Higher scores suggested more hyperactivity and inattention. Next, researchers scored responses on the Difficulties in Emotion Regulation Scale to determine the level of the participants difficulties with emotion regulation. Some items were reverse scored, and a total was calculated for each participant to determine their overall difficulty with emotion regulation. Higher scores suggested more difficulty with emotion regulation. Finally, researchers scored responses on the UPPS-P Impulsive Behavior Scale to determine their level of impulsivity. Some items were reverse scored, and a total was calculated for each participant to determine their level of impulsivity. Higher scores suggested more impulsivity.

Hypotheses and Proposed Analyses

Hypothesis 1. It was hypothesized that symptoms of inattention and hyperactivity as measured by the Barkley Adult ADHD Rating Scale-IV (BAARS-IV) would be positively correlated with impulsive behaviors as measured by the UPPS-P Impulsive Behavior Scale.

Hypothesis 2. It was hypothesized that symptoms of inattention and hyperactivity as measured by the subscale scores from BAARS-IV will be positively correlated to difficulties in emotional regulation as measured by the Difficulties in Emotion Regulation Scale (DERS).

Hypothesis 3. It was hypothesized that impulsive behaviors measured by the UPPS-P are positively related to difficulties in emotion regulation measured by the DERS. Students with higher levels of impulsivity will have more difficulty regulating their emotions.

Hypothesis 4. It was hypothesized that inattention and hyperactivity would mediate the relationship between impulsive behaviors and difficulties in emotional regulation.

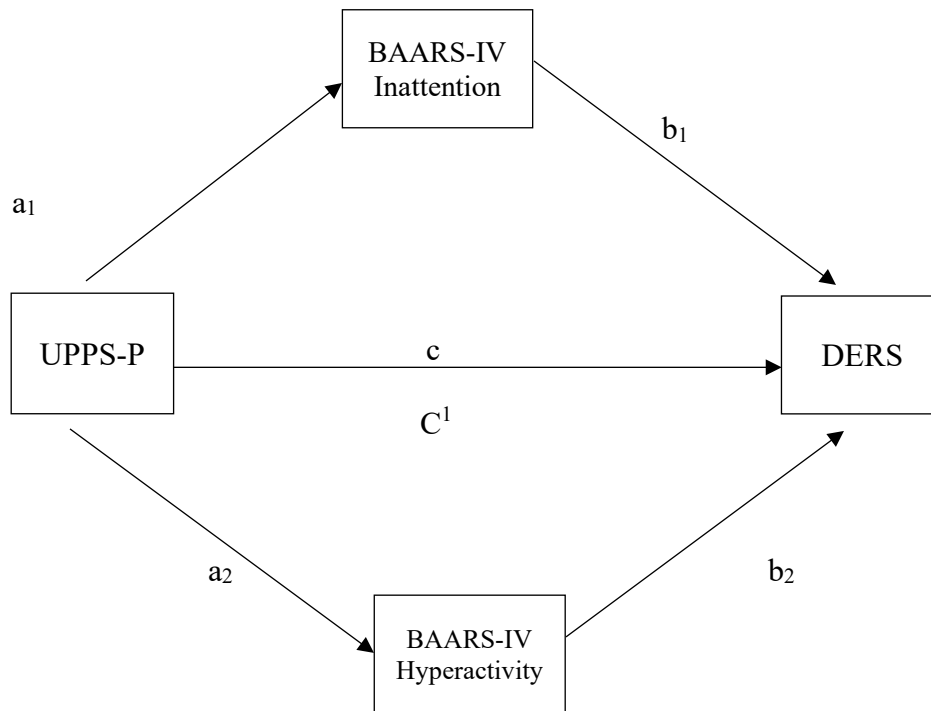


Figure 1. Hayes PROCESS Model 4. X = predictor variable (DV), UPPS-P Impulsive Behavior Scale; M_1 = mediator variable 1, Barkley Adult ADHD Rating Scale - Inattention; M_2 = mediator variable 2, Barkley Adult ADHD Rating Scale - Hyperactivity; Y = outcome variable (IV), Deficits in Emotion Regulation Scale

Results

Table 2 provides a summary of descriptive statistics for the study variables for the total sample and for those with a history of ADHD. Scores on the BAARS-IV Inattention scale ranged between 0-9 (higher scores represent higher levels of inattentive symptoms), with an average of 2.54 for the non-ADHD group, and 4.3 for the ADHD group. The BAARS-IV hyperactivity scores ranged between 0-4 (higher scores represent more hyperactivity) with an average of 1.71 for the non-ADHD sample, and mean scores for the ADHD group were somewhat higher at 2.46. Scores on the DERS data ranged from 39-142 (higher scores represent higher levels of emotional dysregulation), with an average of 84.29 for the total non-ADHD group, whereas the mean score of the ADHD group was somewhat higher (91.08). UPPS-P scores ranged from 75-142 (higher scores represent more impulsivity); with an average of 120.72 for the non-ADHD group and 132.92 for the ADHD group (range 101-153). Table 3 provides a summary of correlations among study variables.

Hypothesis Testing

In the multiple linear regression analysis testing Hypothesis 1, inattention and hyperactivity served as the predictor variables and impulsive behavior was the outcome variable. In this analysis, combined BAARS-IV scores of inattention and hyperactivity significantly predicted impulsivity ($F(2, 112) = 5.18, p = .007$), and accounted for 9% of the variance in impulsive behavior ($R = .29; r^2 = .085$). This was not in the direction that was predicted. While both variables were negatively correlated with impulsivity, hyperactivity was significantly correlated ($\beta = -.217, p = .03$) to impulsive behavior. Inattention ($\beta = -.129, p = .195$) did not contribute significantly to the variance in impulsive behavior. Despite finding a significant relationship between the predictors and the outcome variables, Hypothesis 1 is not supported.

The direction of the relationship was not in the predicted direction; that is, high levels of impulsivity are related to low levels of hyperactivity.

A multiple linear regression was used to test Hypothesis 2, where inattention and hyperactivity served as predictor variables and difficulties in emotional regulation was the outcome variable. The overall model was significant ($F(2, 112) = 17.04, p < .001$) and explained 24% of the variance in difficulties in emotional regulation. In this analysis, while inattention was the strongest predictor variable ($\beta = .33, p < .001$), hyperactivity ($\beta = .247, p = .01$) was also significant. Hypothesis 2 was supported as difficulties in emotional self-regulation was predicted by high levels of both inattention and hyperactivity.

In the multiple regression analysis for Hypothesis 3, impulsive behaviors served as the predictor variable while difficulties in emotional regulation was the outcome variable. The overall regression ($F(1, 112) = 11.67, p = .001$) was significant, but the relationship was not in the predicted direction. Impulsivity was negatively correlated with difficulties in emotional regulation ($\beta = -.31, p < .001$) and accounted for 9% of the variance in difficulties in emotional regulation. Hypothesis 3 is not supported because high levels of difficulties in emotional self-regulation is related to low levels of impulsivity. This relationship was in the opposite direction that I hypothesized.

In Hypothesis 4, I predicted that inattention and hyperactivity would mediate the relationship between impulsivity (UPPS-P) and deficits in emotional regulation (DERS). In the Hayes (2018) parallel multiple mediator model (PROCESS model 4), the independent or antecedent variable (impulsivity) is assumed to have a direct effect on multiple mediators (i.e., inattention and hyperactivity) which then influence the outcome variable (deficits in emotional regulation). The PROCESS analysis generated bootstrap confidence intervals (95%) for all

direct and indirect effects and all pairwise comparisons using 5,000 bootstrap comparisons (Hayes, 2018).

The parallel multiple mediator model allows for partitioning of the total effects of the predictor variable X (impulsivity) on the outcome variable Y (deficits in emotional regulation), into both direct and indirect components to compare the size of the effect of each mediator (Hayes, 2018). Specifically, Model 4 provides a means to determine which indirect effect is strongest after controlling for the effects of the other mediator. Figure 1 shows the total effect (c) of the relationship between impulsivity and deficits in emotional regulation without controlling for the mediators. Direct effects between X (impulsivity) and individual mediators (a_1 , inattention, a_2 , hyperactivity), and Y (deficits in emotional regulation) and the mediator variables (b_1 , b_2) are depicted in Figure 1. Finally, (C_1) shows the direct effect between the predictor and outcome variables after controlling for the influence of the mediators inattention (a_1 , b_1) and then hyperactivity (a_2 , b_2) above and beyond inattention.

Total Effect (c path). The analysis showed that the total effect of the predictor variable (X , impulsivity) on the outcome variable (Y , deficits in emotional regulation) was significant ($F(1,112) = 11.67, p. <.001$). Impulsivity was negatively correlated with deficits in emotional regulation ($B = -.41, p. <.001$), and accounted for 9% of variance. As levels of impulsivity increased, on average, deficits of emotional regulation decreased by .41 points.

Individual Effects (a paths are effects of the predictor variable on potential mediators; b paths are effects of mediators on the outcome variable).

The analysis showed that the direct effect of impulsivity on inattention (a_1) was significant ($F(1, 112) = 5.36, p. = .02$), and, was negatively correlated ($B = -.03$). Impulsivity explained 5% of the variance in inattention. The direct effect of impulsivity on hyperactivity (a_2)

was also significant ($F(1,112) = 8.60, p < .00$); where, hyperactivity explained an additional 2% of the variance in impulsivity after controlling for inattention. Hyperactivity was negatively correlated to impulsivity ($B = -.02, p = .00$), and decreased .02 points as impulsivity increased.

There were significant direct effects for inattention and hyperactivity on deficits in emotional regulation in the predicted directions ($F(3, 110) = 13.33, p < .001$). Inattention (b_1) was positively correlated with the DERS ($B = 3.03, p < .001$), so that deficits in emotional regulation increased as inattention increased. Hyperactivity (b_2) was also positively correlated with the DERS ($B = 3.74, p = .03$) and influenced deficits in emotional regulation in the same direction as inattention. Together inattention and hyperactivity accounted for 27% of the variance in the outcome variable.

Indirect effects (a_1b_1 and a_2b_2). The indirect effect of impulsivity on deficits in emotional regulation via hyperactivity (a_2b_2) was significant ($B = -.07, SE .04$), since the 95% of lower level (LL) and upper level (UL) confidence interval did not cross zero $[-.1651, -.0025]$. Further, the relationship between impulsivity on deficits in emotional regulation via inattention ($a_1b_1, B = -.09, SE = .05 [-.1973, .0018]$) was not significant.

Direct effects (C_1 path after controlling for the influence of mediating variables a_1b_1 minus a_2b_2).

The total effect of impulsivity on deficits in emotional regulation after controlling for the influence of the mediator variables was significant ($B = -.25, SE = .12, p = .03 [-0.4790, -0.0231]$). Specifically, the path from impulsivity through hyperactivity to deficits in emotional regulation (a_2b_2) was significant ($B = -.07, SE = .04 [-.11651, -.0025]$); and, the path of impulsivity through inattention to emotional dysregulation (a_1b_1) was not significant ($B = -.09, SE = .05 [-.1973, .0018]$). These findings suggest that hyperactivity partially mediated the

relationship between impulsivity and deficits in emotional regulation but not through inattention.

Hypothesis 4 was partially supported.

Discussion

Over the past decade, research investigating the core and associated features of ADHD has been extensive (Barkley, 2015; Hirsch et al., 2018, Martel, 2009). Attempts to explore etiological and physiological features of ADHD revealed maturational delays in brain regions mediating attention, impulsivity, and regulation of emotions and behaviors in children and adults (Hoogman et al., 2017). While the core features of ADHD consist of inattention, hyperactivity and/or impulsivity, difficulties in emotion regulation including irritability, low frustration tolerance and trouble regulating moods appear to be associated features of ADHD (APA, 2013, Barkley, 2015). While difficulties in emotional regulation exist in a number of other psychiatric disorders that frequently co-occur with ADHD (i.e., disruptive mood, anxiety and bipolar disorders), recent research suggests the need to articulate the relationships among these symptoms more clearly.

Despite the recent interest in understanding the relationship of emotion dysregulation and impulsivity in various psychiatric populations, studies have not focused on the presence of these problems in non-psychiatric groups. Do these same problems occur in a general sample of college students? In a longitudinal study, Faraone et al. (2006) found that a small number of adults (25%) display subthreshold symptoms and are more impaired than non-ADHD groups. Faraone et al. (2006) found that this group has fewer symptoms than those with persistent ADHD but regardless of diagnosis, subthreshold symptoms were associated with difficulties in emotion regulation. Other studies suggest that 5-10% of adults have subthreshold ADHD (Busing et al. 2010), while DuPaul et al. (2009) found that 2-8% of college students report ADHD symptoms

and have impaired emotion regulation. Others argue that we need to study young adults and college students with ADHD symptoms that do not meet diagnostic criteria to understand the dimensional nature of the core features of the disorder.

In the current study, I investigated the relationship between behavioral impulsivity, emotion dysregulation, inattention, and hyperactivity in a sample of college students with and without a history of ADHD. Further, the study sought to determine if inattention and/or hyperactivity mediated the relationship between difficulties in emotion regulation and impulsivity. Results indicated that higher levels of impulsivity were associated with lower levels of hyperactivity, while higher levels of emotion dysregulation were related to lower levels of impulsivity. In addition, high levels of emotion dysregulation are related to high levels of both inattention and hyperactivity. Finally, results showed both inattention and hyperactivity mediate the relationship between impulsivity and difficulties in emotion regulation

In Hypothesis 1, I predicted that high levels of ADHD symptoms (inattention and hyperactivity) would be positively correlated with impulsive behaviors in college students. The linear multiple regression analysis showed that while combined BAARS-IV scores of hyperactivity and inattention were significantly correlated with impulsivity, the relationship was not in the predicted direction; thus, Hypothesis 1 was not supported. These findings provide new information surrounding the relationship between inattention, hyperactivity, and impulsivity since previous research has focused on a different population than the current study. The current study showed that higher levels of behavioral impulsivity were related to lower levels of hyperactivity and inattention in a sample of college students. While it is not clear why higher levels impulsivity (UPPS-P) were negatively correlated with ADHD symptoms, several hypotheses seem reasonable.

First, previous studies focused primarily on individuals with a clinical diagnosis of ADHD; whereas, the current study included 13 students with a history of ADHD representing 8.77% of the sample. Scores on the hyperactivity measure were not elevated for the majority of non-ADHD students, where 71% indicated that they had 0-2 hyperactivity symptoms. While the majority of the non-ADHD group also did not endorse high levels of inattention (68% had 0-3 symptoms, 16% recorded 4-5 symptoms) 15% of the students indicated moderate to high levels of inattention. It was somewhat surprising that 19% of the non-ADHD students endorsed moderate to severe symptoms of hyperactivity and 15% reported elevated scores on inattention. These college students' group may have a milder form of ADHD similar to what others have labeled subthreshold ADHD (Busing et al., 2010; DuPaul et al., 2009; Faraone et al., 2006).

Of those participants with a history of ADHD, 46% reported moderate to severe levels of hyperactivity, while 54% had only 1-2 symptoms; with 39% endorsing moderate to severe inattention. Thus, individuals with a history of ADHD indicated higher rates of hyperactivity and inattention even while taking medication.

Post-hoc analysis showed those with a history of ADHD did have higher mean scores than the non-ADHD participants on all study variables (see Table 2). It was somewhat surprising that the non-ADHD group had relatively high scores on impulsivity. This suggests that they may exhibit other mood-related or externalizing problems aside from ADHD symptomology.

The relatively high percentage of students without a history of ADHD with elevated scores on hyperactivity, inattention and impulsivity are interesting. However, given the small number of those reporting a history of ADHD, significance tests were not calculated as these results may distort group differences.

Second, previous studies with ADHD groups have been comprised primarily of male children as participants. This sample was older and predominantly female (77% women). Females with ADHD present differently than males and tend to obtain higher scores on inattention, fewer symptoms of hyperactivity and impulsivity, lower self-esteem, more disorganization and forgetfulness, and less intense anger (Barkley, 2015; Quinn & Madhoo, 2014). It is not clear the extent to which age and gender differences contributed to the results found in these data, but it is something to consider in future studies.

Third, differences in how each questionnaire assessed the targeted behaviors may have contributed to the current findings. For example, questions on the hyperactivity scale focused on narrow behaviors including excessive motor activity, fidgeting, or talkativeness, whereas the impulsive behaviors assessed by UPPS-P items were multifaceted. The questions in the UPPS-P scale appear to assess for a broad spectrum of impulsive behaviors, while not specifically assessing for excessive motor activity, talkativeness, or fidgeting. Miller et al. (2010) found that subscales of the UPPS-P differentiated those individuals with a diagnosis of ADHD combined type (high levels of both inattention and hyperactivity) from ADHD inattentive type. The current study analyzed total scores on the UPPS-P rather than looking at the subscale scores. Future research exploring subscale versus total scores on the UPPS-P may yield different results than reported here.

Fourth, although impulsivity may be a core symptom of ADHD, it is also associated with other conduct related and externalizing disorders. In an investigation of impulsivity, Miller et al. (2010) found that scores on the UPPS-P predicted children with ADHD plus comorbid oppositional defiant disorder (ODD) but did not differentiate ADHD subtypes (hyperactive/impulsive, inattentive or combined types). According to Martel and Nigg (2006),

impulsivity found in those with ADHD may be secondary to antisocial traits rather than occurring with hyperactivity or inattention per se.

In Hypothesis 2, I predicted a positive relationship between symptoms of inattention and hyperactivity and difficulties in emotional regulation (DERS). A linear multiple regression analysis showed that Hypothesis 2 was supported. The data showed that as difficulties in emotion regulation increased so did symptoms of inattention and hyperactivity. ADHD symptoms explained 24% of the variance in emotion regulation. Previous research is consistent with these results even though it has not been determined whether emotion dysregulation is a core feature of ADHD (Bunford, Evans, & Wymbs, 2015). However, Shaw et al. (2014) found that difficulties in emotional regulation were related to both the severity and chronicity of ADHD through the lifespan.

Barkley (2015) reported that adults with ADHD exhibit a primary deficit in inhibition. Further, Barkley found that those with higher levels of hyperactivity and impulsivity also exhibit secondary difficulties in the self-regulation of emotions, motivation, and arousal, while those with higher levels of inattention exhibit secondary deficits in working memory. Thus, the association between ADHD and emotion dysregulation may be more relevant for the hyperactive/impulsive and combined presentations (Bunford et al., 2015).

In Hypothesis 3, I predicted a positive relationship between impulsivity and difficulties in emotion regulation, which was not supported. In fact, higher levels of emotion dysregulation (DERS) corresponded to lower levels of impulsivity (UPPS-P). This provides new information that differs from previous research and may reflect differences in the nature of the sample under study and how constructs were measured.

Mean scores on the UPPS-P were significantly higher than reported in a study conducted by Miller et al. (2010) of children with ADHD between 9.0 to 12.8 years of age. Mean scores for the total sample (both the ADHD and non-ADHD students) in the current study were almost identical to those participants in the ADHD plus oppositional defiant group (143.22 versus 142.62), versus the comparison group (143.22 versus 93.29), the ADHD primarily inattentive group (143.22 versus 114.81), and the ADHD primarily hyperactive group (143.22 versus 119.73). The non-ADHD group alone were more similar to ADHD primarily hyperactive group (120.72 versus 119.73) than the comparison group of children (120.72 versus 93.29). These results suggest that the current sample of college students may have other psychological or behavioral problems not assessed by this study.

Although these results differ from previous studies, differences may reflect variations in study procedures and participants. The current study did not experimentally manipulate emotional arousal nor did it include participants with a formal diagnosis of ADHD. While it may be important to investigate dimensional aspects of impulsivity and emotion dysregulation in college-age students, it is likely more critical to study these variables in carefully diagnosed groups of students with ADHD contrasted against others with subthreshold ADHD, non-ADHD, and mood, antisocial and/or conduct disorders to make sense of these findings. Also direct measures of physiological arousal and impulsive behaviors may yield more robust relationships than self-report.

Hypothesis 4 predicted that inattention and hyperactivity would mediate the relationship between impulsive behaviors and difficulties in emotional regulation. A mediation analysis using Hayes' process model indicated that Hypothesis 4 was partially supported. Hyperactivity

mediated the relationship between impulsivity and difficulties in emotion regulation, but not in the predicted direction. Inattention did not add significantly to the mediational model.

Direct effects were significant for impulsivity (UPPS-P) on inattention and hyperactivity, for difficulties in emotion regulation (DERS) on inattention and hyperactivity, and UPPS-P on DERS. Impulsivity had a significant direct effect on both inattention and hyperactivity and accounted for 7% of the variance, where inattention was the strongest predictor (5% of the variance) but not as anticipated. Thus, levels of impulsivity were highest in college students who were more attentive and less hyperactive. Further, ADHD symptoms had a direct effect on difficulties in emotion regulation in the predicted direction and explained 27% of the variance in the outcome variable (DERS). Individuals who reported higher levels of inattention and hyperactivity indicated more trouble regulating both positive and negative emotions, and indicated higher levels of irritability, frustration, and sadness (DERS). The total effect of impulsivity on difficulties in emotional regulation without controlling for the mediators was significant. Although the strength of the relationship reduced, the total effect of the predictor (impulsivity) on the outcome variable (difficulties in emotional regulation) remained significant after controlling for the mediators. Specifically the mediational analyses showed indirect effects of impulsivity on emotional regulation through hyperactivity but not inattention. Thus, hyperactivity partially mediated deficits of impulsivity on emotional regulation but not in the predicted direction.

These findings are somewhat puzzling and a review of the literature does not provide clear explanations for study results. Research is sparse on the effects of ADHD symptomology on emotion dysregulation in adults. Further, Shaw et al. (2014) indicated that research has not determined whether ADHD and emotional dysregulation are separate dimensions, whether

emotion dysregulation is a diagnostic feature of ADHD, or if both are present, they are distinct from either ADHD or emotion dysregulation. Poor cognitive control, deficient working memory, and the inability to inhibit responses contribute to problems that one may have with emotion regulation (Shaw et al., 2014). This might explain the indirect effects found in the current study, where hyperactivity mediated the relationship between behavioral impulsivity and emotion dysregulation but it does not help us make sense of the direction of these relationships.

It is possible that a different mediation pathway from core ADHD symptoms through emotion dysregulation to impulsivity would have been more coherent model for exploring these relationships. This is exactly what Mitchell et al. (2012) reported; that is, high levels of both ADHD symptoms predicted emotion dysregulation and impulsivity. Once the effects of emotion regulation were controlled, ADHD symptoms were no longer predictive of impulsivity.

Barkley and Fischer (2010) previously found that difficulties in emotion regulation explain specific impairments associated with ADHD, such as social rejection, conflicts in parent–child interactions, parenting stress, road rage, and increased interpersonal conflicts in the workplace. Additionally, Barkley and Fischer determined that inattention and/or hyperactivity/impulsivity do not fully explain difficulties in emotion regulation. Barkley and Fischer also found emotional dysregulation contributes to behavioral impairments beyond the core ADHD symptoms that could interfere with family functioning, social interactions, dating relationships, money management, driving, and recreational activities.

Summary and Conclusions

In summary, the current study provided some insight into the relationship between inattention, hyperactivity, impulsivity and difficulties in emotional regulation in college students. Although there were not a sufficient sample of students with a history of ADHD to make

statistical comparisons with those students without a history, there is evidence that problems with low frustration tolerance, irritability, and rapid mood changes are present in individuals with a continuum of ADHD symptoms. Further, the study also suggests there may be a rather large number of college students with subthreshold ADHD symptoms and difficulties with emotional self-regulation and impulsivity. This study supports future research using a dimensional approach for identifying the specific nature of these psychological and behavioral constructs in a non-clinical sample of college-age students.

Study Limitations

Some limitations of the study are noted. First, there were too few male participants to determine gender differences in the current study. Of the 114 participants, there were 88 females, 25 males, and 1 transgender male that participated. Second, the number of items measuring inattention and hyperactivity on the BAARS-IV questionnaires were limited (9 inattention items and 5 hyperactive items). The full scale of the BAARS-IV or the Conners Adult ADHD scale may be a more robust scale that measures hyperactivity/restlessness, impulsivity/emotional lability, and inattention (Conners, Erhardt & Sparrow, 1999).

This study did not use participants with a formal diagnosis of ADHD. Although thirteen participants reported that at the end of the study they had a previous diagnosis of ADHD, they did not receive a comprehensive evaluation to confirm this report. The relationships among predictor, outcome and mediational variables may look entirely different with adults with higher levels of ADHD symptomology.

Finally, an experimental design may have been able to capture the connection between behavioral impulsivity and emotion dysregulation. An experimental design may be more

sensitive to investigating psychological and behavioral constructs using dimensional versus categorical approaches.

Future Directions

Since Martel (2009) suggested difficulties in emotion regulation are more obvious during frustration-eliciting tasks, in future research it may be beneficial to add a frustrating inducing task to determine whether emotion dysregulation is present. In a comprehensive review, emotion dysregulation exists on a continuum across a various developmental, mood and antisocial disorders (Bunford et al., 2015), and may have a negative impact on interpersonal interactions, self-esteem, and risky behaviors. It will be important for investigators to collect data on the prevalence of these difficulties in children and adults.

Future research may also want to investigate emotion regulations difficulties across presentation types of ADHD (primarily hyperactivity/impulsivity, inattentive or combined). Using the entire BAARS-IV or another measure of adult ADHD (e.g., CAARS) would be beneficial to determine total ADHD symptomology as well as aspects of inattention and hyperactivity. Future studies investigating symptoms on a continuum, including a larger sample of ADHD, subthreshold ADHD and non-ADHD samples may shed light on how quickly individuals react to emotions, recover or modulate strong emotional reactions and impairments associated with these symptoms.

Other predictor and mediator variables may yield important information regarding the relationships among negative emotional affect and behavioral impulsivity. Future studies should incorporate other measures of emotion dysregulation including physiological arousal to generate new hypotheses regarding emotional impulsivity and its influence on behavioral inhibition in adults with ADHD symptomology.

Finally, studies using experimental designs that manipulate delay aversion, frustration tolerance and other negative emotional conditions may capture the nuances of the relationship between hyperactivity, impulsivity and emotion dysregulation. Johnson, Carver, and Joormann (2013) found that poor control over one's emotions, displayed as impulsive actions or thoughts, occur in situations where emotions are intensified. Mitchell et al. (2012) suggested that mindfulness-based treatments that include cognitive behavioral and dialectical group therapy that specifically target emotion regulation might be promising. The extent to which emotion regulation is malleable deserves future consideration in both clinical practice and intervention studies with adults with ADHD (Bunford et al., 2015).

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Table 1*Demographics*

Characteristic	<i>N</i>	%
<u>N</u>	114	100
<u>Age</u>		
Mean	21.36	-
Range	18-64	-
<u>Sex</u>		
Male	25	21.9
Female	88	77.2
Transgender	1	0.9
<u>Ethnicity</u>		
White	56	49.1
Black	43	37.7
Hispanic/Latino	8	7.0
American Indian/ Alaska Native	2	1.8
Other	4	3.5
Prefer not to answer	1	0.9
<u>Class Year</u>		
Freshman	35	30.7
Sophomore	24	21.1
Junior	31	27.2
Senior	24	21.1

Table 2*Means and Standard Deviations for DERS, UPPS-P, and BAARS-IV*

Measures	Mean Non-ADHD (SD)	Mean ADHD (SD)
DERS	84.29 (22.74)	91.08 (25.52)
UPPS-P	120.72 (21.88)	132.92 (16.90)
BAARS-IV Hyperactivity	1.71 (1.27)	2.46 (1.23)
BAARS-IV Inattention	2.54 (2.27)	4.31 (2.36)

Note: UPPS-P measured impulsivity; DERS measured difficulties in emotion regulation.

Table 3*Intercorrelation Matrix*

Measure	1	2	3	4
1 BAARS-IV Inattention	-	.393**	.428**	-.214*
2 BAARS-IV Hyperactivity	.393**	-	.377**	-.267**
3 DERS	.428**	.377**	-	.307**
4 UPPS-P	-.214*	-.267**	-.307**	-

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

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

Note: UPPS-P measured impulsivity; DERS measured difficulties in emotion regulation.

Table 4

Hypothesis 1: Summary of the Multiple Regression Analysis for Variables Predicting Impulsivity

Model	Sum of Squares	df	Mean Square	F	p	β
BAARS-IV Inattention	1511.13	1	1511.13	5.36	0.02	-.129
BAARS-IV Hyperactivity	2822.14	2	1411.07	5.18	< 0.001	-.217

Table 5

Hypothesis 2: Summary of the Multiple Regression Analysis for Variables Predicting Deficits in Emotion Regulation

Model	Sum of Squares	df	Mean Square	F	p	β
BAARS-IV Inattention	11017.39	1	11017.39	25.16	< 0.001	.33
BAARS-IV Hyperactivity	14106.99	2	7053.49	17.04	< 0.001	.247

Table 6

Hypothesis 3: Summary of the Multiple Regression Analysis for Impulsivity Predicting Deficits in Emotion Regulation

Model	Sum of Squares	df	Mean Square	F	p	β
DERS	3120.09	1	3120.9	11.67	< 0.001	-.31

Note. DERS measured difficulties in emotion regulation.

Table 7

Hypothesis 4: Summary of the Mediation Analysis for Inattention and Hyperactivity Mediating the Relationship between Impulsivity and Deficits in Emotional Regulation

Effect	Path	β	SE	p	95% CI	
					LL	UL
Direct Effect of UPPS-P on Inattention	a ₁	-0.03	0.01	0.02	-0.0543	-0.0042
Direct Effect of UPPS-P on Hyperactivity	a ₂	-0.02	-.01	0.02	-0.0332	-0.0064
Direct Effect of DERS on Inattention	b ₁	3.03	0.88	< 0.001	1.2804	4.7718
Direct Effect of DERS on Hyperactivity	b ₂	3.74	1.65	0.03	0.4824	7.006
Total Effect of UPPS-P on DERS (without accounting for Inattention and Hyperactivity)	c	-0.41	0.12	< 0.001	-0.6539	-0.1738
Total Effect of UPPS-P on DERS (accounting for Inattention and Hyperactivity)	c ₁	-0.25	0.12	0.03	-0.4790	-0.0231
Indirect Effect of Inattention	a ₁ b ₁	-0.07	0.04	>0.05	-0.1973	0.0018
Indirect Effect of Hyperactivity	a ₂ b ₂	-0.06	0.03	>0.05	-0.1651	-0.0025

Note: UPPS-P measured impulsivity; DERS measured difficulties in emotion regulation.

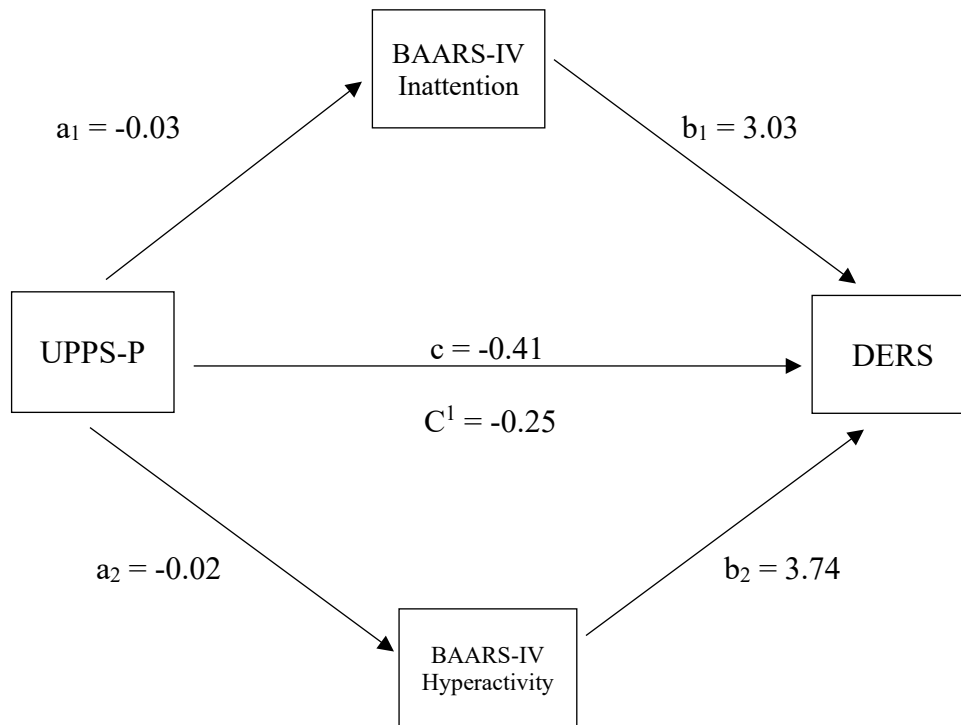
Figure 1

Figure 1. Hayes PROCESS Model 4. X = predictor variable (DV); M₁ = mediator variable 1; M₂ = mediator variable 2; Y = outcome variable (IV)

X UPPS-P impulsivity

M₁ BAARS-IV inattention

M₂ BAARS-IV hyperactivity

Y DERS difficulties in emotional regulation

Appendix A**BAARS-IV**

Please mark the box next to each item that best describes your behavior **DURING THE PAST 6 MONTHS**.

Section 1 (Inattention)	No, this does not occur often	Yes, this occurs often or very often
1. Fail to give close attention to details or make careless mistakes in my work or other activities		
2. Difficulty sustaining my attention in tasks or fun activities		
3. Don't listen when spoken to directly		
4. Don't follow through on instructions and fail to finish work or chores		
5. Have difficulty organizing tasks and activities		
6. Avoid, dislike, or you are reluctant to engage in tasks that require sustained mental effort		
7. Lose things necessary for tasks or activities		
8. Easily distracted by extraneous stimuli or irrelevant thoughts		
9. Forgetful in daily activities		
Section 2 (Hyperactivity)	No, this does not occur often	Yes, this occurs often or very often
10. Fidget with hands or feet or squirm in seat		
11. Leave my seat in classrooms or in other situations in which remaining seated is expected		
12. Shift around excessively or feel restless or hemmed in		
13. Have difficulty engaging in leisure activities quietly (feel uncomfortable, or am loud or noisy)		
14. I am "on the go" or act as if "driven by a motor" (or I feel like I have to be busy or always doing something)		

Appendix B

Difficulties in Emotion Regulation Scale (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item.

- 1-----2-----3-----4-----5
 almost never sometimes about half the time most of the time almost always
 (0-10%) (11-35%) (36-65%) (66-90%) (91-100%)
- _____ 1) I am clear about my feelings.
 _____ 2) I pay attention to how I feel.
 _____ 3) I experience my emotions as overwhelming and out of control.
 _____ 4) I have no idea how I am feeling.
 _____ 5) I have difficulty making sense out of my feelings.
 _____ 6) I am attentive to my feelings.
 _____ 7) I know exactly how I am feeling.
 _____ 8) I care about what I am feeling.
 _____ 9) I am confused about how I feel.
 _____ 10) When I'm upset, I acknowledge my emotions.
 _____ 11) When I'm upset, I become angry with myself for feeling that way.
 _____ 12) When I'm upset, I become embarrassed for feeling that way.
 _____ 13) When I'm upset, I have difficulty getting work done.
 _____ 14) When I'm upset, I become out of control.
 _____ 15) When I'm upset, I believe that I will remain that way for a long time.
 _____ 16) When I'm upset, I believe that I will end up feeling very depressed.
 _____ 17) When I'm upset, I believe that my feelings are valid and important.
 _____ 18) When I'm upset, I have difficulty focusing on other things.
 _____ 19) When I'm upset, I feel out of control.
 _____ 20) When I'm upset, I can still get things done.
 _____ 21) When I'm upset, I feel ashamed at myself for feeling that way.
 _____ 22) When I'm upset, I know that I can find a way to eventually feel better.
 _____ 23) When I'm upset, I feel like I am weak.
 _____ 24) When I'm upset, I feel like I can remain in control of my behaviors.
 _____ 25) When I'm upset, I feel guilty for feeling that way.
 _____ 26) When I'm upset, I have difficulty concentrating.
 _____ 27) When I'm upset, I have difficulty controlling my behaviors.
 _____ 28) When I'm upset, I believe there is nothing I can do to make myself feel better.
 _____ 29) When I'm upset, I become irritated at myself for feeling that way.
 _____ 30) When I'm upset, I start to feel very bad about myself.
 _____ 31) When I'm upset, I believe that wallowing in it is all I can do.
 _____ 32) When I'm upset, I lose control over my behavior.
 _____ 33) When I'm upset, I have difficulty thinking about anything else.
 _____ 34) When I'm upset I take time to figure out what I'm really feeling.
 _____ 35) When I'm upset, it takes me a long time to feel better.
 _____ 36) When I'm upset, my emotions feel overwhelming.

Appendix C

UPPS-P

Below are a number of statements that describe ways in which people act and think. For each statement, please indicate how much you agree or disagree with the statement. If you **Agree Strongly** circle **1**, if you **Agree Somewhat** circle **2**, if you **Disagree somewhat** circle **3**, and if you **Disagree Strongly** circle **4**. Be sure to indicate your agreement or disagreement for every statement below. Also, there are questions on the following pages.

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
1. I have a reserved and cautious attitude toward life.	1	2	3	4
2. I have trouble controlling my impulses.	1	2	3	4
3. I generally seek new and exciting experiences and sensations.	1	2	3	4
4. I generally like to see things through to the end.	1	2	3	4
5. When I am very happy, I can't seem to stop myself from doing things that can have bad consequences.	1	2	3	4
6. My thinking is usually careful and purposeful.	1	2	3	4
7. I have trouble resisting my cravings (for food, cigarettes, etc.).	1	2	3	4
8. I'll try anything once.	1	2	3	4
9. I tend to give up easily.	1	2	3	4
10. When I am in great mood, I tend to get into situations that could cause me problems.	1	2	3	4
11. I am not one of those people who blurt out things without thinking.	1	2	3	4
12. I often get involved in things I later wish I could get out of.	1	2	3	4
13. I like sports and games in which you have to choose your next move very quickly.	1	2	3	4
14. Unfinished tasks really bother me.	1	2	3	4
15. When I am very happy, I tend to do things that may cause problems in my life.	1	2	3	4
16. I like to stop and think things over before I do them.	1	2	3	4
17. When I feel bad, I will often do things I later regret in order to make myself feel better now.	1	2	3	4
18. I would enjoy water skiing.	1	2	3	4
19. Once I get going on something I hate to stop.	1	2	3	4
20. I tend to lose control when I am in a great mood.	1	2	3	4
21. I don't like to start a project until I know exactly how to proceed.	1	2	3	4

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly
22. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.	1	2	3	4
23. I quite enjoy taking risks.	1	2	3	4
24. I concentrate easily.	1	2	3	4
25. When I am really ecstatic, I tend to get out of control.	1	2	3	4
26. I would enjoy parachute jumping.	1	2	3	4
27. I finish what I start.	1	2	3	4
28. I tend to value and follow a rational, "sensible" approach to things.	1	2	3	4
29. When I am upset I often act without thinking.	1	2	3	4
30. Others would say I make bad choices when I am extremely happy about something.	1	2	3	4
31. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.	1	2	3	4
32. I am able to pace myself so as to get things done on time.	1	2	3	4
33. I usually make up my mind through careful reasoning.	1	2	3	4
34. When I feel rejected, I will often say things that I later regret.	1	2	3	4
35. Others are shocked or worried about the things I do when I am feeling very excited.	1	2	3	4
36. I would like to learn to fly an airplane.	1	2	3	4
37. I am a person who always gets the job done.	1	2	3	4
38. I am a cautious person.	1	2	3	4
39. It is hard for me to resist acting on my feelings.	1	2	3	4
40. When I get really happy about something, I tend to do things that can have bad consequences.	1	2	3	4
41. I sometimes like doing things that are a bit frightening.	1	2	3	4
42. I almost always finish projects that I start.	1	2	3	4
43. Before I get into a new situation I like to find out what to expect from it.	1	2	3	4
44. I often make matters worse because I act without thinking when I am upset.	1	2	3	4
45. When overjoyed, I feel like I can't stop myself from going overboard.	1	2	3	4

	Agree Strongly	Agree Some	Disagree Some	Disagree Strongly	
46. I would enjoy the sensation of skiing very fast down a high mountain slope.	1	2	3	4	
47. Sometimes there are so many little things to be done that I just ignore them all.	1	2	3	4	
48. I usually think carefully before doing anything.	1	2	3	4	
49. When I am really excited, I tend not to think of the consequences of my actions.	1	2	3	4	
50. In the heat of an argument, I will often say things that I later regret.	1	2	3	4	
51. I would like to go scuba diving.	1	2	3	4	
52. I tend to act without thinking when I am really excited.	1	2	3	4	
53. I always keep my feelings under control.	1	2	3	4	
54. When I am really happy, I often find myself in situations that I normally wouldn't be comfortable with.	1	2	3	4	
55. Before making up my mind, I consider all the advantages and disadvantages.	1	2	3	4	
56. I would enjoy fast driving.	1	2	3	4	
57. When I am very happy, I feel like it is ok to give in to cravings or overindulge.	1	2	3	4	1
58. Sometimes I do impulsive things that I later regret.		2	3	4	
59. I am surprised at the things I do while in a great mood.	1	2	3		

EFFECT OF IMPULSIVITY ON EMOTION REGULATION IN ADHD

Appendix D

Demographics Questionnaire Part A: Please answer the following questions about yourself.

1. What is your age? _____
2. Class Standing (circle one): Freshman Sophomore Junior Senior
3. What is your gender? _____
4. What is your ethnicity? (circle one): Black/African-American Caucasian Asian
Hispanic/Latino American Indian/Alaska Native
Native Hawaiian or Pacific Islander Other

Demographics Questionnaire Part B: Please answer the following questions about yourself.

1. Have you ever been diagnosed with Attention-Deficit/Hyperactivity Disorder?
_____ YES _____ NO
If yes, at what age were you diagnosed? _____
2. Are you currently taking any medication for ADHD? _____ YES _____ NO
If yes, please list the ADHD medication: _____
3. Have you taken ADHD medication in the past? _____ YES _____ NO
If yes, at what age did you start taking the ADHD medication? _____