The Role of Distress Tolerance and Emotion Regulation in the Health Risk Behaviors of College Students with and without ADHD

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ABSTRACT

Emerging adulthood is a developmental period associated with increased engagement in health risk behaviors, particularly in college students with attention-deficit/hyperactivity disorder (ADHD), a disorder characterized by low distress tolerance and significant difficulty managing emotions. However, research has not examined how these factors impact propensity to engage in health risk behaviors in college students with ADHD. Thus, this study examined the independent and joint effects of ADHD status, emotion regulation, and distress tolerance on the propensity of college students to engage in health risk behaviors (alcohol use, impulsive eating, and drug behaviors). Participants included 143 undergraduate students (81.8% female; 44.1% with ADHD) who completed an online questionnaire via REDCap. Individuals with ADHD reported significantly higher use of maladaptive emotion regulation strategies and lower levels of distress tolerance than the comparison sample. Moderation models using the PROCESS macro for SPSS examined whether the associations between emotion regulation abilities and distress tolerance with health risk behavior engagement were moderated by ADHD diagnostic history. The relation between distress tolerance and engagement in drug use behaviors was moderated by ADHD status, such that for individuals with ADHD, poorer distress tolerance was associated with more drug use. ADHD status also moderated the association between maladaptive emotion regulation strategies and cognitive restraint in eating. For individuals without ADHD, more maladaptive emotion regulation was marginally predictive of less engagement in cognitive restraint around food, but this relation, was not significant for college students with ADHD. Findings from this study provide insight into intervention targets for college students with ADHD, ultimately resulting in significantly decreased societal and personal health costs.

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GENERAL AUDIENCE ABSTRACT

Emerging adulthood is a developmental period associated with increased engagement in health risk behaviors, particularly in college students with attention-deficit/hyperactivity disorder (ADHD), a disorder characterized by low distress tolerance and significant difficulty managing emotions. However, research has not looked at how these factors impact odds of engaging in health risk behaviors in college students with ADHD. Thus, this study examined the independent and combined effects of ADHD status, emotion regulation, and distress tolerance on the propensity of college students to engage in health risk behaviors (alcohol use, impulsive eating, and drug behaviors). Participants included 143 undergraduate students (81.8% female; 44.1% with ADHD) who completed an online questionnaire via REDCap. Individuals with ADHD reported higher use of maladaptive emotion regulation strategies and decreased ability to tolerate distress than the comparison sample. The relation between distress tolerance and engagement in drug use behaviors was moderated by ADHD status, such that for individuals with ADHD, poorer ability to tolerate distress was associated with more drug use. ADHD status also moderated the association between maladaptive emotion regulation strategies and cognitive restraint in eating. For individuals without ADHD, more maladaptive emotion regulation was slightly predictive of less cognitive restraint around food, but this relation was not significant for college students with ADHD. Findings from this study provide insight into intervention targets for college students with ADHD, ultimately resulting in significantly decreased societal and personal health costs.

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Introduction

Distress tolerance and emotion regulation are two transdiagnostic processes linked to a range of emotional and behavioral concerns (Aldao, 2013; Leyro et al., 2010; Zvolensky et al., 2010). In particular, emotion regulation deficits and distress intolerance have been linked to a wide array of personal and social problems, such as addiction and substance abuse, crime, domestic violence, teen pregnancy, school failure, financial problems, sexually transmitted diseases, smoking, and obesity (Tice et al., 2001). Past research has suggested that when individuals with low distress tolerance experience high levels of negative emotion, they can act impulsively in an attempt to decrease this distress, often prioritizing instant gratification (e.g., sexual activity, eating fattening foods, excessive alcohol consumption) over other emotion regulation strategies (Tice et al., 2001). Emerging adulthood, and the college years in particular, are associated with increased autonomy and reduced monitoring (Arnett, 2000). During this developmental period, potentially detrimental health and well-being behaviors increase (e.g., substance abuse, unsafe sexual behavior), while other potentially more health-promoting behaviors (e.g., regular physical activity, healthy dietary choices) decrease (Carter et al., 2010; Cooper, 2002; Hershner & Chervin, 2014; Schulenberg et al., 2005; Tsai & Li, 2004). It has been postulated that distress intolerance may significantly increase young adults' engagement in risk-taking behavior, particularly in individuals with attention-deficit/hyperactivity disorder (ADHD), a disorder characterized by inattention and hyperactivity/impulsivity and an increased risk for negative health outcomes (e.g., substance use, binge-drinking, risky sex; Van Eck et al., 2015). Further, extensive research has demonstrated that individuals with ADHD have significant difficulty managing negative emotionality (e.g., Beheshti et al., 2020; Shaw et al., 2014). As such, the current study examined the association between distress tolerance, emotion regulation abilities, and propensity to engage in health risk behaviors (drug behaviors, alcohol use, impulsive eating), and whether these associations were stronger for college students with ADHD relative to those without ADHD.

Distress Tolerance and Emotion Regulation

Distress tolerance has been broadly defined as an individual's ability to experience and withstand negative psychological states as it pertains to tolerability and aversiveness, appraisal and acceptability, tendency to absorb attention and disrupt functioning, and regulation of emotions (Simons & Gaher, 2005). Individuals with low distress tolerance may experience negative affect as unbearable or upsetting (*tolerance*), perceive their coping abilities as less than others (*appraisal*), find the experience of negative emotions to be intense and all-encompassing (*absorption*), and report great efforts to avoid experiencing negative emotions and a willingness to do anything to stop their distress (*regulation*; Simons & Gaher, 2005; Van Eck et al., 2015). High distress intolerance has been linked to cigarette smoking (Leventhal & Zvolensky, 2015), substance abuse (Bornovalova et al., 2008; Daughters et al., 2005), and eating pathology (Corstorphine et al., 2007). Deficits in distress tolerance have also been linked to poor emotion regulation (Van Eck et al., 2017).

Emotion regulation is the mechanism through which individuals intentionally or unintentionally modify their emotions and behaviors to reach a desired outcome, so as to promote adaptive, goal-oriented behaviors (Aldao et al., 2010; Gross & Thompson, 2007). However, emotion regulation strategies become maladaptive when they alter the emotional responses in an undesired direction, or the long-term costs of utilizing such strategies outweigh the short-term benefits of their use. It has been suggested that increased engagement in maladaptive behaviors could stem from the fact that many of these behaviors are associated with increased costs in the long-term, and few, if any, long-term benefits; while these same behaviors are often associated with many short-term benefits and few costs for the individual (Hall & Fong, 2007). For example, despite the widespread knowledge on the risks of unprotected sexual behavior, smoking, and substance abuse, rates of these behaviors are still unacceptably high (World Health Organization, 2005). Meanwhile, other protective behaviors, such as regular physical activity and healthy eating, are rarely performed with enough consistency to reap the potential health benefits

(Mokdad et al., 2001; Rose, 1994; Tremblay et al., 2002).

Theoretical Models Suggesting Self-Regulation is Associated with Health Risk Behaviors

Self-regulation is an individual's ability to plan, guide, and monitor one's behavior fluidly in the face of changing circumstances (Miller & Brown, 1991). It involves the ability to act according to a self-formulated plan even in the absence of external support or reward contingencies (Brown, 1998), and it varies from individual to individual across behaviors. Kanfer (1970a, 1970b) postulated a three-stage model of self-regulation that included self-monitoring (wherein one observes and records behavior), self-evaluation (the observed behavior is compared to one's personal norm), and self-reinforcement (when one uses verbalizations or external rewards as a means of motivation). Kanfer's model proposed that individuals develop new behaviors by using techniques that strengthen controlled information processing to developing contingencies. Kanfer asserted that individuals whose biological and psychological characterization leave them dependent on external cues for guidance (rather than their own internal feedback messages) may be particularly at risk for health risk behaviors (Kanfer, 1986).

Further, propensity to engage in health risk behaviors tends to be commonly associated with the choice of short-term gratification at the expense of long-term detriments to the individual, society, or both (Funder et al., 1983; Miller, 1980; Wagner, 1993). Properties of alcohol use, substance use, and binge-eating are immediately reinforcing and are weighed against the longer-term negative consequences of engaging in these health risk behaviors. Delayed gratification has been developmentally associated with self-regulation emergence (Kopp, 1982) and may be particularly compromised in individuals whose regulation processes are disrupted, such as individuals with ADHD. Relatedly, Fingarette (1988) postulated that situational factors impact an individual's choice to use drugs as well as the rewards and consequences the individual believes will result. According to Fingarette (1988), the choice is affected by the perception of the pattern of positive and negative reinforcers. This interpretation might suggest that an individual's choice depends on the realistic evaluation of those reinforcers (Brown, 1998). As such, it is

critical to control for delay of gratification when assessing the role of distress tolerance and emotion regulation in health risk behaviors.

Role of Distress Tolerance and Emotion Regulation in Health Risk Behaviors

The period of emerging adulthood is characterized by heightened vulnerability to engage in health risk behaviors, which includes substance abuse, binge eating and obesity, and unsafe sexual behavior (Schoenfelder & Kollins, 2016). Risk-taking can be defined as the voluntary engagement in any behavior that is associated with some probability for negative consequences (Boyer, 2006). This includes behaviors which are either illegal in nature, such as illicit drug use, or that pose a significant health risk, such as excessive alcohol consumption, binge-eating, and smoking. The concept that some people are more inclined to participate in health risk behaviors than others is well documented and suggests that emotion regulation and distress tolerance influence the degree of risk-taking propensity. Specifically, as engagement in risk-taking behaviors often occur during episodes of high arousal such as excessive drinking, poor emotion regulation has been associated with an increased likelihood of risk participation (e.g., Byrnes, 2005; Steinberg, 2004, 2005). Further, individuals with low distress tolerance are faced with a decreased capacity to endure aversive states, which can impair an individual's ability to achieve personal goals when experiencing distress (Van Eck et al., 2017). It has been suggested that this association might occur because the tendency to experience vivid and intense emotions is likely to overwhelm one's measured decisions about risk and rewards (Magar et al., 2008).

In addition, it has been previously found that the use of emotional eating as a coping mechanism has been linked to the use of inadequate emotion regulation skills such as emotional suppression and self-preoccupation (Evers et al., 2010; Spoor et al., 2007; Zijstra, et al., 2012). Researchers have hypothesized that individuals who have difficulty regulating their emotions often turn to substances such as alcohol or food (Polivy & Herman, 2002; Sher & Grekin, 2007). Prior studies suggest that emotional eaters have difficulty in recognizing and managing their mood and will turn to eating as a substitute for effective emotion regulation (Spoor et al., 2007;

Van Strien et al., 2009). In a study by Shriver and colleagues (2021), authors found that poor emotion regulation skills were associated with higher levels of emotional eating, for individuals with both low and high levels of negative body image. However, this effect was stronger among those with a high negative body image, indicating that individuals with better childhood emotion regulation skills are even more protected from engaging in emotional eating when they possess a high body esteem/positive body image by mid-adolescence.

Health Risk Behaviors in Adults with ADHD

Starting in childhood and throughout adulthood, ADHD is associated with an increased risk for negative health behaviors that contribute to chronic medical problems, such as substance use disorders, binge eating and obesity, and risky sexual behavior (Van Eck et al., 2015). Further, individuals with ADHD have at least 1.5 times the average risk of developing dependence for nicotine, alcohol, marijuana, cocaine, and other drugs (Lee et al., 2011), and tend to display earlier onset, rapid progression, and decreased remittance of substance use disorders (Fuemmeler et al., 2007; Molina & Pelham, 2003). They also have higher rates of obesity (Spencer et al., 2014) and binge-eating rates that are three times higher than individuals without ADHD (Bleck & DeBate, 2013). Furthermore, ADHD has been linked with unsafe sexual behavior, including earlier sexual activity and more partners (Brown et al., 2010; Flory et al., 2006). Substance use disorders, obesity, and sexually transmitted infections are directly associated with chronic health problems, as well as morbidity and mortality (Schoenfelder & Kollins, 2016).

The mechanisms underlying the association between ADHD and health risk behaviors include both direct and indirect effects—ADHD may affect risky health behaviors directly as the result of associated neurocognitive impairments, as well as indirectly through social-environment problems resulting from ADHD (Schoenfelder & Kollins, 2016). The two core ADHD symptom domains—inattention and hyperactive/impulsivity—are both linked to health risk behaviors, independent of ADHD diagnosis (Fuemmeler et al., 2007; Molina & Pelham, 2003). Further, it has been suggested that hyperactive/impulsive symptoms are linked in the development of

addiction. For example, Fuemmeler and colleagues (2007) found that hyperactive/impulsive symptoms were associated with almost double the odds of progressing from no smoking to regular smoking in adolescence. Inattention symptoms also appear to interfere with an individual's monitoring of internal states and regulating behavior and have been linked to multiple substance use outcomes (Molina & Pelham, 2003), as well as irregular eating (Davis et al., 2006). Extensive research has also demonstrated that ADHD symptoms are associated with difficulties in managing negative emotionality, and low distress tolerance may significantly increase risk behavior engagement in young adults with ADHD (Van Eck et al., 2015). Despite this, research is needed to assess whether the relation between emotion regulation abilities and levels of distress tolerance with propensity for health risk behaviors differs for college students with versus without ADHD.

Present Study

Given this backdrop, the present study examined the independent and joint effects of ADHD status, emotion regulation, and distress tolerance on the propensity of college students to engage in health risk behaviors (drug behaviors, alcohol use, impulsive eating). Given the heightened vulnerability to engage in health risk behaviors during the emerging adult developmental period (Schoenfelder & Kollins, 2016), it is critical that we expound on the unique and interactive role of these potential risk factors. Further, given the impulsive nature of ADHD, and the tendency for those with ADHD to seek out rewarding experiences that can lead to increased engagement in health risk behaviors with little forethought into the long-term ramifications of such experiences, delay of gratification was included as a covariate. Past research has suggested that individuals with internalizing symptoms (e.g., anxiety, depression) and low distress tolerance may focus more on the experience of distress and pay less attention to emotion regulation strategies that could lower their distress (Van Eck et al., 2017). Additionally, anxiety and depressive symptoms are associated with deficits in distress tolerance and emotion regulation (Anestis et al., 2007), as a result, internalizing symptoms were

controlled for in analyses. Finally, potentially relevant demographic variables (age, gender, socioeconomic status, race, and ethnicity) were examined, with any demographic variable displaying significant correlations with main study variables included in main analyses as covariates. The aims of this study were:

Aim 1) To examine whether rates of emotion regulation, distress tolerance, and health risk behaviors differ among college students with and without a prior ADHD diagnosis. Consistent with prior research, it was predicted that college students with a prior ADHD diagnosis would display less adaptive and more maladaptive emotion regulation abilities, less distress tolerance, and higher engagement in health risk behaviors.

Aim 2) To examine the role of emotion regulation and distress tolerance in predicting propensity to engage in health risk behaviors among college students. Consistent with prior research and theoretical approaches to self-regulation (Brown, 1998), it was hypothesized that college students with poorer emotion regulation abilities and less distress tolerance would endorse increased levels of engagement in health risk behaviors, including increased alcohol consumption, substance use, and impulsive eating.

Aim 3) To examine whether the associations between emotion regulation and distress tolerance with engagement in health risk behaviors are stronger for college students with ADHD relative to college students without ADHD. It was expected that these relations would be stronger for college students with ADHD than those without a prior ADHD diagnosis.

Method

Participants

Participants were 143 undergraduate students (18 – 28 years; *M* = 20.46; *SD* = 1.96; 81.8% female) enrolled in a 4-year university in the United States. Participants were primarily identified as White (65%), Black (11.2%), Asian (16.1%), Biracial/Multiracial (6.3%), and Other (1.4%), with 14.7% identifying as Hispanic or Latino. Just under half of all participants (44.1%)

were previously told they may have Attention Deficit Disorder/ADHD or have been previously diagnosed with Attention Deficit Disorder/ADHD. See Table 1 for more participant demographic information.

Procedures

Participants were recruited during the spring 2022 semester via distribution of flyers across local university campuses, email distribution, social media posts, and through the Psychology Department's Sona Experiment Management System for online research study participation. Upon expressing interest in participating via email or the Sona System, participants were provided additional information about the study and the online consent form. For individuals who agreed to participate, they were then immediately taken to the survey after completing the consent. Participants were instructed to complete the survey in one sitting to receive full credit. Attentional checks were built into each survey to check participant engagement while completing the online questionnaires, as well as a requirement of the participant to submit a university verified email address to receive participation credit outside of the Sona System. A total of 16 participants were removed from the study for not providing university verified email addresses. The survey automatically timed out once the participant had reached the 1-hour mark. Participants were compensated based on the portion of the survey they completed up until that point; for participants using the Sona system only full completion earned a full credit hour of Sona credits. A total of 173 participants started the survey, and 128 participants completed the full survey through the Sona System. Only participants with full survey data were included in the present study. A total of 15 participants completed the full survey outside of the Sona System. Survey completion outside of Sona was only used for ADHD participants as prior research has suggested that college students with ADHD who have experienced adequate academic success to attend college may be better adjusted then the general population of young adults with ADHD, and therefore may not display the same pattern of difficulties (Green & Rabiner, 2012).

Measures

Predictor Variables

Distress Tolerance. The Distress Tolerance Scale (DTS; Simons & Gaher, 2005) is a 15-item self-report measure of one's ability or tolerance for experiencing emotional distress. Items have a 5-point scale (1 = "*Strongly Agree*", 5 = "*Strongly Disagree*") with four items reverse coded. The DTS total score, used in the current study, consists of four subscales representing the four components of distress tolerance: tolerance (3 items, a = .84; "Feeling distressed or upset is unbearable to me."), appraisal (5 items, a = .87; "Other people seem to be able to tolerate feeling distressed or upset better than I can."), absorption (3 items, a = .91; "My feelings of distress are so intense that they completely take over."), regulation (5 items, a = .84; "I'll do anything to stop feeling distressed or upset."). Higher scores on the DTS total score represent greater tolerance for emotional distress.

Emotion Regulation Strategies. The Cognitive Emotion Regulation Questionnaire – Short (CERQ-Short; Garnefski & Kraaij, 2006) is an 18-item questionnaire consisting of nine conceptually different subscales based on different cognitive emotion regulation strategies. It is a shortened version of the original Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001). The CERQ is used to measure the cognitive strategies that encapsulate an individual's tendency to respond to stressful life events as well as which cognitive strategies are employed for a specific event or situation (Garnefski & Kraaj, 2006). For the purposes of the current study, we divided each of the nine subscales into two main composite domains: *adaptive strategies,* which comprises putting into perspective, positive refocusing, positive reappraisal, acceptance, and refocus on planning, and *non-adaptive strategies,* which entails self-blame, other-blame, rumination, and catastrophizing. Each subscale contains 2 items referring to thoughts after the experience of a threatening or stressful life event. The items are measured on a 5-point Likert scale, ranging from 1 (*almost never*) to 5 (*almost always*). For the purposes of the current study, the sums for each subscale encompassing *maladaptive* and separately, *adaptive*

strategies were summed together to create composite variables, with a range of 2 to 10 for each composite.

ADHD Diagnostic Status. Self-reported history of an ADHD diagnosis was used as a moderator variable in regression analyses and to descriptively examine group differences in distress tolerance, emotion regulation, and health risk behaviors.

Delay of Gratification. The Delaying Gratification Inventory (DGI; Hoerger et al., 2011) is a 35-item measure designed to assess individual differences in the tendency to forgo strong immediate satisfaction in an attempt to pursue salient long-term rewards. The DGI covers five domains of delay behavior that includes eating behaviors (e.g., "If my favorite food were in front of me, I would have a difficult time waiting to eat it"); physical pleasures (e.g., "I prefer to explore the physical side of romantic involvements right away"); social behavior (e.g., "I do not consider how my behavior affects other people"); money management (e.g., "I try to spend my money wisely"); and achievement behavior (e.g., "I cannot motivate myself to accomplish long-term goals"). The DGI is scored by summing all items for a possible composite score of 175 and comprised of a total of 35 points on each of the five subscale domains. A higher DGI score indicates better delay of gratification is present. The scale has shown strong internal consistency, test-retest reliability, construct validity, and predictive validity in previous research involving a diverse international sample of over 10,000 participants (Hoerger et al., 2011).

Internalizing Symptoms. The Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) is a 21-item self-report measure that assesses the emotional states scale, ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much or most of the time*), showing the severity of the individuals' experiences over the past week. In the current study, the total DASS-21 composite was used, with scores ranging from 0 to 63.

ADHD Symptoms. Given that ADHD symptoms have been associated with health risk behaviors, independent of ADHD diagnosis (Fuemmeler et al., 2007; Molina & Pelham, 2003), they were included as a covariate in regression analyses. ADHD symptoms were assessed using

the self-report version of the Barkley Adult ADHD Rating Scale-IV (BAARS-IV; Barkley, 2011). The BAARS-IV includes the 18 DSM symptoms of ADHD. Each item is rated using a 4-point scale (1 = "*never or rarely*", 4 = "*very often*"). The BAARS-IV scales demonstrate adequate internal consistency and test-retest reliability (Barkley, 2011). The total ADHD symptom count (0-18) was used as a control variable in this study.

Health Risk Behaviors

Impulsive Eating. The Three Factor Eating Questionnaire Revised 18-item version (TFEQ-R18; Karlsson et al., 2000) is a self-assessment questionnaire that was created to measure the cognitive and behavioral aspects of eating patterns. The instrument is a shortened and revised version of the original 51-item TFEQ (Stunkard & Messick, 1985). The instrument contains 18 items on a 4-point response scale ranging from *definitely true* to *definitely false*. Responses to each of the 18 items are scored between 1 and 4 and item scores are summated into scaled composite scores for cognitive restraint, uncontrolled eating, and emotional eating. Higher scores in the respective scales are indicative of greater cognitive restraint, uncontrolled, or emotional eating. Cognitive Restraint is designed to measure dietary restraint, that is, control over food intake in order to influence body weight and body shape. Uncontrolled Eating measures episodes of loss of control or overeating, while the Emotional Eating scale concerns subjective feelings of hunger and food cravings (Karlsson et al., 2000).

Drug Use. The Drug Use Disorders Identification Test (DUDIT; Berman et al., 2003) is an 11-item self-administered screening instrument for drug-related problems that give information on the level of drug intake and selected criteria for substance abuse/harmful use and dependence. The first nine items are scored on a 5-point scale ranging from 0 to 4, and the last two are scored on a 3-point scale with values 0, 2, and 4. Thus, total scores range from 0 to 44, with higher scores being suggestive of a more severe drug problem. The DUDIT cutoff score for any type of problematic use (i.e., harmful use, substance abuse, or dependency) is generally recommended as 6 for men and 2 for women (Berman et al., 2005). In addition to items covering

amount and frequency of use and signs of hazardous use or dependence, the participant was asked about drugs currently being used, including illicit drugs and prescription drugs of abuse.

Alcohol Use. The Alcohol Use Disorders Identification Test (AUDIT; Barbor et al., 1989) is a widely used, psychometrically complete alcohol screening instrument that assesses harmful and hazardous drinking. This 10-item self-report screening tool assesses alcohol consumption, drinking behaviors, and alcohol-related problems. The measure has a total score range from 0 to 40, with a value of 8 or greater being suggestive of problematic drinking. Psychometrically, the instrument has demonstrated high internal consistency, test–retest reliability, convergent validity, sensitivity, and specificity (for a review see Reinert & Allen, 2007, Rush et al., 2008).

Analytic Plan

First, descriptive statistics and correlations between study variables and demographic variables were examined. Since all participants included in the current study had complete data, no tests of missingness were conducted. For Aim 1, independent sample *t*-tests were run to compare rates of adaptive and maladaptive emotion regulation strategies, distress tolerance, drug behaviors, alcohol use, and impulsive eating among college students with and without a prior ADHD diagnosis. The power analysis with an alpha of .05 and the sample size of 143 indicated that the present study was adequately powered (i.e., power ≥ .80) to detect group differences with a small effect of $d = .25$ or larger.

For Aim 2, multiple regression analyses were run in SPSS, Version 27 (IBM Corp, 2020) to examine the associations between emotion regulation abilities and distress tolerance with engagement in health risk behaviors. A separate model was run for each health risk behavior subtype (drug behaviors, alcohol use, impulsive eating). The power analysis with a sample of 143 and an alpha of .05 suggested that the present study was adequately powered (i.e., power ≥ .80) to detect associations of medium strength ($f^2 \geq .15$) or larger with 6 predictors (distress tolerance, adaptive emotion regulation strategies, maladaptive emotion

regulation strategies, delay of gratification, internalizing symptoms, ADHD symptoms), and any relevant demographic variables as covariates.

Finally, for Aim 3, moderation models were conducted using the PROCESS macro for SPSS (Hayes, 2013) to examine whether the associations between emotion regulation abilities and distress tolerance with health risk behavior engagement were moderated by ADHD diagnostic history. With the sample size of 143, the power analysis with an alpha of .05 indicated that the proposed study is adequately powered (i.e., power ≥ .80) to detect associations of medium strength ($f^2 \geq .18$) or larger with 9 predictors (ADHD status, distress tolerance, adaptive emotion regulation strategies, maladaptive emotion regulation strategies, distress tolerance X ADHD status, adaptive emotion regulation X ADHD status, maladaptive emotion regulation X ADHD status, delay of gratification, internalizing symptoms), and any relevant demographic variables as covariates.

Results

Preliminary Analyses

The preliminary analyses consisted of running descriptive statistics to identify the associations among study variables and to examine differences between demographic variables. Participants reported using both adaptive (M = 5.83, SD = 1.27) and maladaptive emotion regulation strategies (M = 5.26, SD = 1.27) on average. Bivariate correlations between study variables are presented in Table 2. Ethnicity was found to be significantly correlated with drug use (p<.001) and alcohol use (p<.001), and as such was included as a covariate in relevant regression analyses. Body mass index was found to be significantly correlated with emotional eating (p<.001) and was included as a covariate in analyses for this outcome.

Aim 1 - Rates of Emotion Regulation, Distress Tolerance, and Health Risk Behaviors Among College Students with and without a Prior ADHD Diagnosis

Table 3 presents the means and standard deviations for main study variables across the entire sample and for college students with and without a prior ADHD diagnosis; *t*-tests

comparing these variables by ADHD status are also reported. Largely consistent with the hypothesis, college students with a prior ADHD diagnosis displayed more maladaptive emotion regulation abilities, less distress tolerance, and higher engagement in health risk behaviors. Specifically, individuals with ADHD reported significantly higher use of maladaptive emotion regulation strategies (M = 5.53, SD = 1.29) than the comparison sample (M = 5.04, SD = 1.22) on average, t = -2.31, p = .022. Additionally, individuals with ADHD (M = 38.71, SD = 12.90) were more likely to report lower levels of distress tolerance ($p < .001$) than individuals without ADHD (M = 42.26, SD = 14.02), t = 2.74, $p < .001$. Finally, college students with ADHD reported higher levels of drug (t = -5.08, $p < .001$) and alcohol (t = -3.05, $p < .001$) use, when compared to college students without ADHD. Specifically, individuals with ADHD reported significantly higher (though highly variable) drug use (M = 6.13, SD = 8.37) and alcohol use (M = 9.17, SD = 7.39) than the comparison sample (M = 1.08, SD = 2.71 and M = 5.88, SD = 5.53, respectively). In contrast, college students with and without ADHD did not significantly differ on adaptive emotion regulation strategies, cognitive restraint in eating, uncontrolled eating, nor emotional eating (see Table 3).

Aim 2 - The Role of Emotion Regulation and Distress Tolerance in Propensity to Engage in Health Risk Behaviors Among College Students

Table 4 presents results for multiple regression analyses. In contrast to hypotheses, emotion regulation abilities and distress tolerance were largely not significantly related to engagement in health risk behaviors across participants. Specifically, distress tolerance was only significantly associated with cognitive restraint in eating (β = -.274; p = .023). Instead, several covariates emerged as unique predictors. Delay of gratification was significantly associated with drug use (β = -.231; p = .008), alcohol use (β = -.227; p = .019), uncontrolled eating (β = -.299; p = .001), and emotional eating (β = -.184; p = .049), with those displaying a better ability to delay gratification experiencing less engagement across these health risk behaviors. Additionally,

ethnicity was significantly associated with drug and alcohol use, such that non-Latino individuals reported higher levels of drug and alcohol use than individuals who identified as Latino. ADHD symptoms was significantly related to alcohol use and uncontrolled eating, such that those with more ADHD symptoms engaged in more alcohol use and uncontrolled eating. Finally, body mass index was significantly associated with emotional eating, such that those with higher body mass indexes engaged in more emotional eating.

Aim 3 – Does ADHD Status Moderate the Associations Between Emotion Regulation and Distress Tolerance with Engagement in Health Risk Behaviors

Table 5 presents results for multiple regression analyses with interaction terms by ADHD status. Hypotheses that the associations between emotion regulation and distress tolerance with engagement in health risk behaviors would be stronger for college students with ADHD, relative to college students without ADHD were minimally supported. Specifically, only ADHD status and distress tolerance interacted in predicting drug use (b = -0.706; p = .013); see Figure 1. Probing the interaction revealed that for college students with a prior ADHD diagnosis, less distress tolerance was associated with higher engagement in drug use behaviors (b = -0.33, p < .001), but these variables were not significantly related for college students without ADHD (b = 0.02, p = .794). Additionally, ADHD status and maladaptive emotion regulation strategies interacted in predicting cognitive restraint in eating (b = 1.01; p = .020); see Figure 2. Probing the interaction revealed that more maladaptive emotion regulation was marginally predictive of less engagement in cognitive restraint around food for individuals without ADHD (b = -0.75, p = .068); this relation was not significant for college students with ADHD (b = 0.64, p = .177), though the pattern of effects was in the opposite direction. No other significant interactions with ADHD status were found for adaptive emotion regulation, maladaptive emotion regulation, or distress tolerance in predicting health risk behaviors.

Discussion

This study adds to and extends the limited research examining the association between

emotion regulation and distress tolerance with engagement in health risk behaviors among college students with and without ADHD. Consistent with prior research college students with a history of an ADHD diagnosis used more maladaptive emotion regulation strategies, had less distress tolerance, and engaged in more drug and alcohol use. Surprisingly, emotion regulation and distress tolerance were minimally related to individual health risk behaviors on average; however, delay of gratification emerged as a unique predictor of alcohol use, uncontrolled eating, and emotional eating. When examining whether these associations differed for college students with versus without ADHD, results suggested that when individuals with ADHD reported less of an ability to tolerate distress, individuals reported higher engagement in drug use; this relation was non-significant for college students without ADHD. In contrast, utilization of high levels of maladaptive emotion regulation strategies was marginally related to more cognitive restraint (i.e., excess control over food intake in order to influence body weight and body shape) for college students without ADHD only. These findings and their clinical implications are discussed further below.

More Maladaptive Emotion Regulation, Less Distress Tolerance, and Greater Drug and Alcohol Use Among College Students with a Prior ADHD Diagnosis

Group differences emerged for several study variables. Specifically, individuals with ADHD reported significantly higher use of maladaptive emotion regulation strategies, lower levels of distress tolerance, and more drug and alcohol use, in comparison to their non-ADHD peers. This is consistent with most of the extant literature suggesting that ADHD is associated with difficulties in managing negative emotionality (e.g., Van Eck et al., 2015; Young, 2005), increased risk of developing drug dependencies (e.g., Lee et al., 2011), particularly for individuals with higher levels of hyperactivity/impulsivity symptoms (Anker et al., 2020); and increased risk of suffering from alcohol use disorders (Luderer et al., 2021).

Whereas individuals with ADHD reported significantly higher use of maladaptive emotion regulation strategies in comparison to their non-ADHD peers, no group differences

were observed for adaptive emotion regulation strategies. Specifically, our findings showed individuals with and without ADHD endorsing moderate levels of adaptive emotion regulation strategies on average. This finding is in contrast to prior research finding differences among adults with vs. without ADHD; for example, Young (2005) found adults with ADHD to be more likely to use positive reappraisal than their non-ADHD peers. However, our sample was different from some past research in that our study was retrospective in nature, and this could indicate that people may not be as likely to remember using specific strategies when completing retrospective report on emotion regulation strategies. Additionally, these differences could also be explained by the type of sample population used, Young (2005) used a sample of clinic referred individuals, whereas a community population was utilized in the current study. It could be that in a community sample, lower rates and retrospective report may not be as accurate if negative emotions are not as salient. It will be important for future research to examine emotion regulation strategies in vivo in lab, such as through the use of ecological momentary assessment.

Further, in contrast to the limited prior research, we did not find differences in disordered eating among college students with versus without ADHD. This finding could be explained by the high rates of impulsive eating observed in both samples, which could potentially be due to the high proportion of females in the current study. It has been well documented that ADHD and disordered eating behaviors, specifically binge eating, emotional eating, and obesity, are highly comorbid (e.g., Bleck & DeBate, 2013; Spencer et al., 2014). For example, Merkt and Gawrilow (2016) found that college students with ADHD showed higher cognitive restraint of eating and more hunger than non-ADHD college students. Similar to our study, Merkt and colleagues (2016) did not find a higher BMI in participants with ADHD compared to those without. However, our study sample was different in that study authors only included cases with a clinical diagnosis of ADHD, whereas we used self-report of prior childhood ADHD diagnoses. This could impact findings in that not all adults may still

meet criteria for ADHD, and since our sample was majority female, who are statistically underdiagnosed in childhood, may not represent the larger ADHD population (Arnett et al., 2015; Biederman et al., 2002; Mowlem et al., 2019; Novik et al., 2006; Ramtekkar et al., 2010; Willcutt, 2012).

Delay of Gratification and Health Risk Behaviors

Despite not being a focus of the current study, one of the main findings from Aim 2 was that delay of gratification appears to be a robust predictor of health risk behaviors in college students, even after accounting for emotion regulation abilities, distress tolerance, ADHD symptoms, and internalizing symptoms. The findings of the present study are consistent with the larger body of research over the past 40 years suggesting that individuals who display deficits in delaying gratification exhibit increased engagement in health risk behaviors (e.g., Funder et al., 1983; Miller, 1980; Wagner, 1993). It has been suggested that an individual's preference for choosing smaller, immediate rewards is associated with a higher propensity for more impulsive decision making (Doidge et al., 2021; Reynolds et al., 2006; Richards et al., 1999a). For example, alcohol use, substance use, and binge-eating behaviors display properties that are associated with increased costs in the long-term, and few, if any, long-term benefits; while these same behaviors are often associated with many short-term benefits (e.g., feeling good) and few costs for the individual (Hall & Fong, 2007). The present study extends this work by examining these associations in a sample of college students with and without ADHD. Our findings suggest that ability to delay gratification emerged as a unique predictor of substance use, alcohol use, and two disordered eating domains, uncontrolled eating and emotional eating, above and beyond ADHD symptoms (as well as other relevant covariates such as internalizing symptoms).

In contrast, while maladaptive emotion regulation abilities and the ability to tolerate distress were bivariately related to health risk behaviors, neither emerged as unique predictors of increased engagement in health risk behaviors across the entire sample. This finding is

inconsistent with the surfeit of prior research suggesting poor emotion regulation and decreased ability to tolerate distress are both associated with an increased likelihood of risk participation, especially during periods of high arousal such as excessive alcohol consumption (e.g., Byrnes, 2005; Steinberg, 2004, 2005). Even though maladaptive emotion regulation strategies and distress tolerance weren't related across the entire sample, two significant moderation analyses emerged, suggesting that such risk factors may not be universal to all college students.

Associations Between Distress Tolerance and Emotion Regulation for College Students with ADHD

Our findings portend that the associations between distress tolerance with engagement in drug use is stronger for college students with ADHD. Specifically, college students who reported having ADHD and low distress tolerance were more likely to use drugs; in contrast, distress tolerance was unrelated to drug use in college students without ADHD. This is consistent with the extant literature showing that individuals with ADHD who exhibit significant difficulty tolerating distress during highly arousing experiences are at increased odds of engaging in drug use (Van Eck et al., 2017). This may suggest that during periods of high arousal, or intense emotions, individuals with ADHD may attempt to regulate their discomfort by using drugs. As such, targeting increasing of distress tolerance among college students with ADHD may be one avenue to help reduce the elevated rates of substance use observed in this population.

In contrast, the association between maladaptive emotion regulation and cognitive restraint of eating was significant for college students without ADHD (but not those with ADHD), with more maladaptive emotion regulation strategies being associated with greater cognitive restraint in eating. Although this exact association has not been examined in prior research, prior work suggests that more executive control deficits (which emotion dysregulation is a part of; Nelson et al., 2020) are significantly and uniquely associated with less cognitive restraint around eating among individuals with ADHD (Nelson et al., 2020). Past research has postulated that deficits in specific executive control components might lead to a loss of "top-

down" control of attention and behavior related to food, thus leading to eating behaviors that are more driven by emotion and loss of control than planful execution of an individual's health goals (Nelson et al., 2019). As such, it is surprising that maladaptive emotion regulation was not linked with cognitive restraint in our ADHD sample.

It is possible that emotion regulation may not have been linked to health risk behaviors in this sample of college students with ADHD due to the moderately-low base rates of both adaptive and maladaptive cognitive emotion regulation strategies in the current sample. It is possible that by having college students retrospectively report on strategies they use broadly, they may underestimate the use of various strategies either due to lack of insight or viewing past difficulties through rose-colored glasses. Ecological momentary assessment may be one alternative approach to measuring emotion regulation that can capture strategy utilization in real time and thus capture higher rates of strategy use. This will be an important route for future research into the relation between ADHD, emotion regulation, and health risk behaviors. This could indicate that individuals with ADHD are using more social or behavioral strategies, which were not examined by the measure of emotion regulation in the current study. This is an important area for future research to explore. This could indicate that in the current study, emotion regulation is not as important, in relation to engagement in health risk behaviors.

Limitations

These findings should be considered with several limitations in mind. First, an important limitation of this study is that we pulled a convenience sample of college-age undergraduates to complete online surveys, with a majority female sampling who may be less likely to engage in high levels of risky behaviors. Second, it is possible that because our study population was college-aged emerging adults, other health risk behaviors that are already considered high in the emerging adult and college-aged population, such as emotional and uncontrollable disordered eating, were not directly associated with ADHD status; and excessive alcohol consumption was only associated with ADHD status at the group difference level. Thus, it will be important for

future research with larger samples to explore sex and age differences related to engagement in health risk behaviors as a function of regulating strong emotions and tolerating distress in adults with ADHD, regardless of age in adulthood. Sex and age differences were explored in the current study to see if these were related at the bivariate level; since they were not, they were not included in the sample. However, this could be explained by the narrow age range and the predominately female sample. Another possible limitation concerns the short, cross-sectional nature of this study. For example, given that individuals with ADHD struggle with gratification delay in the short-term, we would expect these individuals to display difficulties with engaging in adaptive emotion regulation, and instead opt to decrease their distress and negative emotionality by engaging in health risk behaviors that are gratifying in the short-term, but display long-term consequences. Thus, future research would benefit from investigating longitudinal associations between emotion regulation and/or distress tolerance. For example, individuals in high school who are low in emotion regulation ability and ability to tolerate distress, studying these associations may predict risk in terms of transitioning to college, as well as post-graduation. Finally, an important limitation of this survey is that we only assessed the participants' self-reported diagnosis of ADHD as well as history of emotion regulation and distress tolerance ability. However, it has been postulated that psychosocial functioning in students with self-reported ADHD is comparable to functioning in students without out previously confirmed diagnoses (Richards et al., 1999b). Further, online administration might even be beneficial when it comes to assessing health behaviors, because the bias of sensitive topics is somewhat reduced (Ramo et al., 2011). Nevertheless, it will be beneficial for future research to further examine these associations longitudinally as well as in combination with ecological momentary assessment and online questionnaires.

Conclusion

College students with a prior diagnosis of ADHD reported significantly higher use of maladaptive emotion regulation strategies, lower levels of distress tolerance, and more drug

and alcohol use in comparison to those without ADHD. The effect of the associations between emotion regulation and distress tolerance with engagement in drug use was also found to be stronger for college students with ADHD. Taken together, results highlight the important role of delay of gratification in the engagement of health risk behaviors of college students. Additionally, they support the use of interventions targeting increasing distress intolerance to reduce engagement in comorbid drug use among college students with ADHD. Delay of gratification was observed to be a robust predictor of health risk behavior engagement in college students, even after we accounted for emotion regulation abilities, distress tolerance, ADHD symptoms, and internalizing symptoms. Thus, future research would benefit from a multi-method approach that longitudinally observes this association via ecological momentary assessment; as well as by including a delay of gratification and temporal discounting task to assess for preference of small immediate rewards over larger delayed rewards, instead of relying on cross-sectional report alone. It will also be important for future research to make a point of collecting a more diverse, community sample of individuals, who have a more centered biological sex makeup (or more male heavy given prevalence rates of ADHD). It seems important to approach health promotion via an understanding of the underlying mechanisms associated between health risk behaviors and ADHD.

References

Abramovitch, A., & Schweiger, A. (2009). Unwanted intrusive and worrisome thoughts in adults with attention deficit\hyperactivity disorder. *Psychiatry Research*, *168*(3), 230–233. https://doi.org/10.1016/j.psychres.2008.06.004.

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*, 217-37. https://doi.org/10.1016/j.cpr.2009.11.004

Anestis, M. D., Selby, E. A., Fink, E.L., & Joiner, T. E. (2007). The multifaceted role of distress tolerance in dysregulated eating behaviors. *International Journal of Eating Disorders*, *40*(8), 718–726. https://doi.org/10.1002/eat.20471

Anker, E., Haavik, J., & Heir, T. (2020). Alcohol and drug use disorders in adult attention-deficit/hyperactivity disorder: Prevalence and associations with attention-deficit/hyperactivity disorder symptom severity and emotional dysregulation. *World Journal of Psychiatry*, *10*(9), 202. https://doi.org/10.5498/wjp.v10.i9.202

Arnett, J.J. (2000). Emerging adulthood: A theory of development from the late teens through the twenties. *American Psychologist, 55*, 469-480. https://doi.org/10.1037/0003-066X.55.5.469

Arnett, A. B., Pennington, B. F., Willcutt, E. G., Defries, J. C., & Olson, R. K. (2015). Sex differences in ADHD symptom severity. *Journal of Child Psychology and Psychiatry*, *56*, 632-639. https://doi.org/10.1111/jcpp.12337

Barbor, T., De La Fuente, J. R., Saunders, J., Grant, M. (1989). The Alcohol Use Disorders Identification Test: Guidelines for use in primary health care (WHO Publication No. 89:4). World Health Organization, Geneva.

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

https://doi.org/10.1016/j.jaac.2010.01.019

Barkley, R. A. (2011). The Barkley adult ADHD rating scale–IV. New York, NY: Guilford Press.

Beheshti, A., Chavanon, M. L., & Christiansen, H. (2020). Emotion dysregulation in adults with attention deficit hyperactivity disorder: A meta-analysis. *BMC Psychiatry*, *20*(1), 1-11. https://doi.org/10.1186/s12888-020-2442-7

Berman, A. H., Bergman, H., Palmstierna, T., & Schlyter, F. (2003). *DUDIT − The Drug Use Disorders Identification Test, MANUAL Version 1.0*. Stockholm: Karolinska Institutet, Department of Clinical Neuroscience, Section for Alcohol and Drug Dependence Research.

Berman, A. H., Bergman, H., Palmstierna, T., & Schlyter, F. (2005). Evaluation of the Drug Use Disorders Identification Test (DUDIT) in criminal justice and detoxification settings and in a Swedish population sample. *European Addiction Research*, *11*(1), 22–31. https://doi.org/10.1159/000081413

Bernstein, A., Marshall, E. C., & Zvolensky, M. J. (2011). Multi-method evaluation of distress tolerance measures and construct(s): Concurrent relations to mood and anxiety psychopathology and quality of life. *Journal of Experimental Psychopathology*, *2*(3), 386-399. https://doi.org/10.5127/jep.006610

Bickel, W. K., Odum, A. L., & Madden, G. J. (1999). Impulsivity and cigarette smoking: delay discounting in current, never, and ex-smokers. *Psychopharmacology*, *146*(4), 447-54. https://doi.org/10.1007/PL00005490

Biederman, J., Mick, E., Faraone, S. V., Braaten, E., Doyle, A., Spencer, T., Wilens, T. E., Frazier, E., & Johnson, M. A. (2002). Influence on gender on attention deficit hyperactivity disorder in children referred to a psychiatric clinic. *American Journal of Psychiatry*, *159*(1), 36-42. https://doi.org/10.1176/appi.ajp.159.1.36

Bleck, J., & DeBate, R. D. (2013). Exploring the co-morbidity of attention-deficit/hyperactivity disorder with eating disorders and disordered eating behaviors in a nationally

representative community-based sample. *Eating Behaviors*, *14*(3), 390-393. https://doi.org/10.1016/j.eatbeh.2013.05.009

Bodalski, E. A., Knouse, L. E., & Kovalev, D. (2019). Adult ADHD, emotion dysregulation, and functional outcomes: Examining the role of emotion regulation strategies. *Journal of Psychopathology and Behavioral Assessment, 41,* 81-92. https://doi.org/10.1007/s10862-018-9695-1

Bornovalova, M. A., Gratz, K. L., Daughters, S. B., Nick, B., Delany-Brumsey, A., Lynch, T. R., … Lejuez, C. W. (2008). A multimodal assessment of the relationship between emotion dysregulation and borderline personality disorder among inner-city substance users in residential treatment. *Journal of Psychiatric Research*, *42*(9), 717-26. https://doi.org/10.1016/j.jpsychires.2007.07.014

Boyer, T. W. (2006). The development of risk-taking: A multi-perspective review. *Developmental Review*, *26*, 291–345. https://doi.org/10.1016/j.dr.2006.05.002

Brown, J. M. (1998). Self-regulation and the addictive behaviors. In *W. R. Miller & N. Heather* (Eds.), *Treating addictive behaviors* (2nd ed., pp. 61–73). New York: Plenum.

Brown, L. K., Hadley, W., Stewart, A., Lescano, C., Whiteley, L., Donenberg, G., & DiClemente, R. (2010). Psychiatric disorders and sexual risk among adolescents in mental health treatment. *Journal of Consulting and Clinical Psychology*, *78*(4), 590. https://doi.org/10.1037/a0019632

Bunford, N., Evans, S. W., & Langberg, J. M. (2018). Emotion dysregulation is associated with social impairment among young adolescents with ADHD. *Journal of Attention Disorders, 22*(1), 66–82. https://doi.org/10.1177%2F1087054714527793

Byrnes, J. P. (1998). The nature and development of decision making: A self- regulation model. Mahwah, NJ: Lawrence Erlbaum Associates.

Byrnes, J. P. (2005). The development of self-regulated decision making. In J. E. Jacobs & P. A. Klaczynski (Eds.), *The development of judgment and decision making in children and*

adolescents (pp. 5–38). Mahwah, NJ: Lawrence Erlbaum Associates.

Carter, A.C., Brandon, K.O., & Goldman, M.S. (2010). The college and non-college experience: A review of the factors that influence drinking behavior in young adulthood. *Journal of Studies on Alcohol and Drugs, 71*(5), 742-750. https://doi.org/10.15288/jsad.2010.71.742

Cooper, M.L. (2002). Alcohol use and risky sexual behavior among college students and youth: Evaluating the evidence. *Journal of Studies on Alcohol and Drugs*. (s14), 101-117. https://doi.org/10.15288/jsas.2002.s14.101

Corstorphine, E., Mountford, V., Tomlinson, S., Waller, G., & Meyer, C. (2007). Distress tolerance in the eating disorders. *Eating Behaviors*, *8*(1), 91-97. https://doi.org/10.1016/j.eatbeh.2006.02.003

Daughters, S. B., Lejeuz, C. W., Bornovalova, M. A., Kahler, C. W., Strong, D. R., & Brown, R. A. (2005). Distress tolerance as a predictor of early treatment dropout in a residential substance abuse treatment facility. *Journal of Abnormal Psychology*, *114*(4), 729-34. https://doi.org/10.1037/0021-843X.114.4.729

Davis, C., Levitan, R. D., Smith, M., Tweed, S., & Curtis, C. (2006). Associations among overeating, overweight, and attention deficit/hyperactivity disorder: A structural equation modelling approach. *Eating Behaviors*, *7*(3), 266–274. https://doi.org/10.1016/j.eatbeh.2005.09.006

Doidge, J. L., Flora, D. B., Toplak, M. E. (2021) A meta-analytic review of sex differences on delay of gratification and temporal discounting tasks in ADHD and typically developing samples. *Journal of Attention Disorders*, *25*(4), 540-561. https://doi.org/10.1177/1087054718815588

Evers, C., Stok, F., de Ridder, D. T. D. (2010). Feeding your feelings: Emotion regulation strategies and emotional eating. *Personality and Social Psychology Bulletin*, *36*(6), 792–804. https://doi.org/10.1177%2F0146167210371383

Fairman, K. A., Peckham, A. M., & Sclar, D. A. (2020). Diagnosis and treatment of ADHD in the

United States: Update by gender and race. *Journal of Attention Disorders, 24*(1), 10-19. https://doi.org/10.1177/1087054716688534

Fingarette, H. (1988). Alcoholism: The mythical disease. *The Public Interest, 91*(3). http://login.ezproxy.lib.vt.edu/login?url=https://www.proquest.com/magazines/alcoholism-mythical-disease/docview/1298115820/se-2?accountid=14826

Flory, K., Molina, B. S., Pelham, Jr, W. E., Gnagy, E., & Smith, B. (2006). Childhood ADHD predicts risky sexual behavior in young adulthood. *Journal of Clinical Child and Adolescent Psychology*, *35*(4), 571-577. https://doi.org/10.1207/s15374424jccp3504_8

Fox, H., Axelrol, S., Paliwal, P., Sleeper, J., Sinha, R. (2007). Difficulties in emotion regulation and impulse control during cocaine abstinence. *Drug and Alcohol Dependence*, *89*(2-3), 298-301. https://doi.org/10.1016/j.drugalcdep.2006.12.026

Fox, H., Hong, K., Sinha, R. (2008). Difficulties in emotion regulation and impulse control in recently abstinent alcoholics compared with social drinkers. *Addictive Behaviors, 33*(2), 388-94. https://doi.org/10.1016/j.addbeh.2007.10.002

Fuemmeler, B. F., Kollins, S. H., & McClernon, F. J. (2007). Attention-deficit/hyperactivity disorder symptoms predict nicotine dependence and progression to regular smoking from adolescence to young adulthood. *Journal of Pediatric Psychology*, *32*(10), 1203-1213. https://doi.org/10.1093/jpepsy/jsm051

Funder, D. C., Block, J. H., & Block, J. (1983). Delay of gratification: Some longitudinal personality correlates. *Journal of Personality and Social Psychology, 44*(6), 1198–1213. https://doi.org/10.1037/0022-3514.44.6.1198

Garnefski, N., Kraaij, V. & Spinhoven, Ph. (2001). Negative life events, cognitive emotion regulation and depression. *Personality and Individual Differences*, *30*(8), 1311-1327. https://doi.org/10.1016/s0191-8869(00)00113-6

Garnefski, N., & Kraaj, V. (2006). Cognitive emotion regulation questionnaire – development of a short 18-item version (CERQ-short). *Personality and Individual Differences*, *41*(6),

1045-1053. https://doi.org/10.1016/j.paid.2006.04.010

Gerhrick, J., Loughlin, S., Whalen, C., Potkin, S. F., Fallon, J. H., Jamner, L., Belluzzi, J. D., & Leslie, F. M. (2007). Smoking to self-medicate attentional and emotional dysfunctions. *Nicotine and Tobacco Research*, *9*(Suppl. 4), S523-36. https://doi.org/10.1080/14622200701685039

Granö, N., Virtanen, M., Vahtera, J., Elovainio, M., Kivimäki, M. (2004). Impulsivity as a predictor of smoking and alcohol consumption. *Personality and Individual Differences*, *37*(8), 1693-700. https://doi.org/10.1016/j.paid.2004.03.004

Graziano, P. A., & Garcia, A. (2016). Attention-deficit hyperactivity disorder and children's emotion dysregulation: A meta-analysis. *Clinical Psychology Review*, *46*, 106-123. https://doi.org/10.1016/j.cpr.2016.04.011

Green, A. L., Rabiner, D. L. (2012). What do we really know about ADHD in college students? *Neurotherapeutics*, *9*(3), 559–568. https://doi.org/10.1007/s13311-012-0127-8

Gross, J. J., & Muñoz, R. F. (1995). Emotion regulation and mental health. *Clinical psychology: Science and practice*, *2*(2), 151-164. https://doi.org/10.1111/j.1468-2850.1995.tb00036.x

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York: The Guilford Press.

Hall, P. A., & Fong, G. T. (2007). Temporal self-regulation theory: A model for individual health behavior. *Health Psychology Review*, *1*(1), 6-52. https://doi.org/10.1080/17437190701492437

Hayes, A. F. (2013). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]. Retrieved from http:// www.afhayes.com/public/process2012.pdf.

Herman, C. P., & Polivy, J. (2018). The Self-Regulation of Eating. In *Handbook of self-regulation research, theory, and applications* (pp. 493–505), essay, The Guilford Press.

Hershner, S. D., & Chervin, R. D. (2014). Causes and consequences of sleepiness among college

students. *Nature and Science of Sleep, 6*, 73-84. https://doi.org/10.2147/NSS.S62907

Hoerger, M., Quirk, S. W., & Weed, N. C. (2011). Development and validation of the delaying gratification inventory. *Psychological Assessment, 23*(3), 725-738. https://doi.org/10.1037/a0023286

IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp.

Jarrett, M. A. (2016). Attention-deficit/hyperactivity disorder (ADHD) symptoms, anxiety symptoms, and executive functioning in emerging adults. *Psychological Assessment, 28*(2), 245–250. https://doi.org/10.1037/pas0000190.

Kanfer, F. H. (1970a). Self-monitoring: Methodological limitations and clinical applications. *Journal of Consulting and Clinical Psychology*, *35*(2), 148-152. https://doi.org/10.1037/h0029874

Kanfer, F. H. (1970b). Self-regulation: Research, issues, and speculation. In: Neuringer, C. & Michael, J. L. (Eds.) *Behavior Modification in Clinical Psychology*, New York: Appleton-Century-Crofts, 178-220.

Kanfer, F. H. (1986). Implications of a self-regulation model of therapy for treatment of addictive behaviors. In: Miller, W. R. & Heather, N. (Eds) *Treating Addictive Behaviors: Processes of Change*, pp. 29-47 (New York, Plenum Press).

Karlsson, J., Persson, L. O., Sjöström, L. et al. (2000). Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) study. *International Journal of Obesity*, *24*, 1715–1725. https://doi.org/10.1038/sj.ijo.0801442

Keough, M. E., Riccardi, C. J., Timpano, K. R., Mitchell, M. A., & Schmidt, N. B. (2010). Anxiety symptomology: The association with distress tolerance and anxiety sensitivity. *Behavior Therapy*, *41*(4), 567-574. https://doi.org/10.1016/j.beth.2010.04.002

Kiselica, A. M., Webber, T., & Bornovalova, M. A. (2014). Stability and change in distress

tolerance and its prospective relationship with borderline personality features: A short-term longitudinal study. *Personality Disorders: Theory, Research, and Treatment, 5*(3), 247-256. https://doi.org/10.1037/per0000076

Knouse, L. E., & Mitchell, J. T. (2015). Incautiously optimistic: Positively valanced cognitive avoidance in adult ADHD. *Cognitive and Behavioral Practice, 22*(2), 192–202. https://doi. org/10.1016/j.cbpra.2014.06.003.

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, *18*(2), 199-214. https://doi.org/10.1037/0012-1649.18.2.199

Laible, D., Carlo, G., Panfile, T., Eye, J., & Parker, J. (2010). Negative emotionality and emotion regulation: A person-centered approach to predicting socioemotional adjustment in young adolescents. *Journal of Research in Personality*, *44*(5), 621-629. https://doi.org/10.1016/j.jrp.2010.08.003

Lee, S. S., Humphreys, K. L., Flory, K., Liu, R., & Glass, K. (2011). Prospective association of childhood attention-deficit/hyperactivity disorder (ADHD) and substance use and abuse/dependence: A meta-analytic review. *Clinical Psychology Review*, *31*(3), 328-341. https://doi.org/10.1016/j.cpr.2011.01.006

Leventhal, A. M., & Zvolensky, M. J. (2015). Anxiety, depression, and cigarette smoking: A transdiagnostic vulnerability framework to understanding emotion-smoking comorbidity. *Psychological Bulletin*, *141*(1), 176-212. https://doi.org/10.1037/bul0000003

Leyro, T. M., Zvolensky, M. J., & Bernstein, A. (2010). Distress tolerance and psychopathological symptoms and disorders: A review of the empirical literature among adults. *Psychological Bulletin, 136*(4), 576-600. https://doi.org/10.1037/a0019712

London, A. S., & Landes, S. D. (2021). Cohort change in the prevalence of ADHD among U.S. adults: Evidence of a gender-specific historical period effect. *Current Perspectives*, *25*(6), 771-782. https://doi.org/10.1177/1087054719855689

Lovibond, S. H. & Lovibond, P. F. (1995). Manual for the Depression Anxiety & Stress Scales.

(2nd Ed.) Sydney: Psychology Foundation.

Luderer, M., Quiroga, J. A. R., Faraone, S. V., Zhang-James, Y., & Reif, A. (2021). Alcohol use disorders and ADHD. *Neuroscience and Biobehavioral Review, 128*, 648-660. https://doi.org/10.1016/j.neubiorev.2021.07.010

Magar, E. C. E., Phillips, L. H., & Hosie, J. A. (2008). Self-regulations and risk-taking. *Personality and Individual Differences*. *45*(2), 153-159. https://doi.org/10.1016/j.paid.2008.03.014

Margherio, S. M., Brickner, M. A., Evans, S. W., Sarno-Owens, J., DuPaul, G. J., & Allan, N. P., (2020). The role of emotion regulation in alcohol use among adolescents with attention-deficit hyperactivity disorder. *Psychology of Addictive Behaviors, 34*(7), 772-782. https://doi.org/ 10.1037/abd0000582

Merkt, J. & Gawrilow, C. (2016). Health, dietary habits, and achievement motivation in college students with self-reported ADHD diagnosis. *Journal of Attention Disorders, 20*(9), 727-740. https://doi.org/10.1177/1087054714523127

Mikami, A. Y., Hinshaw, S. P., Patterson, K. A., & Lee, J. C. (2008). Eating pathology among adolescent girls with attention-deficit/hyperactivity disorder. *Journal of Abnormal Psychology*, *117*(1), 225. https://doi.org/10.1037/0021-843X.117.1.225.

Miller, W. R. (1980). *The addictive behaviors: Treatment of alcoholism, drug abuse, smoking, and obesity*. Oxford, England: Pergamon.

Miller, W. R., & Brown, J. M. (1991). Self-regulation as a conceptual basis for the prevention and treatment of addictive behaviors. In N. Heather, W. Miler, & J. Greeley (Eds.), *Self-Control and Addictive Behaviours* (pp. 3-79). Sydney, Australia: Maxwell Macmillan Publishing.

Mokdad, A. H., Bowman, B. A., Ford, E. S., Vinicor, F., Marks, J. S., & Koplan, J. P. (2001). The continuing epidemics of obesity and diabetes in the United States. *Journal of the American Medical Association, 286*(10), 1195-1200.

https://doi.org/10.1001/jama.286.10.1195

Molina, B. S., & Pelham Jr, W. E. (2003). Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. *Journal of Abnormal Psychology, 112*(3), 497. https://doi.org/10.1037/0021-843X.112.3.497

Moore, S. A., Zoellner, L. A., Mollenholdt, N. (2008). Are expressive suppression and cognitive reappraisal associated with stress-related symptoms? *Behaviour Research and Therapy*, *46*(9), 993-1000. https://doi.org/10.1016/j.brat.2008.05.001

Morrell, H., Cohen, L., McChargue, D. (2010). Depression vulnerability predicts cigarette smoking among college students: gender and negative reinforcement expectancies as contributing factors. *Addictive Behaviors*, *35*(6), 607-11. https://doi.org/10.1016/j.addbeh.2010.02.011

Murtagh, A. M., & Todd, S. A. (2004). Self-regulation: A challenge to the strength model. *Journal of Articles in Support of the Null Hypothesis*, *3*(1), 19–51. https://doi.org/10.1371/journal.pone.0109950

Musser, E. D., Backs, R. W., Schmitt, C. F., Ablow, J. C., Measelle, J. R., & Nigg, J. T. (2011). Emotion regulation via the autonomic nervous system in children with attention-deficit/hyperactivity disorder (ADHD). *Journal of Abnormal Child Psychology*, *39*(6), 841–852. https://doi.org/10.1007/s10802-011-9499-1.

Nigg, J., Wong, M., Mertel, M., Jester, J., Puttler, L., Glass, J., Adams, K. M., Fitzgerald, H. E., & Zucker, R. A. (2005). Poor response inhibition as a predictor of problem drinking and illicit drug use in adolescent at risk for alcoholism and other substance use disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *45*(4), 468-75. https://doi.org/10.1097/01.chi.0000199028.76452.a9

Nelson, T. D., Nelson, J. M., Mason, W. A., Tomaso, C. C., Kozikowski, C. B., & Andrews Espy, K. (2019). Executive control and adolescent health: Toward a conceptual framework. *Adolescent Research Review, 4*, 31-43. https://doi.org/10.1007/s40894-018-

0094-3

Nelson, T. D., James, T. D., Nelson, J. M., Johnson, A. B., Mason, W. A., Yaroch, A. L., & Andrew Espy, K. (2020). Associations between specific components of executive control and eating behaviors in adolescence: A study using objective and subjective measures. *Appetite*, *154*. https://doi.org/10.1016/j.appet.2020.104784

Newark, P. E., & Stieglitz, R. D. (2010). Therapy-relevant factors in adult ADHD from a cognitive behavioural perspective. *Attention Deficit and Hyperactivity Disorders*, *2*, 59-72. https://doi.org/10.1007/s12402-010-0023-1

Novik, T. S., Hervas, A., Ralston, S. J., Dalsgaard, S., Rodrigues Pereira, R., Lorenzo, M. J., Baldursson, B., Coghill, D., Curatolo, P., Dopfner, M., Falissard, B., Le Heuzey, M. F., Preuss, U., Rasmussen, P., Riley, A. W., Rothengerger, A., Spiel, G., Stenhausen, H. C., & Vlasveld, L. (2006). Influence of gender on attention-deficit/hyperactivity disorder in Europe – ADORE. *European Child and Adolescent Psychiatry*, *15*(1), i15-i24. https://doi.org/10.1007/s00787-006-1003-z

Pajer, K. A. (1998). What happens to "bad" girls? A review of the adult outcomes of antisocial adolescent girls. *American Journal of Psychiatry*, *155*(7), 862-870. https://doi.org/10.1176/ajp.155.7.862

Polivy, J., & Herman, C. P. (2002). Causes of eating disorders. *Annual Review of Psychology*, *53*(1), 187-213. https://doi.org/10.1146/annurev.psych.53.100901.135103

Quirk, S. W. (2001). Emotional concepts in models of substance abuse. *Drug and Alcohol Review*, *20*(1), 95-104. https://doi.org/10.1080/09595230125185

Ramo, D. E., Hall, S. M., & Prochaska, J. J. (2011). Reliability and validity if self-reported smoking in an anonymous online survey with young adults. *Health Psychology*, *30*(6), 693-701. https://doi.org/10.1037/a0023443.

Ramsay, J. R., Rostain, A. L. (2008) Adult ADHD. Routledge, Taylor & Francis Group, New York.

Ramtekkar, U., Reiersen, A., Todorov, A., & Todd, R. (2010). Sex and age differences in attention-deficit/hyperactivity disorder symptoms and diagnoses: Implications for DSM-V and ICD-11. *Journal of the American Academy of Child and Adolescent Psychiatry*, *49*(3), 217-228. https:/doi.org/10.1016/j.jaac.2009.11.011

Reimherr, F. W., Marchant, B. K., Olson, J. L., Halls, C., Kondo, D. G., Williams, E. D., & Robison, R. J. (2010). Emotional dysregulation as a core feature of adult ADHD: Its relationship with clinical variables and treatment response in two methylphenidate trials. *Journal of ADHD and Related Disorders*, *1*, 53–64.

Reynolds, B., Ortengren, A., Richards, J. B., & de Wit, H. (2006). Dimensions of impulsive behavior: Personality and behavioral measures. *Personality and Individual Differences*, *40*(2), 305-315. https://doi.org/10.1016/j.paid.2005.03.024

Richards, J. B., Zhang, L., Mitchell, S. H., & de Wit, H. (1999a). Delay or probability discounting in a model of impulsive behavior: Effect of alcohol. *Journal of the Experimental Analysis of Behavior*, *71*(2), 121-143. https://doi.org/10.1901/jeab.1999.71-121

Richards, T. L., Rosen, L. A., & Ramirez, C. A. (1999b). Psychological functioning differences among college students with confirmed ADHD, ADHD by self-report only, and without ADHD. *Journal of College Student Development*, *40*(3), 299-304.

Rose, G. (1994). *The strategy of preventive medicine*. Oxford: Oxford University Press.

Rufenacht, E., Euler, S. E., Prada, P., Nicastro, R., Dieben, K., Hasler, R., Pham, E., Perroud, N., & Weibel, S. (2019). Emotion dysregulation in adults suffering from attention deficit hyperactivity disorder (ADHD), a comparison with borderline personality disorder (BPD). *Borderline Personality Disorder and Emotion Dysregulation*, *6*(11). https://doi.org/ 10.1186/s40479-019-0108-1

Sadeh, N., & Baskin-Sommers, A. (2016). Risky, impulsive, and self-destructive behavior questionnaire (RISQ): A validation study. *Assessment*, *24*(8), 1080-1094. https://doi.org/10.1177/1073191116640356

Schoenfelder, E. N., & Kollins, S. H. (2016). Topical review: ADHD and health-risk behaviors: Toward prevention and health promotion. *Journal of Pediatric Psychology*, *41*(7), 735–740. https://doi.org/10.1093/jpepsy/jsv162

Schulenberg, J. E., Merline, A. C., Johnston, L. D., O'Malley, P. M., Bachman, J. G., & Laetz, V. B. (2005). Trajectories of marijuana use during the transition to adulthood: The big picture based on national panel data. *Journal of Drug Issues*, *35*(2), 255-279. https://doi.org/10.1177/002204260503500203

Shaw, P., Stringaris, A., Nigg, J., & Leibenluft, E. (2014). Emotional dysregulation and attention-deficit/hyperactivity disorder. *The American Journal of Psychiatry*, *171*(3), 276-293. https://doi.org/10.1176/appi.ajp.2013.13070966

Sher, K. J., & Grekin, E. R. (2007). Alcohol and Affect Regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (p. 560–580). The Guilford Press.

Shriver, L. H., Dollar, J. M., Calkins, S. D., Keane, S. P., Shanahan, L., & Wideman, L. (2021). Emotional eating in adolescence: Effects of emotion regulation, weight status and negative body image. *Nutrients*, *13*(1), 79. https://doi.org/10.3390/nu13010079

Simons, J. S., & Gaher, R. M. (2005). The distress tolerance scale: Development and validation of a self-report measure. *Motivation and Emotion*, *29*(2), 83-102. https://doi.org/10.1007/s11031-005-7955-3

Spencer, T. J., Faraone, S. V., Tarko, L., McDermott, K., & Biederman, J. (2014). Attention-deficit/hyperactivity disorder and adverse health outcomes in adults. *The Journal of Nervous and Mental Disease*, *202*(10), 725-731. https://doi.org/10.1097/NMD.0000000000000191

Spoor, S., Bekker, M., van Strien, T., van Heck, G. (2007). Relations between negative affect, coping and emotional eating. *Appetite*, *48*(3), 368–376. https://doi.org/10.1016/j.appet.2006.10.005

Steinberg, L. (2004). Risk taking in adolescence: What changes, and why? *Annals of The New*

York Academy of Sciences, *1021*(1), 51–58. https://doi.org/10.1196/annals.1308.005

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, *9*(2), 69–74. https://doi.org/10.1016/j.tics.2004.12.005

Stunkard, A. J., & Messick, S. (1985) The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research*, *29*(1), 71–83. https://doi.org/10.1016/0022-3999(85)90010-8

Tarter, R., Kirisci, L., Mezzich, A., Corenlius, J., Pajer, K., Vanyukov, M., Gardner, W., Blackson, T., & Clark, D. (2003). Neurobehavioral disinhibition in childhood predicts early age at onset of substance use disorder. *The American Journal of Psychiatry*, *160*(6), 1078-85. https://doi.org/10.1176/appi.ajp.160.6.1078

Tice, D. M., Bratslavsky, E., Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology*, *80*(1), 53-67. https://doi.org/10.1037/0022-3514.80.1.53

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development*, *59*(2-3), 25-52. https://doi.org/10.1111/j.1540-5834.1994.tb01276.x

Tremblay, M. S., Katzmarzyk, P. T., & Willms, J. D. (2002). Temporal trends in overweight and obesity in Canada. *International Journal of Obesity*, *26*(4), 538-543. https://doi.org/10.1038/sj.ijo.0801923

Tsai, L. L., & Li, S. P. (2004). Sleep patterns in college students: Gender and grade differences. *Journal of Psychosomatic Research*. *56*(2), 231-237.https://doi.org/10.1016/S0022-3999(03)00507-5

Van Eck, K., Flory, K., & Willis, D. (2015). Does distress tolerance moderate the link between ADHD symptoms and numbers of sexual partners? *ADHD Attention Deficit and Hyperactivity Disorder*, *7*(1), 39-47. https://doi.org/10.1007/s12402-014-0140-3

Van Eck, K., Warren, P., & Flory, K. (2017). A variable-centered and person-centered evaluation

of emotion regulation and distress tolerance: Links to emotional and behavioral concerns. *Journal of Youth and Adolescence*, *46*(1), 136-150. https://doi.org/10.1007/s10964-016-0542-y

Van Strien, T., Konttinen, H., Homberg, J. R., Engels, R. C. M. E., & Winkens, L. H. H. (2016). Emotional eating as a mediator between depression and weight gain. *Appetite*, *100*(1), 216-224. https://doi.org/10.1016/j.appet.2016.02.034

Verdejo-García, A., Lawrence, A., Clark, L. (2008). Impulsivity as a vulnerability marker for substance-use disorders: Review of findings from high-risk research, problem gamblers and genetic association studies. *Neuroscience and Biobehavioral Reviews*, *32*(4), 777-810. https://doi.org/10.1016/j.neubiorev.2007.11.003

Wagner, E. F. (1993). Delay of gratification, coping with stress, and substance use in adolescence. *Experimental and Clinical Psychopharmacology*, *1*(1-4), 27-43. https://doi.org/10.1037/1064-1297.1.1-4.27

Willcutt, E. G. (2012). The prevalence of DSM-IV attention-deficit/hyperactivity disorder: A meta-analytic review. *Neurotherapeutics*, *9*(3), 490-499. https://doi.org/10.1007/s13311-012-0135-8

World Health Organization. (2005). Alcohol use and sexual risk behavior: A cross-cultural study in eight countries. Geneva: WHO. Available from: http://www.who.int/substance_abuse/publications/alcohol_sexual_risk_crosscultural.pdf.

Young, S. (2005). Coping strategies used by adults with ADHD. *Personality and Individual Differences*, *38*(4), 809-816. https://doi.org/10.1016/j.paid.2004.06.005

Zijlstra, H., van Middendorp, H., Devaere, L., Larsen, J. K., van Ramshorst, B., & Geenen, R. (2012). Emotion processing and regulation in women with morbid obesity who apply for bariatric surgery. *Psychology and Health*, *27*(12), 1375-1387. https://doi.org/10.1080/08870446.2011.600761

Zvolensky, M., Vujanovic, A. A., Bernstein, A., & Leyro, T. (2010). Distress tolerance: Theory,

measurement, and relations to psychopathology. *Current Directions in Psychological Science*, *19*, 406-410. https://doi.org/10.1177/0963721410388642

Table 1

Demographic Information for Total Sample

Variable	*M* (*SD*) or %
Age (*n* = 143)	20.46 (1.96)
Biological Sex, female	81.8
Race	
White	65.0
Black	11.2
Asian	16.1
Biracial/Multiracial	6.3
Other	1.4
Ethnicity, Latino	14.7
Body Mass Index	24.72 (4.70)
ADHD Diagnosis	44.1
Undergraduate Year	
Freshman	42.7
Sophomore	21.7
Junior	19.6
Senior	14.7
Super Senior	1.4
	8.4
College Athlete	
Greek Life	36.4
Relationship Status	
Single	58.0
In a Relationship	40.6
Engaged/Married	1.4
Parent Education	
Less than high school	1.4
High school graduate	11.9
Some College	15.9
College/University	26.6
Graduate/Professional	43.4
Work	
<20 hours/week	81.8
More than 20 hours/week	18.2
Grades	
All A's	14.0
A's and B's	60.1
A's, B's, and C's	23.1
C's and D's	2.8

Table 2

Bivariate Correlations Between Study Variables

Variable:	2	3	4	5	6	7	8	9	10	11	12	13
1. ADHD Diagnostic Status	.126	.191*	-.225**	-.272**	.578**	.265**	.393**	.249**	.076	.148	.127	-.229**
2. Adaptive ER Strategies	–	.015	.293**	.129	-.036	-.159	-.045	-.014	-.053	-.003	-.099	-.071
3. Maladaptive ER Strategies		–	-.518**	-.341**	.442**	.608**	.159	.124	.237**	.172*	.227**	.037
4. DTS Total Sum			–	.478**	-.445**	-.623**	-.331**	-.162	-.346**	-.344**	-.264**	.271**
5. DGI Total Sum				–	-.476**	-.325**	-.400**	-.325**	-.144	-.435**	-.335**	.191*
6. BAARS-IV ADHD Symptoms Total					–	.529**	.307**	.276**	.193*	.386**	.341**	-.102
7. DASS-21 Total Sum						–	.193*	.061	.392**	.283**	.307**	-.071
8. DUDIT Total Sum							–	.547**	.048	.202*	.123	-.476**
9. AUDIT Total Sum								–	-.038	.226**	.10	-.235**
10. TFEQ Cognitive Restraint Total Sum									–	.229**	.182*	.034
11. TFEQ Uncontrolled Eating Total Sum										–	.777**	-.079
12. TFEQ Emotional Eating Total Sum											–	.063
13. Ethnicity												–

Note: ADHD = Attention Deficit/Hyperactivity Disorder; ER = Emotion Regulation; DTS = Distress Tolerance Scale; DGI = Delayed Gratification Inventory; BAARS = Barkley's Adult ADHD Self-Rating Scale; DASS = Depression Anxiety and Stress Scale; DUDIT = Drug Use Disorders Identification Test; AUDIT = Alcohol Use Disorders Identification Test; TFEQ = Three-Factor Eating Questionnaire. * $p < 0.05$, ** $p < .01$, *** $p < .001$

Table 3

Means, Standard Deviations, and t-tests for Main Study Variables

Variable	Total Sample *M(SD)*	ADHD Sample *M(SD)*	Comparison Sample *M(SD)*	*t*	*p*	*d*
Adaptive ER Strategies	5.83 (1.27)	5.65 (1.33)	5.97 (1.21)	1.51	.133	0.25
Maladaptive ER Strategies	**5.26 (1.27)**	**5.53 (1.29)**	**5.04 (1.22)**	**-2.31**	**.022**	**-0.39**
Distress Tolerance	**42.26 (14.02)**	**38.71 (12.90)**	**45.05 (14.31)**	**2.74**	**.007**	**0.46**
Delay of Gratification	**126.85 (18.48)**	**121.19 (17.77)**	**131.30 (17.91)**	**3.36**	**.001**	**0.57**
ADHD Symptoms	**37.17 (11.52)**	**44.65 (9.43)**	**31.29 (9.43)**	**-8.41**	**<.001**	**-1.42**
Internalizing Symptoms	**19.93 (13.45)**	**23.94 (12.99)**	**16.78 (13.03)**	**-3.27**	**.001**	**-0.55**
TFEQ – Cognitive Restraint	16.18 (3.99)	16.52 (4.40)	15.91 (3.64)	-0.91	.365	-0.15
TFEQ – Uncontrolled Eating	21.34 (6.44)	22.41 (5.59)	20.50 (6.96)	-1.78	.071	-0.30
TFEQ – Emotional Eating	7.08 (2.76)	7.48 (2.55)	6.78 (2.89)	-1.52	.131	-0.26
Drug Use	**3.30 (6.40)**	**6.13 (8.37)**	**1.08 (2.71)**	**-5.08**	**<.001**	**-0.86**
Alcohol Use	**7.33 (6.60)**	**9.17 (7.39)**	**5.88 (5.53)**	**-3.05**	**.004**	**-0.51**

Note: ER = emotion regulation; DTS = distress tolerance scale; DUDIT = drug use disorders identification test; AUDIT = alcohol use disorder identification test; TFEQ = three-factor eating questionnaire; ADHD = attention-deficit hyperactivity disorder.

Table 4

Aim 2: Multiple Regression Analyses

Variable	β	*p*	R^2
Drug Use			
Adaptive ER Strategies	-.033	.664	
Maladaptive ER Strategies	.036	.707	
Distress Tolerance	-.044	.681	.312
Delay of Gratification	**-.231**	**.008**	
ADHD Symptoms	.140	.121	
Internalizing Symptoms	-.041	.696	
Ethnicity	**-.412**	**<.001**	
Alcohol Use			
Adaptive ER Strategies	-.033	.704	
Maladaptive ER Strategies	.086	.424	
Distress Tolerance	.044	.718	.132
Delay of Gratification	**-.227**	**.019**	
ADHD Symptoms	**.220**	**.031**	
Internalizing Symptoms	-.174	.137	
Ethnicity	**-.199**	**.022**	
Cognitive Restraint			
Adaptive ER Strategies	.087	.310	
Maladaptive ER Strategies	-.087	.418	
Distress Tolerance	**-.274**	**.023**	.149
Delay of Gratification	.005	.956	
ADHD Symptoms	-.041	.682	
Internalizing Symptoms	.320	.006	
Uncontrolled Eating			
Adaptive ER Strategies	.111	.162	
Maladaptive ER Strategies	-.163	.100	
Distress Tolerance	-.176	.102	.230
Delay of Gratification	**-.299**	**.001**	
ADHD Symptoms	**.194**	**.042**	
Internalizing Symptoms	.090	.413	
Emotional Eating			
Adaptive ER Strategies	-.033	.683	
Maladaptive ER Strategies	.035	.731	
Distress Tolerance	.038	.732	.186
Delay of Gratification	**-.184**	**.049**	
ADHD Symptoms	.146	.139	
Internalizing Symptoms	.155	.172	
Body Mass Index	**.233**	**.003**	

Note. Note: ER = emotion regulation; DTS = distress tolerance scale; DUDIT = drug use disorders identification test; AUDIT = alcohol use disorder identification test; TFEQ = three-factor eating questionnaire; ADHD = attention-deficit hyperactivity disorder.

Table 5

Aim 3: Multiple Regression Analyses with Interactions by ADHD Status

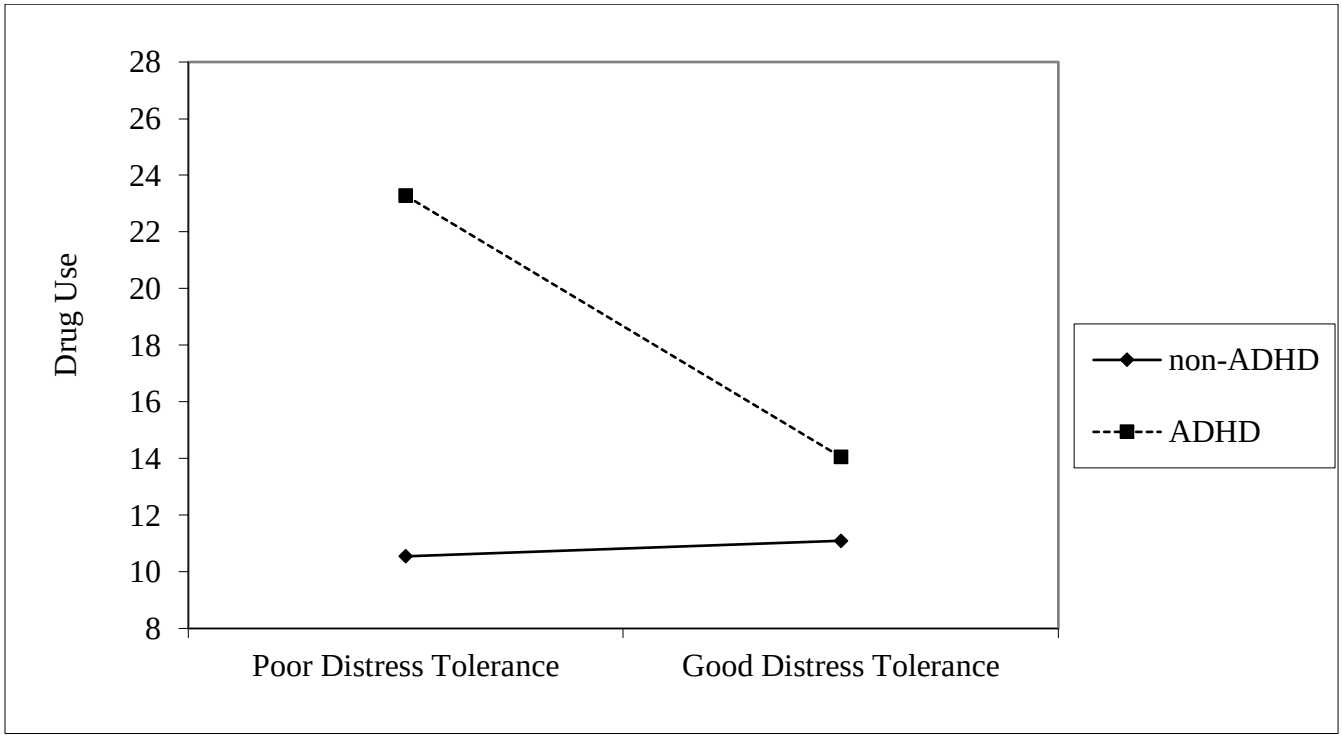
Variable	*b*	*p*	R^2
Drug Use			
Adaptive ER Strategies	0.016	.890	
Maladaptive ER Strategies	0.084	.456	.375
Distress Tolerance	0.080	.535	
Delay of Gratification	**-0.216**	**.006**	
Internalizing Symptoms	-0.007	.943	
Ethnicity	**-0.317**	**<.001**	
ADHD Status	**1.546**	**.006**	
ADHD x Adaptive ER	-0.203	.567	
ADHD x Maladaptive ER	-0.461	.223	
ADHD x Distress Tolerance	**-0.706**	**.013**	
Alcohol Use			
Adaptive ER Strategies	0.178	.185	
Maladaptive ER Strategies	0.084	.531	
Distress Tolerance	-0.097	.525	.124
Delay of Gratification	**-0.227**	**.020**	
Internalizing Symptoms	-0.106	.356	
Ethnicity	**-0.203**	**.031**	
ADHD Status	0.521	.428	
ADHD x Adaptive ER	-0.688	.103	
ADHD x Maladaptive ER	0.011	.980	
ADHD x Distress Tolerance	0.293	.376	
Cognitive Restraint			
Adaptive ER Strategies	0.072	.584	
Maladaptive ER Strategies	-0.239	.068	
Distress Tolerance	-0.257	.086	.164
Delay of Gratification	0.030	.742	
Internalizing Symptoms	**0.274**	**.016**	
ADHD Status	-0.889	.163	
ADHD x Adaptive ER	-0.153	.704	
ADHD x Maladaptive ER	**1.008**	**.020**	
ADHD x Distress Tolerance	0.087	.778	
Uncontrolled Eating			
Adaptive ER Strategies	0.232	.066	
Maladaptive ER Strategies	-0.098	.436	
Distress Tolerance	-0.337	.020	.226
Delay of Gratification	**-0.372**	**<.001**	
Internalizing Symptoms	0.172	.114	
ADHD Status	-0.001	.999	
ADHD x Adaptive ER	-0.248	.521	
ADHD x Maladaptive ER	-0.267	.519	

ADHD x Distress Tolerance	.509	.089	
Emotional Eating			
Adaptive ER Strategies	.083	.521	
Maladaptive ER Strategies	.060	.639	
Distress Tolerance	-.124	.403	.180
Delay of Gratification	**-.243**	**.007**	
Internalizing Symptoms	.215	.056	
Body Mass Index	**.264**	**.001**	
ADHD Status	-.225	.727	
ADHD x Adaptive ER	-.266	.504	
ADHD x Maladaptive ER	-.046	.915	
ADHD x Distress Tolerance	.517	.100	

Note. ER = emotion regulation; DTS = distress tolerance scale; DUDIT = drug use disorders identification test; AUDIT = alcohol use disorder identification test; TFEQ = three-factor eating questionnaire; ADHD = attention-deficit hyperactivity disorder.

Figure 1

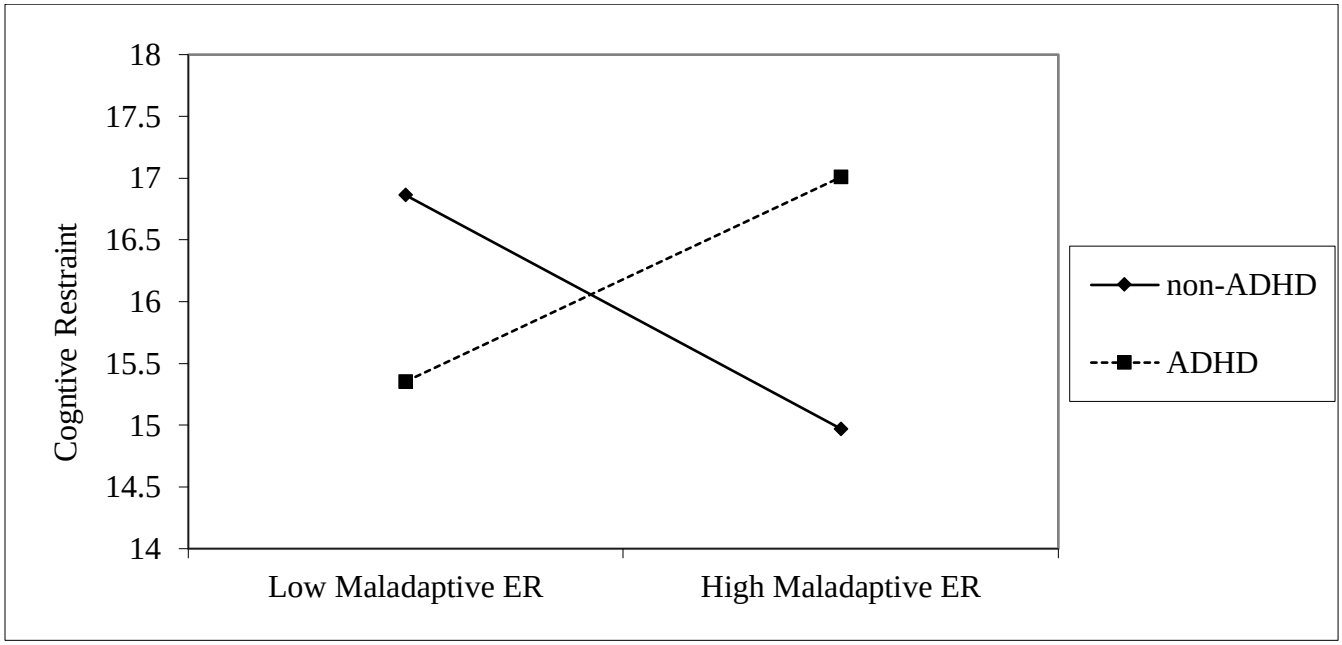
Interaction Between ADHD Diagnostic History and Distress Tolerance Predicting Drug Use



Note. ADHD = attention-deficit hyperactivity disorder.

Figure 2

Interaction Between ADHD Diagnostic History and Distress Tolerance Predicting Drug Use



Note. ER = emotion regulation; ADHD = attention-deficit hyperactivity disorder.