Anhedonia and Impulsivity in College Alcohol Use: A Path Analysis

Sydney N. Stamatovich

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ANHEDONIA AND IMPULSIVITY IN COLLEGE ALCOHOL USE: A PATH ANALYSIS

By

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B.S., Indiana University, 2017

A Thesis Submitted in Partial Fulfillment of
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The members of the Committee appointed to examine the Thesis of Sydney Nichole Stamatovich find it satisfactory and recommend that it be accepted.

Chairperson

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This study tested a path model to explore whether different types of anhedonia are associated with alcohol use and problems via different types of impulsivity in 640 college students (ages 18-25). This study parsed anhedonia into four specific facets: consummatory and anticipatory anhedonia, and “recreational” and social anhedonia. Consummatory anhedonia (i.e., the “liking” of a reward) was hypothesized to be associated with alcohol use and problems via sensation seeking, a component of impulsivity where individuals tend to seek out rewarding, yet sometimes risky stimuli. Further, anticipatory anhedonia (i.e., the process of “looking forward to” or “wanting” a reward) was hypothesized to be associated with alcohol use and problems via negative urgency, a component of impulsivity where individuals act rashly under conditions of negative affect. Both consummatory and anticipatory anhedonia were further divided into “recreational” anhedonia (e.g., deficits in pleasure from food, hobbies/pastimes, sensory experiences), and social anhedonia (e.g., deficits in pleasure from social situations, relationships). Recreational consummatory anhedonia was negatively associated with alcohol use and alcohol related problems through negative urgency, suggesting that individuals higher in this type of anhedonia are less likely to use alcohol when distressed, and may not use it to ameliorate negative affect. Recreational consummatory anhedonia also had significant negative associations with alcohol consumption via sensation seeking, indicating that these individuals are less likely to seek out alcohol as a reward. Further, social anticipatory anhedonia was positively associated with alcohol use and related problems via negative urgency, suggesting that individuals may drink to ameliorate negative affect related to social situations. This study highlights important associations between anhedonia, impulsivity, and alcohol use and related problems.
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Introduction

College students often exhibit risky drinking behaviors. According to the Substance Abuse and Mental Health Services Administration (SAMHSA), around 35% of college students have engaged in binge drinking, while approximately 10% meet the diagnostic threshold for alcohol use disorder (Substance Abuse and Mental Health Services Administration, 2021). Although alcohol consumption is typical for young adults experiencing newfound freedom in a highly social environment, there can be significant consequences associated with excessive drinking. Potential consequences may include the development of a psychological disorder, difficulties within social relationships, the experience or perpetuation of sexual or physical assault, failure to meet academic expectations, and legal consequences (Ayala et al., 2017; White & Hingson, 2013; Substance Abuse and Mental Health Services Administration, 2021).

Considering that alcohol use can have deleterious consequences, and that the severity of use cannot solely be explained by expectations of the college lifestyle, it is important to understand factors that contribute to alcohol consumption and alcohol-related problems in this at-risk population.

Anhedonia is a reward deficiency that can be described as an individual’s inability or reduced ability to experience pleasure, particularly a loss of pleasure to activities that the average person would find pleasurable, such as time with a loved one or an enjoyable activity (Treadway & Zald, 2011; Treadway & Zald, 2013). Anhedonia is an important contributor to the maintenance of various substance use disorders (Hatzigiakoumis et al., 2011; Garfield et al., 2014). In regard to alcohol consumption, anhedonia has been identified as a potential byproduct of withdrawal that perpetuates alcohol craving and contributes to relapse (Koob & Le Moal, 2001; Volkow et al., 2002). It has also been observed that anhedonia can dissipate with
prolonged abstinence (Martinotti et al., 2008, 2011). Conversely, individuals may be more likely to engage in substance use if they have a deficiency in their reward system, potentially inhibiting their response to typical, less risky rewards (Baskin-Sommers & Foti, 2015; Bowirrat & Oscar-Berman, 2005; Volkow et al., 2003). However, additional research on anhedonia as a specific vulnerability to alcohol use is required. While depression and negative affect have been consistently associated with alcohol outcomes (Destoop et al., 2019; Foulds et al., 2015), little research to date has focused in depth on the role of anhedonia in college alcohol consumption and related problems. Thus, this is an area that requires more thorough investigation.

Further, it is important to note that anhedonia is more complex than it is typically regarded. The literature tends to discuss anhedonia as a symptom of a mental disorder. For instance, it is considered one of the hallmark symptoms of major depressive disorder, schizophrenia, and PTSD (Trøstheim et al., 2020). However, as will be discussed in more length throughout this proposal, anhedonia is an invasive and measurable deficit in reward functioning (Höflich et al., 2018; Treadway & Zald, 2013). In addition, anhedonia can be reduced and examined in facets. For example, anhedonia can be categorized as a lack of pleasure from stimuli including food, hobbies, or sensory experiences, as well as the lack of pleasure to social situations including friendship or interactions with family members (Barkus & Badcock, 2019; Treadway & Zald, 2013; Berridge & Robinson, 2003). These facets can be reduced further to what are typically referred to as consummatory (i.e., the “liking”), anticipatory (i.e., the “wanting” or “looking forward to”), and motivational anhedonia (i.e., the “wanting” or effort put in to obtain a reward) (Strauss et al., 2011; Treadway & Zald, 2013; Berridge et al., 2009; Der-Avakian & Markou, 2012). Although anhedonia has been linked to alcohol use, specific facets of
anhedonia have not been adequately investigated in relation to alcohol consumption and related problems, nor have they been explored in depth in the college population.

Another important characteristic of substance use, including alcohol use, is impulsivity (Curcio & George, 2011; LaBrie et al., 2014). Impulsivity can briefly be described as an individual’s predisposition to “act on a whim,” without fully considering the effects of their actions on themselves or others (Bari et al., 2016). The relationship between impulsivity and alcohol use is bidirectional in nature. Both chronic and acute alcohol consumption have been linked to weakened self-regulation, leading to maladaptive and uninhibited behavior (Dick et al., 2010). Conversely, higher levels of impulsivity increase the risk for alcohol-related consequences (Simons et al., 2004), and impulsivity is a significant risk factor for developing alcohol use disorder (Lejuez et al., 2010). Further, such as with anhedonia, impulsivity can be examined further and parsed into facets that are particularly relevant to substance use. The literature has highlighted associations between sensation seeking, the tendency to impulsively seek out rewarding stimuli, and negative urgency, the tendency to act impulsively under conditions of negative affect, and alcohol use (Curcio & George, 2011; Dvorak et al., 2013).

Although anhedonia and impulsivity seem to both have important associations to alcohol use, there has been very little research on their mechanisms of association. It is possible that anhedonia may be a proximal factor for the development of impulsivity. Individuals who do not experience pleasure may be more likely to act impulsively and take risks to obtain rewards; thus, acting impulsively may be a compensatory behavior. Indeed, there is some evidence for a positive association between anhedonia and sensation seeking (Mccann et al., 1990). Currently, the association between anhedonia and negative urgency is not well known, but studies have shown that they may be predictive of hedonic hunger and smoking (Mason et al., 2020; Roys et
Additionally, is it less understood how certain types of anhedonia (e.g., consummatory, anticipatory) may be differentially associated with facets of impulsivity (e.g., sensation seeking, negative urgency). Further, the relationship between anhedonia and impulsivity has primarily been studied in clinical samples, particularly schizophrenia, MDD, and BPD. The results of such research have been mixed, such that higher scores in both physical and social anhedonia predict more impulsive behaviors in individuals with schizophrenia, while negative correlations were found between both physical and social anhedonia in individuals with MDD (Amr & Volpe, 2013). Further, in individuals with BPD, anhedonia has been found to be associated with worsened symptoms and more impulsive behavior, but no such associations were found in a control group (Marissen, 2010). These results are not exceedingly informative for other populations; thus, this is an area of research that requires more attention.

The current study probed this relationship further by investigating the associations between anhedonia, impulsivity, and alcohol use and related problems within a college sample. Specifically, this study investigated impulsivity as a potential mediator or explanatory variable between anhedonia and alcohol use and related problems. Anhedonia was broken down into consummatory (i.e., “liking”) and anticipatory (i.e., “looking forward to” or “wanting”) anhedonia. Unique to this study, anhedonia was further parsed into “recreational” (e.g., pleasure from food, hobbies, activities/pastimes) and social (e.g., pleasure from social interaction) anhedonia. Impulsivity included the facets of sensation seeking, or the tendency to impulsively seek out pleasurable or rewarding stimuli, and negative urgency, the tendency to act impulsively while negatively aroused. In essence, a path model was used to investigate associations between the facets of anhedonia and alcohol and related problems via impulsivity, while controlling for gender and depressive symptoms.
The subsequent literature review will first discuss the prevalence and problems related to alcohol use in college populations. Second, it will discuss the construct of anhedonia, how it is measured, and the comorbidity of anhedonia and alcohol use. Next, impulsivity will be defined, and the relationship between impulsive behavior and alcohol use will be described. Lastly, the current literature regarding potential associations between anhedonia and impulsivity will be discussed.

**Literature Review**

*Alcohol Use and Problems Among College Students*

College students are at a significantly elevated risk of misusing alcohol, with an estimated 10% meeting the diagnostic threshold for alcohol use disorder, and 31% of students indicating that they have struggled with their alcohol use (Substance Abuse and Mental Health Administration, 2021). Further, college students between the ages of 18-24 who are enrolled full-time are more likely to consume alcohol, to binge drink, and to drink in higher frequency than their same-age peers who are either enrolled part-time or are not enrolled in college (Substance Abuse and Mental Health Administration, 2021). Thus, provided the elevated levels of alcohol consumption among this population, college students are more likely to experience alcohol-related problems.

Excessive alcohol use, particularly in binge patterns, is associated with various problems (Wechsler & Nelson, 2008; National Institute on Alcohol Abuse and Alcoholism, 2021). Binging is described as the pattern of drinking that raises blood alcohol concentration (BAC) levels to 0.08 g/dL; this typically occurs after the consumption of 4 drinks for women and 5 drinks for men within a 2-3-hour period. Further, it has been estimated that around 35% of college students have engaged in binge drinking at some point (Substance Abuse and Mental Health Administration, 2021).
Problems associated with this type of drinking often include poor academic performance, impaired social relationships, engagement in risky behaviors (e.g., engaging in unplanned and/or unprotected sex, driving under the influence, and destruction of property), as well as compromised health (Wechsler & Nelson, 2008). Further, it has been estimated that each year about 1,519 college students between the age of 18-24 die from alcohol-related injuries. Additionally, it is estimated that around 696,000 students are assaulted while drinking alcohol, or by another student who has been drinking. An additional 97,000 students report experiencing alcohol-related sexual assault or date rape each year (Hingson et al., 2005; White & Higson, 2013; Substance Abuse and Mental Health Administration, 2021; Jaffe et al., 2017).

Given the number of problems associated alcohol consumption, is important to consider factors that contribute to alcohol use among college students, aside from the college drinking culture. For example, college can be an extremely stressful time for students, as they are provided with a new sense of independence, while also experiencing more demanding responsibilities. Surveys have suggested that up to 45.8% of college students seeking services at their campus counselling or psychological services center met criteria for a psychological disorder (Geisner et al., 2012), with depression and related symptoms being the most prominent issue (Gallagher, 2009; Kitzrow, 2003). Further, a co-morbid diagnosis of alcohol use disorder and depression is common (Flynn, 2000). Although some college students with increased depressive symptoms also report increased rates of alcohol use and problems, the literature is mixed in this population. For example, some literature posits that there are no differences in alcohol consumption between college students with and without depression, while others have suggested that individuals with depressive symptoms are more likely to consume alcohol,
particularly if they believe it will ameliorate some of their symptoms (Weiss et al., 2018; Witkiewitz & Villarroel, 2009). Thus, students with depression may drink as a means of coping, consistent with the self-medication hypothesis of alcohol use (Khantzian, 1985, 2003). Similarly, frequent and heavy alcohol use may also exacerbate depressed mood or negative affect (McHugh & Weiss, 2019). College students may turn to alcohol use as a coping mechanism when experiencing an overall negative affect. For example, daily diary studies in the college population demonstrated positive associations between negative affect and alcohol use and related problems (Park et al., 2004; Simons et al., 2005). Interestingly, negative affect may also work to decrease drinking behaviors, such that they alter an individual’s motivation or interest in drinking (i.e., withdrawal behavior), influencing rates of alcohol consumption (Foulds et al., 2015). Thus, although there are some mixed findings within the current literature, college students may be prone to alcohol consumption and related problems in an attempt to mitigate and cope with their negative emotions (i.e., self-medicate).

Further, there are other theoretical models within the literature that are used to understand alcohol use and related problems in college students aside from self-medication. First, it is important to consider the genetic and neurobiological influences in alcohol use and consequences. Research has consistently shown that genes contribute significantly to risk of developing an alcohol use disorder (Beidel, 2014). For instance, two genes that encode alcohol metabolism, alcohol dehydrogenase and aldehyde dehydrogenase, have the strongest relationship to alcohol use disorder (Beidel, 2014). Genetic variants effect the metabolism and pharmacokinetics of alcohol use, influencing the subjective response to alcohol and reinforcing use. Further, two biological systems have recently received considerable attention in regard to the development of alcohol use disorder. Specifically, the hypothalamic-pituitary-adrenal (HPA)
axis and endogenous opioid system have been implicated in alcohol consumption, such that some individuals may experience greater activation in these systems during alcohol consumption and intoxication, further reinforcing drinking behaviors (Le Merrer et al., 2009, Dai et al., 2007).

**Anhedonia: Definition**

Anhedonia can be defined as a deficit in reward function, which is experienced subjectively as an individual’s inability or significantly reduced ability to experience pleasure from various activities (Zald & Treadway, 2017; Treadway & Zald, 2011; Treadway & Zald, 2013). Anhedonia often accompanies a psychiatric diagnosis and is a hallmark of depression, the negative symptoms of schizophrenia, and PTSD (Amr & Volpe, 2013; Treadway & Zald, 2011; Trøstheim et al., 2020). One study found significant levels of anhedonia in around 37% of individuals with depression and 45% of individuals with schizophrenia (Pelizza & Ferrari, 2009). The presence of anhedonia in psychiatric diagnoses is important, as it impacts treatment outcomes for various disorders, with higher levels of anhedonia predicting longer times to remission, relapse in substance use, and a generally more difficult recovery (Garfield et al., 2014; Hatzigiakoumis et al., 2011; Martinotti et al., 2011; Marissen et al., 2012). However, although anhedonia is an important feature in certain psychiatric diagnoses, some research has examined it as more than a symptom (Harvey et al., 2007; Ho & Sommers, 2013; Zhou et al., 2019).

Much of the existing literature investigates anhedonia as a symptom of a psychiatric diagnosis; however, there has been some effort in the literature to investigate anhedonia more extensively, particularly as a potential precursor or vulnerability to psychiatric diagnoses. This can be referred to as trait anhedonia. For example, it has been proposed that anhedonia is an innate trait that predisposes individuals to schizophrenia, manifesting before the onset of clinical symptoms (Pelizza & Ferrari, 2009). Paul Meehl had hypothesized that anhedonia was among
one of the fundamental schizotypal traits of schizophrenia (together with emotional ambivalence, avoiding social relations, and cognitive-perceptive distortions) and that it was an underlying, integrated functional defect of the central nervous system (Meehl, 1987). It was hypothesized that schizophrenia would develop in individuals with this trait if they were to experience unfavorable environmental conditions or stressors (Phillips & Silverstein, 2003; Meehl, 1987; Lenzeweger et al., 2006). Further, Myerson also considered anhedonia as a potential premorbid trait to depression, hypothesizing that some individuals may be “hypohedonic” (anhedonic) by nature. Specifically, it was posited that the presence of anhedonia may create a mild and chronic form of depression that may predispose these individuals to more severe clinical symptoms (Myerson, 1946). Similar to the emergence of schizophrenia, these individuals may endure diverse stress factors that influence the emergence of depression (Meehl, 1987). Further, more recently, clinical levels of anhedonia have been found in individuals without a depression diagnosis (Franken et al., 2007).

The movement to study anhedonia more extensively has led to the acknowledgement of various types or facets of anhedonia, particularly differentiating between a lack of pleasure from specific activities and stimuli (e.g., hobbies, recreational activities), socialization (e.g., time with a loved one, friendships), and physical touch (e.g., tactile pressure, sex, eating) (Chapman et al., 1976; Gard et al., 2006). However, there is still some lack of consensus to these divisions. For example, physical anhedonia encompasses numerous pleasures regarding physical touch and sensation, such as sex, but one might also consider sex an aspect of social anhedonia. Thus, there are certainly potential overlaps between the constructs of anhedonia. However, for the purpose of this study, a hedonic deficit in regard to specific activities and stimuli, including eating, sensory experiences, hobbies, and pastimes, will be referred to as “recreational” anhedonia to avoid
confusion, while the lack of pleasure to socialization will be referred to “social” anhedonia (Chapman et al., 1976; Barkus & Badcock, 2019). Social anhedonia is an accepted term in the literature, but recreational anhedonia is not a term used in the literature; it was created to assist in differentiating the types of anhedonia that will be discussed in this project.

In addition, recent literature has utilized a neuroscience-based approach to parsing anhedonia and found there are significant differences between facets. Anhedonia is more complex than the inability to feel pleasure; it is an invasive deficit throughout the reward circuitry that influences an individual’s motivation to receive a reward, the pleasure experienced from a reward, the ability to learn or adapt in order to earn a reward, and the anticipation of receiving a reward (Der-Avakian & Markou, 2012). Deficits in these processes can be referred to as consummatory, motivational, and anticipatory anhedonia (Der-Avakian & Markou, 2012).

Through imaging, researchers have been able to differentiate these processes from one another, as (lack of) activity appears in unique brain regions; thus, deficits in each domain might have different implications (Berridge & Robinson, 2003; Knutson et al., 2001; Berridge et al., 2009). For example, consummatory reward, i.e., pleasure from obtaining a reward or the “liking” of a reward, is mediated by opioid hotspots in the nucleus accumbens, the ventral pallidum, and the orbital frontal cortex (OFC) (Berridge et al., 2009; Der-Avakian & Markou, 2012). Motivational reward, described as the exertion of effort to obtain a reward, is controlled by activity in the ventral tegmental area that activate D2 receptors in the nucleus accumbens, lateral hypothalamus, and anterior cingulate cortex (ACC) (Grace, 2000). Lastly, anticipation of a reward, i.e., thinking about or wanting a reward, is the activation of subcortical limbic and prefrontal brain regions, including the thalamus, striatum, prefrontal cortex, and anterior cingulate (Oldham et al., 2018;
This study will focus specifically on the deficits of consummatory and anticipatory anhedonia.

Consummatory anhedonia can be defined as the reduced ability to “like” or enjoy a reward or pleasurable experience, and it contributes to the broader definition of anhedonia (Gard et al., 2006). Consummatory reward can encompass both the recreational (i.e., loss of interest in hobbies or pastimes, sex, food) and social (i.e., loss of interest in social situations, time with loved ones) components of anhedonia. Many empirical studies on anhedonia have focused on consummatory pleasure, with the majority concerning depression. For instance, depressed individuals experience reduced emotional reactivity to laboratory stimuli (Bylsma & Rottenberg, 2011), while also experiencing blunted emotional reactivity to daily events, and more overall negative reactivity. Thus, this shows reduced capacity to “like” pleasurable stimuli (Bylsma & Rottenberg, 2011). In addition, significant irregularities in brain activity and function related to consummatory pleasure have been observed in individuals at risk for depression (Bos et al., 2018; Foti et al., 2011). In terms of social anhedonia, there is a lack of research parsing the consummatory and anticipatory components; however, individuals with schizophrenia have the ability to experience pleasure from stimuli and activities, while also experiencing a deficit in their ability to enjoy socialization and interpersonal relationships (Amr & Volpe, 2013), again suggesting that these are distinct facets. Thus, although there have been efforts to investigate consummatory anhedonia, further research is required to determine the differences in the inability to “like” recreational and social stimuli, as well as the impact that such differences may have on an individual, particularly in more non-clinical populations.

Anticipatory anhedonia can be defined as the reduced ability to “look forward to” or anticipate a reward or pleasurable experience (Gard et al., 2006). Research regarding anticipatory
anhedonia has been conducted primarily in individuals with schizophrenia. In these samples, research has demonstrated that the “in the moment” liking of stimuli may remain intact; however, these individuals tend to have deficits in the anticipatory process of reward (Gard et al., 2007). Further, it has been shown that individuals with social anhedonia exhibit difficulties in anticipating future pleasure, as well as using previous positive experiences to motivate future behaviors (Gold et al., 2008). This may impact an individual’s overall affect, as they are unable to look forward to pleasurable activities or experiences in their life (Strauss et al., 2011; Gard et al., 2007). However, this is an area that require further examination to better understand how anticipatory anhedonia differs in regard to recreational and social stimuli, and how these differences might be impactful.

Anhedonia: Measurement

There are numerous ways to measure anhedonia. As mentioned previously, anhedonia can be measured with brain imaging, self-report, or psychophysiological methods. One of the most used self-report methods in research settings is the Snaith-Hamilton Pleasure Scale (SHAPS) (Snaith et al., 1995). This 14-item self-report scale aims to target the (lack of) “liking” of various stimuli, including questions regarding hobbies, entertainment, and food. Thus, this measure is best for both the recreational and consummatory facets of anhedonia. The Temporal Experience of Pleasure Scale (TEPS) is another self-report scale of 18 items (Gooding & Pflum, 2014). Interestingly, this self-report assessment parsed and investigated anhedonia in terms of consummatory and anticipatory pleasure. Roughly half of the questions assess how much an individual “likes” a certain situation or stimuli, while the other half assesses how much a person might “look forward to” certain situations or stimuli. Further, other researchers have produced lengthy scales for both physical and social anhedonia called the Revised Social Anhedonia Scale.
and Revised Physical Anhedonia Scale (Chapman et al., 1976), as well as the Social Consummatory and Interpersonal Pleasure Scale (Gooding & Pflum, 2014).

Aside from self-report, brain imaging and other laboratory-based techniques are useful for measuring anhedonia. Functional magnetic resonance imaging (fMRI) is a reliable method for observing abnormalities associated with anhedonia, particularly examining the frontal striatal reward processing networks, the ventromedial prefrontal cortex (vmPFC), orbital frontal cortex (OFC), among other areas such as the ventral striatum (VS) (Haber & Knutson, 2010; Sescousse, et al., 2013). Psychophysiology can also be used to assess anhedonia. Particularly, the corrugator (muscles above the eyes, controls furrowing of the brow) and zygomatic (muscles around the mouth, controls smile/frown) facial muscles can be informative when measured via electromyography (EMG). When individuals are viewing various types of stimuli (e.g., positive, negative, and neutral pictures), they experience movements in the corrugator and zygomatic muscles as a response. Individuals with anhedonia can have blunted responses to various images (Kadison et al., 2015; Dimberg et al., 2011).

**Anhedonia and Alcohol Use and Problems**

Anhedonia has been investigated in relation to quit attempts and withdrawal of substance use. Anhedonia is related to poorer treatment outcomes, and diminished response to treatment techniques utilizing reward systems, such as contingency management (Wardle et al., 2017; Crits-Christoph, 2018). Specific to alcohol, anhedonia is a frequent feature in patients with alcohol use disorder during both acute and chronic withdrawal (Heinz et al., 1994; Hatzigiakoumis et al., 2011). It has been suggested that symptoms of anhedonia in substance use may be caused by a functional deficit in the dopaminergic reward system. This idea has been supported by PET and SPECT findings. Research has shown that a reduced striatal density of
unoccupied dopamine D2-receptors is correlated with craving in individuals with substance use (Destoop et al., 2019; Volkow et al., 1996). In studies following the quit attempts of substance users, anhedonia was shown to increase with more frequent use, while it would tend to decrease for some individuals after a period of prolonged abstinence, suggesting that it may be a byproduct of use and withdrawal (Garfield et al., 2014, 2017; Lubman et al., 2018). Fluctuations in the presence of anhedonia during active use and periods of abstinence also suggest that anhedonia might develop during the course of a SUD (Crits-Christoph et al., 2018; Garfield et al., 2014, 2017). Individuals that experience anhedonia during withdrawal tend to experience less successful treatment, are more likely to relapse, and tend to have a more difficult course of recovery overall (Martinotti et al., 2008, 2011).

It has also been proposed that anhedonia may impact the initiation of alcohol use. Anhedonia may, for some individuals, act as a pre-existing vulnerability driving the initiation of substance use, as well as the transition from regular use to addiction (Garfield et al., 2014). As with many disorders, it can be difficult to determine temporal associations. However, anhedonia has been implicated as a psychopathological trait that can arise in adolescence and mediate the association of family history of substance use with polysubstance use patterns across mid-adolescence (Cho et al., 2019). Further, anhedonia during adolescence is correlated with substantial decline in orbital frontal cortex volume; this decline, orbital frontal cortex (OFC) thickness, and volume significantly and predicts subsequent alcohol use frequency during adolescence (Luby et al., 2018). Thus, although further research is required, anhedonia may an important contributor to alcohol use.

There is a gap in the literature regarding the differentiation of unique facets of anhedonia in relation to alcohol use. One study found that patients with schizophrenia and co-morbid
substance use disorders have higher levels of social anhedonia when compared to individuals with only schizophrenia. Both of these groups had higher levels than a control group (Zhornitsky et al., 2012). Further, in a study assessing psychosis-prone individuals, social anhedonia and magical ideation were measured and it was found that these individuals had more severe alcohol use than the control group; however, these findings did not appear to be significant for social anhedonia alone (Kwapil et al., 1997). Individuals with deficits in pleasure to other non-social stimuli appear to experience more alcohol consumption, as well as experience significant alcohol cravings, suggesting that recreational anhedonia might be more predictive of substance use issues than social anhedonia (Martinotti et al., 2008). Further, little has been done to determine whether consummatory or anticipatory anhedonia predict alcohol use and related problems uniquely. Because reward anticipation and experience reinforce behaviors, these could relate to alcohol in a few possible ways. First, it could be that the lack of pleasure and inability to anticipate reward deters individuals from drinking (i.e., there is a lack of reinforcement) (Geaney et al., 2015), while deficits in these areas could also influence an individual to use alcohol in order to alleviate their lack of pleasure or overall negative affect (Destoop et al., 2019; Kaiser et al., 2012). However, a gap in the literature regarding these specific facets of anhedonia and alcohol use warrants further investigation.

**Impulsivity: Definition**

Impulsivity is an important psychological construct that plays a prominent role in many personality theories, as well as the understanding and diagnosis of various forms of psychopathology (Whiteside et al., 2005). It can be defined as an individual’s propensity or predisposition to act in a rapid, unplanned way with minimal regard to the potential negative consequences (Moeller et al., 2001). Individuals with impulse control disorders often fail to resist
an impulse or temptation, as they experience a rise of arousal or excitement before an act, while experiencing pleasure or gratification after the act is performed (American Psychiatric Association, 2014).

There are some important aspects of impulsivity that should be highlighted. First, there is discord throughout the literature in the determination of a generally accepted definition of impulsivity. Particularly, the lack of concise wording contributes to this issue; it is not uncommon for articles to use the terms sensation seeking, risk-taking, or novelty seeking (among many other terms) to discuss impulsivity (Becker et al., 1978). Thus, the previously provided definition was utilized in attempts to separate impulsivity from other aspects of “executive” cognitive functioning. Second, impulsivity is different than simply having poor judgment. Although poor judgment tends to lead to negative consequences, these actions are typically planned, while impulsivity is spur of the moment (Cooper et al., 2014; Becker et al., 1978).

Further, impulsivity can be discussed at both trait and state perspectives. A trait is a quality or characteristic of an individual that is relatively stable over time; thus, trait impulsivity is a personality feature that predisposes an individual to act with little consideration of the possible consequences (Moeller et al., 2001). Although acting on a whim may be advantageous in certain situations, impulsive behaviors are generally quite maladaptive, and these individuals tend to experience various issues throughout their lives. Impulsive traits are considered to be at the core of various psychiatric diagnoses, such as attention deficit/hyperactivity disorder (ADHD), substance use, borderline personality disorder (BPD), and schizophrenia (Bari et al., 2016; Ditrich et al., 2021; Ouzir, 2013). Conversely, state impulsivity is defined as the variable, momentary response to contextual intrinsic and extrinsic triggers (Nguyen et al., 2018). Essentially, this is a momentary change that affects the internal state of an individual. These
changes can be brought about by the external environment (e.g., social situations, drug/alcohol intoxication, or stressful situations), or internally (e.g., memories, thoughts) (Nguyen et al., 2018; Becker et al., 1978; Wingrove & Bond, 1997).

**Impulsivity: Measurement**

Similar to anhedonia, impulsivity is a multi-faceted construct and can be conceptualized and measured in various ways. The Five-Factor Model of personality (FFM; McCrae & Costa, 1990) has been used as a framework for conceptualizing and clarifying the facets of impulsivity. After factor analyzing nine frequently used measures of impulsivity in a sample of college students, four discrete factors were identified which make up another commonly used scale and the scale in which this study utilized, the UPPS Impulsivity Scale (McCrae & Costa, 1990). Further analyses have since been conducted, and another factor has been added to the UPPS Scale (Cyders et al., 2007). The current subscales within the UPPS Impulsivity Scale include: Negative Urgency, (lack of) Premeditation, (lack of) Perseverance, Sensation Seeking, and Positive Urgency. The facets most relevant to the current project are sensation seeking and negative urgency. Negative Urgency refers to the tendency to act impulsively while experiencing negative affect (Whiteside & Lynam, 2001). Sensation seeking refers to an individual’s tendency to seek out new or exciting experiences, including risky or aversive stimuli (Whiteside & Lynam, 2001). These will be discussed in more length in subsequent sections.

Another common way to measure impulsivity is through the Barratt Impulsivity Scale (BIS-11; Patton et al., 1995). The BIS-11 is a self-report questionnaire used to assess certain components of impulsivity, such as planning, cognitive instability, self-control, and cognitive complexity. Additionally, there are numerous behavioral tasks that assess impulsive behavior, such as the Delay Discounting Task and Go-No Go Task. The Delay Discounting Task (DDT;
Kirby & Maraković, 1996) assesses whether people will respond to obtain a small, immediate reward, or whether they will with respond to receive a larger, delayed reward. More impulsive individuals tend to prefer the smaller, immediate reward, as they have difficulty seeing the value in inhibiting their response for a larger reward at a later time. Similarly, the Go-No Go Task measures response inhibition by responding to certain tasks; more response inhibition generally correlates with less impulsivity (Murphy et al., 1999).

**Impulsivity and Alcohol Use and Problems**

Impulsivity plays a significant role in alcohol consumption and related problems. Impulsivity predicts current heavy drinking, as well as past-year heavy drinking (Burnette et al., 2019; Herman et al., 2019; Simons et al., 2010). Higher levels of impulsivity (low self-regulation) are also significantly associated with alcohol-related consequences including decline in physical health, interpersonal conflict, risky sexual behaviors, and poor performance related to education or work (Berey et al., 2017; Simons et al., 2004). Further, impulsivity is implicated in the dysregulation of drug and alcohol use; this can be described as the transition from “control” to the complete “loss of control” of drug use. This transition can occur quite quickly for more impulsive individuals (Koob & Kreek, 2007).

The literature suggests that excessive alcohol use can also significantly impact impulsivity and inhibitory control (Quinn et al., 2012; Reed et al., 2012). Substances of abuse increase impulsive decision making, and higher levels of alcohol and drug intake relate to greater rates of delay discounting, defined as the decline in the present value of a reward with delay to the receipt (Dick et al., 2010; McCarthy et al., 2012). Further, acute administration studies demonstrate that the introduction of D-amphetamine and methylphenidate, stimulants similar to that of many ADHD medications, decreases impulsive decision making in humans (De Wit et al.,
2002; Pietras et al., 2003); however, the administration of substances such as alcohol and cocaine have shown long-term increases in impulsivity, exhibited in both animal and human models (Simon et al., 2007; Winstanley et al., 2009; Koob et al., 2010). These results suggest that impulsivity can be modulated by alcohol, perpetuating use through increases in impulsive decision making.

Experiencing emotional distress can lead people to engage in impulsive behavior, sometimes with the intent of improving their mood (Tice et al., 2001). As discussed previously, this is referred to as negative urgency. Individuals with high negative urgency tend to indulge more in impulsive drinking as a strategy to regulate their mood. For example, a study on college students displaying high levels of negative urgency indicated that they consumed alcohol to ameliorate their emotional distress due to strong desires to increase positive and decrease negative experiences (Anthenien et al., 2017). However, negative urgency is maladaptive and counterproductive. Individuals who attempt to ameliorate their negative affect with alcohol are at risk of experiencing significant alcohol-related problems (Martens et al., 2008). In college students, negative urgency is highly predictive of negative consequences including missing class, performing poorly on tests or assignments, going to work or school while under the influence, risky sexual encounters, and alcohol tolerance (Ham & Hope, 2003; Martens et al., 2008).

Similarly, sensation seeking, has been implicated in alcohol consumption. Sensation seeking is the tendency for an individual to seek out novel, exciting, and pleasurable experiences or stimuli (Yanovitzky, 2006). This is not always harmful; however, individuals high in sensation seeking tend to consume more alcohol and drink more frequently (Bø et al., 2016). This is particularly pertinent for young adults and college students, as this population generally has a higher drive to seek out exciting experiences. College students with high levels of sensation
seeking tend to migrate towards peers that are heavy drinkers and social situations where heavy
drinking tends to occur (i.e., house parties), as well as misperceive drinking norms and alcohol
expectancies. Thus, this contributes to increased alcohol consumption and a higher frequency of
drinking (Scott & Corbin, 2014; Yanovitzky, 2006). However, negative urgency may be more
predictive of alcohol-related consequences than sensation seeking. Sensation seekers may be
more likely to stop their drinking once they have reached the optimal level of arousal and avoid
potential negative consequences, unlike individuals high in negative urgency (Curcio & George,
2011). However, given that these individuals tend to drink more frequently, they are still at risk
of developing alcohol use disorder, as well as other psychiatric or health complications (LaBrie
et al., 2014).

**Anhedonia and Impulsivity**

The literature has made note of the intriguing association between internalizing and
externalizing psychopathology. Internalizing psychopathology causes an internal conflict or
influence an individual to become withdrawn, while externalizing psychopathology consists of
more overt maladaptive behaviors or “acting out” (American Psychiatric Association, 2014). A
hallmark of externalizing behaviors is impulsivity, while internalizing psychopathology includes
the presence of anhedonia. Interestingly, the comorbidity between these disorders is quite high,
and there has been some discussion as to why disorders with very little diagnostic overlap tend to
be associated (Zisner & Beauchaine, 2016).

Comorbid internalizing and externalizing psychopathology, also referred to as heterotypic
comorbidity, influences the ways in which disorders present themselves. Anhedonia in
depression is comprised of withdrawal behaviors and a marked decrease in pleasure; however,
the presence of anhedonia in borderline personality disorder (BPD) is quite different. For
example, individuals with BPD and anhedonia tend to have more severe symptoms and act more impulsively (Marissen et al., 2012). Further, the neural correlates of heterotypic comorbidities seem to differ from that of single disorders along the internalizing and externalizing spectra, although this requires more investigation. For instance, adolescent males with ADHD and comorbid internalizing symptoms (i.e., depressed mood) have been shown to have different volumes of gray matter in the anterior cingulate and mesolimbic regions of the brain, compared to ADHD adolescents without internalizing symptoms (Posner et al., 2014; Sauder et al., 2012). Although this is not specific to anhedonia and impulsivity, these studies suggest there is nuanced relationship between externalizing and internalizing psychopathology that presents itself uniquely both neurologically and behaviorally.

There has been some research that has further explored the relationship between depression and impulsivity. Given the possible symptoms of depression (i.e., loss of energy, disinterest, withdrawal behavior) it would appear that these individuals would be less impulsive; however, various types of impulsivity have been identified in depression. For example, in an in-patient population, severe depression was related to state dependent behavioral loss of control and non-planning, both of which may be particularly predictive of suicide attempts (Corruble et al., 2003). Further, depression’s relationship to impulsivity and difficulties delaying reward-related responses has been found in a subsequent study, as well (Swann et al., 2008).

However, due to the lack of current literature on the matter, the relationship between anhedonia and impulsivity specifically requires further investigation. Individuals with deficits in their ability to experience pleasure may act impulsively in order to seek out a reward, likely through highly pleasurable yet aversive stimuli such as alcohol, risky sexual encounters, or drug use (Loas et al., 2016; Zisner & Beauchaine, 2016). This may also be why anhedonia in BPD is
related to more appetitive or impulsive behavior (Marissen et al., 2012). This may be particularly true when thinking about the relationship between sensation seeking and anhedonia. Sensation seeking is the tendency to purposely seek out a thrilling or pleasurable experience, and one might speculate that individuals may purposefully seek out risky stimuli to ameliorate a deficit in pleasure or reward, or as a compensatory behavior. There is a gap in the literature on this relationship; however, the existing research is mixed and typically conducted in clinical samples. On one hand, lower levels of sensation seeking have been shown to predict anhedonia, and also play an important role in an individual’s predisposition to develop schizophrenia (McCann et al., 1990, Meehl, 1987). On the other hand, higher scores of both physical and social anhedonia have predicted more impulsive behavior, including sensation seeking (Amr & Volpe, 2013). These divergent findings warrant the need for a closer inspection at the association between anhedonia types and impulsivity (negative urgency and sensation seeking).

As with sensation seeking, there has been little effort in the literature to examine the relationship between negative urgency and anhedonia. Anhedonia is an unpleasant experience, and negative urgency is the tendency to act impulsively under conditions of negative affect; thus, it is possible that individuals seek out a pleasurable experience in order to ameliorate their negative affect (Grant et al., 2009; Witkiewitz & Villarroel, 2009). However, the empirical literature is sparse and mixed. For example, among adolescents, low levels of anhedonia and high levels negative urgency predict increases in hedonic hunger (the pleasure toward/drive to eat) (Mason et al., 2020). On the other hand, among tobacco users, anhedonia moderates the relationship between smoking and negative urgency. Specifically, the association between negative urgency and smoking was stronger when levels of anhedonia were higher (Roys et al., 2016). However, it is possible that impulsive behavior may occur because of anhedonia, such
that negative urgency explains the relationship between anhedonia and alcohol use, as individuals act impulsivity to seek out substances and ameliorate negative affect. In sum, more research is needed to further understand the mechanisms of association between anhedonia and impulsivity in substance use, particularly alcohol use.

**Current Study Overview**

This study tested a path model to determine whether different types of anhedonia, including consummatory, anticipatory, social, and “recreational” anhedonia, were associated with alcohol use and problems via sensation seeking and negative urgency. Consummatory anhedonia (i.e., the “liking” of a reward) was hypothesized to be associated with alcohol use and problems via sensation seeking, a component of impulsivity where individuals tend to seek out rewarding, yet sometimes aversive stimuli. Further, anticipatory anhedonia (i.e., the process of “looking forward to” or “wanting” a reward) was hypothesized to be associated with alcohol use and problems via negative urgency, a component of impulsivity where individuals act rashly when negatively aroused. Both the consummatory and anticipatory facets were further divided into “recreational” anhedonia (e.g., deficits in pleasure from food, hobbies, sensory experiences), and social anhedonia (e.g., deficits in pleasure from social situations, relationships), to explore whether there are differences observed in reward deficits of specific stimuli. Gender and depression were statistically controlled for.

**Method**

**Participants**

Eight hundred and twenty-seven participants initially attempted to complete the study survey. However, 187 participants were excluded for several reasons. It was estimated that the average time to complete the full study survey was 1,519 seconds. If participants completed the
survey in 10% of the mean time (151 seconds), they were excluded; thus, 149 participants were excluded. Further, 35 participants were excluded for having significant missing data, or for providing poor quality data. Specifically, participants were excluded if they provided improbable drinking levels (e.g., 100 drinks each day), or levels of drinking that were inconsistent with the rest of their data (e.g., 100 drinks per day but no alcohol-related problems). Three participants were excluded for identifying “non-binary” as their gender.

The final sample consisted of 640 participants. The final sample was 57% males between the ages of 18 and 25 ($M=23.15, SD=1.58$). Seventy percent of the participants identified as White/Caucasian, 14% Black/African American, 6% Asian, 5% Hispanic/Latino, 2% Native American, 1% Multiracial, and <1% Native Hawaiian or other Pacific Island. Around 1% of the sample chose not to identify their race.

**Power Analysis**

The N:q rule was used to estimate a minimum sample size required for the hypothesized model (Jackson, 2003; Kline, 2015). The N:q rule is used by assessing the ratio between the number of cases (N) and the number of estimated parameters within the model (q). The recommended sample size for SEM analyses is at least 200 (Barrett, 2007). Additionally, the ratio of number of cases per parameter is suggested to be 10:1 (Kline, 2015), or at minimum of 5:1 (Bentler & Chou, 1987). The hypothesized model in Figure 1 is specified with 27 free parameters. A sample size of 270 is the minimum sample required to estimate the model. Thus, the current sample size of 640 is sufficient.

**Measures**

*Short Screening Questionnaire*
The short screening questionnaire consisted of three questions. First, it required participants to indicate whether they were between the ages of 18-25. Second, participants indicated that they were currently enrolled full-time at a college or university. Lastly, participants indicated whether they had consumed alcohol within the past 30 days. Eligible participants continued completing the main survey.

**Demographic Information**

Basic demographic information was collected from each participant. These questions inquired about age, gender, race/ethnicity, and year in college (e.g., freshman, sophomore, junior, senior).

**“Recreational” Consummatory Anhedonia**

The Snaith-Hamilton Pleasure Scale (SHAPS; Snaith et al., 1995) is a 14-item, self-report inventory that is primarily used to measure an individual’s ability to experience recreational consummatory (the “liking” of a reward) pleasure. The SHAPS consists of four domains: food and drink, sensory experiences, interests and pastimes, and social interaction. Specifically, the SHAPS asks questions about activities that most people would find pleasurable, such as “I would enjoy my favorite television or radio program” and “I would be able to enjoy my favorite meal.” There are only four questions regarding social interaction, and they were included in the variable of social consummatory anhedonia. Each item has four possible responses: strongly disagree, disagree, agree, and strongly agree; either of the “disagree” responses scores one point, and either of the “agree” responses scores zero points. Typically, a score of 3 or more reflects the presence of anhedonia. However, a new variable was created representing recreational consummatory anhedonia that merged 10 items of the SHAPS and 8 items of the Temporal Experience of Pleasure Scale. The scores from each scale were standardized and averaged.
Higher scores represent more recreational consummatory anhedonia. This variable established adequate reliability in this study ($\alpha = 0.78$).

**“Recreational” Anticipatory Anhedonia**

The Temporal Experience of Pleasure Scale (TEPS; Gard et al., 2006) is an 18-item self-report questionnaire that includes 10 questions regarding an individual’s ability to experience recreational anticipatory (the “looking forward to” of a reward) pleasure. The remaining 8 questions inquire about recreational consummatory anhedonia and were added to the recreational consummatory variable for analysis. The 10 remaining questions of the TEPS included questions such as “when ordering something off the menu, I imagine how good it tastes” and “I look forward to a lot of things in my life.” The TEPS uses a 6-point Likert scale (1= very false to me to 6= very true to me). The scores of the TEPS were averaged, such that higher scores represent higher levels of anhedonia. The 10 items of the TEPS established good reliability ($\alpha = 0.82$).

**Social Consummatory & Anticipatory Anhedonia**

The Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS; Gooding & Pflum, 2014) is a 17-item, self-report scale that measures both the consummatory and anticipatory facets of social anhedonia. For consummatory pleasure, the ACIPS includes 10 questions such as “I enjoy going on group activities like attending sports events or concerts with friends.” For anticipatory pleasure, the ACIPS includes 7 questions such as “I look forward to seeing people when I’m on my way to a party.” The ACIPS uses a 6-point Likert scale (1= very false to me to 6=very true to me). As mentioned previously, there are 4 items of the SHAPS that better fit with the social consummatory facet of anhedonia. Thus, a new variable for social consummatory anhedonia was created by merging the 10 items of the ACIPS and 4 of the SHAPS. These scores were standardized and averaged. Higher scores represent more social
consummatory and anticipatory anhedonia. Both the social consummatory ($\alpha = 0.80$) and social anticipatory anhedonia ($\alpha = 0.89$) variables established good reliability.

**Impulsive Behaviors**

The Impulsive Behavior Scale (UPPS-P; Whiteside & Lynam, 2001) is a 59-item, self-report measure that assesses five distinct dimensions of impulsive behaviors. The five dimensions of impulsivity include: negative urgency, (lack of) premeditation, (lack of) perseverance, sensation seeking, and positive urgency. Example questions for sensation seeking and negative urgency include: “I generally seek new and exciting experiences and sensations” and “I have trouble controlling my impulses.” For this study, only negative urgency and sensation seeking were used for analysis. The UPPS-P uses a 4-point Likert scale (1= agree strongly to 4= disagree strongly); however, some items from each subscale require reverse scoring, such that 1=4, etc. After reverse scoring, total scores on each dimension were averaged, such that higher scores indicate more impulsive behavior. Both the subscale of negative urgency ($\alpha = 0.91$) and sensation seeking ($\alpha = 0.88$) had good internal consistency.

**Depressive Symptoms**

The Center for Epidemiological Studies Depression Scale Revised (CESD-R-20; Radloff, 1977) is a 20-item, self-report rating inventory that measures the potential symptoms of depression. Questions measure 8 different subscales including: Sadness, Loss of Interest, Appetite, Sleep, Thinking/Concentration, Guilt, Fatigue, Movement/Agitation, and Suicidal Ideation. An example question on the CESD-R-20 is “I was bothered by things that usually don’t bother me,” in which the participant must choose between the following responses: Not at All or Less Than One a Day, Some or a Little of the Time (1-2 Days), Occasionally or a Moderate Amount Time (3-4 Days), Most or All of the Time (5-7 Days), or Nearly every day for 2 weeks.
Questions 4, 8, 12, and 16 must be reverse scored. The total score was averaged. The CESD-R-20 demonstrated good reliability in the current study (α = 0.89).

**Alcohol Consumption**

The Daily Drinking Questionnaire, Modified (DDQ-M; Collins et al., 1985) is a self-report inventory that measures the standard number of drinks that an individual has consumed during the week. The DDQ-M provides a seven-day grid for the participants to enter their typical alcohol consumption and the hours they typically spent drinking on each day of the week (Monday-Sunday) for the last 90 days. The average alcohol consumption was calculated for each participant.

**Alcohol Problems**

The Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al., 2007) is a 48-item, self-report scale that is specifically designed to assess alcohol-related problems in samples of college students. The YAACQ measures problems in eight different domains, including: Social/Interpersonal, Academic/Occupational, Risky Behavior, Impaired Control, Poor Self-Care, Diminished Self-Perception, Blackout Drinking, and Physiological Dependence. Example questions include “I have often thought about needing to cut down or stop drinking” and “Drinking has made me feel depressed or sad.” Responses are rated in a dichotomous, yes/no format. Total scores were averaged, and the total score reflects the number of consequences experienced within the past 90 days. Thus, a high score indicates more alcohol-related consequences. The YAACQ established good reliability in the current study (α = 0.87).

**Procedure**

College students were recruited using Amazon Mechanical Turk (MTurk). Previous research using MTurk indicates that samples reflect the demographic make-up of the United
States. Psychiatric diagnoses and substance use reported on MTurk also reflect national prevalence rates fairly closely (Paolacci & Chandler, 2014; Strickland & Stoops, 2019). All questionnaires were completed online. All materials were approved by the university’s institutional review board (IRB) prior to data collection. Participants were first asked to complete a brief screening survey. This verified that participants met minimal inclusion criteria including being a current college student, having consumed alcohol in the past 30 days, and being between the ages of 18-25. Participants subsequently completed the remainder of the questionnaires if they met inclusion criteria. Participants were compensated $2.00 for the completion of the survey. All payments were received directly through MTurk. Research funds and participant payment came from the Graduate Research Grant offered at the University of South Dakota.

Data collection took approximately 5 months to complete.

Data Handling and Preparation

Preliminary analyses were conducted in Stata 17 (StataCorp, 2020) to determine the skewness, mean, and kurtosis of all variables of interest. All variables have acceptable ranges of skewness (i.e., within $|3|$) and kurtosis (i.e., within $|10|$). See Table 1 for descriptive statistics. Missing data was examined, and surveys with a substantial amount of missingness were excluded from analysis (i.e., only completed half of the survey). Further, as mentioned previously, surveys that were completed in 10% of the mean completion time were excluded. Next univariate and multivariate outliers were examined using recommendations from Kline (2015). Observations that were more than 3.29 standard deviations away from the mean were examined for validity (Tabachnick & Fidell, 2007). Univariate normality was assessed using histograms. Scatterplots among observed variables were also examined for linearity. Further, a
correlation matrix was examined to determine the presence of multicollinearity (Tabachnick & Fidell, 2007).

**Results**

**Descriptive Statistics**

Descriptive statistics were analyzed using Stata 17 (StataCorp, 2020). Descriptive statistics are presented in Table 1 and bivariate correlations are presented in Table 2. Contrary to the hypothesis, all facets of anhedonia were negatively correlated with sensation seeking, suggesting that higher levels of anhedonia are associated with less sensation seeking. Although this is in line with the potential withdrawal-like behavior associated with anhedonia, it was hypothesized that these individuals may be higher in sensation seeking as a compensatory behavior. Interestingly, recreational consummatory anhedonia was not significantly correlated with alcohol consumption but was correlated with alcohol related problems. Further, negative urgency wasn’t significantly correlated with the recreational facets of anhedonia but was correlated with both social consummatory and social anticipatory anhedonia.

**Path Model**

The hypothesized model was tested in Mplus 8.4 (Muthen & Muthen, 2021) using maximum likelihood estimation with bias corrected bootstrapped confidence intervals. See Figure 1 for the final path model. The model fit was evaluated according to guidelines of Hu and Bentler (1999). For fit indices, a cutoff value of .95 is considered acceptable for CFI and TLI, a cutoff value close to .06 for RMSEA (with 90% confidence intervals between 0 and .10) is acceptable, and a cutoff value of SRMR < .08 suggests acceptable fit. Modification indices were examined for the original model and the fit was acceptable, $\chi^2(12, N = 640) = 35.137, p < .001$; RMSEA = .05 90% CI [.03, .08]; CFI = .98; SRMR = .04. Modification indices suggested adding
one path: a path from recreational consummatory anhedonia to negative urgency. Adding this path made theoretical sense because it is possible for individuals with difficulties experiencing the “liking” of generally pleasurable experiences or stimuli to act impulsively when negatively aroused. Hence, this pathway was added to the model. This improved model fit, $\chi^2(11, N = 640) = 14.080, p = 0.23; \text{RMSEA} = .021 90\% \text{ CI [.00, .05]; CFI} = .99; \text{SRMR} = .02$. Variance accounted for ($R^2$ values) for the endogenous variables were calculated and reported along with standardized coefficients as measures of effect size. Bias-corrected bootstrapped confidence intervals were used to determine the significance of indirect and total effects (MacKinnon, Lockwood, & Williams, 2004).

**Direct Effects**

First, recreational consummatory anhedonia was significantly and negatively associated with sensation seeking. Further, social anticipatory anhedonia was significantly and positively associated with negative urgency. A direct path from recreational consummatory anhedonia and negative urgency was added to improve model fit, although this path was not originally hypothesized. This path was significant and negative. Both negative urgency and sensation seeking were significantly positively associated with alcohol consumption. As hypothesized, there was a significant direct effect from negative urgency to alcohol-related problems; however, the direct path from sensation seeking to alcohol-related problems was insignificant. All associations occurred while controlling for the effects of gender and depressive symptoms. Additionally, there were significant and positive direct paths from both depression and gender to sensation seeking and negative urgency. As expected, there were significant direct paths from depression to alcohol consumption and alcohol problems. Interestingly, there were no significant
direct paths from gender to alcohol consumption or related problems, suggesting that there were no notable gender differences in direct paths in this sample.

Indirect Effects

There were several significant indirect associations. First, social anticipatory anhedonia was indirectly associated with alcohol consumption and related problems via negative urgency. Consistent with hypothesis, this association was positive, suggesting that more social anticipatory anhedonia was related to more alcohol use and problems through negative urgency. Recreational consummatory anhedonia had a significant indirect association with alcohol consumption via negative urgency, continuing to alcohol related problems. Additionally, recreational consummatory anhedonia had a significant indirect path to alcohol consumption via sensation seeking, but not to alcohol related problems. Inconsistent with hypothesis, the associations with recreational consummatory anhedonia and alcohol use were negative, suggesting less drinking and more withdrawal behavior. Further, there were no significant indirect effects from social consummatory anhedonia and recreational anticipatory anhedonia to alcohol consumption and alcohol-related problems, contrary to the original hypothesis. Further, there were significant indirect associations between depression and alcohol consumption via sensation seeking. Additionally, depression was indirectly associated with alcohol related problems, via sensation seeking and negative urgency. Male gender was indirectly associated with both alcohol consumption via negative urgency, and alcohol related problems through sensation seeking and negative urgency.

Discussion

Alcohol use is a significant concern among college students and has several negative consequences. Although anhedonia and impulsivity have been established as contributors to
alcohol use and problems, their associations have seldomly been examined in tandem, particularly in relation to college alcohol use. The current study examined this further by a) parsing the facets of anhedonia and b) investigating impulsivity, specifically sensation seeking and negative urgency, as potential mediating variables. Thus, the current study tested a path model to examine the indirect effects of facets of anhedonia on alcohol use and alcohol-related problems via sensation seeking and negative urgency, while controlling for depression and gender.

“Recreational” Consummatory Anhedonia and Alcohol Outcomes

Indirect Paths via Sensation Seeking

Recreational consummatory anhedonia refers to deficits in the ability to experience pleasure related to various stimuli or activities, including pastimes, hobbies, food, or other sensory experiences. There were significant associations between this type of anhedonia and alcohol use, via the facets of impulsivity. First, there was a significant path from recreational consummatory anhedonia to alcohol consumption via sensation seeking. The total effect was negative indicating that recreational consummatory anhedonia is overall inversely related to alcohol consumption. It was originally hypothesized that individuals with anhedonia may be more impulsive as a compensatory mechanism for their anhedonia, but the results suggest that individuals with anhedonia showed significant withdrawal behavior and are less likely to seek out alcohol use. Although there is some support in the literature for positive associations between impulsivity and anhedonia, such as in individuals with BPD (Marissen et al., 2012), there is also literature that posits that individuals with loss of interest or pleasure and other depressive symptoms may be less likely to engage in various activities, including substance use (Ramsey et al., 2005; Boden & Fergusson, 2011).
Further, the effect from sensation seeking to alcohol use was positive, as anticipated, indicating increased alcohol consumption among those higher in sensation seeking. Sensation seeking may be associated with alcohol consumption due to these individuals being particularly sensitive to the rewarding outcome of alcohol use and their drive to reach optimal arousal (LaBrie et al., 2014; Magid et al., 2007). Interestingly, the association between sensation seeking and alcohol problems was entirely mediated by alcohol consumption. Hence, sensation seekers in this study who experience alcohol problems do so because of their alcohol consumption. This is congruent with longitudinal research showing similar indirect effects from sensation seeking via drinking quantity (Waddell et al., 2021), but incongruent with other cross-sectional findings where sensation seeking accounted for direct variance in alcohol problems over drinking quantity in college women (Lindgren et al., 2010). Further, sensation seekers don’t typically drink to regulate emotions (Coskunpinar et al., 2013; VanderVeen et al., 2016), and may overall self-regulate more effectively than people with other types of impulsivity (e.g., negative urgency).

**Indirect Paths via Negative Urgency**

The association between recreational consummatory anhedonia and alcohol problems was also mediated via negative urgency. There were two indirect significant pathways from recreational consummatory anhedonia via negative urgency, one to alcohol use to problems, and the other from negative urgency directly to problems. The first path from recreational consummatory anhedonia to alcohol consumption via negative urgency continued to alcohol related problems. The overall relationship was negative, indicating that individuals with recreational consummatory anhedonia are overall less likely to engage in drinking to ameliorate negative affect. While the effects of negative urgency on alcohol outcomes were positive as expected, there was an unexpected inverse association between recreational consummatory anhedonia and negative urgency. In other words, individuals

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with high recreational consummatory anhedonia were less likely to be impulsive (i.e., lower negative urgency and lower sensation seeking). Interestingly, while the effects of recreational consummatory anhedonia on impulsivity were negative, the effects of depressive symptoms on impulsivity were positive and congruent with other studies. In other studies, depressive symptoms were positively associated with negative urgency and negative urgency mediated the association between depression and alcohol outcomes (Gunn et al., 2020; Carton et al., 2018), possibly through deficits in short-term impulse control and efforts to regulate affect. It is possible that these other studies examined depressive symptoms more broadly and did not parse out and explored anhedonia in depth. It is also possible that recreational consummatory anhedonia may behave differently from other forms of anhedonia, or that recreational consummatory anhedonia and depression have more differences from one another than originally expected. The correlation between depression and recreational consummatory anhedonia in the current sample was small ($r = .26$). More research is needed to determine the degree to which depression and recreational consummatory anhedonia are similar, and why they may be differentially associated with impulsivity.

Recreational consummatory anhedonia also had a significant indirect effect to alcohol problems via negative urgency, over and above alcohol use quantity. Overall, as anhedonia increases, alcohol problems appear to decrease regardless of how much alcohol is consumed. Recreational consummatory anhedonia remained significantly associated with alcohol use and alcohol problems while the effects of the other variables were parceled out. The measurement of recreational consummatory anhedonia specifically focuses on exciting or pleasurable stimuli and experiences (e.g., food, relaxation, hobbies, pastimes) and is related to opioid hotspots in the nucleus accumbens (NAcc) and ventral pallidum (VP), in a circuit with the ventral medial
prefrontal cortex (vmPFC) and anterior cingulate cortex (ACC) (Vujonavic et al., 2017; Berridge et al., 2009). Thus, these effects may be so impactful because of deficits in the underlying reward circuitry, which may also lose sensitivity to rewarding substances, such as alcohol. Further, the role of the type of substance may be important. Particularly, alcohol is a depressant and perhaps different associations would be observed for simulant or “upper” type drugs. This is an area that also requires further investigation; however, this study quantified the effects of one certain type of anhedonia over and above the other types of anhedonia, and depression, in respect to alcohol outcomes.

Lastly, the associations between negative urgency and alcohol use and problems were positive, suggesting that higher levels of negative urgency are associated with more alcohol use and related problems. This is in line with previous literature that has indicated that individuals who drink in order to ameliorate negative affect tend to drink in larger quantities and experience more hazardous outcomes (Adams et al., 2012; Martens et al., 2008). Further, previous literature supports the associations between negative urgency and alcohol related problems, over and above alcohol consumption. Studies have shown that negative urgency can independently predict alcohol related problems, regardless of amount of alcohol consumed (Hahn et al., 2015; Kaiser et al., 2012). Although, there are also studies that show negative urgency relating to both alcohol consumption and related problems (LaBrie et al, 2014). Further, the literature suggests that individuals that drink with the intention of relieving some psychological distress tend to experience more alcohol related consequences (e.g., poor social relationships, difficulties at work or academically) (Chandley et al., 2014; Park et al., 2004; White & Hingson, 2013). Particularly, these individuals have more consequences than sensation seekers, possibly due to more overall emotional dysregulation and the use of alcohol as a means of coping. Sensation seekers may also
drink heavily but for the thrill or experience, rather than ameliorating psychological distress; thus, they may have more of the capacity to monitor their drinking (e.g., stopping before becoming too intoxicated) (Cyders et al., 2009, Scott & Corbin, 2014).

**Social Anticipatory Anhedonia and Alcohol Outcomes**

Social anticipatory anhedonia refers to difficulties experiencing pleasure related to the anticipation or ability to look forward to a social event. Social anticipatory anhedonia was positively associated with alcohol problems in two ways: one via a path from social anticipatory anhedonia to negative urgency to alcohol use and alcohol problems; and another via negative urgency to alcohol problems. Interestingly, unlike the facets of consummatory anhedonia, social anticipatory anhedonia had a positive overall effect with alcohol use and problems, and a positive effect to negative urgency. This is in line with the hypothesis and suggests that individuals with this type of anhedonia experience increased negative urgency, which in turn predicts more drinking and alcohol problems. The relationship with alcohol problems was significant via both negative urgency and alcohol use. In other words, both negative urgency and alcohol use mediated the effect of social anticipatory anhedonia on alcohol problems. As social anticipatory anhedonia increases, people experience more negative urgency, which in turn leads to more alcohol problems directly, as well as indirectly via increased consumption.

The associations between social anticipatory anhedonia and alcohol use and related problems are unique, and there are possible explanations for this association. One possible explanation is that individuals with social anticipatory anhedonia may predict a social event or activity to be unpleasant, and in response may consume more alcohol to alleviate distress or in efforts make the event more pleasant. The literature has highlighted that individuals drink more when they anticipate a social experience being stressful or unpleasant, or if they experience
social anxiety (Buckner et al., 2006; Book & Randall, 2002). Thus, this is one possible explanation for higher levels of social anticipatory anhedonia relating to more alcohol consumption and problems through negative urgency. It is interesting that the relationship between the consummatory facet of social anhedonia and alcohol and problems was null; however, the anticipation of reward is a unique process (e.g., activity in thalamus, OFC, mPFC, basil ganglia) (Der-Avakian, 2012) and conditions individuals’ reward responses; thus, deficits in the anticipatory circuity of reward appear to be strong enough to increase drinking and problems.

**Non-significant Associations**

Some of the hypothesized associations within the path model were insignificant. Particularly, neither recreational anticipatory and social consummatory anhedonia had significant paths to alcohol use or related problems. It was initially hypothesized that recreational anticipatory anhedonia would be associated with alcohol use and related problems via negative urgency; however, these results are null. This suggests that the reward process of recreational anticipation may not be substantially impaired in this specific population, and that difficulties in anticipation in regard to recreational activities may not impact alcohol use, nor is it driven by efforts to ameliorate negative affect. Further, social consummatory anhedonia was not significantly associated with alcohol consumption or related problems, nor was it mediated by sensation seeking. This suggests that deficits in the ability to feel pleasure from social interaction may not be as pertinent to alcohol use as initially speculated. Further, it is possible that these specific associations may be better explained by other facets of impulsivity.
**Strengths, Limitations, and Future Directions**

One strength of this study is the investigation of anhedonia in a depth that seldom occurs in the literature, particularly by reducing the construct of anhedonia into specific facets and exploring potential unique relationships with alcohol use and related problems. This study highlighted unique associations between specific facets of anhedonia and alcohol use and problems via impulsivity. Specifically, it illustrated that individuals with difficulties looking forward to socialization experience significant alcohol use and related problems, via negative urgency. Thus, it appears that they may drink in order to ameliorate negative affect associated with difficulties in socialization. Interestingly, consummatory social anhedonia did not have any significant associations with alcohol use or related problems via sensation seeking. Further, although it was opposite of the original hypothesis, individuals with recreational consummatory anhedonia, or difficulties “liking” specific stimuli or experiences, exhibit less alcohol consumption and related problems and thus, appear to experience more withdrawal behavior. These associations between anhedonia and impulsivity have rarely been researched in tandem outside of clinical samples (i.e., schizophrenia, BPD); thus, this study provides insight about these associations within a non-clinical population at risk for alcohol abuse.

Further, this study made a point to control for depressive symptoms. Anhedonia tends to accompany other diagnoses, and is a core feature of depression, as well as schizophrenia and PTSD. Thus, it is often investigated as a symptom. Within the literature, it is far less common for anhedonia to be explored in depth as a distinct reward deficit or explanatory mechanism for a disorder or behavior. This study found that anhedonia predicted alcohol use and problems via impulsivity, while controlling for depressive symptoms. This suggests that the effects of anhedonia are present over and above depressive symptoms, and that the distinct facets of anhedonia associate with alcohol use and related problems uniquely through impulsivity. This
study highlights the importance of investigating the facets of anhedonia, particularly in relation to substance use.

It is important to note that there are limitations in the current study. First, due to the cross-sectional design of the study, it is difficult to infer causation. Further, it important to note that although a confirmatory factor analysis was utilized to assist in parsing the facets of anhedonia, there were high correlations between the facets of anhedonia observed in the correlation matrix. Specifically, the highest correlation ($r(640)=0.84$, $p<0.01$) was found among the facets of social anticipatory and social consummatory anhedonia, although a measure that specifically differentiates the two was used (in addition to the 4 social consummatory items of the SHAPS). These high correlations indicate issues with discriminant validity between facets of anhedonia, suggesting that they may not adequately differentiate between unique constructs. However, unique associations were found between the social anticipatory facet of anhedonia and alcohol use and problems, but not for social consummatory anhedonia, suggesting that although there may be a degree in overlap in the constructs, they are still distinctive.

Further, another potential limitation in this study is the assessment of anhedonia via a self-report inventory. Although consummatory and anticipatory anhedonia are measured reliably with self-report, behavioral and physiological measures have the potential to be more informative about the facets of anhedonia. Particularly, the Effort-Expenditure for Rewards Task (Treadway et al., 2009) is a computer-based measure of motivational reward. This task requires participants to push certain keys on a keyboard with fingers on their dominant or non-dominant hand to win a monetary reward. This task is reliable at tapping into both motivational deficits (i.e., how hard someone is willing to work for a reward), as well as consummatory anhedonia (i.e., do participants “like” the reward they are being presented). Further, the monetary incentive delay
task (Knutson et al., 2000; Knutson et al., 2001) is a reliable behavioral approach in which participants are shown various cues (e.g., circles, squares) that indicate whether they will receive a monetary reward. In addition to these methods, it would be particularly informative to measure the neurological underpinnings of anhedonia via fMRI or EEG in conjunction with self-report or behavioral methods.

Further, there is discord in the literature regarding parsing anhedonia, which was touched on previously. Specifically, there are inconsistencies in how to parse between social and physical anhedonia, as well as anhedonia related to pastimes, hobbies, or activities. Further, motivational and anticipatory anhedonia are often difficult to differentiate, and some researchers have merged the two. For example, some believe that anticipation is the “looking forward to” or “wanting” of a reward, and motivational anhedonia encompasses the approach behavior required to receive the reward. However, others believe that anticipation is part of the process of motivation; thus, their conceptualization of motivational anhedonia includes reward anticipation. However, motivation is a facet that may be best measured by behavioral tasks, and thus, the current study chose to focus on anticipation separately, rather than including in the conceptualization of motivation.

**Clinical Implications**

These findings have the potential to inform clinical approaches. It may be beneficial for mental health providers in college settings to assess anhedonia more thoroughly. For example, if individuals are experiencing recreational consummatory anhedonia, they may exhibit more withdrawal behavior and be less likely to engage in alcohol use as a coping mechanism. However, if students are experiencing more anhedonia in relation to socialization, it is possible that they are at risk for more consequential drinking behavior. Further, although these relationships have previously been established in the literature, this study found associations
between sensation seeking, negative urgency, and alcohol use and consequences; thus, it may also be helpful to assess impulsivity within individuals presenting at student counselling or other college mental health services. Assessing both anhedonia and impulsivity may provide a more in depth “profile” for college clients, which can contribute to case conceptualization and treatment planning.

Summary

The current study tested a path model to explore whether different types of anhedonia are associated with alcohol use and problems via different types of impulsivity, while controlling for depressive symptoms in sample of college students. This study highlighted unique associations. First, there were significant negative associations found between recreational consummatory anhedonia and alcohol use and problems via negative urgency. Recreational consummatory anhedonia also had significant negative associations with alcohol consumption via sensation seeking. Further, there was a significant positive association between social anticipatory anhedonia and alcohol use and problems via negative urgency. Interestingly, these associations remained significant while controlling for gender and depression. Male gender was significantly associated with impulsivity, but there were no significant effects of gender on alcohol use and problems in the full model. There were null findings between social consummatory anhedonia and alcohol use and problems via sensation seeking. Further, the associations between recreational anticipatory anhedonia and alcohol use and problems via negative urgency were also null. Thus, this study highlighted interesting associations between types of anhedonia, impulsivity, and alcohol use, and emphasized the importance of investigating anhedonia in depth. Further, the result of this research has the potential to inform clinical approaches for college alcohol use.
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Table 1

Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>Range</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>640</td>
<td>-</td>
<td>(M)360 (F) 280</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>640</td>
<td>0.00</td>
<td>-0.87-2.15</td>
<td>1.46</td>
<td>2.41</td>
</tr>
<tr>
<td>RA Anhedonia</td>
<td>640</td>
<td>2.43</td>
<td>1.00-5.80</td>
<td>0.54</td>
<td>0.80</td>
</tr>
<tr>
<td>SC Anhedonia</td>
<td>640</td>
<td>-0.01</td>
<td>-1.01-2.74</td>
<td>1.46</td>
<td>2.41</td>
</tr>
<tr>
<td>SA Anhedonia</td>
<td>640</td>
<td>2.43</td>
<td>1.00-5.71</td>
<td>0.50</td>
<td>0.35</td>
</tr>
<tr>
<td>Depression</td>
<td>640</td>
<td>2.73</td>
<td>0-6</td>
<td>-0.22</td>
<td>-1.42</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>639</td>
<td>2.53</td>
<td>1-4</td>
<td>-0.14</td>
<td>-0.67</td>
</tr>
<tr>
<td>Negative Urgency</td>
<td>639</td>
<td>2.30</td>
<td>1-4</td>
<td>-0.05</td>
<td>-0.98</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>634</td>
<td>2.63</td>
<td>0-20</td>
<td>2.57</td>
<td>6.63</td>
</tr>
<tr>
<td>Alcohol Problems</td>
<td>635</td>
<td>18.94</td>
<td>0-48</td>
<td>0.28</td>
<td>-1.15</td>
</tr>
</tbody>
</table>

Note. RA Anhedonia= Recreational Anticipatory Anhedonia, SA Anhedonia= Social Anticipatory Anhedonia, RC Anhedonia= Recreational Consummatory Anhedonia, SC Anhedonia= Social Consummatory Anhedonia, NU= Negative Urgency, SS= Sensation Seeking, DDQ= Daily Drinking Questionnaire, YAACQ= Young Adult Alcohol Consequences Questionnaire. Gender coded 1 (male) and 0 (female). N’s vary due to missing data.
### Table 2

**Correlation Matrix**

<table>
<thead>
<tr>
<th></th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
<th>6.</th>
<th>7.</th>
<th>8.</th>
<th>9.</th>
<th>10.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gender</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. RC Anhedonia</td>
<td>0.15***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. RA Anhedonia</td>
<td>0.10*</td>
<td>0.67***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. SC Anhedonia</td>
<td>0.14**</td>
<td>0.70***</td>
<td>0.73***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. SA Anhedonia</td>
<td>0.13**</td>
<td>0.57***</td>
<td>0.69***</td>
<td>0.84***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Depression</td>
<td>0.07</td>
<td>0.26***</td>
<td>0.27***</td>
<td>0.33***</td>
<td>0.42***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Sensation Seeking</td>
<td>0.20***</td>
<td>-0.18***</td>
<td>-0.18***</td>
<td>-0.15***</td>
<td>-0.09*</td>
<td>0.11**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Negative Urgency</td>
<td>0.12***</td>
<td>0.03</td>
<td>0.08</td>
<td>0.13***</td>
<td>0.25***</td>
<td>0.54***</td>
<td>0.50***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Alcohol Use</td>
<td>0.08*</td>
<td>0.01</td>
<td>0.02</td>
<td>0.05</td>
<td>0.07</td>
<td>0.30***</td>
<td>0.23***</td>
<td>0.31***</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>10. Alcohol Problems</td>
<td>0.11**</td>
<td>0.14***</td>
<td>0.13**</td>
<td>0.16***</td>
<td>0.22***</td>
<td>0.63***</td>
<td>0.22***</td>
<td>0.48***</td>
<td>0.41***</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note. N’s = 634 – 640. RA Anhedonia= Recreational Anticipatory Anhedonia, SA Anhedonia= Social Anticipatory Anhedonia, RC Anhedonia= Recreational Consummatory Anhedonia, SC Anhedonia= Social Consummatory Anhedonia, NU= Negative Urgency, SS= Sensation Seeking, DDQ= Daily Drinking Questionnaire, YAACQ= Young Adult Alcohol Consequences Questionnaire. Gender coded 1 (male) and 0 (female). * p < 0.05, ** p < 0.01, *** p < 0.001.*
Table 3

Confidence Intervals of Direct Paths

<table>
<thead>
<tr>
<th>Outcome/Predictor</th>
<th>Estimate</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Problems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>0.215</td>
<td>[0.141, 0.281]</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>0.054</td>
<td>[-0.013, 0.118]</td>
</tr>
<tr>
<td>Negative Urgency</td>
<td>0.112</td>
<td>[0.036, 0.197]</td>
</tr>
<tr>
<td>Depression</td>
<td>0.495</td>
<td>[0.412, 0.567]</td>
</tr>
<tr>
<td>Gender</td>
<td>0.031</td>
<td>[-0.031, 0.088]</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td>0.140</td>
<td>[0.054, 0.214]</td>
</tr>
<tr>
<td>Negative Urgency</td>
<td>0.113</td>
<td>[0.029, 0.201]</td>
</tr>
<tr>
<td>Depression</td>
<td>0.223</td>
<td>[0.143, 0.294]</td>
</tr>
<tr>
<td>Gender</td>
<td>0.020</td>
<td>[-0.054, 0.095]</td>
</tr>
<tr>
<td>Sensation Seeking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>-0.205</td>
<td>[-0.297, -0.103]</td>
</tr>
<tr>
<td>SC Anhedonia</td>
<td>-0.077</td>
<td>[-0.175, 0.017]</td>
</tr>
<tr>
<td>Depression</td>
<td>0.172</td>
<td>[0.090, 0.241]</td>
</tr>
<tr>
<td>Gender</td>
<td>0.227</td>
<td>[0.153, 0.306]</td>
</tr>
<tr>
<td>Negative Urgency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RA Anhedonia</td>
<td>-0.013</td>
<td>[-0.099, 0.081]</td>
</tr>
<tr>
<td>SA Anhedonia</td>
<td>0.142</td>
<td>[0.057, 0.232]</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>-0.200</td>
<td>[-0.286, -0.110]</td>
</tr>
<tr>
<td>Depression</td>
<td>0.529</td>
<td>[0.456, 0.587]</td>
</tr>
<tr>
<td>Gender</td>
<td>0.097</td>
<td>[0.031, 0.163]</td>
</tr>
</tbody>
</table>

Note. RA Anhedonia= Recreational Anticipatory Anhedonia, SA Anhedonia= Social Anticipatory Anhedonia, RC Anhedonia= Recreational Consummatory Anhedonia, SC Anhedonia= Social Consummatory Anhedonia, NU= Negative Urgency, SS= Sensation Seeking, DDQ= Daily Drinking Questionnaire, YAACQ= Young Adult Alcohol Consequences Questionnaire. Effects are standardized. 95% CI brackets.
Table 4

**Standardized Indirect and Total Effects**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Mediator</th>
<th>Outcome</th>
<th>Indirect</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC Anhedonia</td>
<td>NU</td>
<td>Alc. Consumption</td>
<td>-0.023</td>
<td>-0.051</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>SS</td>
<td>Alc. Consumption</td>
<td>-0.029</td>
<td>-0.051</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>NU</td>
<td>Alc. Problems</td>
<td>-0.022</td>
<td>-0.044</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>SS</td>
<td>Alc. Problems</td>
<td>-0.011</td>
<td>-0.044</td>
</tr>
<tr>
<td>RC Anhedonia</td>
<td>NU → DDQ</td>
<td>Alc. Problems</td>
<td>-0.005</td>
<td>-0.044</td>
</tr>
<tr>
<td>RA Anhedonia</td>
<td>NU</td>
<td>Alc. Consumption</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>RA Anhedonia</td>
<td>NU</td>
<td>Alc. Problems</td>
<td>-0.002</td>
<td>-0.002</td>
</tr>
<tr>
<td>RA Anhedonia</td>
<td>NU → DDQ</td>
<td>Alc. Problems</td>
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<td>0.002</td>
</tr>
<tr>
<td>SA Anhedonia</td>
<td>NU</td>
<td>Alc. Consumption</td>
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<td>0.016</td>
</tr>
<tr>
<td>SA Anhedonia</td>
<td>NU</td>
<td>Alc. Problems</td>
<td>0.016</td>
<td>0.019</td>
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<td>Alc. Problems</td>
<td>0.003</td>
<td>0.019</td>
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<tr>
<td>SC Anhedonia</td>
<td>SS</td>
<td>Alc. Consumption</td>
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<td>-0.011</td>
</tr>
<tr>
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<td>SS</td>
<td>Alc. Problems</td>
<td>-0.004</td>
<td>-0.006</td>
</tr>
<tr>
<td>SC Anhedonia</td>
<td>SS → DDQ</td>
<td>Alc. Problems</td>
<td>-0.002</td>
<td>-0.006</td>
</tr>
</tbody>
</table>

Note. RA Anhedonia = Recreational Anticipatory Anhedonia, SA Anhedonia = Social Anticipatory Anhedonia, RC Anhedonia = Recreational Consummatory Anhedonia, SC Anhedonia = Social Consummatory Anhedonia, NU = Negative Urgency, SS = Sensation Seeking. Effects are standardized. 95% CI brackets. Total effects combine all indirect pathways. Bias-corrected bootstrapped confidence intervals were used to determine the significance of effects. Bold font represents significant effect based on 95% CI.
Figure 1

Finale Path Model

Note. Final model of anhedonia, impulsivity, and alcohol use and related problems. Gender is included with paths to all endogenous variables but is omitted from the figure for clarity. Solid lines indicate significant paths while dotted lines indicate insignificant paths. All values are standardized coefficients. Standard errors are presented in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. 
APPENDICES

Note: Measures were formatted for online completion.

APPENDIX A

Informed Consent – University of South Dakota

TITLE: Emotions and Behaviors in College Alcohol Consumption
PROJECT DIRECTOR: Sydney Stamatovich, B.S.
FACULTY DIRECTOR: Raluca Simons, Ph.D.
PHONE #: 605-677-5353
Department: Clinical Psychology

STATEMENT OF RESEARCH
It is a basic ethical principle that a subject who is to participate in research must give his or her informed consent to such participation. This consent must be based on the understanding of the nature and risk of the research. This document provides information important for this understanding. If you have any questions, please ask. Research projects include only subjects who choose to take part. Please take your time and make your decision, and if you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?
You are invited to be in a research study investigating the behaviors and emotions associated with drinking among college students. You were selected as a possible participant because you are a college student. The purpose of this research study is to learn more about factors that affect college drinking. You will be asked to complete a series of questionnaires about your drinking, behavior, and emotions.

HOW MANY PEOPLE WILL PARTICIPATE?
Approximately 600 people will take part in this study.

HOW LONG WILL I BE IN THIS STUDY?
Your participation in this portion of the study will last approximately 30 minutes.

WHAT WILL HAPPEN DURING THIS STUDY?
You will be asked to complete a series of questionnaires about your drinking, behaviors, and emotions. You are free to stop at any time and are encouraged to stop your participation in the study by exiting your browser if questions become too distressful.

WHAT ARE THE RISKS OF THE STUDY?
You may experience frustration that is often experienced when completing surveys. Some questions asked as a part of this study may be of a sensitive nature, and it is possible that you could become upset or uncomfortable. Although these risks are not viewed as being in excess of “minimal risk,” you should be sure to complete these questionnaires in a private place, where other individuals are unable to view your responses. If you become upset by the questions, you may stop at any time or choose not to answer a question. If you would like to talk to someone about your feelings regarding this study or any behavior that this study inquires about, you are encouraged to contact The University of South Dakota’s Student Counseling Center at 605-677-5777.

WHAT ARE THE BENEFITS OF THIS STUDY?
You may not benefit personally from being in this study. However, we hope that in the future students might benefit from this study because the results will help us better college drinking behaviors.

WHAT ARE THE ALTERNATIVES TO PARTICIPATING IN THIS STUDY?
You may choose not to participate in this study.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?
There will be costs for your participation.

WILL I BE PAID FOR PARTICIPATING?
You will be paid $2.00 for completing the entire survey.

ARE MY RECORDS CONFIDENTIAL?
If you decide to take part in this research study, you will be asked to give us information about your drinking, behavior, and emotions. Confidentiality will be maintained by means of identifying protocols by code only. Thus, no information that can identify you will be associated with any of your responses. A master list linking names to codes will be kept in a separate location accessible only to designated research staff. This master list will be kept for only purposes of contacting participants if needed, and for compensating for participation. This list will be destroyed upon completion of the study. All data will be kept in a secure file accessible only to primary research personnel. If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

IS THIS STUDY VOLUNTARY?
Your participation is voluntary. You may choose not to participate, or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision about whether to participate will not affect your current or future relations with the University of South Dakota.

WHOM MAY I CONTACT IF I HAVE QUESTIONS?
The researchers conducting this study are Sydney Stamatovich, B.S. and Dr. Raluca Simons, Ph.D. You may contact Sydney at Sydney.stamatovich@coyotes.usd.edu if you have questions later. If you have concerns or complaints about the research, please contact Dr. Raluca Simons at 605-677-5353 during daytime hours or via email (raluca.simons@usd.edu). If you have questions regarding your rights as a research subject, you may contact The University of South Dakota Institutional Review Board at (605) 677-6184. You may also call this number for any problems, complaints, or concerns about the research. Please call this number if you cannot reach research staff, or you wish to talk with someone else. General information about being a research subject can be found by clicking “Information for Research Participants” on the Research Compliance web site: http://www.usd.edu/research/research-and-sponsored-programs/human-subjects-protection.cfm.

Indicating “yes” below signifies that you consent to participate in the study.
Appendix B

Short Screening Questionnaire

Please select the most appropriate answer.

1. Are you currently between the ages of 18-25 years?
   
   Yes  
   
   No

2. Are you currently enrolled in a college or university as a full-time student?
   
   Yes  
   
   No

3. Have you consumed alcohol in the past 30 days?
   
   Yes
   
   No
Appendix C

Demographic Information

Please select the most appropriate answer.

1. Age: Please enter numbers only

2. Gender: Male  Female  Other

3. Are you currently enrolled in college or technical school?
   a. Full-time college
   b. Part-time college
   c. Full-time technical school
   d. Part-time technical school
   e. Not enrolled
   f. Do not wish to respond

4. Please select year in school.

5. Please choose one racial group that best describes you.
   a. Asian
   b. African American
   c. Hispanic or Latino
   d. Native American or Alaskan Native
   e. Native Hawaiian or other Pacific Islander
   f. White or Caucasian
   g. Multiracial
   h. Other
Appendix D

Snaith-Hamilton Pleasure Scale (SHAPS)

This questionnaire is designed to measure your ability to experience pleasure in the last few days. It is important to reach each statement very carefully. Choose one of the numbers to indicate how much you agree or disagree with each statement.

1. I would enjoy my favorite television or radio program.
   1. Strongly disagree
   2. Disagree
   3. Agree
   4. Strongly Agree

2. I would enjoy being with my family or close friends.
   1. Definitely Agree
   2. Agree
   3. Disagree
   4. Strongly Disagree

3. I would find pleasure in my hobbies and pastimes.
   1. Strongly disagree
   2. Disagree
   3. Agree
   4. Strongly Agree

4. I would be able to enjoy my favorite meal.
   1. Definitely Agree
   2. Agree
   3. Disagree
   4. Strongly Disagree

5. I would enjoy a warm bath or refreshing shower.
   1. Definitely Agree
   2. Agree
   3. Disagree
   4. Strongly Disagree
6. I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread.

   1. Strongly disagree
   2. Disagree
   3. Agree
   4. Strongly Agree

7. I would enjoy seeing other people’s smiling faces.

   1. Definitely Agree
   2. Agree
   3. Disagree
   4. Strongly Disagree

8. I would enjoy looking smart when I have made an effort with my appearance.

   1. Strongly disagree
   2. Disagree
   3. Agree
   4. Strongly Agree

9. I would enjoy reading a book, magazine, or newspaper.

   1. Definitely Agree
   2. Agree
   3. Disagree
   4. Strongly Disagree

10. I would enjoy a cup of tea or coffee or my favorite drink.

    1. Strongly disagree
    2. Disagree
    3. Agree
    4. Strongly Agree

11. I would find pleasure in small things, e.g. bright sunny day, a telephone call from a friend.

    1. Strongly disagree
    2. Disagree
    3. Agree
    4. Strongly Agree

12. I would be able to enjoy a beautiful landscape or view.
13. I would get pleasure from helping others.

1. Strongly disagree
2. Disagree
3. Agree
4. Strongly Agree

14. I would feel pleasure when I receive praise from other people.

1. Definitely Agree
2. Agree
3. Disagree
4. Strongly Disagree
Appendix E

Temporal Experience of Pleasure Scale (TEPS)

For each statement, please indicate how much each is true or false to you. The corresponding choices are as follows: Very false to me choose 1, False to me choose 2, Somewhat false to me choose 3, Somewhat true to me choose 4, True to me choose 5, Very true to me choose 6. Be sure to indicate your agreement or disagreement for every statement below.

1. When something exciting is coming up in my life, I really look forward to it.
   1 2 3 4 5 6

2. The sound of cracking wood in the fireplace is very relaxing.
   1 2 3 4 5 6

3. When I think about eating my favorite food, I can almost taste how it is.
   1 2 3 4 5 6

4. I love the sounds of rain on the windows when I’m lying in my warm bed.
   1 2 3 4 5 6

5. The smell of freshly cut grass is enjoyable to me.
   1 2 3 4 5 6

6. I enjoy taking a deep breath of fresh air when I walk outside.
   1 2 3 4 5 6

7. I don’t look forward to things like eating out at restaurants. (R)
   1 2 3 4 5 6

8. A hot cup of coffee or tea on a cold morning is very satisfying to me.
   1 2 3 4 5 6

9. I love it when people play with my hair.
   1 2 3 4 5 6

10. I really enjoy the feeling of a good yawn.
    1 2 3 4 5 6
11. When I’m on the way to an amusement park, I can hardly wait to ride the roller coasters.

12. I get so excited the night before a major holiday I can hardly sleep.

13. I appreciate the beauty of a fresh snowfall.

14. When I think of something tasty, like a chocolate chip cookie, I have to have one.

15. Looking forward to a pleasurable experience is in itself pleasurable.

16. I look forward to a lot of things in my life.

17. When ordering something off the menu, I imagine how good it will taste.

18. When I hear about a new movie starring my favorite actor, I can’t wait to see it.
Appendix F

Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS)

Please read each statement carefully and decide how true that statement is for you in general. Please respond to all items. In the rare case where you have never had the experience described, think about the most similar experience you’ve had and make your response. Choose from the following 6 response options and INDICATE your response in the space to the right of the item.

<table>
<thead>
<tr>
<th></th>
<th>Very false for me</th>
<th>Moderately false for me</th>
<th>Slightly false for me</th>
<th>Slightly true for me</th>
<th>Moderately true for me</th>
<th>Very true for me</th>
</tr>
</thead>
</table>

1. I look forward to seeing people when I’m on my way to a party or get-together.  
   1 2 3 4 5 6

2. I enjoy looking at photographs of my friends and family.  
   1 2 3 4 5 6

3. I don’t really look forward to family get togethers or gatherings. (R)  
   1 2 3 4 5 6

4. I enjoy joking and talking with a friend or coworker.  
   1 2 3 4 5 6

5. A good meal always tastes better when you eat it with someone you feel close to.  
   1 2 3 4 5 6

6. I like it when people call or text me to say hi.  
   1 2 3 4 5 6

7. When something good happens to me, I can’t wait to share the news with others.  
   1 2 3 4 5 6

8. If I learned of a group where the people shared similar interests as me, I would be interested in joining in.  
   1 2 3 4 5 6
9. I enjoy watching films about friendship or relationships with my friends.

1  2  3  4  5  6

10. I imagine how much fun it would be to go on vacation with a friend or someone I love.

1  2  3  4  5  6

11. I appreciate being invited to hang out with people I know after school or work.

1  2  3  4  5  6

12. I am pleased when I see a friend or someone I love who I haven’t seen for a while.

1  2  3  4  5  6

13. I enjoy going on group activities like attending sports events or concerts with friends.

1  2  3  4  5  6

14. I look forward to watching my favorite TV shows with my friends.

1  2  3  4  5  6

15. I am excited when a friend that I haven’t seen in a while contacts me to make plans.

1  2  3  4  5  6

16. I like talking with others while waiting in line.

1  2  3  4  5  6

17. I enjoy it when a friend and I can discuss important things.

1  2  3  4  5  6
Appendix G

UPPS-P Impulsive Behavior Scale

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 choose 1, if you Agree Somewhat choose 2, if you Disagree somewhat choose 3, and if you Disagree strongly choose 4. Be sure to indicate your agreement or disagreement for every statement below. Also, there are questions on the following pages.

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
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.
31. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.
32. I am able to pace myself so as to get things done on time.
33. I usually make up my mind through careful reasoning.
34. When I feel rejected, I will often say things that I later regret.
35. Others are shocked or worried about the things I do when I am feeling very excited.
36. I would like to learn to fly an airplane.
37. I am a person who always gets the job done.
38. I am a cautious person.
39. It is hard for me to resist acting on my feelings.
40. When I get really happy about something, I tend to do things that can have bad consequences.
41. I sometimes like doing things that are a bit frightening.
42. I almost always finish projects that I start.
43. Before I get into a new situation I like to find out what to expect from it.
44. I often make matters worse because I act without thinking when I am upset.
45. When overjoyed, I feel like I can’t stop myself from going overboard.
46. I would enjoy the sensation of skiing very fast down a high mountain slope.
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
58. Sometimes I do impulsive things that I later regret.
   1 2 3 4
59. I am surprised at the things I do while in a great mood.
   1 2 3 4
Appendix H

Center for Epidemiologic Studies Depression Scale, Revised (CESD-R-20)

Below is a list of the ways you might have felt or behavior. Please identify how often you have felt during the past week.
0=Rarely or None of the Time (Less than 1 Day)
1=Some or a Little of the Time (1-2 Days)
2= Occasionally or a Moderate Amount of Time (3-4 Days)
3= Most or All of the Time (5-7 Days)
4= Nearly every day for 2 weeks

During the past week:

1. I was bothered by things that usually don’t bother me.
   - 0. Rarely or None of the Time (Less than 1 Day)
   - 1. Some or a Little of the Time (1-2 Days)
   - 2. Occasionally or a Moderate Amount Time (3-4 Days)
   - 3. Most or All of the Time (5-7 Days)
   - 4. Nearly every day for 2 weeks

2. I did not feel like eating; my appetite was poor.
   - 0. Rarely or None of the Time (Less than 1 Day)
   - 1. Some or a Little of the Time (1-2 Days)
   - 2. Occasionally or a Moderate Amount Time (3-4 Days)
   - 3. Most or All of the Time (5-7 Days)
   - 4. Nearly every day for 2 weeks

3. I felt that I could not shake off the blues even with the help from my family or friends.
   - 0. Rarely or None of the Time (Less than 1 Day)
   - 1. Some or a Little of the Time (1-2 Days)
   - 2. Occasionally or a Moderate Amount Time (3-4 Days)
   - 3. Most or All of the Time (5-7 Days)
   - 4. Nearly every day for 2 weeks

4. I felt that I was just as good as other people.
   - 0. Rarely or None of the Time (Less than 1 Day)
   - 1. Some or a Little of the Time (1-2 Days)
   - 2. Occasionally or a Moderate Amount Time (3-4 Days)
   - 3. Most or All of the Time (5-7 Days)
   - 4. Nearly every day for 2 weeks

5. I had trouble keeping my mind on what I was doing.
   - 0. Rarely or None of the Time (Less than 1 Day)

78
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

6. I felt depressed.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

7. I felt that everything I did was an effort.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

8. I felt hopeful about the future.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

9. I thought my life had been a failure.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

10. I felt fearful.
    0. Rarely or None of the Time (Less than 1 Day)
    1. Some or a Little of the Time (1-2 Days)
    2. Occasionally or a Moderate Amount Time (3-4 Days)
    3. Most or All of the Time (5-7 Days)
    4. Nearly every day for 2 weeks

11. My sleep was restless.
    0. Rarely or None of the Time (Less than 1 Day)
    1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

12. I was happy.

0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

13. I talked less than usual.

0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks


0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

15. People were unfriendly.

0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

16. I enjoyed life.

0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

17. I had crying spells.

0. Rarely or None of the Time (Less than 1 Day)
1. Some or a Little of the Time (1-2 Days)
2. Occasionally or a Moderate Amount Time (3-4 Days)
3. Most or All of the Time (5-7 Days)
4. Nearly every day for 2 weeks

18. I felt sad.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

19. I felt that people dislike me.
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks

20. I could not get “going.”
   0. Rarely or None of the Time (Less than 1 Day)
   1. Some or a Little of the Time (1-2 Days)
   2. Occasionally or a Moderate Amount Time (3-4 Days)
   3. Most or All of the Time (5-7 Days)
   4. Nearly every day for 2 weeks
Appendix I

Daily Drinking Questionnaire (DDQ), Modified

INSTRUCTIONS
For the past 3 months, please fill in a number for each day of the week indicating the typical number of drinks you usually consume on that day, and the typical number of hours you usually drink on that day. A standard drink is defined as a 12 oz. Beer or wine cooler, 5 oz. of wine, or 1.5 oz. of hard alcohol (if you had a “double” in a mixed drink, count it as 2 drinks). Please enter only numbers.

Please be sure to fill out the information regarding your weight and height.

<table>
<thead>
<tr>
<th></th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please enter your height: ____________

Please enter your weight: ____________
Appendix J

Young Adult Alcohol Consequences Questionnaire (YAACQ)

Below is a list of things that sometimes happen to people either during, or after they have been drinking alcohol. Next to each item below, please mark an “X” in either the YES or NO column to indicate whether that item describes something that has happened to you IN THE PAST YEAR.

In the past year...

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>1.</td>
<td>While drinking, I have said or done embarrassing things.</td>
</tr>
<tr>
<td>2.</td>
<td>The quality of my work or schoolwork has suffered because of my drinking.</td>
</tr>
<tr>
<td>3.</td>
<td>I have felt badly about myself because of my drinking.</td>
</tr>
<tr>
<td>4.</td>
<td>I have driven a car when I knew I had too much to drink to drive safely.</td>
</tr>
<tr>
<td>5.</td>
<td>I have had a hangover (headache, sick stomach) the morning after I had been drinking.</td>
</tr>
<tr>
<td>6.</td>
<td>I have passed out from drinking.</td>
</tr>
<tr>
<td>7.</td>
<td>I have taken foolish risks when I have been drinking.</td>
</tr>
<tr>
<td>8.</td>
<td>I have felt very sick to my stomach or thrown up after drinking.</td>
</tr>
<tr>
<td>9.</td>
<td>I have gotten into trouble at work or school because of drinking.</td>
</tr>
<tr>
<td>10.</td>
<td>I often drank more than I originally had planned.</td>
</tr>
<tr>
<td>11.</td>
<td>My drinking has created problems between myself and my boyfriend/girlfriend/spouse, parents, or other near relatives.</td>
</tr>
<tr>
<td>12.</td>
<td>I have been unhappy because of my drinking.</td>
</tr>
<tr>
<td>13.</td>
<td>I have gotten into physical fights because of drinking.</td>
</tr>
<tr>
<td>14.</td>
<td>I have spent too much time drinking.</td>
</tr>
<tr>
<td>15.</td>
<td>I have not gone to work or missed classes at school because of drinking, a hangover, or illness caused by drinking.</td>
</tr>
<tr>
<td>16.</td>
<td>I have felt like I needed a drink after I’d gotten up (that is, before breakfast).</td>
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<tr>
<td>17.</td>
<td>I have become very rude, obnoxious or insulting after drinking.</td>
</tr>
<tr>
<td>18.</td>
<td>I have felt guilty about my drinking.</td>
</tr>
<tr>
<td>19.</td>
<td>I have damaged property, or done something disruptive such as setting off a false fire alarm, or other things like that after I had been drinking.</td>
</tr>
<tr>
<td>20.</td>
<td>Because of my drinking, I have not eaten properly.</td>
</tr>
<tr>
<td>21.</td>
<td>I have been less physically active because of drinking.</td>
</tr>
<tr>
<td>22.</td>
<td>I have had “the shakes” after stopping or cutting down on drinking (e.g., hands shake so that coffee cup rattles in the saucer or have trouble lighting a cigarette).</td>
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<tr>
<td>23.</td>
<td>My boyfriend/girlfriend/spouse/parents have complained to me about my drinking.</td>
</tr>
<tr>
<td>24.</td>
<td>I have woken up in an unexpected place after heavy drinking.</td>
</tr>
</tbody>
</table>
I have found that I needed larger amounts of alcohol to feel any effect, or that I could no longer get high or drunk on the amount that used to get me high or drunk.

As a result of drinking, I neglected to protect myself or my partner from a sexually transmitted disease (STD) or an unwanted pregnancy.

I have neglected my obligations to family, work, or school because of drinking.

I often have ended up drinking on nights when I had planned not to drink.

When drinking, I have done impulsive things that I regretted later.

I have often found it difficult to limit how much I drink.

My drinking has gotten me into sexual situations I later regretted.

I’ve not been able to remember large stretches of time while drinking heavily.

While drinking, I have said harsh or cruel things to someone.

Because of my drinking I have not slept properly.

My physical appearance has been harmed by my drinking.

I have said things while drinking that I later regretted.

I have awakened the day after drinking and found that I could not remember a part of the evening before.

I have been overweight because of drinking.

I haven’t been as sharp mentally because of my drinking.

I have received a lower grade on an exam or paper than I ordinarily could have because of my drinking.

I have tried to quit drinking because I thought I was drinking too much.

I have felt anxious, agitated, or restless after stopping or cutting down on drinking.

I have not had as much time to pursue activities or recreation because of drinking.

I have injured someone else while drinking or intoxicated.

I often have thought about needing to cut down or stop drinking.

I have had less energy or felt tired because of my drinking.

I have had a blackout after drinking heavily (i.e., could not remember hours at a time).

Drinking has made me feel depressed or sad.