

**Key Personality Traits and Alcohol Use Disorder Symptoms in First and Second Year
College Students: Detangling Antecedent from Consequence**

by

Lucy Riley

A thesis submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Master of Science

Auburn, Alabama
May 5, 2018

Keywords: Alcohol Use Disorder, College Students, Personality

Copyright 2018 by Lucy K. Riley

Approved by

Dr. Diana Samek, Assistant Professor of Human Development & Family Studies (Chair)
Dr. Stephen Erath, Associate Professor of Human Development & Family Studies
Dr. Ben Hinnant, Associate Professor of Human Development & Family Studies

Abstract

Background. Studies have consistently shown that low constraint and high negative emotionality are associated with higher levels for alcohol use and greater alcohol related problems. Less research has examined associations between these traits and alcohol use disorder (AUD) from the first to second year of college, or evaluated gender differences in these associations. **Methods.** The College Experiences Study ($N=209$) was used to detangle antecedent vs. consequence between constraint, negative emotionality, and AUD symptoms using a cross-lagged panel model. **Results.** Providing evidence for a scar/complication model, greater AUD symptoms in the first year of college was predictive of decreases in constraint in the second year, but only for males. Surprisingly, negative emotionality was not associated with AUD for either gender. **Conclusion.** Increased education on college campuses regarding symptoms of AUD could provide knowledge and awareness for college students facing various challenges as a result of their alcohol use.

Acknowledgments

I would like to thank my family for encouraging me to continue my education and supporting me throughout my graduate program.

I would like to thank the College Experiences Study participants for making this project possible through their time and effort.

I would like to thank Dr. Rebecca Goodman for her tremendous guidance and support during my first year as a M.S. student, and also for continually making herself available to me even though we are states apart.

I would like to thank all of the undergraduate research assistants who have recruited and managed our participants since the Fall of 2015. Sharonda Watson (Fall 2015), Katie Scholder and Bri DiPalmo (Spring 2016), Savannah Grimes and Miranda Peacot (Fall 2016), Mary Catherine Cunningham (Fall 2016-Spring 2017), Laura Parker and Kathlene Gorman (Spring 2017), Allison Tidwell (Fall 2017), Chase Woodly, Michael Miley, and Ben Cage (Fall 2017-Spring 2018), Tiffani Appling and Phillip Robinson (Spring 2018).

I would like to thank my committee members, Dr. Ben Hinnant and Dr. Stephen Erath for their feedback, and expert advice on this thesis project.

Lastly, I would like to thank Dr. Diana Samek for her tremendous support, encouragement, guidance on this thesis project, and all of graduate school. Dr. Samek went above and beyond her call of duty as an advisor by funding trips to conferences, dedicating time and energy to me through individualized one-on-one training that not many people receive, and

providing timely and excellent feedback. I consider myself lucky to have had you as my mentor and advisor.

This project was supported by funding from the Auburn University Alabama Agricultural Experiment Station Young Investigator Support Award (Project 1006129, PI Samek, USDA National Institute of Food and Agriculture).

Table of Contents

Abstract	ii
Acknowledgments.....	iii
List of Tables	vi
List of Figures	vii
List of Abbreviations	viii
Introduction	1
Methods	13
Results	16
Discussion	20
References	28
Appendix	54

List of Tables

Table 1	38
Table 2	45
Table 3	47
Table 4	49

List of Figures

Figure 1	50
Figure 2	51
Figure 3	52
Figure 4	53

List of Abbreviations

APA	American Psychological Association
AUD	Alcohol use disorder
CDC	Center for Disease Control and Prevention
NIAAA	National Institute of Alcohol Abuse and Alcoholism
NIDA	National Institute on Drug Abuse
NIH	National Institute of Health
SAMHSA	Substance Abuse and Mental Health Services Administration

Introduction

Alcohol is one of the most commonly used and abused substances in the United States (National Institute on Drug Abuse [NIDA], 2017). For example, nearly 60% of those ages 18-25 have used alcohol in the past month (NIDA, 2016). As many as two-thirds of those who used alcohol in the past month also reported binge drinking, which is generally defined as 5 or more drinks on one occasion (Substance Abuse and Mental Health Service Administration [SAMHSA], 2014). There are many negative outcomes associated with alcohol use and abuse, some of which include unintentional and intentional injuries, sexually transmitted diseases, and high blood pressure (Center for Disease Control and Prevention [CDC], 2017a).

One particular concern is the excess amount of use among college students, as it has long been shown that college students use and abuse alcohol more than their non-college attending peers (Barnes, Welte, Hoffman, and Tidwell, 2010; Dawson, Grant, Sinson, and Chou, 2004; SAMSHA, 2014; Slutske, 2004, 2005). Further, although there is extant research on risk factors associated with alcohol use and binge drinking in college and young adult populations (Chassin, Pitts, and Prost, 2002; Malmberg et al., 2013; Quinn, Stappennbeck, and Fromme, 2011; Schulenberg, O'Mally, Bachman, Wadsworth, and Johnston, 1996; Shin, Hong, and Jeon 2012; Slutske, 2005; Thompson, Roemer, and Leadbeater, 2015), less research has evaluated the risk factors for alcohol use *disorder* (AUD), specifically. AUD refers not to the quantity one drinks, but instead it refers to a pattern of alcohol use that results in impairment in overall physical, psychological, and/or social health (American Psychological Association [APA], 2013). Not surprisingly, AUD in particular is associated with severe and potentially disastrous outcomes, such as school failure and loss of work place productivity, divorce, legal problems, and poor physical health, including early death (CDC, 2017a; Foster, Hicks, Iacono, and McGue, 2015;

Greig, Baker, Lewin, Webster, and Carr, 2006; Hicks, Iacono, and McGue, 2010; Huang, Lanza, and Anglin, 2013; Meier et al., 2012).

There are several risk factors which can increase the likelihood of an individual developing AUD. These risks include, consistent drinking over time, earlier age onset of alcohol use, family history of alcohol use, mental health issues, and social and cultural factors (CDC, 2017b; NIAAA, 2017a, 2017b; Tetrault and O'Connor, 2017). Approximately 6% of Americans ages 18 and older met the criteria for AUD in 2015; however, roughly 20% of college students met the criteria for AUD (NIAAA, 2017a), which is more than three times the rate of the general adult population (Blanco et al., 2008). With such alarming rates of AUD in college students and such detrimental negative outcomes associated with AUD (Hicks, Iacono, and McGue, 2010; NIAAA, 2017a; SAMSHA, 2014), it is essential to further investigate the risk and protective factors leading to AUD during transitions through college.

This paper seeks to fill these gaps by further investigating how key personality traits, including constraint and negative emotionality, are associated with AUD symptoms, AUD diagnosis, as well as overall rate of frequent binge drinking in the first and second years of college. Research has shown that these two personality traits are particularly salient in relation to alcohol use and alcohol use problems (Adams, Milich, Lynam, and Charnigo, 2013; McGue, Slutske, Taylor, and Iacono, 1997; Samek, Hicks, Durbin, Hinnant, Iacono, and McGue, 2018). The trait of constraint is characterized as careful cautious, and danger avoidant behavior, as well as endorsement of traditional values (Tellegan & Waller, 2008). Therefore, low constraint represents greater personality-based risk for substance use problems as it represents greater disinhibited and non-traditional behavior. The key personality trait of negative emotionality is characterized as the mood experiences of stress, dissatisfaction, anger, fear, nervousness, and

guilt (Watson, Clark, & Tellegan, 1988; Samek et al., 2018). Therefore, high negative emotionality represents greater personality-based risk for substance use problems as it represents greater experiences of negative emotion, particularly in times of stress. Using a longitudinal design, I teased apart antecedent vs. consequence in the associations between these key personality traits and AUD symptomatology, diagnosis, and rate of frequent binge drinking to better understand the salience of these traits in relation to specific problematic drinking outcomes.

Review of the Literature

Gender Differences in AUD

First, it is important to note that men have been consistently more likely to consume a greater quantity of alcohol than women (CDC, 2016; Clement, 1999; National Institutes of Health [NIH], 2015; Wagoner, Blocker, McCoy, Sutfin, Champion, and Wolfson, 2012). However, there is accumulating evidence that women are at a greater risk for negative outcomes even with lower drinking patterns than men (NIH, 2015). For example, Foster and colleagues (2015) found that there were greater psychiatric and psychosocial problems among women with AUD than men in adulthood; specifically, women with AUD experienced more risk exposure in adolescence and internalizing disorders outcomes than men with AUD in adolescence and later young adulthood. More recently, Foster, Hicks, Durbin, Iacono, and McGue (2017) found support for a gender risk severity paradox, which refers to the notion that although women tend to have lower rates of AUD and lower levels of risk exposure, they have a faster accumulation of consequences of AUD during emerging adulthood. Particularly interesting was the results that found women with a desistent course of AUD had longer lasting negative effects in relation to their mental health (including depression) compared to men, where men with a desistent course

were able to recover more quickly from the negative effects of AUD. In recent years, it has been found that the rate of AUD among women has increased substantially and is considered a public health concern (Grant, Chou, Saha, Pickering, Kerridge, Ruan, et al., 2017). While recent research has shown rates of past-year AUD among men 18 or older (16.7%) are still higher than women (9%), there has been as much as an 84% increase in AUD among women in the past 12 months from 2001-2002 to 2012-2013 (Grant et al., 2017).

Such differences among males and females call for further investigation into whether there are differential risk factors for AUD by gender. While some research has explored the gender differences in motivations and consequences of alcohol use and AUD (Foster et al., 2015, 2017; Nolan-Hoeksema and Hilt, 2006; Nolan-Hoeksema, 2004; Olenick and Chalmaers, 1991; Ratliff and Burkhart, 1984), no research to date has evaluated gender differences in the associations between key personality traits and alcohol use problems in the context of the first two years of college, thus the present study will add a novel contribution to the literature by exploring for such gender differences. Based on the existing literature I expect to find differences in prevalence rates but perhaps not in the associations between key personality traits and AUD (Samek et al., 2018).

College vs. Non-College Samples

With higher rates of alcohol use and abuse among college students compared to their non-college counterparts (NIDA, 2016; NIAAA, 2015a, 2017a), it seems distinctly important to investigate key predictors of AUD in the college population. In addition to the drinking norms surrounding the college experiences, it is important to also consider college students beliefs (i.e. perceptions) about drinking in college, or the role of drinking in college. For example, Hustad et al. (2014) examined individual's beliefs about the role of drinking in college and found that this

perception (i.e., the importance of using alcohol in college) largely mediated the relationship between personality (i.e. impulsivity and sensation seeking) and alcohol use and problems. Considering the normalization of high levels of alcohol use and abuse within the college environment, the college experience may allow for the enhancement of risky personality traits, which could contribute to increased levels of alcohol use and abuse (i.e. AUD).

Key Personality Traits Associated with Alcohol Use

According to the APA (2013), personality is defined as individual characteristic patterns of thinking, feeling, and behaving. There has been research investigating the plasticity and consistency of personality throughout development (Blonigen, Carlson, Hicks, Krueger, and Iacono, 2008; Roberts and DelVecchio, 2000), as well as the biological vs. environmental influences on personality (Belcher, Volkow, Moller, and Ferre, 2014; Matterson, McGue, and Iacono, 2013). Roberts and DelVecchio found that personality trait consistency peaked around the age of 50, although it was shown to be quite stable by late adolescence (i.e., by age 18). In another study, Blonigen and colleagues (2008) found that individuals scoring highest in constraint and lowest in negative emotionality (i.e., those at low personality-based risk) demonstrated the most stability in their personality scores from age 17 to age 24; however individuals who were the opposite (low in constraint and high in negative emotionality; i.e. high personality-based risk at age 17) experienced the most change. They were more likely to experience increases in constraint and decreases in negative emotionality by the time they were 24. This is in line with the idea that personality generally matures with age, such that individuals gain increases in constraint and decreases in negative emotionality by the late 20s and early 30s.

Studies have consistently shown that low constraint and high negative emotionality are directly associated with higher levels of alcohol use and more alcohol related problems (Adams

et al., 2013; Hustad, Pearson, Neighbors, and Borsari, 2014; Kuntsche, Fischer, and Gmel, 2008; Littlefield, Sher, and Wood, 2009; McGue et al., 1997; Pearson and Hustad, 2014). For example, Shin and colleagues (2012) aimed to unpack the distinct facets of impulsivity and how they contribute to alcohol use and abuse among young adults between the ages of 18 and 25 through a cross-sectional study. Regression analyses revealed that higher scores of negative urgency (defined as doing something for instant gratification while feeling sad, and then later regretting it) and sensation seeking (defined as the enjoyment of taking risks) significantly predicted higher rates of alcohol use and problems, including AUD diagnosis.

Twin and adoption studies have consistently shown that personality is influenced by both genetic and environmental factors (Matteson et al., 2013; Verhulst, Neale, & Kendler, 2015)). The average heritability estimate is .50 indicating almost half of the total variance in personality by late adolescence and young adulthood is explained by genetic factors; the other half is explained by unique environmental experiences (Matteson et al., 2013). Similarly, the heritability of AUD is estimated to be about .50 (Verhulst et al., 2015). Research has shown both the cross-sectional associations between key traits (constraint, negative emotionality) and AUD symptoms and related externalizing problems are predominately due to shared genetic influences (Khremiri, Kuja-Halkola, Larsson, & Jayaram-Lindstrom, 2016; Krueger, Hicks, Patrick, Carlson, Iacono, & McGue, 2002; Littlefield et al., 2012; Slutske, Heath, Madden, Bucholz, Statham, & Martin, 2002). Research has also shown the longitudinal associations from ages 17 to 29 are also predominately explained by one common additive genetic factor (Samek et al., 2018). Altogether, this work suggests both personality and AUD are at least somewhat biologically influenced, but less is known on whether personality acts as a vulnerability factor or

consequence of AUD in the population of college students transitioning through their first and second years.

College Context as a Critical Juncture

Although few studies have examined the relationship of personality and alcohol use in college populations using longitudinal designs, there is at least some evidence that personality is an antecedent rather than a consequence of alcohol use patterns (Littlefield, Verges, Wood, and Sher, 2012; McAdams and Donnellan, 2008; Pearson and Hustad, 2014; Quinn et al., 2011). For example, McAdams and Donnellan (2008) assessed first year college students using a longitudinal design, where students were assessed during the fall and spring semester of their freshmen year. The results showed a small effect (standardized regression coefficient of .13) for impulsive sensation seeking predicting later drinking; however, they did not analyze how earlier drinking predicted later impulsive sensation seeking. In a similar study, Cho, Llaneza, Adkins, Cooke, Kendler, Clark et al. (2015) found that there is an overall increase in alcohol use across the first year of college (49% fall semester to 69% spring semester having used alcohol at least once), and that personality was an important indicator of individuals increasing their alcohol use. For example, females with higher scores of sensation seeking had increased odds of transitioning to a higher use group.

Another particularly relevant longitudinal study (Quinn and Fromme, 2011) tested how personality traits and protective environments in high school predicted personality and alcohol outcomes during the transition from the last year of high school to the first year of college. Results showed that sensation seeking was more strongly related to alcohol outcomes than impulsivity. Additionally, protective environments (i.e. perceived awareness and caring of parents and other adults in high school) had lasting implications during this transition for those

who were impulsive, whereas this protective environment only delayed effects until college for those who were high in sensation seeking (Quinn and Fromme, 2011). Furthermore, students who were high in both sensation seeking and protective environments during high school experienced the sharpest increase in alcohol use and alcohol problems during the transition to college. This unique finding further exposes the way in which specific personality traits individually impact different alcohol outcomes.

Providing some evidence for a transaction effect, Quinn et al. (2011) showed via latent difference score modeling that heavier drinking in the first three years of college predicted greater increases in sensation seeking in the fall of senior year of college, supporting the notion that personality change may also be a consequence of heavy drinking in college. Sensation seeking in high school was also associated with increases in heavy drinking in college, but this effect was less pronounced. This study suggest there may be important bidirectionality involved in the associations between key personality traits and alcohol problems for college students, and it may depend on the particular developmental period analyzed.

Following this, Littlefield and colleagues (2012) demonstrated evidence that personality was both an antecedent and a consequence of heavy drinking when analyzed in smaller time frames. Specifically, novelty seeking assessed during fall of freshman year was significantly associated with increases in heavy drinking during spring of sophomore year. Heavy drinking during spring of sophomore year was then subsequently and significantly associated with increases in novelty seeking in spring of senior year. However the bidirectional associations between novelty seeking and heavy drinking were small and not significantly different than zero when analyzed from fall of freshman year to spring of senior year. Further analyses showed that novelty seeking at the end of fall of senior year predicted increases in heavy drinking post-

college. Based on these findings, I expect to find evidence of bidirectionality in my analysis of key personality traits (negative emotionality and constraint) in relation to AUD symptoms during the first two years of college. However, an additionally unique aspect of the proposed study is that I will be evaluating AUD symptoms, as well as comparing how results replicate when evaluating AUD diagnosis rather than symptomatology, as well as in relation to a measure of frequent binge drinking in the same time frame, and whether there are significant gender differences in these associations.

Theoretical Frameworks

In order to further extend the existing literature on key personality traits and AUD among college students and tease apart the speculation of consequence vs. antecedent, three theoretical models are tested based on the premises provided by earlier research (Klein et al., 2011; Samek et al., 2018; Tackett, 2006). The first model, vulnerability/predisposition, posited that individuals possess a trait(s) that may increase the risk for future development of AUD. This is similar to the Scarr and McCartney's (1983) concept of genotype-environment correlation, which suggests that genetically-influenced traits (such as personality) impact exposure or selection into certain life experiences, particularly as people get older and have more freedom in selecting environments that best fit with their genetically-influenced traits and attitudes. For example, individuals who are impulsive may be more likely to select into risky situations, such as attending parties or bars, where the drinking is embedded in the environment and risky behavior is encouraged. Support for this theory would be evidenced if personality traits are a significant predictor of subsequent AUD symptoms, after controlling for the stability of these variables over time and the residual correlations at each assessment, and if AUD symptoms are not a significant predictor of subsequent personality traits.

The second model, scar/complication, proposed that problems and/or risky situations initiate a change in personality maturation. More specifically, an individual in the environment where heavy drinking is the norm may experience a rise in impulsive types of behaviors (e.g. risky sexual behavior, driving under the influence). Support for this theory would be evidenced if AUD symptoms were a significant predictor of subsequent personality, and personality did not significantly predict subsequent AUD symptoms, after accounting for the stability of these variables over time and within-assessment correlations. A third model proposes that the relationships between personality and AUD symptoms are bidirectional and transactional in nature. Thus, while personality traits can act as a predisposition or vulnerability for subsequent exposure to risky environments and AUD, experiences of heavy drinking and AUD can also serve as a marker for subsequent personality-based risk. Support for this model would show significant associations between personality traits on subsequent AUD symptoms and vice versa, after accounting for the stability of these variables over time and within-assessment associations. Based on prior research (Quinn et al., 2011; Littlefield et al., 2012), I expected to find support for this bidirectional/transactional model of AUD-personality development in evaluating these associations in the first two years of college. I did not have specific hypotheses of how results may vary by gender, as this has been little explored.

A Final Area of Exploration: Perceptions of Alcohol Use

In addition to the relationship between personality, alcohol use, and AUD, researchers have demonstrated that individual perceptions are strongly correlated with alcohol use behaviors (Hustad et al., 2014; Islam, Day, Conigrave, and Topp, 2013; Pearson and Hustad, 2014; Quinn and Fromme, 2011). For examples, Islam and colleagues (2013) confirmed that the more alcohol consumed, the more likely adults were to perceive they had a problem. However, as alcohol use

tends to rise and peak during the college years (Littlefield et al., 2009; Quinn and Harden, 2013; Vrieze, Vaidyanathan, Hicks, Iacono, and McGue, 2014), there is reason to suspect college students that meet criteria for AUD might not perceive their drinking as problematic. They may consider their level of drinking as normal as many of those around them tend to drink, even when meeting the criteria for disordered use (and as a result, impairment in physical or psychosocial health).

To further understand this, I investigated how an individual's perceptions of whether their own alcohol use is problematic maps on to whether or not they met the criteria for AUD, as well how these perceptions map onto personality-based risk. There is evidence which suggests that impulsivity and sensation seeking may impact perceptions about the importance of drinking in college (Pearson and Hustad, 2014) and that individual's perceptions influence drinking habits (Quinn and Fromme, 2011). For example, Quinn and Fromme (2011) found that for every 1 standard deviation increase in the student's perception that their parents were aware and caring there was as much as a 19% decrease in the number of drinks consumed. However, less is known about whether students that meet AUD believe they have drinking problems and why or why not that may be the case.

I expected to find that those who met the criteria for AUD would not perceive their alcohol use as problematic due to the nature of this developmental period and population. I also expected to find that those who scored low in constraint and high in negative emotionality (i.e., those at greater personality-based risk) would be less likely to perceive themselves as having a drinking problem compared to those that scored higher in constraint and lower in negative emotionality (i.e., those at low personality-based risk).

Overview

This study examined the extent to which constraint and negative emotionality in the first year of college significantly predicted AUD symptoms in the second year of college, while simultaneously examining the extent to which AUD symptoms in the first year of college predicted personality in the second year of college (see Figure 1). These analyses were analyzed in relation to AUD symptoms, as well as in relation to AUD diagnosis (*yes vs. no*) as well as a measure of frequent binge drinking (stating they have consumed 5 or more drinks on average each time they drank in the past year).

While binge drinking and AUD symptoms are likely correlated, it was important to evaluate whether personality traits would be more relevant to one vs. the others to better understand the etiology of personality-AUD development within the college population. Using the additional measure of AUD diagnosis allows for a consistent measure of problematic alcohol use across samples, but potentially neglects the variability of individuals that met the AUD criteria. However, assessing AUD symptom count allows for further understanding of the variability between individuals that is possibly lost in a dichotomous variable. Using AUD diagnosis (and frequent binge drinking) and AUD symptom count offers an innovative approach, because little to no research has examined these outcomes together, thus uniquely contributing to research.

I also investigated personal perceptions of how whether students' believe their own alcohol use is problematic maps onto whether they met criteria for AUD or had high vs. low personality-based risk. I address this directly by comparing answers to an open-ended question "Are you at all concerned about your level of alcohol use at this time?" for those that met criteria for AUD versus those who do not, as well as for those that score low in constraint and high in

negative emotionality. There is limited research on the role of individual perceptions and AUD in college populations, thus this explorative component of the study provides additional novelty.

Methods

Participants

Participants were recruited from a moderate sized University in the Southeast. Out of all the incoming freshmen for the fall semester of 2015, 700 were randomly selected to invite to participate in this study. Of the 700 eligible students, 73% ($N = 511$) were successfully located, and 210 of those successfully located (41%) agreed to participate in the online survey at Wave 1. At Wave 2, 178 individuals participated (84.3% retention). The average time between assessments was 10.63 months (range = 7.26 – 16.48 months). Data from both waves will be used for the present study, with an average age of 19.1 years ($SD = .40$) at Wave 1 (one participant was excluded due to outlier age, 49 years).

Out of the 209 eligible that participants at Wave 1, 38% were male, 90% were white, 6% were black, and 4% were of other ethnic minority status. Compared to the general population of first year students at this university, students in this study were slightly more likely to be female (60% vs. 50%) and white (90% vs. 80%; Office of Institutional Research, 2016). Of the 178 participants at Wave 2, the average age was 19.9 ($SD = .39$) at the time of participation. Further, 37% were male, 88% were white, 6% were black, and 6% were of other ethnic minority status. An analysis of those that participated at Wave 1 but not at Wave 2 showed no significant differences in participation at Wave 2 by gender ($\chi^2(1) = 3.01, p = .08$), ethnicity/race ($\chi^2(5) = 1.77, p = .88$), or Wave 1 AUD symptom count ($t(207) = .52, p = .60$). The vast majority of participants were students at Wave 2 ($n = 168$ or 96% of all Wave 2 cases).

Procedure

Written consent was needed for all participants before receiving survey instructions. All participants were compensated 20 dollars for their time and effort at Wave 1, and 50 dollars at Wave 2. Target participants who completed the Wave 1 survey, were invited to complete the Wave 2 survey, approximately 300 days after they had completed the first survey. A wide variety of measures were used to assess various aspects of participant's college experiences, and the survey took an average of 1 to 2 hours to complete.

Measures

Alcohol Use Disorder. Alcohol use disorder symptoms were measured using a total of 91 quantitative items, adapted from the Substance Abuse Module (Robins, Babor, & Cottler, 1987) of the Composite International Diagnostic Interview (Robins, Wing, Wittchen, Hu, Helzer, Babor, et al., 1988). Items were adapted for DSM-5 criteria (APA, 2013), with a total range of 1 to 11 DSM-5 symptoms. Each symptom was assessed by one or more survey questions to appropriately measure that symptom (see Table 1 for details). Two of the eleven possible AUD symptoms were necessary to qualify for AUD diagnosis (APA, 2013).

Frequent binge drinking. Frequent binge drinking was defined as reporting 5 or more drinks on one occasion and refers to drinking at this rate on average each time they drank in the past year (assessed by "How many drinks did you have on average, each time you drank during the past 12 months?" Participants could answer the question on a scale of 1 (*1-2 drinks*) to 10 (*19 or more drinks*). This was subsequently coded into 1 = 5+ drinks on average to 0 = less than 5 drinks on average to calculate the final frequent binge drinking variable.

Personality traits. Personality traits were assessed at Wave 1 and Wave 2 of the study, using the 198-item version of the Multidimensional Personality Questionnaire (MPQ, Tellegen &

Waller, 2008). Some questions were answered on a 4-point Likert scale (e.g., *1 = Definitely True to 4 = Definitely False*) and others items contained two alternatives (e.g. *1 = Definitely A to 4 = Definitely B*). The MPQ assesses 10 primary scales which relate to 3 higher ordered traits (constraint, negative emotionality, and positive emotionality). Constraint consisted of 3 lower ordered traits: traditionalism, harm avoidance, and control. Negative emotionality consisted of 3 lower ordered traits; alienation, aggression, and stress reaction. Positive emotionality consisted of 4 lower ordered traits: achievement, well-being, social potency, and social closeness, but was not evaluated here given that it is not a salient predictor of AUD (e.g., Samek et al., 2018). Inter-item reliability coefficients ranged from .92 to .81 across all scales and waves of assessment.

Perceptions. Alcohol use perceptions will be examined through the open ended responses provided to the question “Are you at all concerned about your level of alcohol use at this time? Please describe why or why not.” These responses were coded in such a way that they were qualified as yes vs. no vs. not sure vs. not answered. I primarily coded these answers and 25% of the answers were double-coded by Dr. Samek. After assessing the responses that were double coded, there was 98% agreement, and myself and Dr. Samek met and came to a consensus for the two discrepancies.

Analytic Plan

The primary objective of this study was to determine if personality has an antecedent, consequential, or transactional relationship with AUD symptoms. In order to determine if higher negative emotionality scores and lower constraint scores at Wave 1 predicted greater AUD symptoms at Wave 2, and whether greater AUD symptoms at Wave 1 predicted lower levels of constraint and higher levels of negative emotionality at Wave 2, a cross-lagged-panel model was analyzed (see Figure 1). AUD symptoms were log-transformed to better approximate normality

assumptions. All analyses were tested in Mplus, version 7.2. Cross-lagged models were conducted for personality traits in relation to AUD symptoms, AUD diagnosis (*yes vs. no*), and frequent binge drinking (*yes vs. no*) in the past year in separate analyses. Standardized coefficients (β) are presented for analyses involving continuous AUD outcomes (i.e., symptoms) via multivariate regression/path analysis and unstandardized coefficients (B), standard errors (S.E.), and odds ratios (OR) are presented for categorical AUD outcomes (AUD diagnosis and frequency of binge drinking) via logistic regression/path analysis.

Gender differences for the associations between personality traits and AUD symptoms were evaluated by a multiple group model. This approach estimates all paths from the cross-lagged model for males and females, separately. A chi square difference test was used to detect whether or not results differed significantly by gender by constraining each path to be equivalent across gender and comparing change in model fit for the free and constrained models. I replicated results using the two categorical problematic drinking variables AUD diagnosis and frequent binge drinking.

Finally, exploratory qualitative analyses were conducted related to individual perceptions of alcohol use based on personality and AUD symptoms at both Wave 1 and Wave 2. Z-tests were used to test for significant differences and see if the proportion of participants that viewed their alcohol use being problematic (*yes vs. no*) were significantly associated with AUD diagnosis (*yes vs. no*) and high personality-based risk (*yes vs. no*; defined as 1 SD above the mean for negative emotionality and 1 SD below the mean for constraint for yes and any other score for no).

Results

Results revealed that 24.6% of participants met the criteria for AUD at Wave 1, and 25.8% met the criteria for AUD at Wave 2. Tables 2-3 shows the frequencies of AUD symptoms and diagnosis across waves, divided by gender. Males had higher rates of most symptoms compared to females at both Waves and overall, rates of AUD criteria among males remained consistent across both waves (30% of males met the criteria for AUD at Wave 1 and at Wave 2); however there was a slight increase in the rates for females (22% at Wave 1 to 24% at Wave 2), but this change was non-significant ($z = .85$; $p = .39$). There was only one significant gender difference in endorsement of AUD symptoms by gender; at Wave 2, there were more females (18%) than males (6%) that met the criteria for the symptom “alcohol use is continued despite knowledge of having a persistent physical or psychological problem that is likely to have been caused or exacerbated by alcohol” ($z = 2.56$; $p = .01$).

Rates of frequent binge drinking were relatively stable from Wave 1 (33%, $n = 68$) to Wave 2 (34%, $n = 61$). Males reported frequent binge drinking more than females (43% males, 26% females; $z = 2.50$; $p = .01$) at Wave 1 as well as at Wave 2 (48% males, 27% females; $z = 2.73$; $p = .01$). There was a significant association between AUD diagnosis and whether or not participants had engaged in frequent binge drinking in the last year at Wave 1 ($\chi^2(1) = 31.31$, $p < .001$) and Wave 2 ($\chi^2(1) = 43.27$, $p < .001$). For example, 61% of those with AUD also reported frequent binge drinking at Wave 1.

As shown in Table 4 personality traits were highly stable over time, with correlations ranging from .79 to .87 ($ps < .001$) for constraint and from .72 to .73 ($ps < .001$) for negative emotionality across gender. AUD symptoms were also stable; both males and females' correlations across time were .72 ($p < .001$). Constraint at Wave 2 was significantly correlated

with AUD symptoms at Wave 1 and 2 for both males and females; however at Wave 1 this did not reach statistical significance for males, likely due to less power from smaller sub-sample size (see Table 4 for details). Surprisingly, negative emotionality was not significantly correlated with AUD symptoms at either time point or across time for males or females (see Table 4 for details).

Cross-Lagged Panel Results: AUD Symptoms

Figure 2 shows the cross-lagged panel results involving personality traits and AUD symptoms by gender. Results showed several similarities by gender. Namely, the stability of constraint, negative emotionality, and AUD symptoms across time was substantial and significantly different from zero for both males and females (β s ranged from .67 to .84). Notably, personality traits at Wave 1 did not significantly predicted AUD symptoms at Wave 2 (absolute β s ranged from .02 to .12), thus results did not support a predisposition/vulnerability model of AUD-personality development. However for males, results showed a significant effect of AUD symptoms at Wave 1 on constraint at Wave 2 ($\beta = -.19, p < .001$); this path was not significant for females ($\beta = .03, p = .56$). Follow-up chi-square analyses showed constraining this path to be equivalent across gender resulted in a significant decrement to model fit ($\chi^2 (1) = 15.04, p < .001$), suggesting this path is significantly different for males vs. females. This supports a significant scar/complication model of AUD-personality development in the first two years of college, but only for men and not women.

The only other difference by gender concerned the association between negative emotionality at Wave 1 and constraint at Wave 2, which was significantly and inversely associated for females ($\beta = -.10, p < .05$) but not males ($\beta = .09, p = .26$), and this difference in paths was statistically significant ($\chi^2 (1) = 5.99, p < .01$). This pathway was not hypothesized but suggests greater negative emotionality in the first year of college is associated with rank-order

decreases in constraint in the second year of college, but only for women and not men. Results for females did not align with any of the three models of AUD-personality development and suggests personality is perhaps less relevant to females AUD in the first and second years of college.

How do Results Compare to AUD Diagnosis and Frequent Binge Drinking?

Additional analyses were included considering two categorical outcomes (AUD diagnosis and frequent binge drinking) to compare similarities and differences with AUD symptom count. For AUD diagnosis (see Figure 3) there was replicated support for stability of variables across time for both males and females. Results also replicated those for AUD symptoms, as results showed support for a scar/complication model such that AUD diagnosis at Wave 1 was associated with decreases in constraint at Wave 2, but only for males (see Figure 3 for details). Results also replicated the finding for females that greater negative emotionality at Wave 1 was significantly associated with decreases in constraint at Wave 2 and that neither constraint nor negative emotionality at Wave 1 was significantly associated with AUD diagnosis (or vice versa) for females. Results also showed an increase risk for AUD diagnosis at Wave 2 for those that met the criteria for AUD at Wave 1, where females that met the criteria for AUD at Wave 1 had nearly double the odds of meeting the criteria for an AUD diagnosis at Wave 2 (OR = 31.23) compared to males (OR = 17.27).

For frequent binge drinking (Figure 4), there was consistent replication in the stability of variables across time by gender. Results for frequent binge drinking did not echo a statistically significant finding of support for a scar/complication model among males, as frequent binge drinking at Wave 1 did not significantly predict constraint at Wave 2 (see Figure 4 for details). Similar to the findings for AUD diagnosis, there were increased odds for frequent binge drinking

at Wave 2 for those who reported frequent binge drinking at Wave 1; however results differed by gender. For males, there was a 16-fold greater odds of meeting the criteria for frequent binge drinking at Wave 2 for those that met the criteria at Wave 1, whereas there was 7.29-fold greater odds of meeting the criteria for females.

Post-hoc Analyses of Constraint and Problematic Alcohol Use Alone

As there were no significant associations between negative emotionality and AUD symptoms (see Table 4), I conducted three post-hoc analyses evaluating gender differences in the cross-lagged associations between constraint and AUD symptoms, AUD diagnosis, and frequent binge drinking. There were no major changes in results (see figures 1-3 in the Appendix for details).

Do Perceptions of Problematic Alcohol Use Matter?

At Wave 1 and Wave 2, only 1% ($n = 2$) participants reported that they were concerned with their alcohol use. The vast majority reported they had no concern with their alcohol use at the time they were assessed ($n = 148$, 70% at Wave 1; $n = 137$, 77% at Wave 2). Few said that they were not sure if they were concerned or not ($n = 2$, 1% at Wave 1; $n = 3$, 2% at Wave 2). A total of 58 participants (28% of sample) did not answer the open ended question at Wave 1, and 20% ($n = 36$) did not answer the question at Wave 2. As there was too little data points for comparison of whether they thought they had a problem with alcohol use at this time by AUD and personality-based risk, I was unable to conduct further exploratory analyses. In general, college students do not appear to think they have a problem with alcohol use regardless of whether or not they meet the AUD diagnosis.

Discussion

The purpose of this study was to evaluate the relationship between the key personality traits of constraint and negative emotionality in relation to three problematic alcohol use outcomes (AUD symptoms, AUD diagnosis, and rate of frequent binge drinking) during the transition from the first to second year of college by gender. Contrary to expectations, results showed support for a scar/complication model (Klein et al., 2011; Samek et al., 2018; Tackett, 2006) for males but not females. That is, for men, greater AUD symptoms in the first year of college was associated with significant rank-order decreases in constraint during the second year of college. Results involving AUD diagnosis and frequent binge drinking as outcomes replicated this general pattern. Results also suggest negative emotionality is not relevant to AUD symptoms for this population, for either men or women.

The support for the scar/complication hypothesis for males was not expected. Although past research suggests bidirectionality is likely relevant to the association between key personality traits and alcohol problems (Littlefield et al., 2012; Quinn and Fromme, 2011), there was some evidence from Quinn et al. (2011) that heavier drinking in the first three years of college was associated with greater increases in sensation seeking by the fourth year of college. Our results also fit in with this notion, suggesting that problematic alcohol use in the first year of college may be especially relevant to personality change later on. Additionally, results also concerning the scar/complication model for males align well with findings demonstrating that alcohol use initiation in adolescence was associated with significant decreases in constraint and increases in negative emotionality from early adolescence into young adulthood (Blonigen, Durbin, Hicks, Johnson, McGue, Iacono, 2015). As Blonigen and colleagues discuss, these deviations from normative maturation of personality as a result of alcohol use may represent the

co-development of these traits and alcohol use behaviors during this important developmental stage. As the present study included a small sample of a unique population, replication with larger sample sizes and greater power are necessary to better understand the nature of this effect and how it unfolds in the developmental transition to college, throughout college, and two-three years post-college when alcohol use rates decline (Littlefield et al., 2009).

Results found evidence for stability in personality traits and AUD symptoms across time. This follows previous research demonstrating strong stability of personality traits by age 18 (Blonigen et al., 2008; Roberts and DelVecchio, 2000). Specifically, via their meta-analysis, Roberts and DelVecchio found that there is relatively high stability of personality across the life span overall, with a stepwise increase in personality stability from childhood to emerging adulthood (college years) to adulthood with a peak around age 50. Nonetheless, the stability of personality was quite strong by late adolescent and early adulthood (estimated population correlation ranging from .54 to .60 from ages 18-29). This corresponds well to the stability coefficients found in the current study, where constraint and negative emotionality were remarkably stable from the first year of college to the second.

Surprisingly, results revealed that negative emotionality was not significantly associated with problematic drinking outcomes at either time point for males or females. These findings align with previous research by Samek and colleagues (2018), which found that negative emotionality seemed less relevant to AUD compared to traits like constraint and aggressive undercontrol. Samek et al found no evidence for negative emotionality predicting later AUD, or AUD predicting later negative emotionality from ages 17 to 24 and 24 to 29. Notably, Samek and colleagues discussed that research linking negative emotionality to substance use problems seems to be evaluating middle-aged samples (McGue et al., 1997), with less support for negative

emotionality being linked to AUD among emerging adult/college populations. My results seem to support this idea, as negative emotionality was not significantly associated with any problematic alcohol outcomes.

Results of the current study were consistent with previous work finding that males were likely to consume more alcohol, and were more likely to meet the criteria for AUD than women (CDC, 2016; Foster et al., 2015); however this difference was not statistically significant likely due to small sample size. There was only one significant gender difference in AUD symptoms, where females were more likely to continue drinking despite knowledge of having persistent or recurrent physical or psychological problems caused or exacerbated by alcohol use. These results perhaps align with the gender severity paradox outlined by Foster et al. (2017), in that even though females did not have rates of AUD that surpass males, they did report more problems as a result of their drinking in the second year of college. More research is needed to better address this potential paradox and when it begins.

Lastly, this study aimed to explore individual perceptions and evaluate the role they may play in the relationship between AUD symptoms and key personality traits. There were essentially <1% of participants who said they believed they had a problem with their alcohol use, so I was unable to evaluate that by AUD diagnosis or personality-based risk cut-off. There is little to no research evaluating college students concern for their level of alcohol use. Results from the current study demonstrate college students generally do not believe they have a problem with alcohol use regardless of whether or not they meet the criteria for AUD. Based on the cumulative evidence of increasing rates of alcohol use during the college years (Littlefield et al., 2009; Quinn and Harden, 2013; Vrieze, Vaidyanathan, Hicks, Iacono, and McGue, 2014), and the perception that alcohol use is important in college (Hustad et al., 2014), it is possible that

because first and second year college students are embedded in a culture of excessive drinking, they may perceive their alcohol use as normal, even when it might actually be problematic. On the other hand, perhaps AUD is not as problematic in this developmental context in comparison to other contexts. This deserves more attention.

Limitations, Strengths, and Future Directions

There are several unique contributions of the current study. First and foremost, this is the first study that I am aware of that evaluated the prospective influences of AUD-constraint-negative emotionality development in the first two years of college. Secondly, this study also evaluates for differences in prevalence of AUD symptoms and AUD-personality development by gender. Another strength is the inclusion of both continuous and categorical measures of problematic drinking (AUD symptoms, AUD diagnosis, and frequent binge drinking). Results showed clear support for replication across alcohol measures, with the strongest effects demonstrated for AUD symptoms, likely due to increased sensitivity for this continuously measured alcohol variable. Including multiple measures provides the opportunity to further understand the difference between AUD symptoms and AUD diagnosis, as well as the importance of investigating AUD and frequent binge drinking separately.

Despite the unique contributions of this study, there are several key limitations. First, larger sample sizes may be needed to better evaluate the small effect sizes and gender differences in the associations between AUD and personality. Second, there was a lack of diversity in sample demographics, where there was an overrepresentation of white students and minority students were underrepresented. Additionally, participants were more likely to be female than the general student population. Therefore, results from this study may not generalize to all first and second year college students. Replication with larger and more diverse samples are necessary to

better understand how AUD-personality interplay unfolds overtime for different populations of first and second year college students.

Following this, future research should replicate this study with a larger sample, and consider following students from senior year of high school throughout all four years of college and beyond. Additionally, there should be further investigation into the role of individual perceptions in alcohol use among college students, as well as how personality characteristics influence individual perceptions.

Practical Implications

Given the significant link between low constraint and greater alcohol problems, study results may support the use of personality-targeted alcohol use prevention/intervention programs in the first year student population. Conrod and colleagues (2013) found support for a personality-targeted approach among high school students. This program assessed the personality of 9th graders from 100 secondary schools in London. Students scoring one standard deviation above the average on anxiety sensitivity, hopelessness, impulsivity, or sensation seeking were randomly selected into treatment or control groups. The goal of this program was not to alter or change individual's personality, only address personality risk and alcohol use. Individuals who received treatment attended two 90-minute sessions focused on cognitive behavior therapy, motivation enhancement, and various exercises related to identifying risky versus adaptive coping responses. Results suggested a decrease in drinking and binge drinking as far out as 2 years post-intervention. There was additionally evidence of herd effects, where low-risk individuals from treatment schools also reported lower rates of alcohol use compared to low-risk individuals for control schools. It remains to be tested whether such approaches could work for first year college students, but may be promising. If personality targeted

intervention/prevention programs could be implemented at the beginning of college, it may reduce the rate of AUD among college populations, while simultaneously reducing the negative effects that result from AUD in college.

Lastly, increased education on college campuses regarding the symptoms and criteria of AUD, could also potentially provide awareness to individuals who have problematic alcohol behaviors, as well as warning signs for those who know someone who might drink at problematic levels. With an increased education and awareness of AUD symptoms and criteria, college students may be better prepared to make educated decisions regarding alcohol use, and have a better understanding of the potential outcomes associated with problematic drinking.

Conclusion

In conclusion, the present study found four notable findings. First, there was evidence of differing etiology for AUD-personality development between males and females. The current study found support for a scar/complication model, where AUD symptoms predicted decreases in constraint during the second year of college for males, whereas results for females suggested that personality traits were less relevant to their AUD patterns in this time frame. The second notable finding was that these results were consistent across different problematic drinking outcomes, including AUD symptoms, diagnosis, and frequent binge drinking. The third take-away is that negative emotionality appears not relevant to the likelihood of alcohol use problems or vice versa. In combination with prior research (Blonigen et al., 2008; Littlefield et al., 2012; McAdams and Donnellan, 2008; Quinn et al., 2011; Samek et al., 2018), traits related to behavioral disinhibition, impulsivity, and sensation seeking appear most relevant to problematic alcohol use for this population. Finally, results showed that college students in general were not concerned for their level of alcohol use, regardless of their AUD status. Further research with

larger, more diverse samples is needed to investigate personality-AUD development in the population of first and second year college students. Such research would further our understanding of the interplay between key personality traits and AUD in a variety of college populations (e.g., land grant, community colleges, historically black colleges and universities), allowing for more knowledge to inform effective AUD intervention, prevention, and treatment resources for this at-risk population.

References

- Adams, Z. W., Milich, R., Lynam, D. R., & Charnigo, R. J. (2013) Interactive effects of drinking history and impulsivity on college drinking. *Addictive Behaviors*, 38(12), 2860-2867. doi: 10.1016/j.addbeh.2013.08.009
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, D.C: American Psychiatric Association.
- Barnes, G. M., Welte, J. W., Hoffman, J. H., & Tidwell, M. O. (2010). Comparisons of gambling and alcohol use among college students and non-college young people in the united states. *Journal of American College Health*, 58(5), 443-452. doi: 10.1080/07448480903540499
- Belcher, A. M., Volkow, N. D., Moeller, F. G., and Ferre, S. (2008). Personality traits and vulnerability or resilience to substance use disorders. *Trends in Cognitive Sciences*, 18(4), 211-217. doi.org/10.1016/j.tics.2014.01.010
- Blanco, C. Okuda, M., Wright, C. Hasin, D. S., Grant, B. F., Liu, S., and Olfson, M. (2008). Mental health of college students and their non-college attending peers. *Archives of General Psychiatry*, 65(12), 1429-1437.
- Blonigen, D.M., Carlson, M. D., Hicks, B.M., Krueger, R. F., & Iacono, W. G. (2008). Stability and change in personality traits from late adolescence to early adulthood: A longitudinal twin study. *Journal of Personality*, 76(2). doi: 10.1111/j.1467-6494.2007.00485.x
- Blonigen, D. M., Durbin, E., Hicks, B.M., Johnson, W., McGue, M., & Iacono, W. G. (2015). Alcohol use initiation is associated with changes in personality trait trajectories from early adolescence to young adulthood. *Alcoholism: Clinical and Experimental Research*, 39(11). doi: 10.1111/acer.12878

- Center for disease Control and Prevention. (2017a). *Alcohol and Public Health: Binge Drinking*. Retrieved from: <https://www.cdc.gov/alcohol/fact-sheets/binge-drinking.htm> Retrieved on: (2017, October 10).
- Center for Disease Control and Prevention. (2017b). *Alcohol and Public Health: Frequently Asked Questions*. Retrieved from: <https://www.cdc.gov/alcohol/faqs.htm>. Retrieved on: (2017, October 3)
- Center for Disease Control and Prevention [CDC]. (2016, March 7). *Excessive alcohol use and risks to men's health*. Retrieved from: <https://www.cdc.gov/alcohol/fact-sheets/mens-health.htm>. Retrieved on: (2017, July 24).
- Chassin, L., Pitts, S., & Prost, J. (2002). Binge drinking trajectories from adolescence to emerging adulthood in a high-risk sample: Predictors and substance abuse outcomes. *Journal of Consulting and Clinical Psychology, 70*(1), 67-78. doi: 10.1037/0022-006X.70.1.67
- Cho, S. B., Llaneza, D. C., Adkins, A. E., Cooke, M., Kendler, K. S., Clark, S.L., & Dick, D. M. (2015). Patterns of substance use across the first year of college and associated risk factors. *Frontiers in Psychiatry, 6*(152). doi: 10.3389/fpsy.2015.00152
- Clements, R. (1999). Prevalence of Alcohol-use Disorders and Alcohol-Related Problems in a College Student Sample. *Journal of American College Health, 48*(3), 111-118. doi: 10.1080/07448489909595682
- Conrod, P. J., O' Leary-Barrett, M., Newton, N., Tropper, L., Castellanos-Ryan, N., Mackie, C., & Girard, A. (2013). Effectiveness of a selective, personality-targeted prevention program for adolescent alcohol use and misuse. *Journal of the American Medical Association, Psychiatry, 70*(3), 334-342. doi:10.1001/jamapsychiatry.2013.651

- Dawson, D. A., Grant, B. F., Sinson, F. S., & Chou, P. S. (2004). Another look at heavy episodic drinking and alcohol use disorders among college and noncollege youth. *Journal of Studies on Alcohol*, 65(4), 477-488. doi: 10.15288/jsa.2004.65.477
- Foster, K. T., Hicks, B. M., Durbin, C. E., Iacono, W. G., McGue, M. (2017). The gender risk-severity paradox for alcohol use disorder from adolescence through young adulthood. *Society for the Study of Emerging Adulthood*. doi: 10.1177/2167696817740453
- Foster K. T., Hicks, B. M., Iacono, W. G., & McGue, M. (2015). Gender differences in the structure of risk for alcohol use disorder in adolescence and young adulthood. *Psychological Medicine*, 45, 3047-3058. doi:10.1017/S0033291715001014
- Grant, Chou, Saha, Pickering, Kerridge, Ruan, et al., (2017). Prevalence of 12-Month alcohol use, high risk drinking, and DSM-IV alcohol use disorder in the United States, 2001-2002 to 2012-2013. *Journal of the American Medical Association, Psychiatry*, 74(9), 911-923. doi:10.1001/jamapsychiatry.2017.2161
- Greig, R., Baker, A., Lewin, T., Webster, R., & Carr, V. (2006). Long-term follow-up of people with co-existing psychiatric and substance use disorders: Patterns of use and outcomes. *Drug and Alcohol Review*, 25(3), 249-258. doi: 10.1080/09595230600657741
- Hicks B, Iacono WG, & McGue M. (2010). Consequences of an adolescent onset and persistent course of alcohol dependence in men: adolescent risk factors and adult outcomes. *Alcoholism, Clinical and Experimental Research*, 34(5), 819-833. doi: 10.1111/j.1530-0277.2010.01154.x
- Huang, D., Lanza, H., Anglin, M. (2013). Association between adolescent substance use and obesity in young adulthood: A group-based dual trajectory analysis. *Addictive Behaviors*, 38(11), 2653-2660. doi: 10.1016/j.addbeh.2013.06.024
- Hustad, J. T. P., Pearson, M. R., Neighbors, C., and Borsari, B. (2014). The role of alcohol

- perceptions as mediators between personality and alcohol-related outcomes among incoming college-student drinkers. *Psychology of Addictive Behaviors*, 28(2), 336-347. doi: 10.1037/a0033785
- Islam, M. M., Day, C. A., Conigrave, K. M., & Topp, L. (2013). Self-perceived problem with alcohol use among opioid substitution treatment clients. *Addictive Behaviors*, 38(4), 2018-2021. doi: 10.1016/j.addbeh.2012.12.001
- Khemiri, L. Kuja-Halkola, R., Larsson, H., & Jayaram-Lindstorm, N. (2016). Genetic overlap between impulsivity and alcohol dependence: A large scale national twin study. *Psychological Medicine*, 46, 1091-1102. doi:10.1017/S0033291715002652
- Klein, D. N., Kotov, R., & Bufferd, S. J. (2011). Personality and depression: Explanatory models and review of the evidence. *Annual Review of Clinical Psychology*, 7, 269-395.
- Kuntsche, E., Fischer, M., & Gmel, G. (2008). Personality factors and alcohol use: A mediator analysis of drinking motives. *Personality and Individual Differences*, 45(8), 796-800. doi:10.1016/j.paid.2008.08.009
- Krueger, R. F., Hicks, B. M., Patrick, C. J., Carlson, S. R., Iacono, W.G., & McGue, M. (2002). Etiological connections among substance dependence, antisocial behavior and personality: Modeling the externalizing spectrum. *Journal of Abnormal Psychology*, 111(3), 411-424. doi.org/10.1037/0021-843X.111.3.411
- Littlefield, A. K., Sher, K. J., & Wood, P. K. (2009). Is “maturing out” of problematic alcohol involvement related to personality change? *Journal of Abnormal Psychology*, 118(2), 360-374. doi: 10.1037/a0015125
- Littlefield, A., Verges, A. Wood, P., & Sher, K. (2012). Transactional models between personality and alcohol involvement: A further examination. *Journal of Abnormal*

Psychology, 121(3), 778-783. doi: 10.1037/a0026912

Malmberg, M., Kleinjan, M., Overbeek, G., Vermulst, A. A., Lammers, J., & Engels, R. C. M. E. (2013). Are there reciprocal relationships between substance use risk personality profiles and alcohol or tobacco use in early adolescence? *Addictive Behaviors*, 15(2), 217-226. doi.org/10.1016/j.addbeh.2013.08.003

Matterson, L. K., McGue, M., & Iacono, W. G. (2013). Shared environmental influences on personality: A combined twin and adoption approach. *Behavior Genetics*, 43, 491-504. doi: 10.1007/s10519-013-9616-8

Meier, M., Caspi, A., Ambler, A., Harrington, H., Houts, R., Keefe, R., ... (2012). Persistent cannabis users show neuropsychological decline from childhood to midlife. *Proceedings of the National Academy of Sciences of the United States of America*, 109(40), E2657-E2664. doi: 10.1073/pnas.1206820109

McGue, M., Slutske, W., Taylor, J., & Iacono, W. G. (1997). Personality and substance use disorders: I. Effects of gender and alcoholism subtype. *Alcoholism: Clinical and Experimental Research*, 21(3), 513-520. doi: 10.1111/j.1530-0277.1997.tb03797.x

McAdams, K., & Donnellan, M. (2008). Facets of personality and drinking in first year college students. *Personality and Individual Differences*, 46(2009), 207-212. doi: 10.1016/j.paid.2008.09.028

Muthen, L. K., & Muthen, B. O. (1998–2012). Mplus user's guide (7th ed.). Los Angeles: Muthen and Muthen.

National Institute on Alcohol Abuse and Alcoholism [NIAAA]. (2017a, July). *Alcohol facts and statistics*. Retrieved from: <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/alcohol-facts-and-statistics>.

Retrieved on: (2017, September, 7).

National Institute on Alcohol Abuse and Alcoholism [NIAAA] (2017b). *Parenting to Prevent*

Childhood Alcohol Use. Retrieved from:

<https://pubs.niaaa.nih.gov/publications/adolescentflyer/adolflyer.htm>. Retrieved on:

(2017, October 3).

National Institute on Drug Abuse [NIDA]. (2017a, May). *Commonly abused drugs charts*.

Retrieved from: <https://www.drugabuse.gov/drugs-abuse/commonly-abused-drugs-charts>

National Institute on Drug Abuse [NIDA]. (2016, September). *Drugs of abuse: Alcohol*.

Retrieved from: <https://www.drugabuse.gov/drugs-abuse/alcohol>. Retrieved on: (2017,

July 24).

National Institutes of Health [NIH]. (2015, November). *Male and female drinking patterns*

become more alike in the U.S. Retrieved from: [https://www.nih.gov/news-events/news-](https://www.nih.gov/news-events/news-releases/male-female-drinking-patterns-becoming-more-alike-us)

[releases/male-female-drinking-patterns-becoming-more-alike-us](https://www.nih.gov/news-events/news-releases/male-female-drinking-patterns-becoming-more-alike-us). Retrieved on: (2017,

July 24).

Nolan Hoksema, S., & Hilt, L. (2006). Possible contributors to the gender differences in alcohol

use and problems. *The Journal of General Psychology*, 133(4), 357-374. doi:

10.3200/GENP.133.4.357-374

Nolan-Hoksema, S. (2004) Gender differences in risk factors and consequences for alcohol use

and problems. *Clinical Psychology Review*, 24(8), 981-1010. doi:

10.1016/j.cpr.2004.08.003

Office of Institutional Research, Auburn University. (2016). *Total Enrollment by Gender and*

Race/Ethnicity Selected Fall Terms, 1976-2016. Retrieved from: [https://web.auburn.](https://web.auburn.edu/ir/factbook/enrollment/enrtrends/eebg.aspx)

[edu/ir/factbook/enrollment/enrtrends/eebg.aspx](https://web.auburn.edu/ir/factbook/enrollment/enrtrends/eebg.aspx)

- Olenick, N. L., & Chalmers, D. K. (1991). Gender-specific drinking styles in alcoholics and nonalcoholics. *Journal of Studies on Alcohol*, 52(4), 325 – 330.
- Pearson, M. R., & Hustad, J. T. P. (2014). Personality and alcohol-related outcomes among mandated college students: Descriptive norms, injunctive norms, and college-related alcohol beliefs as mediators. *Addictive Behaviors*, 39(5), 879–884.
doi: 10.1016/j.addbeh.2014.01.008
- Quinn, P. D. & Fromme, K. (2011). The role of person-environment interactions in increased alcohol use in the transition to college. *Society for the Study of Addiction*, 106(6), 1104-1113. doi: 10.1111/j.1360-0443.2011.03411.x
- Quinn, P. D., & Harden, K. P. (2013). Differential changes in impulsivity and sensation seeking and the escalation of substance use from adolescence to early adulthood. *Development and Psychopathology*, 25(1), 223–239. doi: 10.1017/S0954579412000284
- Quinn, P. D., Stappenbeck, C. A., & Fromme, K. (2011) Collegiate heavy drinking prospectively predicts change in sensation seeking and impulsivity. *Journal of Abnormal Psychology*, 120(3), 543-556. doi: 10.1037/a0023159
- Ratliff, K., & Burkhart, B. (1984). Sex differences in motivations for the effects of drinking among college students. *Journal of Studies on Alcohol*, 45(1), 26-32. doi: 10.15288/jsa.1984.45.26
- Roberts, B. W.M. and DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *American Psychological Association*, 126(1), 3-25. doi: 10.1037//0033-2909.126.1.3
- Robins, L. N., Wing, J., Wittchen, H. U., Helzer, J. E., Babor, T. F., Burke, J., ... & Towle, L. H. (1988). The Composite International Diagnostic Interview: An epidemiologic instrument

- suitable for use in conjunction with different diagnostic systems and in different cultures. *Archives of General Psychiatry*, 45, 1069-1077.
- Robins, L.M., Babor, T., & Cottler, L.B. (1987). *Composite International Diagnostic Interview: Expanded Substance Abuse Module*. St. Louis: Authors.
- Samek, D. R., Hicks, B. M., Durbin, E., Hinnant, J. B., Iacono, W.G., & McGue, M. (2018). Codevelopment between key personality traits and alcohol use disorder from adolescence through young adulthood. *Journal of Personality*, (online first publication), 1-22. doi: 10.1111/jopy.12311
- Sandra Scarr, & Kathleen McCartney. (1983). How people make their own environments: A Theory of genotype environment effects. *The Society of Research in Child Development, Inc.* (54). 424–435. Retrieved from: http://www.jstor.org/stable/1129703?seq=1#page_scan_tab_contents
- Schulenberg, J., O'Malley, P., Bachman, J., Wadsworth, K., Johnston, L. (1996) Getting drunk and growing up: Trajectories of frequent binge drinking during the transition to young adulthood. *Journal of Studies on Alcohol*, 57(3). 289-304. doi:10.15288/jsa.1996.57.289
- Shin, S. H., Hong, H. G., & Jeon, S.-M. (2012). Personality and alcohol use: The role of impulsivity. *Addictive Behaviors*, 37(1), 102–107. doi:10.1016/j.addbeh.2011.09.006
- Slutske, W. (2005). Alcohol use disorders among US college students and their non-college attending peers. *Archives of general Psychiatry*, 62(3), 321-327. doi:10.1001/archpsyc.62.3.321
- Slutske, W. S., Heath, A. C., Madden, P. A. F., Bucholz, K. K., Statham, & Martin, N. G. (2002). Personality and the genetic risk for alcohol dependence. *Journal of Abnormal Psychology*, 11(1), 124-133.

- Slutske, W. S., Hunt-Carter, E. E., Nabors-Oberg, R. E., Sher, K. J., Bucholz, K. K., Madden, P. A. F., ...Heath, A. C. (2004). Do college students drink more than their non-college attending peers? Evidence from a population-based longitudinal female twin study. *Journal of Abnormal Psychology, 113*(4), 530-540. doi: 10.1037/0021-843X.113.4.530
- Substance Abuse and Mental Health Service Administration [SAMHSA]. (2014). *Behavioral health trends in the United States: Results from the 2014 national survey on drug use and health*. Retrieved from: <https://www.samhsa.gov/data/sites/default/files/NSDUH-FRR1-2014/NSDUH-FRR1-2014.pdf>. Retrieved on: (2017, September).
- Tackett, J. L. (2006). Evaluating models of the personality-psychopathology relationship in children and adolescents. *Clinical Psychology Review, 26*, 584-599.
- Tellegen, A., & Waller, N. G. (2008). Exploring personality through test construction: Development of the Multidimensional Personality Questionnaire. In G. L. Boyle, G. Matthews, & D. H. Saklofske (Eds.), *Handbook of personality theory and testing: Volume II. Personality measurement and assessment* (pp. 261–292). Thousand Oaks, CA: Sage.
- Tetrault, J. & O'Connor, P. (2017). *Risky drinking and alcohol use disorder: Epidemiology, pathogenesis, clinical manifestations, course, assessment, and diagnosis*. Retrieved from: <http://www.uptodate.com/contents/risky-drinking-and-alcohol-use-disorder-epidemiology-pathogenesis-clinical-manifestations-course-assessment-and-diagnosis>. Retrieved on: (2017, September).
- Thompson, K., Roemer, A., & Leadbeater, B. (2015). Impulsive personality, parental monitoring, and alcohol outcomes from adolescence through young adulthood. *Journal of Adolescent Health, 57*(3), 320–326. doi: 10.1016/j.jadohealth.2015.05.005

- U. S. Department of Health and Human Services, National Institutes of Health, National Institute of Alcohol Abuse and Alcoholism [NIAAA]. (2015a). *Alcohol use disorder*. Retrieved from: <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/alcohol-use-disorders>. Retrieved on: (2017, July 24).
- Verhulst, B., Neale, M. C., & Kendler, K. S. (2015). The heritability of alcohol use disorders: A meta-analysis of twin and adoption studies. *Psychological Medicine, 45*, 1061-1072. doi:10.1017/S0033291714002165
- Vrieze, S. L., Vaidyanathan, U., Hicks, B. M., Iacono, W. G., & McGue, M. (2014). The role of constraint in the development of nicotine, marijuana, and alcohol dependence in young adulthood. *Behavior Genetics, 44*(1), 14-24. doi: 10.1007/s10519-013-9629-3
- Wagoner, K. G., Blocker, J., McCoy, T. P., Stutfin, E. L., Champion, H., & Wolfson, M. (2012). Free alcohol use and consequences: Gender differences among undergraduates. *American Journal of Health Behavior, 34*(4), 446-458(13). doi.org/10.5993/AJHB.36.4.2
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*, 1063–1070.

Table 1. Alcohol use disorder symptom, questions used to measure symptom, and how symptom was assigned

AUD Symptom	Variable Name (Question)	Symptom Assignment
1. Alcohol is often taken in larger amounts or over a longer period than was intended.	ALC_139 (During the LAST 12 months, have you often ended up drinking much more than you intended when you began, or over more days than you intended to?)	If yes
2. There is a persistent desire or unsuccessful efforts to cut down or control alcohol use.	ALC_142 (During the LAST 12 months, have you repeatedly wanted to reduce or control your drinking?) ALC_145 (During the LAST 12 months, have you more than once wanted to stop drinking but couldn't?)	If yes to either
3. A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects.	ALC_91 (In the last 12 months, has your drinking become so regular that you would drink throughout the day, every day, no matter what the situation?) ALC_148 (During the LAST 12 months, has there been a period where you spent so much time drinking that you had little time for anything else?)	If yes to either
4. Craving, or a strong desire or	ALC_58 (In the LAST 12 months, did	If yes

urge to use alcohol.

you ever want a drink so badly that you couldn't think of anything else?)

5. Recurrent alcohol use resulting in a failure to fulfill major role obligations at work, school, or home.

ALC_151 (During the 12 months, has there been a period where you spent so much time drinking that you had little time for your family?)

If yes to any

ALC_154 (During the LAST 12 months, has your drinking sometimes taken up so much time you've had trouble getting your work or chores done?)

ALC_160 (During the LAST 12 months, have you often taken care of children at a time when you had been drinking (more than one or two drinks)?)

ALC_163 (During the LAST 12 months, have you often been drinking while working? (Including working at home if your occupation is carried out at home.)

ALC_166 (During the LAST 12 months, has your drinking or being hung over often kept you from working when you intended to work?)

6. Continued alcohol use

The following is a multi-part question.

If yes to any

despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.

In the LAST 12 months, did you drink after you realized that drinking had caused you to have problems with any of the following?

ALC_78b_83_1

(Work?)

ALC_78b_83_2

(Fighting?)

ALC_78b_83_3

(Driving?)

ALC_78b_83_4

(The police?)

ALC_78b_83_5

(Friends)

ALC_78b_83_6

(Relatives)

7. Important social, occupational, or recreational activities are given up or reduced because of alcohol use.

ALC_157 (During the LAST 12 months, have you given up or greatly reduced important activities in order to drink--like sports, work, or associating with friends or relatives?)

If yes

8. Recurrent alcohol use in situations in which it is physically hazardous.

ALC_87 (In the LAST 12 months, have you been high from drinking in a situation where it increased your chances of getting hurt--for instance, while driving a car or boat, using guns, knives, or machinery, crossing against traffic, climbing, or swimming?)

If yes to **ALC_87**

9. Alcohol use is continued despite knowledge of

The following is a multi-part question.

If yes to any **ALC_173c79_1** through

having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by alcohol.

During the LAST 12 months, did you continue to drink when you knew that drinking caused you to have any of the following?

ALC_183 or
ALC_192

ALC_173c79_1 (An injury?)

ALC_173c79_2
(Fits?)

ALC_173c79_3
(Liver trouble?)

ALC_173c79_4
(Stomach trouble?)

ALC_173c79_5
(Numbness)

ALC_173c79_6
(Memory trouble)

ALC_173c79_7
(Pancreatitis?)

ALC_183 (During the LAST 12 months, have you EVER continued to drink when you knew that you had (another) serious physical illness that might be made worse by drinking?)

ALC_192 (During the LAST 12 months, did you continue drinking once you knew that drinking caused you psychological or emotional problems?)

10. Tolerance, as defined by either of the following:
a. A need for markedly

a. ALC_129 (During the LAST 12 months, did you find you needed to drink a lot more often in order

If yes to either

increased amounts of alcohol to achieve intoxication or desired effect.

b. A markedly diminished effect with continued use of the same amount of alcohol.

11. Withdrawal, as manifested by either of the following:

a. The characteristic withdrawal syndrome for alcohol (refer to Criteria A and B of the criteria set for alcohol withdrawal).

b. Alcohol (or a closely related substance, such as a benzodiazepine) is taken to relieve or avoid withdrawal symptoms.

to get an effect, or that you could no longer get high on the amount you used to drink?)

b. ALC_136 (In the last 12 months, have you found you began to be able to drink a lot more before you got drunk (your speech got thick or you were unsteady on your feet)?)

a. ALC_94 (In the last 12 months, have you cut down or stopped drinking after drinking for several days in a row?)

The following is a multi-part question. People who cut down or stop drinking after drinking for several days in a row often have withdrawal symptoms like the shakes.

ALC_98 (In the LAST 12 months, have you had the shakes after stopping or cutting down on drinking (for example, your hands shake so that your coffee cup rattles in the saucer or you have trouble lighting a cigarette or your eyelids or tongue tremble)?)

ALC_101 (In the last 12 months, have you

a. if yes to ever cut down (**ALC_94**), then must meet at least two or more of the following withdrawal symptoms (assessed via **ALC_98** through **ALC_108_9**)

OR

b. If yes to either **ALC_120** or **ALC_125**, then must have occurred more than once

had fits or seizures
after stopping or
cutting down on
drinking?)

ALC_107 (In the
LAST 12 months,
have you seen or
heard things that
weren't really there
after cutting down on
drinking?)

*The following is a
multi-part question*

In the LAST 12
months, have you
had any of these
problems after
stopping or cutting
down on drinking?
Remember, I'm not
talking about
problems you had
while drinking or the
effects of hangovers,
but problems
associated with
stopping or cutting
down on drinking.

ALC_108_1
(Throwing up or
feeling like you
might throw up?)

ALC_108_2 (Feeling
really weak or tired?)

ALC_108_3 (Having
your heart race?)

ALC_108_4
(Sweating a lot more
than usual?)

ALC_108_5 (Feeling
very nervous or
uptight?)

ALC_108_6 (Feeling
sad or irritable
(crabby?)

ALC_108_7 (Getting more headaches than usual?)

ALC_108_8 (Having your mind play tricks on you, like having things change their appearance right before your eyes?)

ALC_108_9 (Having trouble sleeping?)

The following is a multi-part question.

b. ALC_120 (During the last 12 months, have you taken a drink to keep from having withdrawal symptoms or to make them go away?)

ALC_125 (During the LAST 12 months, did you take a prescription pill (e.g., benzodiazepine or anxiety pill) to keep from having withdrawal symptoms or to make them go away?)

Table 2. Rates of alcohol use disorder symptoms at Wave 1 by gender

AUD Symptom	Wave 1		
	<i>n</i> (%) meeting symptom criteria		
	Males (<i>n</i> = 78)	Females (<i>n</i> = 129)	<i>z</i> -test (1 <i>df</i>)
1. Alcohol is often taken in larger amounts or over a longer period than was intended.	23 (30%)	27 (21%)	1.41
2. There is a persistent desire or unsuccessful efforts to cut down or control alcohol use.	9 (12%)	9 (7%)	1.15
3. A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects.	4 (5%)	2 (2%)	1.08
4. Craving, or a strong desire or urge to use alcohol.	2 (3%)	3 (2%)	.43
5. Recurrent alcohol use resulting in a failure to fulfill major role obligations at work, school, or home.	5 (6%)	7 (5%)	0
6. Continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.	6 (8%)	7 (5%)	.82
7. Important social, occupational, or recreational activities are given up or reduced because of alcohol use.	3 (4%)	2 (2%)	.78
8. Recurrent alcohol use in situations in which it is physically hazardous.	5 (6%)	3 (2%)	1.34
9. Alcohol use is continued despite knowledge of having a persistent or recurrent	13 (17%)	18 (14%)	.57

physical or psychological problem that is likely to have been caused or exacerbated by alcohol.			
10. Tolerance, as defined by either of the following:	19 (24%)	18 (14%)	1.40
a. A need for markedly increased amounts of alcohol to achieve intoxication or desired effect.			
b. A markedly diminished effect with continued use of the same amount of alcohol.			
11. Withdrawal, as manifested by either of the following:	6 (8%)	7 (5%)	.82
a. The characteristic withdrawal syndrome for alcohol (refer to Criteria A and B of the criteria set for alcohol withdrawal).			
b. Alcohol (or a closely related substance, such as a benzodiazepine) is taken to relieve or avoid withdrawal symptoms.			
<i>n</i> (%) of those meeting at least one symptoms	33 (42%)	43 (33%)	1.28
<i>n</i> (%) of those meeting AUD Diagnosis (two symptoms)	23 (30%)	28 (22%)	1.25

Notes. This tables shows the frequencies of those who met each AUD symptom at waves 1 by gender. Gender differences were tested using a *z*-test on 1 degree of freedom (*df*). Endorsement of two symptoms is required for a DSM-5 AUD diagnosis (APA, 2013). Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$. There were no difference in overall AUD rates by gender across waves (last row in Table).

Table 3. Rates of alcohol use disorder symptoms at Wave 2 by gender

AUD Symptom	Wave 2		z-test (1 <i>df</i>)
	<i>n</i> (%) meeting symptom criteria		
	Males (<i>n</i> = 64)	Females (<i>n</i> = 114)	
1. Alcohol is often taken in larger amounts or over a longer period than was intended.	13 (17%)	21 (19%)	.66
2. There is a persistent desire or unsuccessful efforts to cut down or control alcohol use.	7 (9%)	11 (9%)	.92
3. A great deal of time is spent in activities necessary to obtain alcohol, use alcohol, or recover from its effects.	1 (1%)	2 (2%)	.55
4. Craving, or a strong desire or urge to use alcohol.	1 (1%)	2 (2%)	.55
5. Recurrent alcohol use resulting in a failure to fulfill major role obligations at work, school, or home.	2 (3%)	8 (6%)	.97
6. Continued alcohol use despite having persistent or recurrent social or interpersonal problems caused or exacerbated by the effects of alcohol.	3 (4%)	8 (6%)	.60
7. Important social, occupational, or recreational activities are given up or reduced because of alcohol use.	0 (0%)	3 (2%)	1.52
8. Recurrent alcohol use in situations in which it is physically hazardous.	8 (10%)	6 (5%)	1.20
9. Alcohol use is continued despite knowledge of having a persistent or recurrent physical or psychological	5 (6%)	21 (18%)	2.56**

problem that is likely to have been caused or exacerbated by alcohol.			
10. Tolerance, as defined by either of the following:	16 (21%)	22 (17%)	.64
a. A need for markedly increased amounts of alcohol to achieve intoxication or desired effect.			
b. A markedly diminished effect with continued use of the same amount of alcohol.			
11. Withdrawal, as manifested by either of the following:	3 (4%)	5 (4%)	.00
a. The characteristic withdrawal syndrome for alcohol (refer to Criteria A and B of the criteria set for alcohol withdrawal).			
b. Alcohol (or a closely related substance, such as a benzodiazepine) is taken to relieve or avoid withdrawal symptoms.			
<i>n</i> (%) of those meeting at least one symptoms	27 (42%)	38 (33%)	1.28
<i>n</i> (%) of those meeting AUD Diagnosis (two symptoms)	19 (30%)	27 (24%)	.85

Notes. This tables shows the frequencies of those who met each AUD symptom at wave 2 by gender. Gender differences were tested using a z-test on 1 degree of freedom (*df*). Endorsement of two symptoms is required for a DSM-5 AUD diagnosis (APA, 2013). Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$. Note, there was only one significant gender difference in rate of AUD symptom: females had significantly higher rates of symptom 9 (continued use despite problems, 18%) than males (6%), $p < .001$. There were no difference in overall AUD rates by gender across waves (last row in Table).

Table 4. Correlations between constraint, negative emotionality, and log transformed alcohol use disorder (AUD) symptoms for females ($N = 129$, top half of diagonal) and males ($N = 80$, bottom half of diagonal)

	1	2	3	4	5	6	M (SD)	% Valid Data
1. Constraint at Wave 1	--	.79***	-.09	-.07	-.35***	-.34***	140.50 (16.34)	96.9
2. Constraint at Wave 2	.87***	--	-.17	-.08	-.26**	-.23***	139.90 (17.30)	100
3. Negative Emotionality at Wave 1	-.15	-.01	--	.73***	.15	.13	91.69 (13.32)	96.9
4. Negative Emotionality at Wave 2	.07	.18	.72***	--	.12	.15	90.35 (13.78)	100
5. AUD symptoms at Wave 1	-.19	-.38***	-.03	-.11	--	.72***	.91 (1.68)	100
6. AUD symptoms at Wave 2	-.23	-.37***	-.09	-.16	.72***	--	.96 (1.63)	100
M	140.50	139.9	91.69	90.35	.91	.96		
(SD)	(16.34)	(17.30)	(13.32)	(13.78)	(1.68)	(1.63)		
% Valid Data	92.3	98.3	92.3	98.3	100	100		

Notes. The bottom half of the diagonal are the correlations for males. The upper half of the diagonal are the correlations for females. Means and standard deviation (*SD*) in the column for females, in the row for males. Significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$.

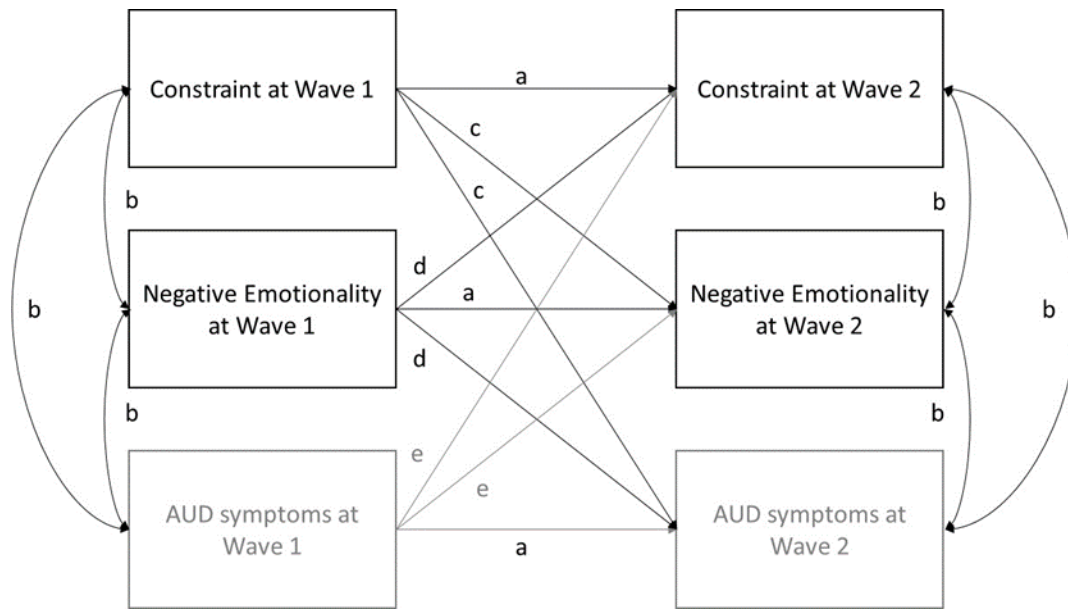
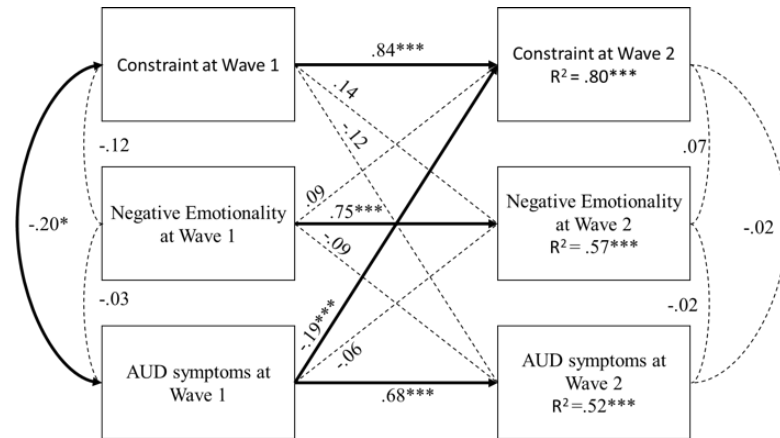


Figure 1. Cross-lagged model depicting study analyses. AUD = Alcohol Use Disorder. This figure represents the analytic model for the first set of analyses for this study (the same model will be run in relation to AUD diagnosis and frequent binge drinking instead of AUD symptoms). Paths labelled **a** refer to stability paths. Paths labelled **b** refer to the within time correlations at each assessment. Paths labelled **c** represent the effects of constraint at Wave 1 on negative emotionality and AUD symptoms at Wave 2 (after accounting for stability of traits over time and correlations within each time point). Paths labelled **d** refer to the effects of negative emotionality at Wave 1 on constraint and AUD symptoms at Wave 2 (after accounting for stability of traits over time and correlations within each time point). Lastly, paths labelled **e** (and shown in gray) refer to the effects of AUD symptoms at Wave 1 on constraint and negative emotionality at Wave 2 (after accounting for stability of traits over time and correlations within each time point).

2a. Results for Males (N = 61)



2b. Results for Females (N = 113)

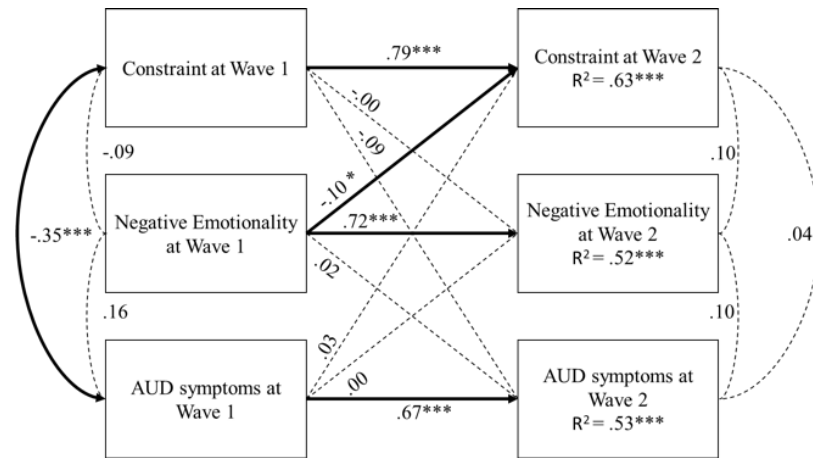


Figure 2. Cross-lagged panel model results for constraint, negative emotionality, and alcohol use disorder (AUD) symptoms by males vs. females. This figure shows standardized coefficients for cross-lagged model results for males (2a) and females (2b). Bolded lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability in personality traits and AUD symptoms across time. There were two significant gender differences. For males, AUD symptoms at Wave 1 significantly predicted constraint at Wave 2. This path was not significantly different than zero for females, and the gender difference in this pathway was statistically significant ($\chi^2(1) = 15.04, p < .001$). These results support a scar/complication model of personality-AUD development for males and no effect of personality on subsequent AUD symptoms or AUD symptoms on subsequent personality for females. Additionally, for females, negative emotionality at Wave 1 predicted decreases in constraint at wave 2, whereas this path was not significant for males. The gender difference in this pathway was statistically significant ($\chi^2(1) = 5.99, p < .01$). This path was not hypothesized but suggests that greater negative emotionality in the first year of college is associated with a reduction of constraint in the second year of college for females but not males. Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$.

Figure 3a. Results for Males (N = 57)

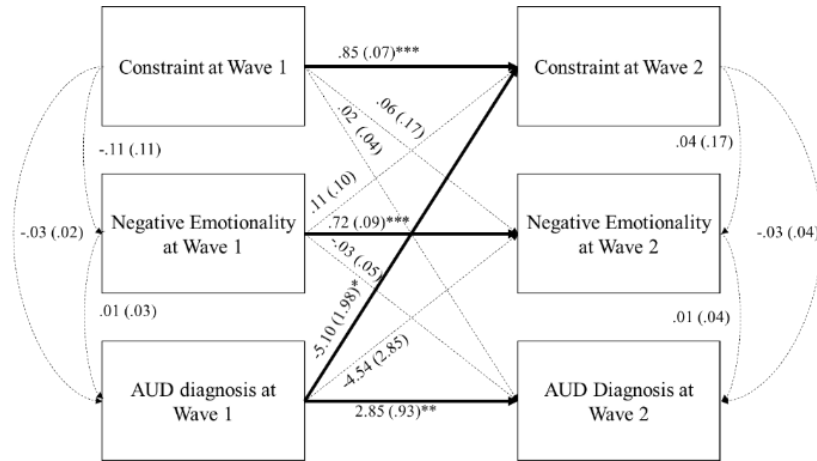


Figure 3b. Results for Females (N = 110)

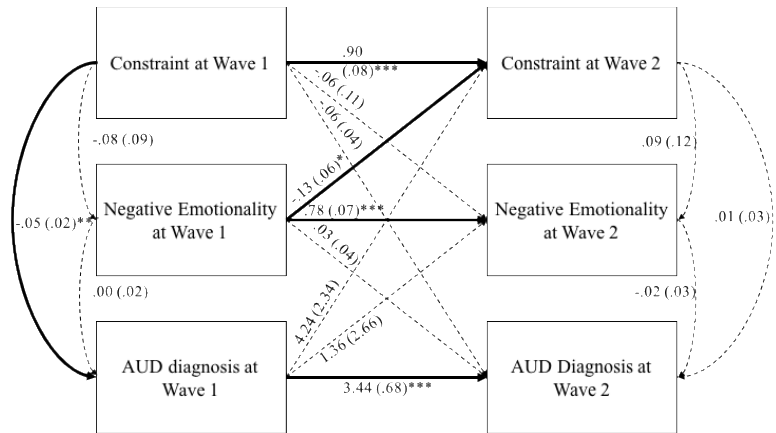


Figure 3. Logistic regression for constraint, negative emotionality, and alcohol use disorder diagnosis by males vs. females. This figure shows unstandardized coefficients (standard errors) for logistic regression for males (3a) and females (3b). Bold lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability in personality traits and AUD diagnosis across time. There were similar patterns for AUD diagnosis as there were for AUD symptoms (shown in Figure 2). For males, AUD diagnosis at Wave 1 significantly predicted constraint at wave 2. For females, negative emotionality at Wave 1 significantly predicted constraint at Wave 2. Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$.

Figure 4a.
Results for
Males (N = 57)

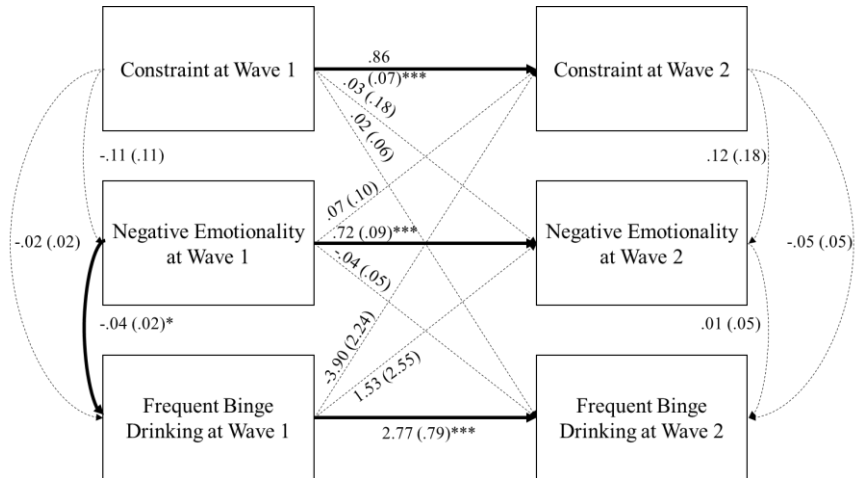


Figure 4b.
Results for
Females (N = 110)

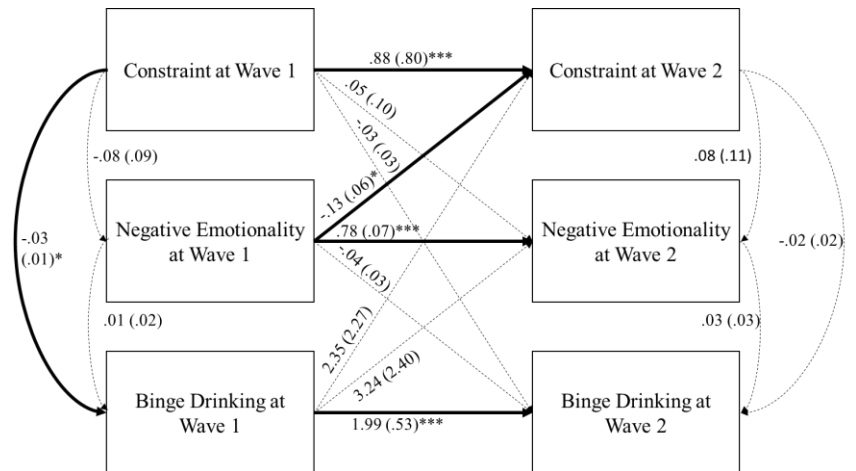


Figure 4. Logistic regression for constraint, negative emotionality, and frequent binge drinking. The figure shows unstandardized coefficients (standard errors) for logistic regression for males (4a) and females (4b). Bolded lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability in personality traits and frequent binge drinking. Female's negative emotionality at Wave 1 significantly predicted constraint at Wave 2; however, frequent binge drinking at Wave 1 did not significantly predict decreases in constraint for males at Wave 2 for males, as was found for AUD symptoms (shown in **Figure 2**) and AUD diagnosis (**Figure 3**). Nonetheless, the overall pattern of results using AUD symptoms or AUD were replicated. Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$.

Appendix

Figure 1a. Results for Males (N = 61)

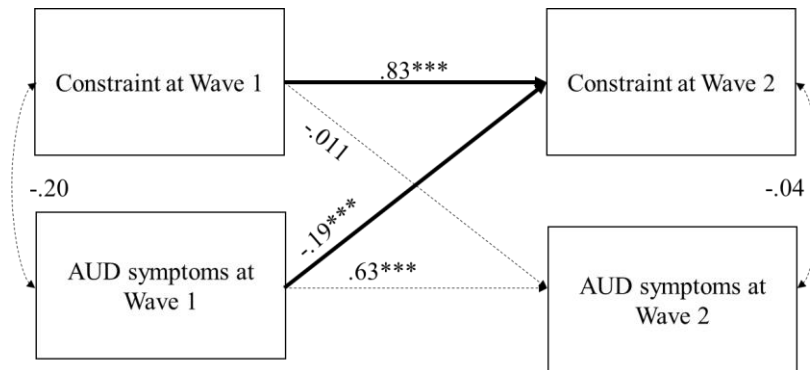


Figure 1b. Results for Females (N = 113)

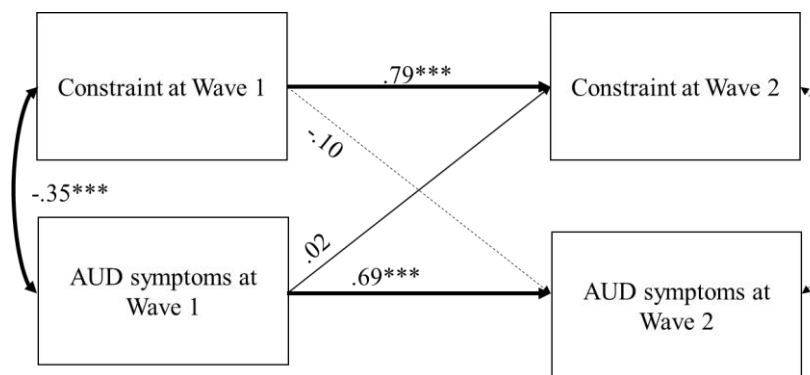


Figure 1. Cross Lagged Panel Model for constraint and alcohol use disorder symptoms.

This figure shows standardized coefficients for cross-lagged model results for males (1a) and females (1b). Bolded lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability of constraint and (log transformed) AUD symptoms across time. There was one significant gender difference. For males, AUD symptoms at Wave 1 significantly predicted rank-order decreases in constraint at Wave 2; whereas for females this association was not significantly different and the difference in male and females was significantly different ($\chi^2(1) = 9.87, p < .01$). These results support a scar/complication model of personality-AUD development for males and no effect of personality on subsequent AUD symptoms for females. Similar patterns were shown when including negative emotionality into the model (shown in **Figure 2** in the mail Tables and Figures document). Statistical significance is denoted by *** $p < .001$, ** $p < .01$, * $p < .05$.

Figure 2a. Results for Males (N = 57)

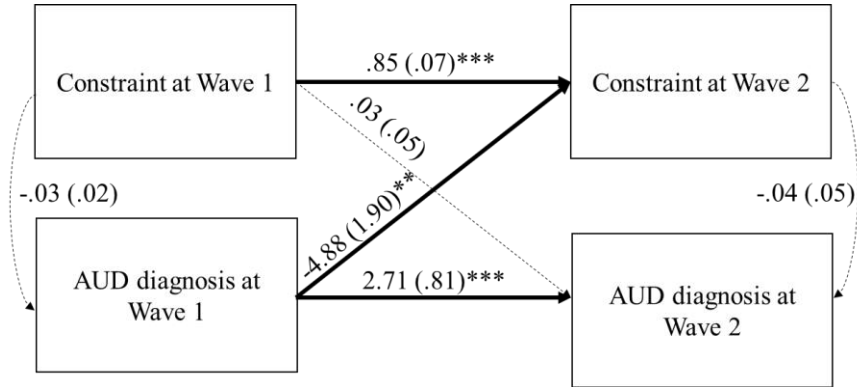


Figure 2b. Results for Females (N = 110)

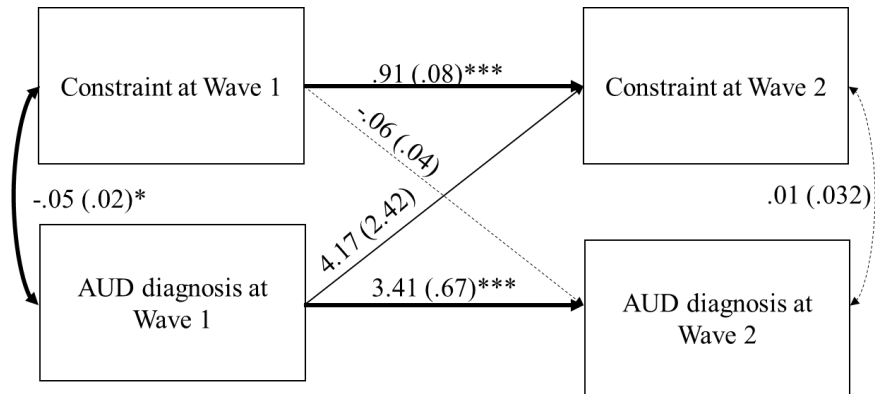


Figure 2. Logistic regression for constraint and alcohol use disorder diagnosis. This figure shows unstandardized coefficients (standard errors) for logistic regression for males (2a) and females (2b). Bold lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability in constraint and AUD diagnosis across time. There were similar patterns of AUD diagnosis as there were for AUD symptoms (shown in Figure 1 of the Appendix). For males, AUD diagnosis at Wave 1 significantly predicted constraint at Wave 2. Similar patterns were shown when including negative emotionality into the model (shown in Figure 3 in the mail Tables and Figures document). Statistical significance is denoted by $^{***} p < .001$, $^{**} p < .01$, $^* p < .05$.

Figure 3a. Results for Males (N = 57)

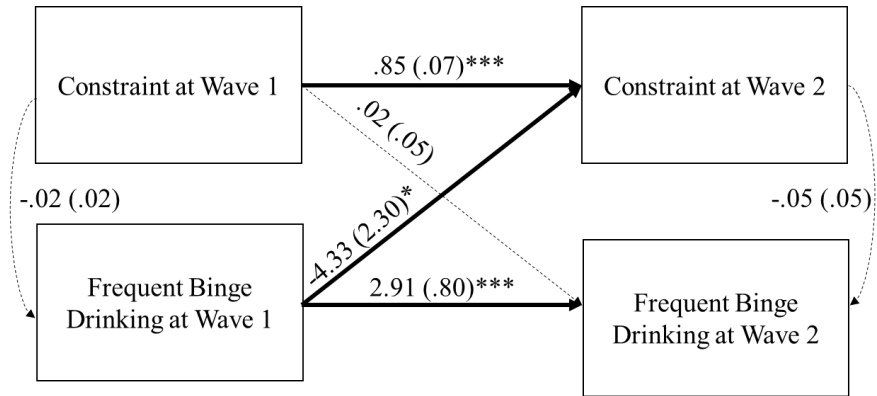


Figure 3b. Results for Females (N = 110)

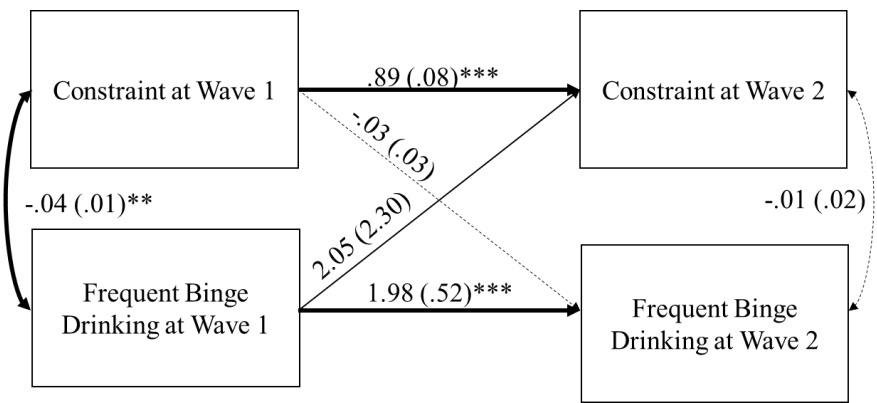


Figure 3. Logistic regression for constraint and frequent binge drinking. The figure shows unstandardized coefficients (standard error) for logistic regression for males (3a) and females (3b). Bolded lines indicate significant pathways, and dashed lines indicate non-significant pathways. For both genders, there was substantial stability in constraint and frequent binge drinking. Frequent binge drinking at Wave 1 significantly predicted constraint at Wave 2, but only for males. Similar patterns were shown when including negative emotionality into the model (shown in Figure 4 in the mail Tables and Figures document). Statistical significance is denoted by $*** p < .001$, $**p < .01$, $* p < .05$.