

**A PROSPECTIVE EXAMINATION OF HOW ALCOHOL
CONSUMPTION MIGHT DRIVE CHANGES IN URGENCY AND
DRINKING MOTIVES OVER THE FIRST YEAR OF COLLEGE**

by

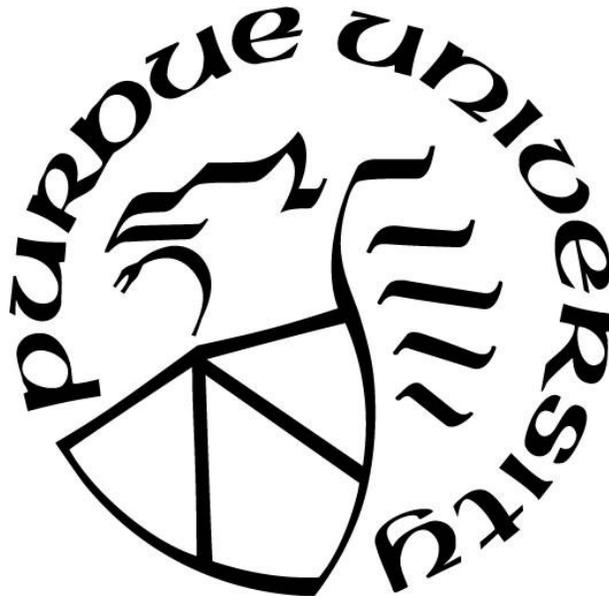
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ABSTRACT

Two impulsivity-related traits, negative and positive urgency (i.e., the tendency to act rashly in the face of extreme negative and positive emotions, respectively) are important risk factors for alcohol use escalation during college and for problematic and disordered level alcohol use, in part through increasing motives for alcohol use. The majority of research to date has focused on the causal direction from trait to motives to alcohol consumption. The goal of the current study was to conduct an initial test of how continued and escalating alcohol use may drive increases and shifts in positive and negative urgency, and how such changes drive subsequent increased drinking motives over the first year of college. Data were analyzed using an archival dataset of 418 first-year college students (age 18-21) enrolled in an introduction to psychology course at a large Midwestern university. Participants were sampled at three timepoints: at the beginning of the fall semester, the end of the fall semester, and the end of the spring semester. A series of hierarchical multiple regression and mediation analyses were used to test study hypotheses. Changes in alcohol use did not predict later changes in positive and negative urgency. Results did replicate previous research showing that changes in positive and negative urgency predicted later changes in drinking motives. Finally, there was some evidence that alcohol use at baseline predicted changes in enhancement drinking motives through changes in positive urgency; but this pattern was not seen with negative urgency. This work extends existing work with urgency theory, which has primarily focused on the effects of urgency on subsequent alcohol consumption and not the inverse. The fact that alcohol use drives subsequent changes in positive urgency and drinking motives can help to better identify mechanisms contributing increased risk for transition to problematic levels of alcohol consumption, can lead to better identification of those at risk for problematic alcohol use and can set the stage to better integrate urgency theory with other well-established alcohol risk models.

CHAPTER 1. INTRODUCTION

Heavy alcohol use is widespread among college students and often results in negative consequences, such as drinking and driving, risky sexual behavior, and academic decline (Martens et al., 2008). Two impulsivity-related traits, negative and positive urgency (i.e., the tendency to act rashly in the face of extreme negative and positive emotions, respectively; Cyders & Smith, 2008) are important risk factors for alcohol use escalation during college (e.g., Cyders et al., 2007; Settles et al., 2010) and for problematic and disordered level alcohol use (e.g., Coskunpinar, Dir, & Cyders, 2013). Recent work has suggested that urgency may be an important factor in the transition from positive emotion-based drinking to negative emotion-based drinking (Zorrilla & Koob, 2019), a key risk factor for the transition to Alcohol Use Disorder (AUD). However, the majority of research to date has focused on the causal direction from urgency traits to alcohol consumption. The goal of the current study is to conduct an initial test of how continued and escalating alcohol use may drive changes in positive and negative urgency, and how such changes drive subsequent increased drinking motives and risky alcohol consumption in college students.

1.1 Alcohol Use in College Students

Around 80% of college students consume alcohol annually and, of those who drink, 40% engage in binge drinking, defined as 4 or more drinks consumed in a single drinking episode for women and 5 or more drinks for men (Mallett et al., 2019). Binge drinking is the leading cause of serious injury and death among college students in the United States (Azagba et al., 2020). Studies conducted in multiple countries have indicated that college students are at higher risk for developing problematic alcohol use patterns and AUD than their non-college peers (Dawson et al., 2004). College students undergo an important transitional phase during their college years that often involves living away from family and friends for the first time and being exposed to considerable vulnerability factors, such as peer influences and often new and continuous exposure to alcohol (Borsari et al., 2007). Therefore, first-year college students are a particularly at-risk population for developing problematic patterns and norms surrounding alcohol use (Derefinko et al., 2016).

Although there are some natural fluctuations in alcohol consumption across the semester, the first year of college is a time where alcohol use increases overall from the start to the end of the year (Derefinko et al., 2016). Along with increases in drinking come increases in risky behavior and negative outcomes, such as drinking and driving, risky sexual behavior, binge drinking, and academic decline (Martens et al., 2008; Azagba et al., 2020). Thus, we need to know how best to intervene to decrease these behaviors and minimize negative outcomes, as well as to identify individuals who are at the greatest risk (i.e., identifying individual differences related to this escalation) and to determine possible mechanisms of change (i.e., determining potential treatment targets).

1.2 Negative and Positive Urgency as Risk Factors for Increases in Risky Alcohol Use

Negative and positive urgency may be prime candidates to identify those who are at most proximal risk for transition to AUD. Negative and positive urgency are emotion-based impulsive personality traits that reflect rash action in response to extreme negative or positive emotions, respectively (Cyders & Smith, 2008). These traits have been proposed as key factors in identifying who is at risk for more problematic and risky types of alcohol use behavior (Smith & Cyders, 2016). For example, whereas sensation seeking is involved in drinking frequency, negative urgency is more highly related to drinking quantity (i.e., number of drinks consumed in a single drinking episode) and AUD (Coskunpinar et al., 2013; Fischer & Smith, 2004). Thus, they have been proposed to be particularly important markers for the transition to problematic alcohol use, as well as other forms of risk-taking and maladaptive behavior (Berg et al., 2015).

Cyders and Smith's (2008) theory of urgency suggests that experiencing an intense positive or negative emotional state can interfere with rational decision making and lead to a higher likelihood of engaging in risky behavior to alleviate or address the emotional state. When experiencing an intense negative mood, research has shown that attempts to regulate these emotions can impair self-control behaviors (Swendsen et al., 2000), which can then lead to maladaptive coping strategies like drinking. Research has also shown that individuals are prone to engage in heavy and high-risk drinking when experiencing elevated positive mood states (Jones et al., 2020; Rankin & Maggs, 2006; Simons et al., 2010). The tendency to engage in risky behavior when faced with extreme positive or negative emotions increases the likelihood of repeated behavior in the future: Even rash actions can be reinforced, and with each engagement

in a maladaptive response to extreme emotion (e.g., heavy drinking) instead of a more adaptive response, the risky behavior is reinforced leading to an increased reliance on it in the future when faced with similar emotional states (Cyders & Smith, 2008).

The role of urgency in the prediction of increased alcohol use and alcohol consequences during the transition of college has been documented in several longitudinal studies (Cyders et al., 2009; Zapolski et al., 2009; Settles et al., 2010). Research has also demonstrated that positive and negative urgency are associated with higher disinhibition (Johnson et al., 2020), which can lead to risky behavior like increased alcohol use.

1.3 Integrating Urgency Theory and the Koobian Stage Model for the Transition to AUD

The Koobian Model of AUD posits a psychiatric-motivational framework wherein addiction has aspects of both impulse control and compulsive disorders (Koob & Volkow, 2010). Impulse control disorders are characterized by increased arousal before an impulsive act and pleasure after committing the act and are largely associated with positive reinforcement mechanisms. Conversely, compulsive disorders are characterized by stress before committing a compulsive repetitive behavior and relief upon performing it and are largely associated with negative reinforcement. Put together, the Koobian model yields an addiction cycle comprised of three stages: binge/intoxication, withdrawal/negative affect, and preoccupation/anticipation. The binge/intoxication stage marks the initiation of use and subsequent use episodes as motivation to use alcohol for its reinforcing effects develops. The withdrawal/negative affect stage follows in which discontinuation of use can trigger intense physical and motivational withdrawal symptoms. The final stage of preoccupation/anticipation is characterized by a significant increase in drug craving in response to conditioned cues (see Koob & Volkow, 2010). The early stages are characterized by higher impulsivity, while the later stages primarily involve a combination of impulsivity and compulsivity. Notably, as an individual moves from impulsivity to compulsivity there is also a shift from positive reinforcement driven behavior to negative reinforcement (Koob, 2004). These stages are characterized by escalation in use that causes brain adaptations that further solidify alcohol use behaviors ultimately leading to addiction which is much more resistant to change (Koob & Volkow, 2010).

Recently, some have suggested an integration of urgency theory and the Koobian three-stage model. Work on the “dark side” affective dysregulation hypothesis suggests that alcohol

and other drugs of abuse initially activate parts of the brain that elicit pleasurable emotional states, and that in order for the brain to restore homeostasis, a decrease in mood and an increase in negative emotions follows (Zorrilla & Koob, 2019). This model further proposes that with repeated cycles of intoxication and withdrawal from alcohol, negative emotions initiate increasingly earlier and to a greater degree than positive emotional states. Under this conceptualization, substance use is increased through negative reinforcement mechanisms, in order to relieve or prevent physical or emotional consequences of the negative affect stage. This shift from positive affect to negative affect is associated with increased alcohol use and chance of developing an alcohol use disorder. This shift lines up nicely with how negative and positive urgency might contribute to the onset and worsening of problematic alcohol use (Cyders & Smith, 2008) and the authors of this theory (Zorrilla & Koob, 2019) have suggested that negative urgency is a key factor in this transition to negative reinforcement-based drinking and transition to AUD. In this integration, shifts from positive to negative urgency may be driven by escalations in alcohol use, and then drive subsequent increases in risky alcohol consumption. However, this model has yet to be tested empirically, as previous work has mostly focused on how changes in these traits lead to changes in drinking and not the other way around (see Figure 1, top panel). The one recent study that examined how alcohol use might drive changes in urgency (Kaiser et al., 2016) did not examine how changes in urgency might further drive changes in drinking motives as the current study sought to test.

1.4 The Importance of Drinking Motives as Mechanisms and for Intervention

One well-studied and important mechanism of how negative and positive urgency impart risk for AUD escalation is through the development of drinking motives. The Acquired Preparedness (AP) model of alcoholism risk posits that differences in key personality traits (e.g., urgency) influence drinking behavior through alcohol-related learning (Smith & Anderson, 2001). In all, this research has suggested that urgency influences alcohol use both directly, and indirectly, through making one more likely to form drinking expectancies (i.e., “If I drink, I expect _____ to happen”) and drinking motives (i.e., “I drink alcohol in order to...”) that then perpetuate subsequent alcohol use (Anthenien et al., 2017). Drinking expectancies and motives are formed and learned through either direct experiences or by observing others’ behavior, in line with Social Learning Theory (Bandura, 1977).

Drinking motives exist as one of the most proximal determinants of alcohol use that reflect a combination of expectancies obtained through past drinking experiences, need for affective change and current situational factors (Cox & Klinger, 2004). There are two dimensions that make up the motivational model of alcohol use, valence (positive or negative reinforcement) and source (internal or external) of the outcomes people expect to achieve through alcohol use (Crutzen & Kuntsche, 2013). Research has focused on four distinct categories of drinking motives (Cooper, 1994): coping motives (i.e., drinking to reduce negative affect), enhancement motives (i.e., drinking to enhance positive affect), social motives (i.e., drinking to obtain social benefits), and conformity motives (i.e., drinking to fit in, avoid social rejection, or peer pressure). In this model, enhancement and social motives utilize positive reinforcement, whereas coping and conformity motives involve negative reinforcement. Both enhancement and coping motives involve internal motivation, which research has shown to be particularly associated with alcohol use as well as alcohol related problems (Kuntsche et al., 2005). Motives operate both indirectly through heavy drinking and directly to account for alcohol problems and the importance of motivational models in understanding alcohol problems in college students has been supported (Carey & Correia, 1997).

Positive and negative urgency appear to influence the development of drinking motives. For example, Settles and colleagues (2010), examined the AP model in first year college students and found that positive urgency predicted positive/arousing expectancies, which in turn predicted increased drinking, whereas negative urgency predicted coping motives, which similarly predicted an increase in drinking quantity. These models remained significant after controlling for typical experience of good and bad moods, suggesting positive and negative urgency as important predictors above and beyond typical affect (Settles et al., 2010).

The Motivational Model of Alcohol Use (Cox & Klinger, 1988) also conceptualizes the potential for a reciprocal effect between drinking motives and alcohol use, such that motives predict drinking and drinking predicts motives. Feedback processes such as this are in line with social learning theory that assumes outcome expectancies from drinking impact drinking behavior (Maisto et al., 1999). Although a Dutch study conducted with 13-16-year-olds did not find support for drinking affecting motives, it was suggested that because past drinking behavior affects motives, perhaps this feedback loop would only be present in those with more drinking experience (Schelleman-Offermans et al., 2011). A subsequent study examined drinking motives

and drinking behavior in adults at two timepoints, three months apart (Crutzen et al., 2013). Results did indicate that number of drinking days at timepoint one was positively correlated with endorsed social, enhancement and coping motives at time two. The study also found evidence that drinking motives can influence each other over time; for example, social motives at timepoint one predicted enhancement motives at timepoint two. The authors posited that this relationship could reflect situations where individuals drink for social reasons (e.g., a party), which could in turn lead to increased drinking behavior, which subsequently manifests in positive expectancies of alcohol use and endorsed enhancement motives at timepoint two.

As the transition into college is often accompanied by a culture of heavy and normalized alcohol use that is associated with harmful outcomes (e.g., academic problems, risky sexual activity, aggressive behavior, blackouts; Rinker et al., 2016), research on drinking motives in this population has aimed to identify potential points of understanding and intervention. Data have shown that college students tend to endorse social and enhancement motives most highly and that the endorsement of these motives is associated with heavy alcohol use (Kuntsche et al., 2005). Although coping motives are traditionally less endorsed in college students, those who are having trouble adjusting to college are at an increased risk of utilizing coping motives (Carver & Scheier, 1994). Thus, drinking motives have been targeted in prevention and intervention focused treatments for college student drinking (Canale et al., 2015; Elder et al., 2005; Watt et al., 2006; Wurdak et al., 2016).

Although motives are undeniably an important mechanism in how drinking escalates during college, targeting motives and expectancies may be of limited utility for the following reasons: 1) Although they are more proximal predictors of alcohol use, only changing motives, without changing the predictors of them (e.g., urgency) may leave one at risk to re-develop drinking motives and subsequent drinking. 2) Although motives can be changed in intervention (Watt et al., 2006), they can also change naturally; however, research has not yet documented how much motives change in college and how this rapid change might be a risk factor in and of itself. 3) Just like there are individual differences in the development of motives, predicted in part by urgency (Jones et al., 2014), there may be individual differences in how malleable motives are and what might predict this malleability. Thus, more research is necessary to really understand how not just levels of these traits and motives predict drinking, but the interactive changes in these factors over time.

1.5 The Current Study

Thus, the goal of the current study was to extend previous work to examine how alcohol use might lead to subsequent changes in urgency and drinking motives. This work extended existing work with urgency theory, which has just recently begun to focus on the effects of alcohol use on urgency, by further testing how these changes might drive changes in drinking motives. Understanding how alcohol use drives subsequent changes in urgency and drinking motives might help to better identify mechanisms contributing increased risk for transition to problematic levels of alcohol consumption, can lead to better identification of those at risk for AUD, and can set the stage to better integrate urgency theory with the well-established Koobian model.

As shown in the top panel of Figure 1, the majority of research to date has focused on the direction from trait to motives to alcohol consumption (e.g., Cyders et al., 2009; Zapsolski et al., 2009; Settles et al., 2010). The specific hypotheses for the current study are shown in the bottom panel of Figure 1:

- 1) Increases in alcohol use from the beginning to the end of the fall semester of college will predict a) decreases in positive urgency and b) increases in negative urgency over the second semester of college (as suggested by Zorrilla & Koob, 2019).
- 2) Changes in positive and negative urgency from the beginning to the end of the fall semester of college will predict changes in drinking motives over the second semester of college. Specifically, a) decreases in positive urgency will predict decreases in enhancement motives and increases in coping motives, and b) increases in negative urgency will predict increases in coping motives and decreases in enhancement motives (as supported by Settles et al., 2010).
- 3) The relationship between alcohol use at the beginning of the fall semester and drinking motives at the end of the spring semester will be mediated by positive and negative urgency at the end of the fall semester, such that alcohol consumption will be related to decreased enhancement motives through decreased positive urgency, whereas alcohol consumption will be related to increased coping motives through increased negative urgency.

CHAPTER 2. METHODS

2.1 Participants

Participants were drawn from an archival data set that examined the relationship between alcohol use and impulsivity in first-year college students (data previously reported by Cyders et al., 2009; Zapolski et al., 2009; Settles et al., 2010; these papers primarily focused on the effects of traits on subsequent motives and behaviors, not the effects of alcohol consumption on subsequent changes in traits and motives). Participants were 414 first-year students from a large Midwestern university enrolled in an introduction to psychology course. The sample was 73.7% female, 86.5% White and had an age range of 18-21 ($M=18.16$, $SD=0.76$). A post hoc power analysis (G*Power; Faul et al., 2007) was conducted to determine if the study would be adequately powered to determine at least a small effect size, with results indicating the number of participants in the sample should be adequate ($f^2=0.02$, $\alpha=0.05$, $1-\beta=0.82$).

2.2 Measures

2.2.1 Demographics

Participants reported age, gender, and race.

2.2.2 Alcohol Use

Drinking quantity and frequency were assessed using the Drinking Styles Questionnaire-Revised (DSQ-R; Smith et al., 1995). The DSQ-R is a self-report measure that consists of 16 items that assess different aspects of drinking behavior. This scale demonstrates high internal consistency (Cronbach's $\alpha=.92-.94$) for the Drink/Drunkenness scale from which items in this study were pulled. Drinking quantity was assessed using the item "Which of the following best describes how much alcohol you usually drink at one time?", which uses a Likert scale ranging from 1 (*I don't drink alcohol at all*), to 5 (*I usually drink a lot of alcohol- more than 9 beers or drinks*). Drinking frequency was assessed using the item "Which of the following best describes how often you drink alcohol?", which uses a Likert scale ranging from 1 (*I have never*

had a drink of alcohol), to 6 (*I drink alcohol almost daily*). Alcohol use was measured using a computed alcohol quantity x frequency variable by multiplying the two items together.

2.2.3 Drinking Motives

Drinking Motives were measured using the Drinking Motives Questionnaire (DMQ; Cooper, 1994). The DMQ consists of 20 items, five items for each of the four drinking motives (coping, enhancement, social, conformity), that assess different motivations for consuming alcohol. Participants responded to each statement (e.g. “To forget your worries”) on a 5-point Likert scale indicating the degree they drink for each reason with 1 (*almost never/never*), 2 (*some of the time*), 3 (*half of the time*), 4 (*most of the time*), 5 (*almost always/always*). This scale has demonstrated good internal consistency (Cronbach’s $\alpha > .80$) for each subscale. Coping motives and enhancement motives were the two subscales used in this study and each were calculated by taking the mean of the five items that make up each subscale.

2.2.4 Positive Urgency

Positive urgency, a facet of impulsivity, was assessed using the Positive Urgency Measure (Cyders et al., 2007). This self-report measure consists of 14 items that use a 4-point Likert scale ranging from 1 (*agree strongly*) to 4 (*disagree strongly*). Sample items include: “When I get really happy about something, I tend to do things that can have bad consequences” and “I tend to act without thinking when I am really excited”. This scale has been shown to demonstrate good internal consistency in both past research (Cronbach’s $\alpha = .94$) and the parent study to the current project (Cronbach’s $\alpha = .96$). It has also been shown to be unidimensional and show good discriminant validity in comparison to measures of other impulsivity facets (Cyders & Smith, 2007). This scale was calculated by taking the mean of all 14 items, after reverse scoring each item.

2.2.5 Negative Urgency

Negative urgency, a facet of impulsivity, was measured using the negative urgency subscale of the revised UPPS-R Impulsive Behavior Scale (Whiteside & Lynam, 2001). This subscale consists of 12 items that use a 4-point Likert scale ranging from 1 (*agree strongly*) to 4

(*disagree strongly*). Sample items include: “When I feel bad, I will often do things I later regret in order to make myself feel better now”, and “When I am upset, I often act without thinking.” Internal consistency for the parent study was good (Cronbach’s alpha=.85), and consistent with past research. This subscale has also been shown to be unidimensional and demonstrates good discriminant validity in comparison to measures of other impulsivity facets (Cyders & Smith, 2007). This subscale was calculated by taking the mean of the 12 items, after reverse scoring all required items (all except item 43).

2.3 Procedure

Participants were recruited through an online research participation website advertising a longitudinal study for first year college students. Participants were sampled at three timepoints: at the beginning of the fall semester (Time 1), at the end of the fall semester (Time 2), and at the end of the spring semester (Time 3). All participants were enrolled in an introduction to psychology course at time of recruitment. Students arrived for a group-based in-person assessment in the lab and completed demographic information and the previously mentioned measures as part of a larger self-report questionnaire. Participants received course credit for their participation at Time 1, and were paid \$10 for their participation at Times 2 and 3.

2.4 Data Analysis Plan

All analyses were performed using SPSS 27.0 and the PROCESS macro (Hayes, 2017). Exploratory analyses of variables of interest occurred by running descriptive statistics (e.g., means, standard deviations, and frequencies). Bivariate correlations were conducted to further examine associations between urgency, drinking motives, alcohol use, and covariates. The variables were also assessed for normal distribution skewness and kurtosis and outliers were screened for. Missing data was imputed using multiple imputation (Rubin, 2004).

Study hypotheses were tested using hierarchical regression models. Gender, and race were added as covariates in each model to control for their unique and combined contribution to substance use patterns (Newton-Howes et al., 2019; O’Malley & Johnston, 2002). Age was not added due to its limited range. Due to lack of diversity in the sample (88% White) race was dummy coded (0=White, 1=Non-white). Separate analyses were conducted for positive and

negative urgency. Separate analyses were also conducted for enhancement and coping motives. Alcohol consumption was measured using a computed alcohol quantity x frequency variable.

Hypothesis 1 was tested in two hierarchical multiple regression models in SPSS. The model for Hypothesis 1a included gender and race covariates (Step 1), alcohol consumption and positive urgency at Time 1 (Step 2), and alcohol consumption at Time 2 (Step 3) to predict positive urgency at Time 3. Hypothesis 1b included gender and race covariates (Step 1), alcohol consumption and negative urgency at Time 1 (Step 2), and alcohol consumption at Time 2 (Step 3) to predict negative urgency at Time 3. In both analyses, the R^2 change for Step 3 was used to evaluate study hypotheses ($p < .05$).

Hypothesis 2 was tested in two hierarchical multiple regression models in SPSS. The model for Hypothesis 2a included gender and race covariates (Step 1), positive urgency and enhancement motives at Time 1 (Step 2), and positive urgency at Time 2 (Step 3) to predict enhancement motives at Time 3. The model for Hypothesis 2b included gender and race covariates (Step 1), negative urgency and coping motives at Time 1 (Step 2), and negative urgency at Time 2 (Step 3) to predict coping motives at Time 3. In both analyses, the R^2 change for Step 3 was used to evaluate study hypotheses ($p < .05$).

Hypothesis 3 was tested with two separate mediation models conducted in PROCESS. The first included alcohol use at Time 1 as the independent variable, positive urgency at Time 2 as the mediator, and enhancement motives at Time 3 as the outcome variable, controlling for gender and race covariates, as well as positive urgency and enhancement motives at Time 1. The second included alcohol use at Time 1 as the independent variable, negative urgency at Time 2 as the mediator, and coping motives at Time 3 as the outcome variable, controlling for gender and race covariates, as well as negative urgency and coping motives at Time 1. For both analyses, the 95% confidence interval of the indirect effect was examined (i.e., whether or not it contains zero) to evaluate study hypotheses.

2.5 Missing Data Analysis

Individuals who participated in all three timepoints did not differ from those who did not on any key study variable (p -values $> .13$). Therefore, it was concluded that data were missing at random, and missing data were imputed using multiple imputation in SPSS (Rubin, 2004), which has been shown to result in less bias than other methods of handling missing data (Rubin, 1996).

Each study variable (e.g., negative urgency, positive urgency, motives, and alcohol use) was imputed separately from their own scale's items at all three timepoints. Five imputations were created for each of these study variable datasets, as five imputations have been shown to be significant in accounting for variability among the imputed values (Rubin, 1996). Missing data were largely due to attrition, with a similar amount of missing data among all study variables at the same timepoint. Missing data among study variables at Time 1 ranged from 0.2-2.4%, missing data at Time 2 ranged from 8.9-10.4%, and missing data at Time 3 ranged from 28.7-29.7% of the total sample. After imputation, study scales were computed using imputed items. Means, standard deviations, and coefficient alphas of study variables were examined post imputation (see Table 1) to assess if the imputation process resulted in significant bias, and it seems that across imputed data sets the data showed similar distributions, means, standard deviations, and internal consistency for each subscale to the original unimputed data. The only exceptions were the coefficient alphas of the computed alcohol use Time 3 variable, likely due to being composed of only two variables along with the higher percentage of missing data at that timepoint. Percent change in means of study variables from the unimputed data to each of the five imputations were calculated. All Time 1 variables across each of the five imputations yielded a less than 1% change from the unimputed data. Time 2 variables ranged from 0.33-6.4% change from the unimputed data. Due to the higher volume of missing data at Time 3, these variables showed a higher range of 2.71-23.81% change from the unimputed data. To probe this change further, the operationalized scale points of each measure were examined. Despite any changes due to the imputation process, the mean values for each imputation of every study variable rounded to the same scale point on each measure. Analyses were then conducted and reported using each individual imputation, as well as the pooled results of all five imputations.

CHAPTER 3. RESULTS

3.1 Descriptive Statistics and Correlations

Pooled means and correlations were calculated for the computed study scales (Table 1). Alcohol use increased slightly over the three timepoints: Time 1 (M=11.26), Time 2 (M=11.95), and Time 3 (M=11.98). This change was significant in the original data ($F(2, 580)=7.60$, $p<.001$), as well as four out of five of the imputed datasets (F's ranging from 4.33-9.16, p-values ranging from $<.001$ -.013). Negative urgency also increased slightly over the three timepoints: Time 1 (M=2.25), Time 2 (2.26), Time 3 (2.29), and this change was significant in the original dataset ($F(2, 530)=3.60$, $p=.028$) and significant or trending significant in two out of five of the imputed datasets (F's ranging from 2.77-3.11, p-values ranging from .046-.063). Positive urgency was relatively stable over time: Time 1 (M=1.74), Time 2 (M=1.82), Time 3 (M=2.01), and any change was not significant in the original dataset ($F(2, 552)=.080$, $p=.923$), but was significant in all five of the imputed datasets (F's ranging from 23.47-57.04, p-values all $<.001$.) Enhancement motives increased from Time 1 (M=2.47) to Time 3 (M=2.77), and any change was not significant in the original dataset ($F(1, 290)=2.53$, $p=.113$), but change was significant in all five imputed datasets (F's ranging from 27.04-35.91, p-values all $<.001$). Coping motives increased from Time 1 (M=1.79) to Time 3 (M=2.34) and this change was trending significant in the original dataset ($F(1, 289)=3.85$, $p=.051$) as well as all five imputed datasets (F's ranging from 90.04-104.39, p-values all $<.001$). Time 2 motives were not used in any analyses in the current examination. See Tables 2 and 3 for complete F tests and post hoc comparisons.

Many of the study variables were significantly correlated as supported by prior research (Adams et al., 2012). Covariates gender and race were significantly correlated with many study variables (p-values ranging from .001-.038). Alcohol use, negative urgency, positive urgency, enhancement motives, and coping motives were all significantly correlated amongst themselves (p-values ranging from .000-.008). Pertaining to the hypotheses tested, other notable correlations include a significant positive correlation between alcohol use and negative urgency at all three timepoints (p-values ranging from $<.001$ -.008), significant positive correlations of coping and enhancement motives with alcohol use (p-values ranging from .000-.002), significant positive correlations between coping motives and negative urgency (p-values all $<.001$), and significant

positive correlations between enhancement motives and positive urgency (p-values ranging from $<.001-.013$). See Table 4 for a full correlation matrix of study variables.

The skewness and kurtosis of study variables were assessed. Skewness and kurtosis for alcohol use at all three timepoints were within limits across the original dataset and all five imputed datasets (skewness ranging from $-.13-.26$, kurtosis ranging from $-1.34(-.892)$). All three timepoints of negative urgency were within normal limits for skewness and kurtosis across the original dataset and all five imputed datasets (skewness ranging from $-.25-.29$, kurtosis ranging from $-.45(-.08)$). Skewness and kurtosis for positive urgency at all three timepoints were within limits across the original dataset and all five imputed datasets (skewness ranging from $-.02-.93$, kurtosis ranging from $-1.33, .73$). Enhancement motives at Time 1 and Time 3 demonstrated skewness and kurtosis within limits across the original dataset and all five imputed datasets (skewness ranging from $-.31-.25$, kurtosis ranging from $-1.33(-1.04)$). Skewness and kurtosis for coping motives at Time 3 were within limits across the original dataset and all five imputed datasets (skewness ranging from $.13-.90$, kurtosis ranging from $-1.30-.15$). However, coping motives at Time 1 demonstrated kurtosis within limits across the original dataset and all five imputed datasets (kurtosis ranging from $.87-.95$), but data were positively skewed across the original dataset and all five imputed datasets (skewness ranging from $1.19-1.21$).

3.2 Aim 1: Changes in Alcohol Use leading to Changes in Urgency

The first regression analysis in this aim examined changes in alcohol use over the fall semester of college to predict positive urgency at the end of the spring semester (Table 7). Time 1 alcohol use and positive urgency were controlled for in the analysis, as were gender and race. There was no significant effect of alcohol use at Time 2 to predict positive urgency at the end of the spring semester in any of the five imputed datasets, nor in the pooled results (see Table 5) of all imputed datasets ($B=.001, p=.909$). Gender ($B=.159, p=.032$) and Time 1 positive urgency ($B=.343, p<.001$) were significantly related to positive urgency at the end of the spring semester. There was no significant effect of alcohol use at Time 1 ($B=.004, p=.668$) or race ($B=.074, p=.448$) to predict positive urgency at the end of the spring semester.

The second regression analysis in this aim examined changes in alcohol use over the fall semester of college to predict negative urgency at the end of the spring semester (Table 8). Time 1 alcohol use and negative urgency were controlled for in the analysis, as were gender and race.

Similarly, there was no significant effect of alcohol use at Time 2 to predict negative urgency at the end of the spring semester in in any of the five imputed datasets, nor in the pooled results (see Table 5) of all imputed datasets ($B=.007$, $p=.285$). Time 1 negative urgency was significantly related to negative urgency at the end of the spring semester ($B=.400$, $p<.001$). There was no significant effect of alcohol use at Time 1 ($B=.000$, $p=.945$), gender ($B=.032$, $p=.566$), or race ($B=-.059$, $p=.481$), to predict negative urgency at the end of the spring semester.

3.3 Aim 2: Changes in Urgency leading to Changes in Drinking Motives

The first regression analysis in this aim examined changes in positive urgency over the fall semester of college to predict enhancement motives at the end of the spring semester (Table 9). Time 1 positive urgency and enhancement motives were controlled for in the analysis, as were gender and race. There was a significant effect of positive urgency at the end of the fall semester to predict enhancement motives at the end of the spring semester in each of the five imputed datasets, as well as in the pooled results (see Table 6) of all imputed datasets ($B=.231$, $p=.019$). Time 1 enhancement motives were significantly related to enhancement motives at the end of the spring semester ($B=.508$, $p<.001$). There was no significant effect of positive urgency at Time 1 ($B=-.139$, $p=.208$), gender ($B=-.079$, $p=.538$), or race ($B=-.173$, $p=.306$) to predict enhancement motives at the end of the spring semester.

The second regression analysis in this aim examined negative urgency over the fall semester of college to predict coping motives at the end of the spring semester (Table 10). Time 1 negative urgency and coping motives were controlled for in the analysis, as were gender and race. There was a significant effect of negative urgency at the end of the fall semester to predict coping motives at the end of the spring semester in each of the five imputed datasets, as well as in the pooled results (see Table 6) of all imputed datasets ($B=.299$, $p=.035$). Time 1 coping motives were significantly related to coping motives at the end of the spring semester ($B=.414$, $p<.001$). There was no significant effect of negative urgency at Time 1 ($B=-.118$, $p=.406$), gender ($B=.114$, $p=.419$), or race ($B=-.063$, $p=.698$) to predict coping motives at the end of the spring semester.

3.4 Aim 3: Alcohol Use leading to Changes in Drinking Motives Mediated by Urgency

The first mediation analysis in this aim examined the relationship between alcohol use at the beginning of the fall semester and enhancement motives at the end of the spring semester mediated by positive urgency at the end of the fall semester (Table 11). Time 1 positive urgency and enhancement motives were controlled for in the analysis, as were gender and race. Alcohol use at Time 1 significantly predicted positive urgency at Time 2 in all five imputed datasets, as well as the pooled results (see Figure 2) of all imputed datasets ($B=.0126$, $SE=.0061$, p-values ranging from .034-.047). Positive urgency at Time 2 significantly predicted enhancement motives at Time 3 in all five imputed datasets, as well as the pooled results of all imputed datasets ($B=.2234$, $SE=.0988$, p-values ranging from .004-.049). Alcohol use at Time 1 did not significantly predict enhancement motives at Time 3 in any of the five imputed datasets, nor in the pooled results of the imputed datasets ($B=.0092$, $SE=.0118$, p-values ranging from .295-.701). However, there was a small significant indirect effect of alcohol use on enhancement motives through positive urgency in three out of five imputed datasets, as well as in the pooled results of all imputed datasets ($B=.0028$, 95% CI [.0000, .0007]).

The second mediation analysis examined the relationship between alcohol use at the beginning of the fall semester and coping motives at the end of the spring semester mediated by negative urgency at the end of the fall semester (Table 12). Time 1 negative urgency and coping motives were controlled for in the analysis, as were gender and race. Alcohol use at Time 1 did not significantly predict negative urgency at Time 2 in any of the five imputed datasets, nor in the pooled results (see Figure 3) of all imputed datasets ($B=.0007$, $SE=.0036$, p-values ranging from .433-.948). Negative urgency at Time 2 significantly predicted coping motives at Time 3 in four out of five imputed datasets, as well as the pooled results of all imputed datasets ($B=.2970$, $SE=.1388$, p-values ranging from .003-.042). Alcohol use at Time 1 did not significantly predict coping motives at Time 3 in any of the five imputed datasets, nor in the pooled results of the imputed datasets ($B=.0099$, $SE=.0180$, p-values ranging from .059-.735). There was no significant indirect effect of alcohol use on coping motives through negative urgency in any of the five imputed datasets, nor in the pooled results of all imputed datasets ($B=.0002$, 95% CI [-.0020, .0030]).

CHAPTER 4. DISCUSSION

This study is one of the first to empirically test the integration of urgency theory with the Koobian model of addiction, examining whether alcohol consumption can lead to changes in positive and negative urgency (as proposed in part by Zorrilla & Koob, 2019). Furthermore, this study aimed to understand how changes in alcohol use and urgency could drive changes in drinking motives in order to help identify factors contributing to the development and maintenance of drinking motives. The Koobian model suggests that alcohol use and its associated brain neuroadaptations drive a shift from positive affect to negative affect, which increases risk for the development of AUD (Zorrilla & Koob, 2019). As an initial test of combining this theory with urgency theory, this study aimed to replicate recent findings (Kaiser et al., 2016) that escalations in alcohol use over the first semester of college would predict changes in negative and positive urgency over the first year of college, and extend these findings such that these changes in urgency would drive subsequent changes in drinking motives. Overall, I found that changes in alcohol use did not predict later changes in positive and negative urgency. Second, I replicated previous findings showing that changes in positive and negative urgency predicted later changes in drinking motives. Finally, there was some evidence that alcohol use at baseline predicted changes in enhancement drinking motives through changes in positive urgency; this pattern was not seen with coping motives and negative urgency.

Prior theory proposed that changes in alcohol use could lead to changes in urgency (Zorrilla & Koob, 2019), further escalating and solidifying alcohol use. However, this study did not find support for the theory that changes in alcohol use predict changes in either positive or negative urgency. This does not corroborate previous work linking alcohol and impulsive personality changes (Hicks et al., 2012; Kaiser et al., 2016; Littlefield et al., 2009). One reason for these disparate findings could be that the developmental period in the current sample was not ideal for examining the effects of alcohol on impulsive personality change, and that a later developmental period might show these effects. For example, Littlefield and colleagues (2009) found support for a reciprocal effect between changes in problematic alcohol use and changes in impulsive personality traits related to maturation out of problematic use. Maturing out refers to normative decline in problematic alcohol use wherein heavy use tends to increase through late adolescence, peak in the early 20s, and then decline after this period with age. Similarly, research

has shown that impulsivity tends to follow this same pattern of maturing out, where impulsivity increases through adolescence and early adulthood, and then decreases during adulthood (Argyriou et al., 2018). Results of Littlefield and colleagues' (2009) study found that decreases in impulsivity predicted decreases in alcohol use, as well as decreases in alcohol use predicted decreases in impulsivity. Conversely, increased or persistent alcohol use was associated with more stability in impulsivity over time. This study suggests then that alcohol use might help to maintain impulsivity over the lifespan (Littlefield et al., 2009) and that effects of alcohol on personality might not be detected until middle adulthood.

Alcohol effects on personality have been detected in other studies of middle adulthood, including both how alcohol might attenuate maturing out of impulsive personality and how alcohol can contribute to personality change. One study found that risky alcohol use was associated with increased extraversion and decreased emotional stability, agreeableness, and conscientiousness in an adult sample (Hakulinen & Jokela, 2019). Results of this study indicated that risky alcohol use attenuated normative personality change (consistent with theories of "maturing out"), suggesting that alcohol use can serve to maintain personality traits such as impulsivity that otherwise tend to decline over time. Another study supported the idea that increased alcohol use can lead to changes in personality traits (Hicks et al., 2012). Hicks and colleagues (2012) found that adolescent onset and persistence of AUD among a sample transitioning from adolescence to young adulthood (17-24 years) were associated with greater changes in behavioral disinhibition and negative emotionality. These changes were consistent with the Koobian "dark side" affective dysregulation hypothesis as onset and persistent course of AUD led to stability in negative emotionality that contrasts with normative decline observed with age. These results suggest that chronic alcohol use may decrease potential developmental trajectories in a way that maintains more deviant personality structures that further contributes to AUD via a reciprocal effect. This may be more consistent with the withdrawal/negative affect stage of the Koobian model (Zorrilla & Koob, 2019), which is characterized by a shift toward negative affect-based drinking. Results of this study suggest that such a shift might not occur until a later developmental stage, and therefore null results here might be driven, in part, by the use of a first-year college sample.

Although it's possible that using a younger developmental period contributed to the null effects found in this study, other research suggests that such relationships can be detected and

tested among first-year college students. A recent study by Kaiser and colleagues (2016) investigated the reciprocal relationship between urgency traits and alcohol use over a similar population to the present study (first-year college students). The researchers found a reciprocal effect between alcohol use and urgency, and found that alcohol use at time 1 did indeed predict both increased positive urgency and increased negative urgency at time 2 around a year later. This study demonstrates the anticipated results of the current study in a similar population, which would support the Koobian model's notion that alcohol use can lead to changes in personality traits that can then further predict subsequent alcohol use. However, the current study did not replicate these findings; differences in the research methods might explain these disparate results. The study conducted by Kaiser and colleagues (2016) assessed changes in urgency traits over a one-year period, which is three months longer than the present study, and they observed greater change in both positive and negative urgency traits, as well as alcohol use between the two timepoints. Results of the current study show that both positive and negative urgency were fairly stable over the 9-months assessed, as was alcohol use, likely leading to limited power to detect effects and test study hypotheses. Perhaps the slightly longer timespan, which encompassed an entire summer break as well, along with the greater variability across study variables (Kaiser et al., 2016) contributed to increased power to detect effects in their study.

While results of the current study conflict with previous research by suggesting that urgency is not significantly affected by escalations in alcohol use, given prior findings in this same domain it seems more likely that something specific to this study design or sample characteristics perhaps contribute to these null findings rather than serve to disprove previous theory. An important consideration here is the relatively short period of time sampled in the current study, and whether or not personality can change over a 9-month period. Some research has supported the idea that personality is rather stable over time (Costa & McCrae, 1994; McCrae & Costa, 1999), but others suggest that it can change in small systematic ways (Robins et al., 2001). In a study assessing personality change from the beginning to the end of college, Robins and colleagues (2001) found small to medium sized changes in mean-level Big Five dimensions (extraversion, conscientiousness, neuroticism, agreeableness, and openness to experience) from Year 1 to Year 4. However, relatively few participants showed reliable changes in personality scale scores on an individual level, and those that did were consistent with mean-level changes with no dramatic differences.

Another study assessed personality change across a 50-year timespan and found small mean-level decreases in personality traits in a pattern consistent with theories of maturation, but that the overall personality profile (e.g., levels of traits compared to each other) was relatively stable (Damian et al., 2019). Results of this study suggest that while personality (both trait level and profile level) has a certain stability across the lifespan, it is also slightly malleable, particularly in regard to maturation. However, previous research does suggest that mean-level changes in personality traits are more easily observable over a large period of time, or in response to new or traumatic experiences (Golsteyn & Schildberg-Hörisch, 2017).

Therefore, the lack of significant results in the current study could be in large part due to the fact that these variables were assessed over a relatively short period of time with limited time for change to occur. There was only one semester (typically four months) between Time 1 and Time 2, and the entire study (Time 1 to Time 3) spanned only nine months. Given the relatively brief window of assessment in the current study, it seems implausible that a large amount of change in these personality traits would be observed to make predictors of this change significantly detectable. Individual differences in personality traits may be stable across many years, or even decades (Bleidorn et al., 2021) and this stability is at its peak during middle adulthood, with relatively lower stability during both young adulthood (as examined in the current study) and old age. Personality becomes less stable when examining change over long intervals of time, or perhaps when bridging across developmental periods (e.g., young adulthood into middle adulthood). Urgency and alcohol use were fairly stable across the study period; this stability provided limited variability, limited change to predict, and reduced power to detect any effects that might exist in nature. Therefore, despite the increased malleability of personality traits during this developmental period, perhaps the timespan (nine months) was too short to observe significant enough changes to detect. It could be that there would be an increased chance of observing change across study variables, thereby increasing power, over a larger time period, such as the entirety of college (freshman to senior year), rather than just over a nine-month period since change is often small in scale and requires large periods of time.

The second aim of the study examined whether changes in urgency might lead to changes in drinking motives. Replicating prior research (e.g., Settles et al., 2010), this study found that changes in both positive and negative urgency lead to changes in enhancement and coping motives respectively over the first year of college. These results provide further support for the

AP model of risk (Smith & Anderson, 2001) through the idea that changes in personality traits can predict and likely contribute to changes in motives to drink, even over a relatively short time period. The current results are important to consider because changes in urgency led to increases in the two drinking motives that are not only associated with increased alcohol use in general, but also with increased alcohol-related problems (Adams et al., 2012; Kuntsche et al., 2005). Additionally, research has consistently found evidence that the relationship between urgency and alcohol use or other drinking behaviors is mediated by drinking motives (Anderson et al., 2020; Wolkowicz et al., 2020; Yang et al., 2019). For example, individuals higher in negative urgency who may have difficulty tolerating distress may more easily develop strong coping motives, which in turn can then perpetuate future use, making this relationship clinically relevant.

The current study and prior research demonstrate that positive urgency is associated with increased enhancement motives and negative urgency is associated with increased coping motives; this can provide useful information for identifying individuals at increased risk for developing these high-risk drinking motives, who then might be ideal candidates for targeted interventions. Since intervening on urgency has been proposed but has not yet comprehensively studied or documented (e.g., Hershberger et al., 2017), intervening at the drinking motive level could be an effective treatment option, as existing interventions for motives have been supported (Canale et al., 2015; Elder et al., 2005; Watt et al., 2006; Wurdak et al., 2016). Interventions have also been successful in changing drinking motives themselves (Blevins et al., 2019; Blevins & Stephens, 2016). A randomized controlled treatment trial was conducted to evaluate the impact of a brief coping motive feedback-based intervention compared to a standard feedback control (Blevins & Stephens, 2016). They observed significant reductions in drinking to cope with depression in the coping motive feedback condition, and while there were significant reductions in both drinking and negative consequences, they did not significantly differ between conditions. In another study, Blevins and colleagues (2019) developed an ecological momentary intervention (EMI) specifically designed to target drinking to cope with anxiety or depression. Their results indicated that coping motives, as well as number of drinking days, and alcohol related problems all significantly decreased over time following the intervention. This intervention presents promising pilot data for in the moment interventions geared at reducing particular high-risk drinking motives.

However, changing motives alone without also modifying more distal predictors (e.g., urgency, alcohol consumption) could be less effective long-term, as individuals could return to pre-treatment motive levels after treatment completion. Despite modifying drinking motives, the risk for continued escalation in drinking and any alcohol related consequences might persist because the risk from certain personality traits like urgency might persist. The results of this study add to a growing literature indicating that motives can be affected by urgency; therefore, existing interventions for motives could be integrated with urgency-related treatments (see proposed by Zapolski et al., 2009) to create novel and easily implemented, targeted treatments in the college population. The integration of urgency with motives treatments could help focus interventions on key factors related to risk for developing an alcohol use disorder later in life and improve effectiveness and treatment outcomes by modifying a key mechanism by which drinking motives might be driving future use (see Zorrilla & Koob, 2019).

The last aim of this study examined, in line with the Koobian model (Zorrilla & Koob, 2019), whether alcohol use would predict changes in drinking motives in part through changes in positive and negative urgency. The Koobian model posits that with repeated cycles of intoxication and withdrawal from alcohol, negative emotions initiate increasingly earlier and to a greater degree than positive emotional states, and this shift from positive to negative affect is then associated with increased alcohol use and chance of developing an alcohol use disorder. My results do not provide support for this idea and did not corroborate previous findings documenting alcohol's effects on a shift to negative emotion-based drinking (e.g., Hussong et al., 2001; Peterson et al., 2021).

One reason for these disparate findings is the use of first-year college students in the current study. It seems likely that first year college students, who often have been exposed to heavy and regular alcohol use for the first time (Derefinko et al., 2016), may not have been drinking long enough or heavily enough to make a shift from positive affect-based drinking toward the more potentially harmful negative affect-based drinking. A study by Cho and colleagues (2019) found that positive reinforcement, but not negative reinforcement, was associated with increased alcohol use among individuals without an AUD. While both positive and negative reinforcement were associated with increased use among those with an AUD, the relationship was much stronger for negative reinforcement. Results of that study suggest that

negative reinforcement's effect on perpetuated alcohol use is only significant in those with an AUD, which is characterized by heavier use.

Considering this shift is also brought on by repeated cycles of intoxication, it is also possible that the drinking quantity and frequency of this sample was not high enough to cause individuals to begin experiencing this type of shift toward negative-urgency based drinking (see Cho et al., 2019). The mean combined drinking quantity and frequency in this sample was between 11-13 for all three timepoints on a scale with a maximum value of 30. Therefore, alcohol use in the current sample was on the relatively low side, and fairly restricted. Prior research indicates that binge drinking and repeated cycles of intoxication are the most toxic to the brain in leading to changes in brain chemistry (Zorrilla & Koob, 2019); the combined alcohol use variable in this study was relatively stable over all three timepoints in this study. Therefore, the alcohol use observed in this sample may not have been enough to cause an increase in negative urgency and initiate a shift to a more negative affect-based drinking pattern.

A small novel finding from the current study suggests that alcohol use may contribute to changes in positive urgency, which can lead to increased enhancement motives that can then perpetuate use. The Koobian model does not explicitly discuss this kind of parallel process that could be at play during earlier stages of alcohol use, although positive emotions and reinforcement are thought to be at play in the binge-intoxication stage of AUD. However, the model does not explicitly hypothesize that alcohol use drives positive emotions in a meaningful way. Therefore, it is particularly interesting within the framework of the Koobian model because it suggests that even before a shift from positive affect-based drinking to negative affect-based drinking occurs, alcohol use might contribute to an increase in positive urgency, which can reinforce enhancement motive development. Therefore, positive urgency might be more applicable during the binge/intoxication stage of the Koobian model and alcohol use might lead to increases in this trait and subsequent enhancement motives. This finding provides preliminary empirical support that positive urgency can be influenced by alcohol use, adding to a significant literature that has already established how positive urgency influences alcohol use, suggesting an important feedback loop in the process, as well as provides an expansion of Koobian theory. This pattern warrants further examination and replication due to the small effect detected in the current study.

If these findings are replicated in future research they also serve to potentially highlight the importance of identifying people early who are at risk for developing AUD. As alcohol use patterns becomes more ingrained, changes in other factors like personality, learning, and brain chemistry occur, which then further sustain alcohol use behavior (Zorrilla & Koob, 2019). This helps to possibly explain why alcohol use is less modifiable later in the course of one's drinking (Gossop et al., 2003; Witkiewitz et al., 2017), because these more stable constructs like personality traits have been affected by drinking, which are much more resistant to change. The results of the current study might suggest that these personality changes can happen very early in one's drinking, even when drinking quantity and frequency are not particularly high. The fact that I am observing even small changes in a normative college sample over a relatively short period of time, suggest that these changes could possibly be even greater if assessed further in the future, when such patterns of drinking would be even more difficult to modify. Future research will be needed to examine these patterns further.

The current findings suggest initial support for extending this line of research by examining a shift from positive to negative urgency in future research across a longer time span, with an older, more developmentally appropriate sample (as this sample may not have transitioned toward the withdrawal/negative affect stage due to being early on in their drinking), and within a sample with higher alcohol use rates. This model would examine how continued cycles of alcohol use first predict increases in positive urgency and then subsequent increases in negative urgency. This model would perhaps better map onto the Koobian model, by containing both positive and negative urgency in a single model to directly examine a shift from more positive affect-based drinking to negative affect-based drinking as a direct result of alcohol use. The results of this study provide preliminary support for further examining the idea that alcohol use can cause changes in not only brain chemistry (Zorrilla & Koob, 2019) but personality as well, which could increase the risk of developing a more problematic drinking pattern or AUD later in life through the effects on one's learning about alcohol. This work begins to extend existing work with urgency theory, which has primarily focused on the effects of urgency and drinking motives on subsequent alcohol consumption and not how alcohol use might lead to changes in motives through changes in urgency.

The current study findings should be considered within the methods used to treat the data. I used multiple imputation (Rubin, 2004) to handle missing data, so it is important to discuss the

degree to which this may have introduced bias into the data. Having a large amount of missing data can itself lead to bias and cause a reduction in efficiency (Madley-Dowd, 2019). A common approach to handling missing data is listwise deletion, which excludes individuals with any missing data from analyses. However, this can greatly restrict sample size and reduce power of analyses, as well as introduce bias depending on what underlying mechanism caused the missing data (van Ginkel et al., 2020). Conversely, multiple imputation was created to resolve issues of bias, power reduction, and waste of datapoints (van Ginkel et al., 2020). Multiple imputation has been shown to be effective in handling missing data in both cross sectional and longitudinal data (Huque et al., 2018). As discussed in the data analysis plan, study variables showed similar distributions, means, standard deviations, and internal consistency across imputed data sets compared to the original unimputed data. Furthermore, although Time 3 had a higher percentage of missing data due to attrition, research has shown that for data that are missing at random, multiple imputation can help reduce bias even when the proportion of missing data is large (Madley-Dowd, 2019). Therefore, I concluded that the use of multiple imputation likely resulted in less bias to the data than another method of handling missing data.

Results of the current study led to a number of important next directions to consider in future research aimed at replicating findings and extending work on the integration of the Koobian model with urgency theory and drinking motives. This line of research should be further studied across different populations in order to better understand if and how these theories might integrate to help predict substance use across the lifespan. Future research should include studies of this integration in younger populations (e.g., adolescence) where drinking may first initially occur (Aiken et al., 2018). If this population exhibits similar patterns to those found among college students in the current study, after further replication in a similar sample due to the small effect detected, it would start to suggest that drinking's effect on positive urgency and enhancement motive development is particularly characteristic of younger drinkers. On the other hand, if this relationship is not replicated it might suggest that adolescence is a time before urgency starts to be affected by drinking, and therefore represents a time that would be potentially good to intervene at since personality factors that perpetuate use are not yet solidified.

Furthermore, future research should also examine the integration of these theories with a heavier use population of those with AUDs. This would be an ideal population to test not only the hypothesis concerning negative urgency and coping motives, but to also potentially examine

the model characteristic of a shift from positive to negative urgency as described above. Since the Koobian model posits that shifts toward negative-affect based drinking are characteristic of those with AUD (Zorrilla & Koob, 2019), it would benefit future research to see if negative urgency does mediate the relationship between alcohol use and coping motives in such a population.

Being able to look at these research questions across different developmental periods could help to potentially identify where certain groups tend to fall within the Koobian model. For instance, perhaps the current sample of college students tends to fall within the binge/intoxication phase, and maybe AUD samples would exhibit increased negative urgency that placed them in the negative affect, withdrawal phase. Furthermore, future research could begin to examine whether increases in these urgency traits tend to interrupt the “maturing out” phenomenon described above. In this way alcohol use’s effect on urgency would serve to perpetuate future use. If the theories initially suggested by this line of research are supported it could then potentially help guide intervention and prevention efforts in the future, through identifying the mechanisms by which alcohol use affects drinking motives, and thereby providing evidence for the utility of targeted interventions that consider individual differences in personality traits like urgency.

4.1 Limitations

Despite potential implications that warrant future research, this study is not without limitations. In addition to limitations related to the sample, longitudinal timespan, and limited change in key variables discussed above, other limitations could have influenced study findings. For example, data were obtained through self-report and therefore are limited by participants’ openness, willingness to report, self-awareness, and social desirability. It is possible that participants are not always fully aware of their drinking quantity and frequency, as they were assessed retrospectively, or are not completely willing to divulge the extent to which they may engage in drinking and could therefore underreport their drinking for a variety of reasons both conscious and unconscious. If participants’ reports are not entirely accurate this could potentially contribute to limited variability in study variables and make it difficult to be adequately powered to test study hypotheses. Therefore, it might be beneficial for future studies to consider alternative means of assessing alcohol use and other key variables in the moment through use of

Ecological Momentary Assessment (EMA). This could help minimize the issue of retrospective reporting, and also provide participants with a way to document their alcohol use and motives to drink as they occur.

Another limitation of the study is the limited racial/ethnic diversity of the sample (88% white), which could limit generalizability of any findings; in future research it will be important to actively recruit a more diverse sample. Some research has demonstrated measurement invariance of UPPS impulsivity measures and that the relationship between UPPS traits and substance use appears invariant across racial and ethnic minority groups (Liu, 2021). However, this needs to be tested more systematically and with prospective data. If the UPPS traits do not relate to substance use similarly across racial and ethnic groups, it would strongly question the appropriateness of asking these questions in such groups. However, if results were replicated in more diverse samples, this would be an interesting finding for future research, as it could suggest that something about urgency in this integrated model does translate across race and ethnicity.

Another potential limitation of this study was in how I measured alcohol use. I used a two-item combined drinking quantity and frequency measure and this could potentially miss some important nuances of drinking behavior. For instance, I did not have information on drinking patterns, such as weekend versus weekday drinking or binge drinking episodes. Previous research has found that in a sample of freshmen college students, drinking frequency significantly increased during the weekend (Thursday-Sunday) as compared to weekdays, and that endorsed drinking varied considerably from week to week (Del Boca et al., 2004). This could make it difficult for participants to report on their general drinking quantity and frequency if it is more highly situational and variable. Additionally, it might be more important to measure alcohol related consequences and risky behavior in combination with alcohol use itself, since these outcomes would be important markers of individuals at risk for developing harmful patterns of use.

The way I measured alcohol use also did not specifically take into account or code for events that may affect drinking such as holidays, spring break, or end of semester final exams. Del Boca and colleagues (2004) also found that drinking quantity significantly increased during specific events and holidays throughout the year (e.g., Spring Break, New Year's week, Thanksgiving, and Halloween). Results of their study also found that drinking was endorsed more frequently and at higher rates during times were usual responsibilities or contingencies

were lower, such as on weekends, holidays, and at the start of the semester, whereas drinking frequency was lowest during exam periods. However, the language of questions was phrased in a way where participants were instructed to answer on their overall patterns of drinking, rather than their drinking at any particular day or week. But it is important to note that if survey timepoints (e.g., Time 2 at the end of the fall semester and Time 3 at the end of the spring semester) fell during final exams this could potentially bias participants toward reporting less alcohol use. If this was the case then perhaps alcohol use may have been underreported, which could have contributed to the lower mean alcohol use across all three timepoints in the sample, and therefore made it more difficult to detect change as it did not differ greatly between timepoints.

4.2 Conclusions

Overall, this study represents a novel integration of the Koobian model of AUD with both urgency theory and drinking motives that extends our understanding of how alcohol use might drive subsequent changes in urgency and drinking motives. This work extends existing work with urgency theory, which has primarily focused on the effects of urgency on subsequent alcohol consumption and only recently begun to examine the reciprocal relationship between alcohol use and urgency. Results from this study found support for the idea that alcohol use might drive subsequent changes in positive urgency, which might further drive specific drinking motives. This is an important finding to be further explored and replicated in future research as it begins to suggest that personality traits might be changed by alcohol use, even over a relatively short time period at relatively low levels of drinking, which can confer additional risk for developing problematic patterns of drinking consistent with AUD. Understanding how alcohol use drives subsequent changes in negative urgency and drinking motives in a later developmental stages or in the context of higher drinking levels might help to better identify mechanisms contributing increased risk for transition to problematic levels of alcohol consumption, begin to better identify those at risk for AUD, and could set the stage to better integrate urgency theory with the well-established Koobian model.

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TABLES

Table 1. Means and standard deviations of study variables across imputations

Variable	Unimputed			Imputation 1			Imputation 2			Imputation 3			Imputation 4			Imputation 5		
	M	SD	α	M	SD	α	M	SD	α	M	SD	α	M	SD	α	M	SD	α
Alcohol Use T1	11.26	7.44	.886	11.22	7.44	.883	11.23	7.43	.878	11.28	7.43	.881	11.29	7.43	.883	11.26	7.42	.878
Positive Urgency T1	1.73	0.57	.934	1.74	0.57	.931	1.74	0.57	.931	1.74	0.57	.931	1.74	0.57	.932	1.74	0.57	.931
Negative Urgency T1	2.26	0.59	.881	2.25	0.59	.879	2.25	0.59	.879	2.25	0.59	.878	2.25	0.59	.880	2.25	0.59	.878
Enhancement Motives T1	2.46	1.28	.935	2.47	1.28	.933	2.47	1.28	.934	2.47	1.28	.934	2.47	1.28	.934	2.47	1.28	.934
Coping Motives T1	1.80	0.91	.876	1.79	0.90	.865	1.79	0.90	.870	1.79	0.90	.870	1.79	0.90	.867	1.79	0.90	.866
Alcohol Use T2	11.99	7.51	.910	12.18	7.69	.868	11.54	7.33	.680	12.14	8.18	.880	11.92	7.55	.829	11.95	7.45	.812
Positive Urgency T2	1.72	0.59	.944	1.80	0.62	.928	1.82	0.64	.926	1.83	0.64	.928	1.81	0.62	.928	1.82	0.63	.930
Negative Urgency T2	2.23	0.58	.892	2.26	0.59	.867	2.27	0.60	.875	2.25	0.58	.861	2.25	0.58	.855	2.25	0.58	.863
Alcohol Use T3	12.12	7.55	.899	11.96	8.38	.788	11.86	7.23	.548	11.30	7.36	.504	12.60	7.57	.691	12.19	7.74	.514
Positive Urgency T3	1.74	0.56	.939	2.03	0.68	.914	1.96	0.60	.890	1.83	0.64	.926	2.00	0.64	.900	1.94	0.59	.901
Negative Urgency T3	2.21	0.56	.884	2.31	0.52	.764	2.31	0.53	.780	2.27	0.51	.761	2.28	0.51	.750	2.28	0.51	.768
Enhancement Motives T3	2.57	1.26	.930	2.75	1.14	.823	2.76	1.14	.815	2.78	1.14	.864	2.75	1.14	.842	2.83	1.21	.868
Coping Motives T3	1.89	0.90	.878	2.33	1.05	.810	2.33	1.08	.802	2.31	1.04	.830	2.34	1.12	.835	2.34	1.09	.862

Table 2. F tests of study variables across imputations

Variable	Unimputed		Imputation 1		Imputation 2		Imputation 3		Imputation 4		Imputation 5	
	F	p	F	p	F	p	F	p	F	p	F	p
Alcohol Use	7.60*	<.001	5.03*	.007	2.33	.098	4.55*	.011	9.16*	<.001	4.33*	.013
Positive Urgency	.08	.923	43.20*	<.001	28.05*	<.001	57.04*	<.001	34.03*	<.001	23.47*	<.001
Negative Urgency	3.6*	.028	3.1*	.046	2.77	.063	.22	.803	.73	.484	.79	.454
Enhancement Motives	2.53	.113	27.04*	<.001	28.22	<.001	32.56	<.001	29.72	<.001	35.91	<.001
Coping Motives	3.85	.051	104.39*	<.001	98.83*	<.001	90.04*	<.001	109.76*	<.001	97.85*	<.001

*Significant at p<.05 level

Table 3. Post hoc contrasts of study variables across imputations

Variable	Unimputed		Imputation 1		Imputation 2		Imputation 3		Imputation 4		Imputation 5	
	I-J	<i>p</i>	I-J	<i>p</i>	I-J	<i>p</i>	I-J	<i>p</i>	I-J	<i>p</i>	I-J	<i>p</i>
Alcohol Use												
Time 3-1	.77*	.002	.74*	.050	.63	.069	.02	.96	1.31	<.001	.93*	.017
Time 3-2	.12	.551	-.22	.477	.32	.303	-.84*	.007	.68*	.044	.24	.505
Positive Urgency												
Time 3-1	-.01	.821	.29*	<.001	.23*	<.001	.36*	<.001	.26*	<.001	.21*	<.001
Time 3-2	.01	.873	.23*	<.001	.14*	<.001	.27*	<.001	.19*	<.001	.13*	<.001
Negative Urgency												
Time 3-1	-.07*	.020	.06*	.040	.06*	.038	.01	.673	.03	.377	.02	.424
Time 3-2	-.02	.460	.05*	.049	.04	.109	.02	.525	.03	.277	.03	.227
Enhancement Motives												
Time 3-1	.08	.113	.28*	<.001	.30*	<.001	.31*	<.001	.29*	<.001	.36*	<.001
Coping Motives												
Time 3-1	.09	.051	.54*	<.001	.54*	<.001	.52*	<.001	.58*	<.001	.55*	<.001

*Significant at $p < .05$ level

Table 4. Pooled correlation matrix of study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender	-														
2. Race	.045	-													
3. Alcohol Use T1	.038	-.150**	-												
4. Alcohol Use T2	.052	-.099	.796**	-											
5. Alcohol Use T3	.043	-.087	.535**	.627**	-										
6. Negative Urgency T1	.020	-.054	.276**	.202**	.164**	-									
7. Negative Urgency T2	.020	-.075	.231**	.205**	.193**	.716**	-								
8. Negative Urgency T3	.045	-.069	.208**	.191**	.198**	.479**	.570**	-							
9. Positive Urgency T1	.153**	-.063	.287**	.224**	.195**	.610**	.485**	.339**	-						
10. Positive Urgency T2	.168**	.010	.223**	.219**	.173	.410**	.603**	.380**	.564**	-					
11. Positive Urgency T3	.162**	.015	.150**	.124*	.137	.238**	.291**	.536**	.337**	.420**	-				
12. Coping Motives T1	-.017	-.068	.603**	.479**	.367**	.457**	.352**	.311**	.431**	.302**	.222**	-			
13. Coping Motives T3	.046	-.048	.275**	.257**	.302**	.206**	.238**	.402**	.158**	.238**	.591**	.380**	-		
14. Enhancement Motives T1	.053	-.120*	.821**	.692**	.485**	.250**	.214**	.177**	.288**	.185**	.126*	.582**	.273**	-	
15. Enhancement Motives T3	.010	-.112*	.500**	.500**	.541**	.176**	.177**	.262**	.169**	.188**	.336**	.328**	.550**	.576**	-

*Significant at $p < .05$ level

Table 5. Aim 1 Summary of pooled regression results

	B	SE	p-level
<i>Dependent Variable: Positive Urgency Time 3</i>			
Step One			
Gender	.237	.076	.002*
Race	.018	.101	.862
Step Two			
Gender	.161	.074	.030*
Race	.075	.097	.436
Alcohol Use Time 1	.005	.004	.278
Positive Urgency Time 1	.343	.062	<.001*
Step Three			
Gender	.159	.074	.032*
Race	.074	.097	.448
Alcohol Use Time 1	.004	.009	.668
Positive Urgency Time 1	.343	.062	<.001*
Alcohol Use Time 2	.001	.010	.909
<i>Dependent Variable: Negative Urgency Time 3</i>			
Step One			
Gender	.055	.063	.385
Race	-.113	.091	.218
Step Two			
Gender	.036	.057	.532
Race	-.056	.084	.509
Alcohol Use Time 1	.005	.004	.158
Negative Urgency Time 1	.400	.062	<.001*
Step Three			
Gender	.032	.056	.566
Race	-.059	.083	.481

Table 5 continued

Alcohol Use Time 1	.000	.006	.945
Negative Urgency Time 1	.402	.061	<.001*
Alcohol Use Time 2	.007	.006	.285

*Significant at p<.05 level

Table 6. Aim 2 Summary of pooled regression results

	B	SE	p-level
<i>Dependent Variable: Enhancement Motives Time 3</i>			
Step One			
Gender	.035	.143	.809
Race	-.401	.191	.037*
Step Two			
Gender	-.055	.126	.665
Race	-.152	.165	.360
Positive Urgency Time 1	.004	.099	.967
Enhancement Motives Time 1	.511	.048	<.001*
Step Three			
Gender	-.079	.127	.538
Race	-.173	.168	.306
Positive Urgency Time 1	-.139	.110	.208
Enhancement Motives Time 1	.508	.047	<.001*
Positive Urgency Time 2	.231	.098	.019*
<i>Dependent Variable: Coping Motives Time 3</i>			
Step One			
Gender	.109	.148	.464
Race	-.166	.174	.339
Step Two			
Gender	.115	.140	.418
Race	-.082	.165	.619
Negative Urgency Time 1	.088	.101	.387
Coping Motives Time 1	.420	.075	<.001*
Step Three			
Gender	.114	.140	.419
Race	-.063	.163	.698

Table 6 continued

Negative Urgency Time 1	-.118	.141	.406
Coping Motives Time 1	.414	.073	<.001*
Negative Urgency Time 2	.299	.140	.035*

*Significant at $p < .05$ level

Table 7. Full Aim 1 Analyses for Original and Imputed Datasets – Positive Urgency

	B	SE	Beta	p-level	R ²	R ² change	p
<i>Original Data</i>							
<i>Dependent Variable: Positive Urgency Time 3</i>							
Step One					.034	.034	.008*
Gender	.244	.079	.185	.002*			
Race	.001	.106	.001	.992			
Step Two					.345	.310	<.001*
Gender	.115	.066	.087	.083			
Race	.068	.088	.038	.441			
Alcohol Use Time 1	.007	.004	.097	.064			
Positive Urgency Time 1	.512	.050	.530	<.001*			
Step Three					.347	.003	.295
Gender	.119	.066	.091	.072			
Race	.067	.088	.038	.447			
Alcohol Use Time 1	.000	.008	-.006	.956			
Positive Urgency Time 1	.513	.050	.531	<.001*			
Alcohol Use Time 2	.009	.008	.115	.295			
<i>Imputation 1</i>							
<i>Dependent Variable: Positive Urgency Time 3</i>							
Step One					.027	.027	.004*
Gender	.254	.077	.163	.001*			
Race	.031	.103	.015	.761			
Step Two					.108	.081	<.001*
Gender	.181	.075	.116	.016*			
Race	.085	.100	.041	.395			
Alcohol Use Time 1	.005	.005	.053	.285			
Positive Urgency Time 1	.321	.059	.270	<.001*			
Step Three					.109	.000	.819
Gender	.180	.075	.116	.017*			
Race	.085	.100	.041	.395			

Table 7 continued

Alcohol Use Time 1	.004	.007	.039	.622			
Positive Urgency Time 1	.321	.059	.270	<.001*			
Alcohol Use Time 2	.002	.007	.018	.819			
<hr/>							
<i>Imputation 2</i>							
<i>Dependent Variable: Positive Urgency Time 3</i>							
<hr/>							
Step One					.025	.025	.006*
Gender	.220	.069	.158	.001*			
Race	.001	.092	.001	.990			
Step Two					.161	.136	<.001*
Gender	.137	.065	.099	.035*			
Race	.062	.087	.033	.473			
Alcohol Use Time 1	.004	.004	.051	.292			
Positive Urgency Time 1	.378	.051	.357	<.001*			
Step Three					.164	.003	.199
Gender	.138	.065	.099	.033*			
Race	.063	.087	.034	.465			
Alcohol Use Time 1	.012	.007	.152	.100			
Positive Urgency Time 1	.378	.051	.356	<.001*			
Alcohol Use Time 2	-.010	.007	-.117	.199			
<hr/>							
<i>Imputation 3</i>							
<i>Dependent Variable: Positive Urgency Time 3</i>							
<hr/>							
Step One					.020	.020	.017*
Gender	.246	.086	.142	.004*			
Race	.009	.115	.004	.938			
Step Two					.094	.074	<.001*
Gender	.170	.084	.098	.043*			
Race	.067	.112	.029	.549			
Alcohol Use Time 1	.005	.005	.054	.282			
Positive Urgency Time 1	.339	.067	.256	<.001*			
Step Three					.099	.005	.133

Table 7 continued

Gender	.157	.084	.091	.063
Race	.062	.112	.027	.579
Alcohol Use Time 1	-.001	.007	-.008	.907
Positive Urgency Time 1	.337	.066	.254	<.001*
Alcohol Use Time 2	.009	.006	.095	.133

Imputation 4

Dependent Variable: Positive Urgency Time 3

Step One					.026	.026	.005*
Gender	.239	.073	.161	.001*			
Race	.017	.098	.009	.863			
Step Two					.127	.101	<.001*
Gender	.164	.070	.111	.020*			
Race	.078	.094	.039	.408			
Alcohol Use Time 1	.006	.004	.067	.176			
Positive Urgency Time 1	.334	.055	.298	<.001*			
Step Three					.127	.000	.962
Gender	.164	.070	.111	.020*			
Race	.078	.094	.039	.412			
Alcohol Use Time 1	.005	.007	.063	.461			
Positive Urgency Time 1	.334	.055	.298	<.001*			
Alcohol Use Time 2	.000	.007	.004	.962			

Imputation 5

Dependent Variable: Positive Urgency Time 3

Step One					.029	.029	.003*
Gender	.228	.067	.168	<.001*			
Race	.029	.089	.016	.745			
Step Two					.147	.118	<.001*
Gender	.152	.064	.112	.017*			
Race	.084	.085	.046	.322			
Alcohol Use Time 1	.004	.004	.049	.313			

Table 7 continued

Positive Urgency Time 1	.344	.050	.332	<.001*			
Step Three					.148	.001	.501
Gender	.153	.064	.113	.016*			
Race	.080	.085	.044	.352			
Alcohol Use Time 1	.000	.007	-.005	.956			
Positive Urgency Time 1	.345	.051	.333	<.001*			
Alcohol Use Time 2	.005	.007	.062	.501			

*Significant at p<.05 level

Table 8. Full Aim 1 Analyses for Original and Imputed Datasets – Negative Urgency

	B	SE	Beta	p-level	R ²	R ² change	p
<i>Original Data</i>							
<i>Dependent Variable: Negative Urgency Time 3</i>							
Step One					.012	.012	.187
Gender	.074	.081	.056	.363			
Race	-.179	.108	-.101	.098			
Step Two					.447	.434	<.001*
Gender	-.026	.062	-.019	.674			
Race	-.085	.082	-.048	.302			
Alcohol Use Time 1	.008	.004	.107	.027*			
Negative Urgency Time 1	.592	.045	.628	<.001*			
Step Three					.452	.005	.352
Gender	-.020	.061	-.015	.740			
Race	-.080	.082	-.045	.328			
Alcohol Use Time 1	-.003	.008	-.039	.708			
Negative Urgency Time 1	.596	.045	.631	<.001*			
Alcohol Use Time 2	.012	.008	.162	.118			
<i>Imputation 1</i>							
<i>Dependent Variable: Negative Urgency Time 3</i>							
Step One					.005	.005	.352
Gender	.063	.060	.053	.291			
Race	-.083	.080	-.052	.301			
Step Two					.225	.219	<.001*
Gender	.045	.053	.037	.401			
Race	-.030	.072	-.018	.680			
Alcohol Use Time 1	.004	.003	.063	.175			
Negative Urgency Time 1	.394	.040	.449	<.001*			
Step Three					.218	.003	.234
Gender	.042	.053	.035	.430			
Race	-.029	.072	-.018	.683			

Table 8 continued

Alcohol Use Time 1	.000	.005	-.006	.936			
Negative Urgency Time 1	.396	.040	.451	<.001*			
Alcohol Use Time 2	.006	.005	.086	.234			
<hr/>							
<i>Imputation 2</i>							
<i>Dependent Variable: Negative Urgency Time 3</i>							
<hr/>							
Step One					.010	.010	.123
Gender	.053	.061	.043	.383			
Race	-.155	.082	-.094	.059			
Step Two					.231	.221	<.001*
Gender	.033	.054	.027	.537			
Race	-.106	.073	-.064	.149			
Alcohol Use Time 1	.003	.003	.043	.349			
Negative Urgency Time 1	.410	.041	.458	<.001*			
Step Three					.233	.002	.329
Gender	.033	.054	.027	.546			
Race	-.106	.073	-.065	.147			
Alcohol Use Time 1	-.002	.006	-.031	.730			
Negative Urgency Time 1	.410	.041	.459	<.001*			
Alcohol Use Time 2	.006	.006	.085	.329			
<hr/>							
<i>Imputation 3</i>							
<i>Dependent Variable: Negative Urgency Time 3</i>							
<hr/>							
Step One					.007	.007	.228
Gender	.070	.060	.058	.242			
Race	-.105	.080	-.065	.190			
Step Two					.182	.175	<.001*
Gender	.054	.054	.045	.321			
Race	-.050	.074	-.031	.498			
Alcohol Use Time 1	.006	.003	.088	.065			
Negative Urgency Time 1	.339	.041	.387	<.001*			
Step Three					.196	.013	.010*

Table 8 continued

Gender	.039	.054	.033	.474
Race	-.055	.073	-.034	.450
Alcohol Use Time 1	-.001	.004	-.013	.828
Negative Urgency Time 1	.343	.041	.391	<.001*
Alcohol Use Time 2	.010	.004	.154	.010*

*Imputation 4**Dependent Variable: Negative Urgency Time 3*

Step One					.005	.005	.382
Gender	.066	.059	.056	.264			
Race	-.069	.079	-.044	.383			
Step Two					.249	.245	<.001*
Gender	.045	.051	.038	.384			
Race	-.006	.070	-.004	.934			
Alcohol Use Time 1	.006	.003	.094	.040*			
Negative Urgency Time 1	.398	.039	.463	<.001*			
Step Three					.255	.006	.078
Gender	.045	.051	.038	.385			
Race	-.013	.070	-.008	.851			
Alcohol Use Time 1	-.001	.005	-.021	.795			
Negative Urgency Time 1	.401	.039	.466	<.001*			
Alcohol Use Time 2	.009	.005	.137	.078			

*Imputation 5**Dependent Variable: Negative Urgency Time 3*

Step One					.009	.009	.003*
Gender	.023	.059	.019	.699			
Race	-.152	.079	-.095	.057			
Step Two					.314	.305	<.001*
Gender	.002	.049	.001	.973			
Race	-.089	.067	-.056	.184			
Alcohol Use Time 1	.005	.003	.072	.097			

Table 8 continued

Negative Urgency Time 1	.460	.037	.530	<.001*			
Step Three					.315	.000	.677
Gender	.002	.049	.002	.965			
Race	-.091	.067	-.057	.175			
Alcohol Use Time 1	.003	.006	.042	.620			
Negative Urgency Time 1	.461	.037	.531	<.001*			
Alcohol Use Time 2	.002	.006	.035	.677			

*Significant at p<.05 level

Table 9. Full Aim 2 Analyses for Original and Imputed Datasets – Positive Urgency

	B	SE	Beta	p-level	R ²	R ² change	p
<i>Original Data</i>							
<i>Dependent Variable: Enhancement Motives Time 3</i>							
Step One					.013	.013	.160
Gender	.002	.182	.001	.993			
Race	-.473	.248	-.116	.057			
Step Two					.621	.607	<.001*
Gender	-.060	.115	-.020	.599			
Race	-.150	.155	-.037	.355			
Positive Urgency Time 1	-.102	.087	-.047	.245			
Enhancement Motives Time 1	.790	.039	.797	<.001*			
Step Three					.625	.004	.088
Gender	-.084	.115	-.028	.465			
Race	-.144	.155	-.035	.352			
Positive Urgency Time 1	-.225	.113	-.103	.048*			
Enhancement Motives Time 1	.790	.039	.797	<.001*			
Positive Urgency Time 2	.188	.110	.087	.088			
<i>Imputation 1</i>							
<i>Dependent Variable: Enhancement Motives Time 3</i>							
Step One					.008	.008	.186
Gender	.003	.132	.001	.979			
Race	-.324	.177	-.091	.067			
Step Two					.346	.337	<.001*
Gender	-.093	.109	-.035	.391			
Race	-.066	.145	-.019	.648			
Positive Urgency Time 1	.031	.086	.015	.719			
Enhancement Motives Time 1	.517	.038	.582	<.001*			
Step Three					.355	.009	.018*
Gender	-.122	.109	-.046	.263			
Race	-.081	.144	-.023	.573			

Table 9 continued

Positive Urgency Time 1	-.105	.103	-.052	.309			
Enhancement Motives Time 1	.515	.038	.579	<.001*			
Positive Urgency Time 2	.219	.092	.119	.018*			
<hr/>							
<i>Imputation 2</i>							
<i>Dependent Variable: Enhancement Motives Time 3</i>							
<hr/>							
Step One					.019	.019	.020*
Gender	-.120	.110	-.045	.275			
Race	-.493	.176	-.139	.005*			
Step Two					.329	.309	<.001*
Gender	-.120	.110	-.045	.275			
Race	-.246	.147	-.069	.096			
Positive Urgency Time 1	.056	.088	.028	.520			
Enhancement Motives Time 1	.492	.038	.553	<.001*			
Step Three					.342	.013	.005*
Gender	-.147	.110	-.055	.182			
Race	-.276	.146	-.078	.060*			
Positive Urgency Time 1	-.105	.104	-.052	.312			
Enhancement Motives Time 1	.490	.038	.551	<.001*			
Positive Urgency Time 2	.256	.090	.142	.005*			
<hr/>							
<i>Imputation 3</i>							
<i>Dependent Variable: Enhancement Motives Time 3</i>							
<hr/>							
Step One					.014	.014	.058
Gender	.055	.132	.021	.676			
Race	-.419	.176	-.118	.018*			
Step Two					.342	.328	<.001*
Gender	-.034	.109	-.013	.756			
Race	-.173	.146	-.049	.237			
Positive Urgency Time 1	.003	.087	.002	.969			
Enhancement Motives Time 1	.514	.038	.578	<.001*			
Step Three					.357	.014	.003*

Table 9 continued

Gender	-.059	.108	-.022	.587
Race	-.200	.144	-.056	.166
Positive Urgency Time 1	-.159	.101	-.078	.119
Enhancement Motives Time 1	.511	.037	.575	<.001*
Positive Urgency Time 2	.260	.087	.146	.003*

*Imputation 4**Dependent Variable: Enhancement Motives Time 3*

Step One					.013	.013	.076
Gender	.098	.132	.037	.457			
Race	-.386	.177	-.109	.029*			
Step Two					.377	.364	<.001*
Gender	.013	.106	.005	.902			
Race	-.125	.142	-.035	.380			
Positive Urgency Time 1	-.048	.083	-.024	.568			
Enhancement Motives Time 1	.548	.037	.615	<.001*			
Step Three					.384	.007	.037*
Gender	-.005	.106	-.002	.966			
Race	-.138	.141	-.039	.331			
Positive Urgency Time 1	-.156	.098	-.078	.112			
Enhancement Motives Time 1	.545	.037	.611	<.001*			
Positive Urgency Time 2	.183	.087	.100	.037*			

*Imputation 5**Dependent Variable: Enhancement Motives Time 3*

Step One					.010	.010	.127
Gender	.040	.140	.014	.778			
Race	-.382	.188	-.101	.043*			
Step Two					.263	.252	<.001*
Gender	-.039	.123	-.014	.752			
Race	-.151	.164	-.040	.357			
Positive Urgency Time 1	-.023	.098	-.010	.818			

Table 9 continued

Enhancement Motives Time 1	.483	.043	.510	<.001*			
Step Three					.273	.010	.020*
Gender	-.062	.123	-.022	.614			
Race	-.171	.164	-.045	.296			
Positive Urgency Time 1	-.170	.116	-.079	.143			
Enhancement Motives Time 1	.480	.043	.506	<.001*			
Positive Urgency Time 2	.238	.102	.123	.020*			

*Significant at p<.05 level

Table 10. Full Aim 2 Analyses for Original and Imputed Datasets – Negative Urgency

	B	SE	Beta	p-level	R ²	R ² change	p
<i>Original Data</i>							
<i>Dependent Variable: Coping Motives Time 3</i>							
Step One					.011	.011	.240
Gender	.044	.131	.021	.741			
Race	-.297	.176	-.105	.092			
Step Two					.413	.402	<.001*
Gender	-.035	.102	-.017	.731			
Race	-.105	.137	-.037	.443			
Negative Urgency Time 1	.092	.082	.062	.263			
Coping Motives Time 1	.601	.055	.605	<.001*			
Step Three					.413	.001	.595
Gender	-.031	.103	-.015	.760			
Race	-.099	.137	-.035	.474			
Negative Urgency Time 1	.046	.119	.031	.703			
Coping Motives Time 1	.600	.055	.603	<.001*			
Negative Urgency Time 2	.062	.117	.041	.595			
<i>Imputation 1</i>							
<i>Dependent Variable: Coping Motives Time 3</i>							
Step One					.003	.003	.539
Gender	.105	.120	.044	.383			
Race	-.118	.162	-.036	.467			
Step Two					.156	.153	<.001*
Gender	.110	.111	.046	.324			
Race	-.029	.150	-.009	.845			
Negative Urgency Time 1	.042	.091	.024	.642			
Coping Motives Time 1	.451	.061	.380	<.001*			
Step Three					.172	.017	.005*
Gender	.113	.110	.047	.306			
Race	-.011	.148	-.004	.939			

Table 10 continued

Negative Urgency Time 1	-.182	.120	-.104	.129
Coping Motives Time 1	.444	.061	.375	<.001*
Negative Urgency Time 2	.328	.116	.183	.005*

*Imputation 2**Dependent Variable: Coping Motives Time 3*

Step One					.001	.001	.749
Gender	.010	.124	.004	.933			
Race	-.126	.166	-.038	.448			
Step Two					.152	.151	<.001*
Gender	.019	.114	.008	.868			
Race	-.036	.154	-.011	.817			
Negative Urgency Time 1	.093	.093	.052	.319			
Coping Motives Time 1	.439	.063	.363	<.001*			
Step Three					.170	.018	.003*
Gender	.019	.113	.008	.868			
Race	-.020	.152	-.006	.895			
Negative Urgency Time 1	-.151	.124	-.083	.225			
Coping Motives Time 1	.430	.062	.355	<.001*			
Negative Urgency Time 2	.352	.119	.194	.003*			

*Imputation 3**Dependent Variable: Coping Motives Time 3*

Step One					.005	.005	.352
Gender	.075	.120	.031	.531			
Race	-.214	.161	-.066	.184			
Step Two					.122	.117	<.001*
Gender	.080	.113	.033	.480			
Race	-.139	.152	-.043	.360			
Negative Urgency Time 1	.118	.093	.067	.202			
Coping Motives Time 1	.364	.062	.308	<.001*			
Step Three					.129	.007	.083

Table 10 continued

Gender	.075	.113	.031	.505			
Race	-.124	.152	-.039	.413			
Negative Urgency Time 1	-.026	.124	-.015	.837			
Coping Motives Time 1	.363	.062	.307	<.001*			
Negative Urgency Time 2	.210	.121	.116	.083			
<hr/>							
<i>Imputation 4</i>							
<i>Dependent Variable: Coping Motives Time 3</i>							
<hr/>							
Step One					.005	.005	.366
Gender	.146	.128	.057	.255			
Race	-.154	.172	-.045	.371			
Step Two					.141	.136	<.001*
Gender	.151	.119	.059	.208			
Race	-.069	.160	-.020	.669			
Negative Urgency Time 1	.063	.097	.034	.517			
Coping Motives Time 1	.446	.066	.354	<.001*			
Step Three					.150	.009	.042*
Gender	.150	.119	.059	.207			
Race	-.055	.160	-.016	.732			
Negative Urgency Time 1	-.114	.130	-.061	.381			
Coping Motives Time 1	.438	.065	.347	<.001*			
Negative Urgency Time 2	.264	.129	.136	.042*			
<hr/>							
<i>Imputation 5</i>							
<i>Dependent Variable: Coping Motives Time 3</i>							
<hr/>							
Step One					.011	.011	.112
Gender	.209	.124	.084	.093			
Race	-.221	.167	-.066	.187			
Step Two					.140	.129	<.001*
Gender	.214	.116	.085	.067			
Race	-.138	.156	-.041	.377			
Negative Urgency Time 1	.122	.095	.067	.198			

Table 10 continued

Coping Motives Time 1	.399	.064	.325	<.001*			
Step Three					.155	.014	.009*
Gender	.215	.115	.086	.064			
Race	-.107	.156	-.032	.494			
Negative Urgency Time 1	-.117	.132	-.064	.374			
Coping Motives Time 1	.394	.063	.322	<.001*			
Negative Urgency Time 2	.339	.130	.180	.009*			

*Significant at p<.05 level

Table 11. Full Aim 3 Mediation Analyses for Original and Imputed Datasets – Positive Urgency

	B	SE	<i>p</i> - level	<i>R</i>	<i>R</i> ²	<i>p</i>	LLCI	ULCI
<i>Original Data</i>								
Dependent Variable: Positive Urgency Time 2				.687	.472	.000*		
Alcohol Use Time 1	.018	.006	.003*					
Gender	.134	.063	.034*					
Race	-.006	.085	.948					
Positive Urgency Time 1	.644	.048	.000*					
Enhancement Motives Time 1	-.078	.034	.023*					
Dependent Variable: Enhancement Motives Time 3				.796	.633	.000*		
Alcohol Use Time 1	.798	.200	.000*					
Positive Urgency Time 2	.141	.111	.205					
Gender	-.067	.114	.559					
Race	-.111	.154	.473					
Positive Urgency Time 1	-.211	.112	.061					
Enhancement Motives Time 1	.674	.062	.000*					
Indirect Effect	.0025	.0023					-.0012	.0077
<i>Imputation 1</i>								
Dependent Variable: Positive Urgency Time 2				.600	.360	.000*		
Alcohol Use Time 1	.012	.006	.047*					
Gender	.132	.059	.025*					
Race	.082	.078	.296					
Positive Urgency Time 1	.614	.047	.000*					
Enhancement Motives Time 1	-.044	.034	.199					
Dependent Variable: Enhancement Motives Time 3				.597	.356	.000*		
Alcohol Use Time 1	.010	.011	.349					

Table 11 continued

Positive Urgency Time 2	.210	.093	.024*		
Gender	-.119	.109	.274		
Race	-.069	.115	.633		
Positive Urgency Time 1	-.107	.103	.299		
Enhancement Motives Time 1	.467	.063	.000*		
Indirect Effect	.0025	.0018		-.0002	.0067

Imputation 2

Dependent Variable: Positive Urgency Time 2				.587	.344	.000*
Alcohol Use Time 1	.013	.006	.000*			
Gender	.104	.061	.086			
Race	.132	.081	.105			
Positive Urgency Time 1	.621	.048	.000*			
Enhancement Motives Time 1	-.052	.036	.144			
Dependent Variable: Enhancement Motives Time 3				.586	.344	.000*
Alcohol Use Time 1	.012	.011	.295			
Positive Urgency Time 2	.246	.090	.007*			
Gender	-.144	.110	.190			
Race	-.261	.147	.076			
Positive Urgency Time 1	-.107	.104	.302			
Enhancement Motives Time 1	.436	.064	.000*			
Indirect Effect	.0032	.0019		.0000	.0075	

*

Imputation 3

Dependent Variable: Positive Urgency Time 2				.575	.330	.000*
Alcohol Use Time 1	.013	.006	.043*			
Gender	.098	.062	.114			
Race	.122	.083	.143			

Table 11 continued

Positive Urgency Time 1	.615	.049	.000*			
Enhancement Motives Time 1	-.051	.036	.162			
Dependent Variable: Enhancement Motives Time 3				.598	.358	.000*
Alcohol Use Time 1	.008	.011	.475			
Positive Urgency Time 2	.253	.088	.004*			
Gender	-.057	.108	.597			
Race	-.190	.145	.191			
Positive Urgency Time 1	-.160	.102	.115			
Enhancement Motives Time 1	.475	.063	.000*			
Indirect Effect	.0032	.0019				.0001 .0075
	*					
<i>Imputation 4</i>						
Dependent Variable: Positive Urgency Time 2				.570	.325	.000*
Alcohol Use Time 1	.013	.006	.042*			
Gender	.098	.060	.105			
Race	.084	.081	.298			
Positive Urgency Time 1	.581	.048	.000*			
Enhancement Motives Time 1	-.041	.035	.247			
Dependent Variable: Enhancement Motives Time 3				.621	.386	.000*
Alcohol Use Time 1	.011	.011	.298			
Positive Urgency Time 2	.174	.088	.049*			
Gender	-.002	.106	.984			
Race	-.124	.142	.383			
Positive Urgency Time 1	-.158	.098	.107			
Enhancement Motives Time 1	.493	.062	.000*			
Indirect Effect	.0022	.0016				-.0003 .0059

Table 11 continued

Imputation 5

Dependent Variable: Positive Urgency Time 2				.585	.343	.000*		
Alcohol Use Time 1	.013	.006	.036*					
Gender	.099	.060	.100					
Race	.098	.081	.226					
Positive Urgency Time 1	.610	.048	.000*					
Enhancement Motives Time 1	-.045	.035	.198					
Dependent Variable: Enhancement Motives Time 3				.523	.273	.000*		
Alcohol Use Time 1	.005	.013	.701					
Positive Urgency Time 2	.234	.102	.023*					
Gender	-.061	.123	.620					
Race	-.165	.165	.316					
Positive Urgency Time 1	-.171	.116	.142					
Enhancement Motives Time 1	.457	.072	.000*					
Indirect Effect	.0030	.0019					.0000	.0074
	*							

*Significant at p<.05 level

Table 12. Full Aim 3 Mediation Analyses for Original and Imputed Datasets – Negative Urgency

	B	SE	p-level	R	R ²	p	LLCI	ULCI
<i>Original Data</i>								
Dependent Variable: Negative Urgency Time 2				.787	.619	.000*		
Alcohol Use Time 1	.006	.004	.153					
Gender	-.063	.054	.248					
Race	-.094	.073	.198					
Negative Urgency Time 1	.747	.043	.000*					
Coping Motives Time 1	-.006	.035	.855					
Dependent Variable: Coping Motives Time 3				.658	.433	.000*		
Alcohol Use Time 1	.022	.007	.003*					
Negative Urgency Time 2	.031	.116	.786					
Gender	-.039	.101	.698					
Race	-.057	.136	.675					
Negative Urgency Time 1	.082	.118	.489					
Coping Motives Time 1	.491	.065	.000*					
Indirect Effect	.0002	.0009					-.0015	.0022
<i>Imputation 1</i>								
Dependent Variable: Positive Urgency Time 2				.712	.507	.000*		
Alcohol Use Time 1	.000	.004	.930					
Gender	-.010	.048	.837					
Race	-.054	.064	.407					
Negative Urgency Time 1	.684	.039	.000*					
Coping Motives Time 1	.018	.032	.577					
Dependent Variable: Coping Motives Time 3				.424	.180	.000*		
Alcohol Use Time 1	.015	.008	.059					
Negative Urgency Time 2	.328	.116	.005*					
Gender	.099	.110	.367					

Table 12 continued

Race	.028	.149	.854		
Negative Urgency Time 1	-.181	.120	.131		
Coping Motives Time 1	.367	.073	.000*		
Indirect Effect	.0001	.0013		-.0027	.0026

Imputation 2

Dependent Variable: Negative Urgency Time 2				.718	.515	.000*
Alcohol Use Time 1	.001	.004	.803			
Gender	-.000	.048	.995			
Race	-.042	.065	.515			
Negative Urgency Time 1	.693	.039	.000*			
Coping Motives Time 1	.023	.032	.473			
Dependent Variable: Coping Motives Time 3				.413	.171	.000*
Alcohol Use Time 1	.003	.008	.735			
Negative Urgency Time 2	.352	.119	.003*			
Gender	.016	.114	.888			
Race	-.013	.154	.934			
Negative Urgency Time 1	-.150	.124	.227			
Coping Motives Time 1	.415	.076	.000*			
Indirect Effect	.0003	.0013			-.0026	.0029

Imputation 3

Dependent Variable: Negative Urgency Time 2				.712	.507	.000*
Alcohol Use Time 1	-.000	.003	.948			
Gender	.022	.047	.632			
Race	-.072	.064	.257			
Negative Urgency Time 1	.684	.038	.000*			
Coping Motives Time 1	.007	.031	.834			
Dependent Variable: Coping Motives Time 3				.364	.133	.000*

Table 12 continued

Alcohol Use Time 1	.011	.008	.207		
Negative Urgency Time 2	.211	.121	.082		
Gender	.066	.113	.562		
Race	-.097	.153	.528		
Negative Urgency Time 1	-.025	.124	.838		
Coping Motives Time 1	.310	.075	.000*		
Indirect Effect	.0000	.0008		-.0020	.0016

Imputation 4

Dependent Variable: .720 .519 **.000***

Negative Urgency Time 2

Alcohol Use Time 1	-.000	.003	.987
Gender	.001	.046	.990
Race	-.052	.063	.404
Negative Urgency Time 1	.671	.038	.000*
Coping Motives Time 1	.032	.031	.299

Dependent Variable: .390 .152 **.000***

Coping Motives Time 3

Alcohol Use Time 1	.008	.009	.363
Negative Urgency Time 2	.264	.129	.042*
Gender	.143	.119	.230
Race	-.034	.162	.833
Negative Urgency Time 1	-.113	.130	.384
Coping Motives Time 1	.397	.079	.000*

Indirect Effect .0000 .0010 -.0024 .0021

Imputation 5

Dependent Variable: .744 .554 **.000***

Negative Urgency Time 2

Alcohol Use Time 1	.003	.003	.433
Gender	-.005	.045	.908
Race	-.086	.060	.154
Negative Urgency Time 1	.707	.036	.000*

Table 12 continued

Coping Motives Time 1	.000	.029	.988			
Dependent Variable: Coping Motives Time 3				.399	.159	.000*
Alcohol Use Time 1	.013	.009	.135			
Negative Urgency Time 2	.331	.130	.011*			
Gender	.203	.116	.080			
Race	-.074	.157	.636			
Negative Urgency Time 1	-.111	.132	.402			
Coping Motives Time 1	.330	.076	.000*			
Indirect Effect	.0009	.0012			-.0015	.0034

*Significant at p<.05 level

FIGURES

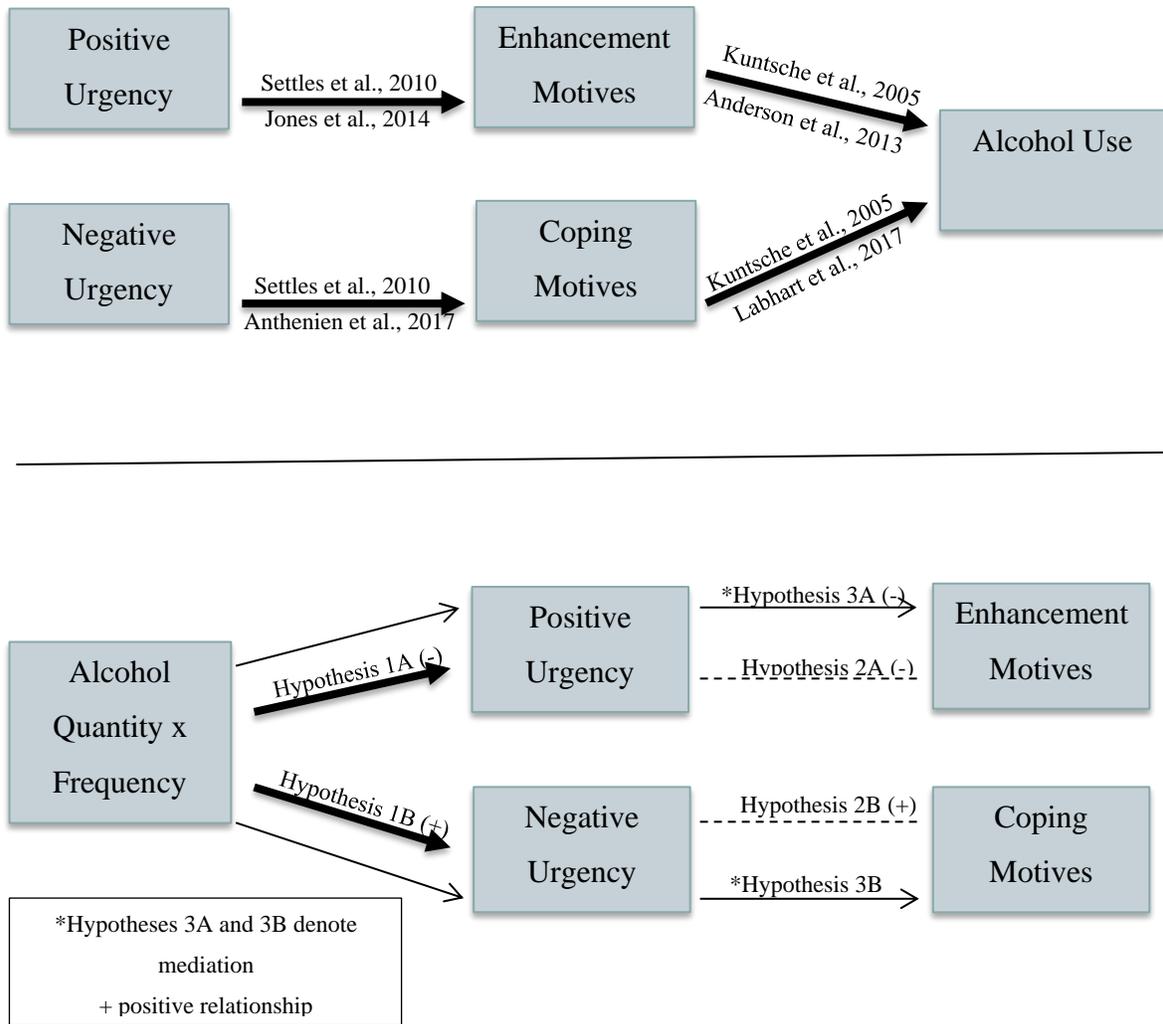


Figure 1. Theoretical Models

Top panel – Urgency theory examined in previous work, along with associated studies.

Bottom panel – Theoretical model guiding the current study and hypotheses.

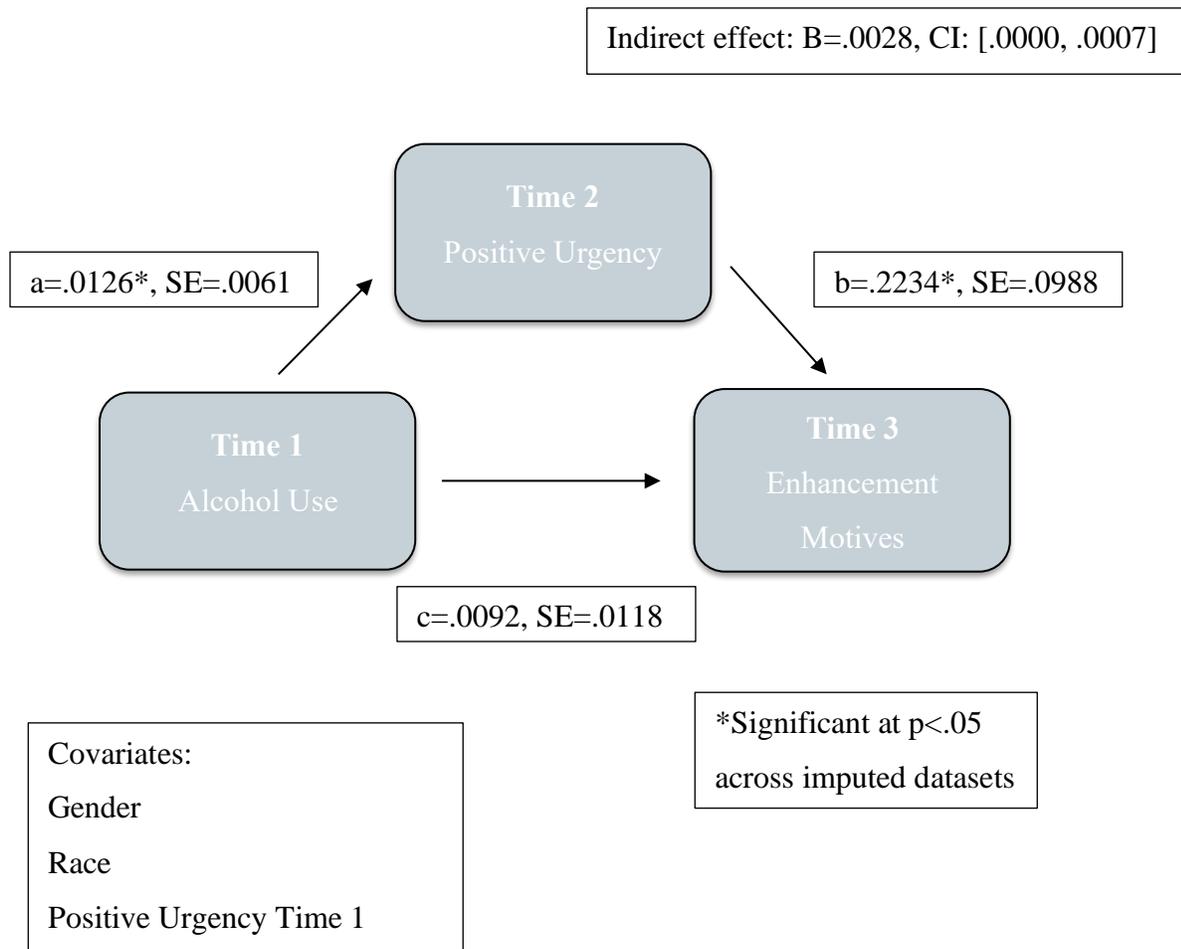


Figure 2. Pooled Mediation Model for Alcohol Use on Enhancement Motives through Positive Urgency

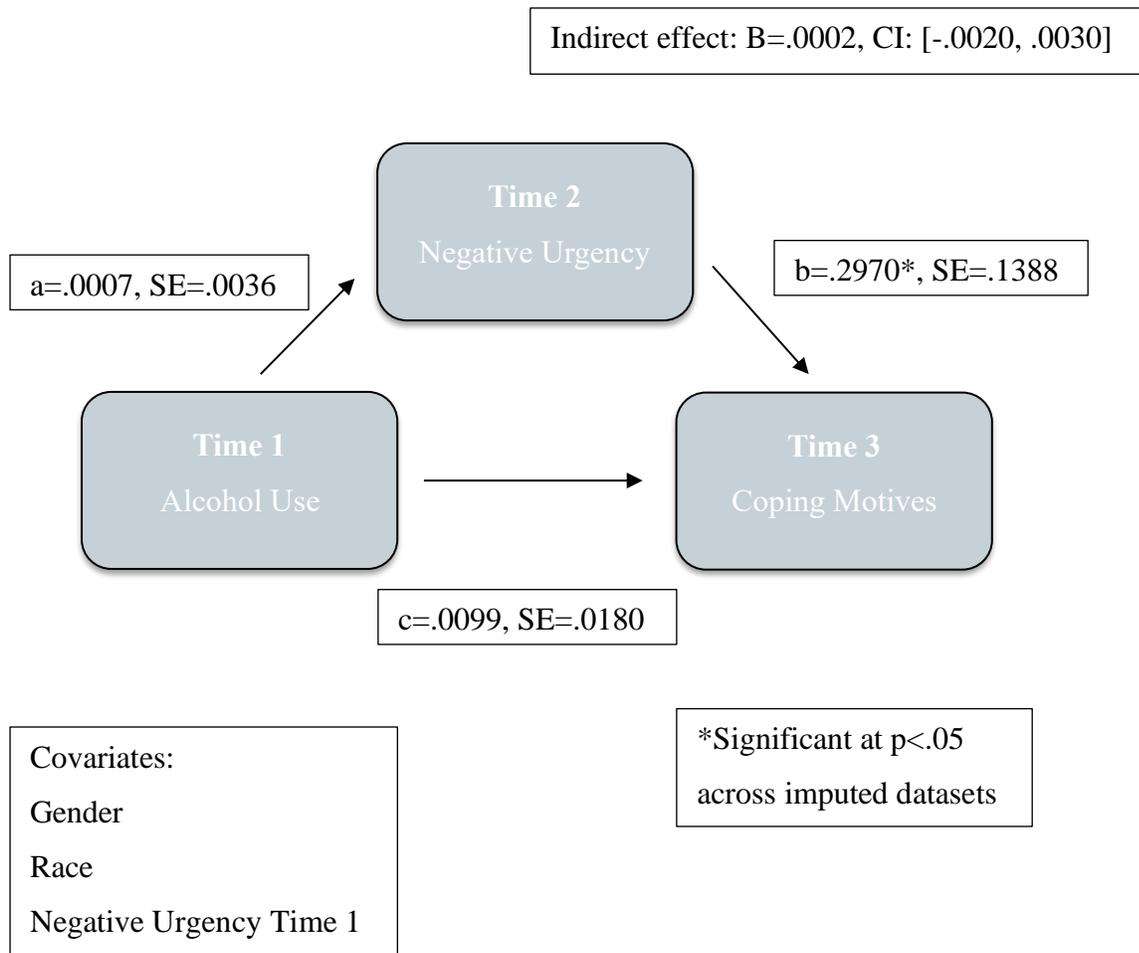


Figure 3. Pooled Mediation Model for Alcohol Use on Coping Motives through Negative Urgency