Published in final edited form as:

Subst Use Misuse. 2018 December 06; 53(14): 2386–2393. doi:10.1080/10826084.2018.1480036.

Bidirectional relations of impulsive personality and alcohol use across three waves of data collection

Alison J. Kaiser¹, Heather A. Davis², Richard Milich, Ph.D.², Gregory T. Smith², and Richard Charnigo³

¹University of Virginia Health System

²Department of Psychology, University of Kentucky

³Department of Biostatistics, University of Kentucky

Abstract

Objective: To explore the bidirectional relations between alcohol use and three impulsive personality traits, to advance understanding of risk processes. Participants: 525 college students (mean age = 18.95 years) recruited in August 2008 and 2009 and followed up annually for three years.

Methods: Personality and past/current substance use were assessed.

Results: T2 sensation seeking mediated the predictive relationship between T1 and T3 alcohol use, and T2 alcohol use mediated the predictive relationship between T1 and T3 sensation seeking. In addition, T2 alcohol problems mediated the predictive relationship between T1 alcohol use and T3 negative urgency.

Conclusions: Findings support a bidirectional relationship between sensation seeking and alcohol use, and drinking anticipates drinking problems, which predict increases in negative urgency. For some individuals, there appears to be an ongoing process of increased risk in the form of increases in both drinking and high-risk personality traits.

Keywords

impulsivity; alcohol use; college students; personality

Impulsigenic personality traits are related to a variety of negative mental health outcomes and risky behaviors (Fischer, Smith, & Cyders, 2008). There are multiple personality traits that dispose individuals to impulsive behavior (Whiteside & Lynam, 2001). For example, the UPPS model (Lynam, Smith, Whiteside, & Cyders, 2006) specifies five distinct impulsigenic traits: (lack of) premeditation, the tendency to act without consideration of

Corresponding Author: Richard Milich, Ph.D. 202A Kastle Hall, Department of Psychology, University of Kentucky, Lexington, KY, USA 40506 0044; milich@uky.edu; phone: 859-257-4396; fax: 859-323-1979.

Footnotes

¹-Including the insignificant paths in the model did not improve the fit. In an effort to be parsimonious, we removed the insignificant paths and only included paths that contributed to model variance.

The authors have no conflicts of interest to report.

potential outcomes; sensation seeking, the tendency to seek out novel or exciting experiences and a willingness to take risks to do so; (lack of) perseverance, difficulty persisting on dull tasks; negative urgency, the tendency to act rashly when experiencing negative affect; and positive urgency, the tendency to act rashly when experiencing positive affect. Meaningful differences among the UPPS traits in relation to outcomes of interest support the utility of the model (Lynam & Miller, 2004).

Historically, researchers and clinicians generally have agreed that impulsivity primarily represents a risk factor as opposed to being a result of problematic substance use (Verdejo-García, Behcara, Recknor, & Pérez-García, 2007). Indeed, negative urgency, lack of premeditation, and sensation seeking each predict unique variance in subsequent substance use (Horvath, Milich, Lynam, Leukefeld, & Clayton, 2004; Peterson & Smith, in press). However, research suggests that the relation may in fact be bidirectional (Horvath et al., 2004; Lejuez et al., 2010; Littlefield, Sher, & Wood, 2009; Peterson & Smith, in press; Riley, Rukavina, & Smith, 2016; Verdejo-García et al., 2007), with impulsigenic traits both increasing risk for, and being impacted by, substance use. Consistent with this idea, Littlefield et al. (2009) demonstrated that changes in personality and problem drinking co-occurred over time.

Just as several impulsigenic traits each predict unique variance in substance use behaviors, it may be that substance use impacts the different traits differently. This possibility is important to investigate. Understanding what mechanisms account for the influence of substance use on later impulsigenic traits may improve our ability to reduce risk transdiagnostically and counteract maladaptive personality change as a result of substance use.

Alcohol use may influence impulsigenic personality through its impact on the development of alcohol-related problems or alcohol use disorders. For example, the development of an alcohol use disorder is associated with a significant increase in verbal aggression and impulsiveness (Östlund, Hensing, Sundh, Spak, 2007). Observed longitudinal changes in impulsive personality as a result of substance use may reflect the onset of substance-related problems.

For two reasons, negative urgency may be the impulsigenic trait most likely to change following problem drinking. First, reciprocal relations between negative urgency and problem drinking have been demonstrated in adolescence (Riley et al., 2016). Second, negative urgency demonstrates robust relationships with substance use disorders and substance related problems (Fischer & Smith, 2008; Settles et al., 2012; Smith & Cyders, 2016; Verdejo-García et al., 2007).

A reciprocal relationship between alcohol use and personality may exist among young adults. Among early adolescents, drinking behavior and negative urgency predicted each other reciprocally over time (Riley et al., 2016); we tested whether the same was true for the college years. We also tested for a reciprocal relationship between alcohol use and sensation seeking: if alcohol use is reinforcing, it might heighten prior sensation seeking tendencies, which in turn might lead to more drinking.

Persons' perceptions of their friends' alcohol use can be understood to reflect social and environmental factors that may influence one's alcohol use. Peer norms for substance use have been found to influence individuals' substance use behaviors (Andrews, Tildesley, Hops, & Li, 2002; Fergusson, Swain-Campbell, & Horwood, 2001). Individuals tend to have friends whose levels of sensation seeking are similar to their own (Yanovitzky, 2006), and individuals with high levels of sensation seeking tend to have friends with higher rates of substance use (Romer & Hennessy, 2007). It may be that elevated peer drinking norms for substance abuse mark a context in which high levels of drinking are common, as well as a context in which high-risk, high-sensation behaviors are valued. If the latter is the case, peer drinking norms might mediate the predictive relationship between alcohol use and subsequent sensation seeking (Yanovitzky, 2006)

The current study used a three-year, three wave, longitudinal design to achieve the following aims. First, we examined the relation between impulsogenic traits and subsequent alcohol use. We predicted that the UPPS factors of sensation seeking, lack of premeditation, and negative urgency would predict alcohol use at subsequent time points. Second, we reversed the predictive direction and tested the prediction that alcohol use would predict increases in the same three traits. Third, we examined two possible reciprocal relationships: between alcohol use and (a) negative urgency and (b) sensation seeking. Fourth, we sought to examine whether alcohol-related problems accounted for the relation between Time (T1) alcohol use and Time 3 (T3) impulsogenic traits. We predicted that Time 2 (T2) alcohol-related problems would mediate the relation between T1 alcohol use and T3 negative urgency. Fifth, we tested the possibility that T2 peer drinking norms mediate the predictive effect from T1 drinking to T3 personality; we hypothesized this effect may be present for sensation seeking.

Methods

Participants

Participants were 525 college students (48.0% male; mean age = 18.95 years) from a public university in the southeastern U.S. Approximately 81% identified as Caucasian, 12% African-American, and 6% as other. "High risk" participants were identified via pre-study screening and were invited to enroll. The goal of this screening was to oversample "high risk" participants to ensure sufficient variability in substance use. Students in introductory psychology courses were administered a screening questionnaire during the first two weeks of the semester. The questionnaire used was developed by the study team and assessed the presence of conduct problem behaviors based upon the Diagnostic and Statistical Manual of Mental Disorders IV Conduct Disorder criteria (American Psychiatric Association, 2000), that occurred prior to age 18, such as stealing, lying, and fighting (12 items, $\alpha = .75$), and which may portend later substance use disorders. A composite score determined the distribution of scores for predicted substance use risk (calculated separately by gender). Whereas all first year introductory psychology students were eligible to participate, those whose scores fell within the top 25% for their gender on the high-risk status measure were specifically invited to participate through email. "High risk" participants made up 23.1% of the final sample

Measures

Impulsigenic personality.—The UPPS-P (Lynam et al., 2006) is a 59-item self-report inventory measuring negative urgency, (lack of) premeditation, (lack of) perseverance, sensation seeking, and positive urgency. Each item is rated on a 4-point scale and mean scores are calculated for each trait. The current study investigated the roles of negative urgency, sensation seeking, and lack of premeditation, as all three have predicted alcohol use prospectively in prior studies. The measure of each trait demonstrated good internal consistency ($\alpha = .84-.89$) and stability over 12 months (r values ranged from .70 to .88).

Alcohol use.—The Life History Calendar (LHC; Caspi et al., 1996) is a retrospective interview assessment for obtaining retrospective data on life events and health behaviors. Tests of reliability and validity for this measure have demonstrated good agreement between the measure and other reports of substance use (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001). In the current study, average weekly alcohol use showed good stability across the two 1-year time lags: T1 to T2: $r = .74$; T2 to T3: $r = .74$.

At T1, participants filled out the LHC on four month periods retrospectively, covering from the fall of 7th grade to the current time. At T2, participants reported on one-month periods dating back to the month of their T1 participation, and at T3, they reported on one-month periods dating back to the month of their T2 participation. For each period, data were collected regarding use, frequency, average amount, and/or highest amount for tobacco, alcohol, and marijuana. In the current study, we report only on use of alcohol from the current timepoint. That is, each alcohol use variable (T1, T2, T3) referred to the average amount a participant drank per week during the period in which they were assessed. Average weekly alcohol use at T1, T2, and T3 was estimated using the LHC items “Which of the following best describes how frequently you used alcohol during each of the months you drank?” and “Which of the following describes, on average, how much alcohol you used during the months that you drank?” From these responses, an average weekly count variable was computed by multiplying the frequency and average episodic amount, which resulted in an estimate of the number of drinks participants consumed on average in a week.

Alcohol problems.—The Alcohol Use Disorders Identification Test (Babor et al., 2001) is a 10-question screening instrument for identifying individuals at risk for hazardous drinking. Questions assess drinking behavior, adverse psychological reactions and drinking-related consequences. Eight of the 10 AUDIT items were used to create a composite score. The two items omitted from the composite score assessed frequency and average amount of alcohol use, and were not included due to the importance of distinguishing between alcohol use and alcohol problems in the analyses. The composite score had acceptable internal consistency (range of T1-T3 assessments: $\alpha = .72 - .75$).

Friend group norms.—The Peer Substance Use Questionnaire was created for use in the present study. At each time point, participants were asked to select their three closest friends and then asked questions regarding their friends’ use and attitudes toward use of various substances (alcohol, marijuana, tobacco, stimulants, cocaine, amphetamines, acid/LSD, ecstasy/MDMA, and club drugs). Participants were asked if their friends drank alcohol, and

if applicable how much/often their friends drank, with responses ranging from “less than once a month” (1) to “almost everyday, sometimes in large amounts” (7). The average score for a participant’s three friends was used as an indicator of friend alcohol norms for the analyses. This measure demonstrated good stability across the two 1-year time lags: T1 to T2: $r = .72$, T2 to T3: $r = .75$.

Procedure

The study was approved by the Institutional Review Board (IRB). Informed consent was obtained from participants at each assessment. Participants were recruited from introductory psychology courses and received course credit and monetary incentives for participation. Follow-up sessions occurred approximately one-year (T2) and two-years (T3) following initial participation (T1).

Data Analyses

Longitudinal structural equation modeling (SEM) was used to test research questions. Six variables at each of the three time points were included: negative urgency, sensation seeking, lack of premeditation, average weekly alcohol use, alcohol problems, and friend norms. Average weekly alcohol use was positively skewed and thus square-root transformed to make its distribution of scores more normal. The six T1 variables were allowed to covary, as were the disturbance terms among the T2 and among the T3 variables. Variables and error terms were not allowed to covary across time points.

Prospective pathways included in the model were as follows. First, we specified autoregressive pathways within all key variables (the three personality traits and alcohol use). Thus, this model involved each variable predicting itself at the next time point. Second, we modeled pathways from each of the T1 personality variables to T2 alcohol use, and from each of the T2 personality variables to T3 alcohol use. Third, we modeled pathways from T1 alcohol use to each of the T2 personality variables and from T2 alcohol use to each of the T3 personality variables. Fourth, we modeled pathways from (a) alcohol use at T1 or T2 to alcohol problems and friend norms the subsequent wave, and (b) alcohol problems and friend norms at T1 or T2 to alcohol use the subsequent wave. Fifth, we modeled pathways from personality at T1 or T2 to alcohol problems and friend norms the subsequent wave. Sixth, we modeled pathways from (a) alcohol problems and friend norms at T1 or T2 to personality the subsequent wave, (b) alcohol problems at T1 or T2 to friend norms the subsequent wave, and (c) friend norms at T1 or T2 to alcohol problems the subsequent wave.

As described below, when direct paths were present relating alcohol and personality, we tested mediation effects. We also tested whether T2 alcohol problems mediated the predictive influence of T1 alcohol use on T3 negative urgency. Because of the complexity of the models, pathways that were found to be non-significant in the full model were removed. Figure 1 depicts the resulting, reduced model.

To test mediation, the bias-correcting bootstrapping method available in Mplus was used. We anticipated small effect sizes in the prediction of personality change. Overall model fit was assessed using four indices: the Comparative Fit Index (CFI), the Normative Fit Index (NFI), the root mean square error of approximation (RMSEA), and the relative chi-square

(CMIN/df). CFI and NFI values above .95 represent a very good fit (Hu & Bentler, 1999), whereas RMSEA values of .08 or lower indicate acceptable fit (Little, 2013). CMIN/df values below 3 are considered to be adequate fit (Little, 2013). AMOS 22 was used to perform the SEM analysis.

Results

Follow-up and Retention

Of the 525 individuals who participated at T1, 459 (87%) participated again at T2 and 417 (79%) participated at T3. Analyses comparing retained and non-retained participants on demographic (gender, age, race) and other study variables indicated no significant differences (all p 's > .05). Therefore, data were assumed to be missing at random. Because excluding participants with incomplete data could bias results, the expectation maximization (EM) procedure was used to impute missing values. Thirty-eight participants who abstained from alcohol use at all three time points were excluded from the analyses.

Preliminary Analyses

Means and standard deviations for the variables of interest at each time point are listed in Table 1. Bivariate correlations between all study variables are presented in Table 2.

Personality Predicting Alcohol Use

For both prediction from T1 to T2 and from T2 to T3, sensation seeking was the only personality variable to predict alcohol use ($\beta = 0.06$, $p = .019$ and $\beta = 0.12$, $p < .001$, respectively).

Alcohol Use Predicting Personality

For both prediction from T1 to T2 and from T2 to T3, alcohol use significantly predicted all three personality variables (T1 to T2: negative urgency, $\beta = 0.14$, $p < .001$; sensation seeking, $\beta = 0.11$, $p = .001$; lack of premeditation, $\beta = 0.11$, $p = .002$; T2 to T3: negative urgency, $\beta = 0.14$, $p = .009$; sensation seeking, $\beta = 0.11$, $p < .001$; lack of premeditation, $\beta = 0.17$, $p < .001$).

Reciprocal Relationship between Alcohol Use and Personality

We considered three possible reciprocal relationships: (1) between negative urgency and alcohol use, (2) between sensation seeking and alcohol use, and (3) between lack of premeditation and alcohol use. Because neither negative urgency nor lack of premeditation predicted alcohol use prospectively, we ruled out reciprocal prediction with those traits. However, there was clear evidence of a reciprocal relationship between sensation seeking and alcohol use. T1 alcohol use predicted T2 sensation seeking, and T2 sensation seeking predicted T3 alcohol use. The test of sensation seeking as a mediator was significant: $B = .01$, $z = 2.44$, $p < .01$. Also, T1 sensation seeking predicted T2 alcohol use, which in turn predicted T3 sensation seeking: $B = .01$, $z = 2.39$, $p < .01$. Thus, alcohol use is associated with subsequent increases in sensation seeking, and sensation seeking is, in turn, associated with further increases in alcohol use.

Alcohol Problems as a Mediator

T1 alcohol use was found to be a significant predictor of alcohol problems at T2 ($\beta = .42, p < .001$). In turn, T2 alcohol problems were found to be a significant predictor of T3 negative urgency ($\beta = .15, p = .002$), but not of T3 sensation seeking or T3 lack of premeditation. The indirect pathway (T1 alcohol use to T2 alcohol problems to T3 negative urgency) was significantly greater than zero ($\beta = 0.16, p = .010$).

Friend Norms as a Mediator

Alcohol use at T1 predicted T2 friend norms for alcohol use ($\beta = .42, p < .001$). Counter to hypotheses, T2 friend norms for alcohol use significantly predicted T3 negative urgency ($\beta = -0.13, p = .002$) and T3 sensation seeking ($\beta = -0.10, p < .001$), but in the opposite direction from what was predicted. The relation between T2 friend norms and T3 lack of premeditation was not significant. Because the friend norm to personality pathways did not conform to predictions, friend drinking norms were ruled out as a potential mediator.

Model Fit

In the full model, fit was as follows: CMIN/df = 5.38, df = 69, CFI = 0.96, NFI = 0.95, RMSEA = 0.10. Model fit was somewhat improved in the reduced model, which was the basis for the reported results: CMIN/df = 4.23, df = 92, CFI = 0.96, NFI = 0.95, RMSEA = 0.08. Figure 1 depicts the reduced SEM model.

Conclusion

The present study sought to examine the bidirectional relations of alcohol use with impulsive personality in a longitudinal sample of college students with a focus on clarifying the mechanism(s) that might account for the impact of alcohol use on later impulsivity. Notable findings of the present research include: 1) the longitudinal impact of alcohol use on all three of the impulsogenic traits, 2) the mediating role of alcohol-related problems in the relation between alcohol use and subsequent negative urgency, and 3) the reciprocal relationship in which alcohol use and sensation seeking each predicted increases in the other. The possibility that elevations in alcohol use and in sensation seeking each predict increases in the other is important for both alcohol-specific and transdiagnostic risk.

It may be that personality helps shape individuals' experiences of alcohol use. Perhaps sensation seeking but not negative urgency predicts positive drinking experiences, such as feeling more sociable, which in turn leads to higher levels of consumption (Park, Kim, Gellis, Zaso, & Maisto, 2014). In contrast to sensation seeking, negative urgency predicts negative consequences of alcohol use, which did not predict increases in consumption in the current sample. Sensation seeking may have emerged as the better predictor of alcohol use in the current study because it better predicts the types of experiences that make individuals more likely to drink. This possibility merits further exploration, particularly because negative urgency has been shown to predict increased drinking quantity in college students (Settles, Cyders, & Smith, 2010) and increased drinking frequency among adolescents (Riley et al., 2016).

As hypothesized, alcohol use predicted increases in all three impulsive personality traits across both time lags. The effect of alcohol use on lack of premeditation and sensation seeking is consistent with the findings of Quinn and colleagues (2011), where heavy drinking was found to predict increases in both traits among college students. The current study further demonstrated that alcohol consumption also impacts negative urgency longitudinally, as previously shown in youth (Riley et al., 2016). Findings are consistent with the Correspondence Principle (Caspi, Roberts, & Shiner, 2005), which suggests that the traits that draw individuals to particular life experiences tend to be reinforced and deepened by these experiences. The results of the present study highlight the usefulness of examining the relations between personality traits and risky behavior using a longitudinal, bidirectional design.

Sensation seeking has been found to be more related to frequency/amount of alcohol use, whereas negative urgency is more related to alcohol problems (Coskunpinar, Dir & Cyders, 2013). This pattern was partially supported in our sample: negative urgency's cross-sectional correlations with alcohol problems (ranging from $r = .36$ to $r = .42$) were higher than those of sensation seeking (ranging from $r = .21$ to $r = .33$), though correlations of both traits with concurrent alcohol use were relatively similar.

Alcohol-related problems were found to mediate the relation between alcohol use and later negative urgency. Apparently individuals engaging in heavy alcohol use are at increased risk for the development of alcohol problems, and the onset of alcohol problems may make individuals more likely to engage in impulsive behaviors (i.e., consuming alcohol) when experiencing distress. As theorized elsewhere, it may be that heavy alcohol use provides immediate reinforcement in the form of distraction from distress, thus reinforcing the personality disposition to drink heavily when distressed, which is a defining feature of negative urgency (Riley & Smith, 2017). This could occur even when that use leads to problems. T3 sensation seeking and lack of premeditation were not significantly predicted by T2 alcohol problems in either model, suggesting that this mediating mechanism may be unique to negative urgency. Indeed, the possibility of increases in the tendency to seek out new or exciting experiences or to act without forethought as a result of alcohol-related problems seems less compelling.

Consistent with Quinn and colleagues (2011), friend norms for alcohol use did not account for the relation between alcohol use and personality. Friend alcohol norms predicted reductions in negative urgency and sensation seeking, when increases were hypothesized. We know of no prior studies relating friend norms to negative urgency, but past work has shown a positive relationship between sensation seeking and peer use (Park, Sher, & Krull, 2008). Thus, our non-hypothesized results merit both replication and a compelling theoretical framework before definitive conclusions can be drawn.

Limitations of the current study are as follows. The sample lacked sufficient racial and ethnic diversity to allow for an examination of these potential factors. Second, 23.1% of our final sample was recruited as high-risk due to conduct problems. Although this over-sampling is a study strength because it can permit identification of risk processes that are difficult to detect in a general population study, this sample does not represent a general

population of college students. It is important to note the findings described in this study demonstrated a process that is present and detectable when enough high-risk individuals are studied, and cannot be generalized to a general population of college students. Conduct problems tend to correlate with impulsogenic traits (Settles et al., 2012), so the sampling procedure may have resulted in higher levels of such traits than present in the general population. Additionally, self-report profiles of conduct problem behaviors were assessed using a questionnaire developed for the study; its validity is not known. Future studies should assess conduct problems using multiple valid methods to ensure high-risk status. Third, the Peer Substance Use questionnaire was developed for the present study to measure peer alcohol norms. Because it is the first use of the measure, it does not have the extensive validation history present for other measures used in the study (i.e., the LHC). Fourth, although a college student sample seemed well-suited to the research questions of interest, it should be noted that participants were not randomly selected from the entire population of young adults. The unique nature of the context experienced by college students may also have contributed to the observed changes in personality. Future studies may extend this research to non-college student populations.

Historically, risk research has focused on prediction of alcohol use from impulsogenic personality traits (Settles et al., 2010). The present study examined both prediction of personality change from drinking behavior and the presence of bidirectional associations between the two sets of variables. In this college student sample that included a substantial high-risk subgroup, alcohol use predicted increases in three impulsogenic traits, each of which increases risk transdiagnostically. Alcohol use and sensation seeking each predicted increases in the other. Evidence of relationships between alcohol use and multiple impulsogenic personality traits speaks to the potential value of multiple, trait-appropriate forms of intervention.

Acknowledgments:

Funding for this study was provided by NIDA grant DA005312 awarded to the University of Kentucky Center on Drug Abuse Research Translation (CDART).

References

- American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders: DSM-IV-TR Washington, DC: American Psychiatric Association.
- Andrews JA, Tildesley E, Hops H, & Li F (2002). The influence of peers on young adult substance use. *Health Psychology, 21*(4), 349–357. [PubMed: 12090677]
- Babor TF, Higgins-Biddle JC, Saunders JB, & Monteiro (2001) AUDIT: The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care, Second Edition, WHO Document No.WHO/MSD/MSB/01.6a, Geneva, Switzerland: World Health Organization.
- Caspi A, Moffitt TE, Thornton A, Freedman D, Amell JW, Harrington H, ... & Silva PA (1996). The life history calendar: a research and clinical assessment method for collecting retrospective event-history data. *International Journal of Methods in Psychiatric Research, 6*, 101–115.
- Caspi A, Roberts BW, & Shiner RL (2005). Personality development: Stability and change. *Annual Reviews of Psychology, 56*, 453–484.
- Coskunpinar A, Dir AL, & Cyders MA (2013). Multidimensionality in impulsivity and alcohol Use: a meta-analysis using the UPPS model of impulsivity. *Alcoholism: Clinical and Experimental Research, 37*(9), 1441–1450.

- Fergusson DM, Swain-Campbell NR, & Horwood LJ (2002). Deviant peer affiliations, crime and substance use: A fixed effects regression analysis. *Journal of abnormal child psychology*, 30(4), 419–430. [PubMed: 12108769]
- Fischer S, Smith GT, & Cyders MA (2008). Another look at impulsivity: A meta-analytic review comparing specific dispositions to rash action in their relationship to bulimic symptoms. *Clinical Psychology Review*, 28(8), 1413–1425. [PubMed: 18848741]
- Fischer S, & Smith GT (2008). Binge eating, problem drinking, and pathological gambling: Linking behavior to shared traits and social learning. *Personality and individual Differences*, 44(4), 789–800.
- Horvath LS, Milich R, Lynam D, Leukefeld C, & Clayton R (2004). Sensation seeking and substance use: a cross-lagged panel design. *Individual Differences Research*, 2(3), 175–183.
- Hu LT, & Bentler PM (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55.
- Lejuez CW, Magidson JF, Mitchell SH, Sinha R, Stevens MC, & De Wit H (2010). Behavioral and biological indicators of impulsivity in the development of alcohol use, problems, and disorders. *Alcoholism: Clinical and Experimental Research*, 34(8), 1334–1345.
- Little J (2013). Multilevel confirmatory ordinal factor analysis of the Life Skills Profile–16. *Psychological Assessment*, 25(3), 810–825. [PubMed: 23647047]
- Littlefield AK, Sher KJ, & Wood PK (2009). Is “maturing out” of problematic alcohol involvement related to personality change?. *Journal of Abnormal Psychology*, 118(2), 360–374. [PubMed: 19413410]
- Lynam DR, Smith GT, Whiteside SP, & Cyders MA (2006). The UPPS-P: Assessing five personality pathways to impulsive behavior West Lafayette, IN: Purdue University.
- Lynam DR, & Miller JD (2004). Personality pathways to impulsive behavior and their relations to deviance: Results from three samples. *Journal of Quantitative Criminology*, 20(4), 319–341.
- Östlund A, Hensing G, Sundh V, & Spak F (2007). Changes in some personality traits after recovery from alcohol dependence/abuse, anxiety and depression—Results of a 5-year follow-up in a general population sample of women. *Nordic Journal of Psychiatry*, 61(4), 279–287. [PubMed: 17763121]
- Park A, Kim J, Gellis LA, Zaso MJ, & Maisto SA (2014). Short-term prospective effects of impulsivity on binge drinking: Mediation by positive and negative drinking consequences. *Journal of American College Health*, 62(8), 517–525. [PubMed: 24901736]
- Park A, Sher KJ, & Krull JL (2008). Risky drinking in college changes as fraternity/sorority affiliation changes: a person-environment perspective. *Psychology of Addictive Behaviors*, 22(2), 219–229. [PubMed: 18540719]
- Peterson SJ, & Smith GT (in press). Application of the Expectancy Concept to Substance Use. In *The Oxford Handbook of Adolescent Substance Abuse*
- Quinn PD, Stappenbeck CA, & Fromme K (2011). Collegiate heavy drinking prospectively predicts change in sensation seeking and impulsivity. *Journal of Abnormal Psychology*, 120(3), 543–556. [PubMed: 21443288]
- Riley EN, Rukavina M, & Smith GT (2016). The reciprocal predictive relationship between high-risk personality and drinking: An 8-wave longitudinal study in early adolescents. *Journal of Abnormal Psychology*, 125(6), 798–804. [PubMed: 27505408]
- Riley EN, & Smith GT (2017). Childhood drinking and depressive symptom level predict harmful personality change. *Clinical Psychological Science*, 5, 85–97. [PubMed: 28392979]
- Romer D & Hennessy M *Prev Sci* (2007) 8: 89 <https://doi.org/10.1007/s11121-007-0064-7> [PubMed: 17286212]
- Settles RF, Cyders M, & Smith GT (2010). Longitudinal validation of the acquired preparedness model of drinking risk. *Psychology of Addictive Behaviors*, 24(2), 198–208. [PubMed: 20565146]
- Settles RE, Fischer S, Cyders MA, Combs JL, Gunn RL, & Smith GT (2012). Negative urgency: a personality predictor of externalizing behavior characterized by neuroticism, low conscientiousness, and disagreeableness. *Journal of Abnormal Psychology*, 121(1), 160–172. [PubMed: 21859164]

- Smith GT, & Cyders MA (2016). Integrating affect and impulsivity: The role of positive and negative urgency in substance use risk. *Drug and Alcohol Dependence*, 163, S3–S12. [PubMed: 27306729]
- Verdejo-García A, Bechara A, Recknor EC, & Pérez-García M (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence*, 91(2), 213–219. [PubMed: 17629632]
- Whiteside SP, & Lynam DR (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences*, 30(4), 669–689.
- Yanovitzky I (2006). Sensation seeking and alcohol use by college students: Examining multiple pathways of effects. *Journal of Health Communication*, 11(3), 269–280. [PubMed: 16624794]

Note: Error terms, stability coefficients, beta values, and covariances are not shown. Significant positive relations are shown as solid lines, and significant negative relations are shown as dashed lines. The meditational pathway is indicated with bolded lines.

Figure 1:
Bidirectional Model

Table 1.

Descriptive statistics at T1, T2, and T3

	T1 Mean (SD)	T1 Range	T2 Mean (SD)	T2 Range	T3 Mean (SD)	T3 Range
Negative urgency	2.23 (0.55)	1.00 – 3.92	2.27 (0.54)	1.00 – 4.00	2.28 (0.53)	1.00 – 3.83
Sensation seeking	3.00 (0.54)	1.25 – 4.00	3.00 (0.57)	1.17 – 4.00	3.00 (0.59)	1.08 – 4.00
Lack of premeditation	2.00 (0.45)	1.00 – 3.36	2.03 (0.45)	1.00 – 4.00	2.06 (0.44)	1.09 – 3.45
Alcohol use	5.95 (7.65)	0 – 45.00	6.43 (7.96)	0 – 45.00	6.36 (8.51)	0 – 56.00
Friend alcohol norms	2.73 (1.57)	0 – 7.00	3.02 (1.52)	0 – 6.67	3.14 (1.44)	0 – 6.00
Alcohol problems	4.41 (4.51)	0 – 23.00	4.52 (4.58)	0 – 20.00	4.66 (4.51)	0 – 18.00

Note: $n = 525$. Alcohol use indicates average number of drinks consumed per week.

Table 2.

Correlations among study variables at T1, T2, and T3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. T1 Alc	-																
2. T1 NU	.19*	-															
3. T1 SS	.28*	.06	-														
4. T1 LOP	.35*	.39*	.36*	-													
5. T1 FAN	.60*	.15*	.16*	.28*	-												
6. T1 AP	.57*	.36*	.21*	.34*	.54*	-											
7. T2 Alc	.74*	.19*	.26*	.27*	.54*	.49*	-										
8. T2 NU	.26*	.74*	.18*	.36*	.14*	.37*	.25*	-									
9. T2 SS	.28*	.00	.84*	.32*	.12*	.18*	.30*	.15*	-								
10. T2 LOP	.36*	.38*	.31*	.74*	.25*	.32*	.25*	.51*	.29*	-							
11. T2 FAN	.60*	.15*	.15*	.28*	.72*	.50*	.61*	.18*	.14*	.24*	-						
12. T2 AP	.66*	.28*	.23*	.25*	.51*	.72*	.71*	.36*	.24*	.33*	.56*	-					
13. T3 Alc	.58*	.15*	.26*	.30*	.46*	.38*	.74*	.15*	.30*	.25*	.52*	.51*	-				
14. T3 NU	.23*	.70*	.10 ⁺	.39*	.16*	.29*	.30*	.70*	.14*	.49*	.17*	.39*	.31*	-			
15. T3 SS	.27*	.08*	.81*	.31*	.12*	.20*	.31*	.20*	.88*	.29*	.11 ⁺	.25*	.32*	.20*	-		
16. T3 LOP	.36*	.30*	.31*	.66*	.26*	.29*	.34*	.41*	.33*	.73*	.28*	.31*	.33*	.48*	.34*	-	
17. T3 FAN	.52*	.10 ⁺	.12*	.19*	.64*	.44*	.57*	.14*	.10 ⁺	.16*	.75*	.49*	.50*	.13*	.13*	.20*	-
18. T3 AP	.60*	.26*	.24*	.24*	.48*	.63*	.69*	.30*	.28*	.30*	.56*	.80*	.63*	.42*	.33*	.33*	.59*

Note: $n = 525$. Alc = alcohol use, NU = negative urgency, SS = sensation seeking, LOP = lack of premeditation, FAN = friend alcohol norms, AP = alcohol problems.

⁺ $p < .05$

* $p < .01$