

Impulsivity-like Traits, College Drinking Culture, and Alcohol Outcomes: Examination of a
Prospective Multiple Mediation Model among College Students in Spain, Argentina, and USA

Adrian J. Bravo^{a,□}, Matthew R. Pearson^a, Angelina Pilatti^{b,c}, Jennifer P. Read^d, Laura Mezquita^e,
Manuel I. Ibáñez^{e,f}, Generós Ortet^{e,f}

^a Center on Alcoholism, Substance Abuse, and Addictions, University of New Mexico, USA

^b Universidad Nacional de Córdoba, Facultad de Psicología, Córdoba, Argentina

^c Instituto de Investigaciones Psicológicas, IIPSI, Unidad Ejecutora CONICET, Córdoba, Argentina

^d Department of Psychology, University at Buffalo, USA

^e Department of Basic and Clinical Psychology and Psychobiology, Universitat Jaume I, Castelló de la Plana, Castellón, Spain

^f Centre for Biomedical Research Network on Mental Health (CIBERSAM), Instituto de Salud Carlos III, Madrid, Spain

HIGHLIGHTS

- Tested a mediation model among college drinkers in Argentina, Spain and US.
- College alcohol beliefs prospectively predicted increased alcohol use/consequences.
- Impulsivity-like traits relate to alcohol outcomes via college alcohol beliefs.
- Model was invariant across countries/sex, suggesting a culturally-universal model.

□ Corresponding author at: Center on Alcoholism, Substance Abuse, and Addictions, 2650 Yale Blvd SE, Albuquerque, NM 87106, USA. E-mail address: ajbravo@unm.edu (A.J. Bravo).

Abstract

Aims: The present study examined (both cross-sectionally and prospectively) the mediational role of college alcohol beliefs in the relationship between impulsivity-like traits and alcohol outcomes (i.e., alcohol use and negative consequences) among college student drinkers from the U.S., Spain, and Argentina. **Methods:** A sample of 1429 (U.S. = 733, Spain = 292, Argentina = 404) drinkers (at least one drinking episode within the previous month) completed the baseline survey, and 242 drinkers completed the follow-up. To test study aims, a cross-sectional model was first employed to examine whether the proposed double-mediated paths (i.e., each dimension of impulsivity → college alcohol beliefs → alcohol use → negative alcohol-related consequences) extends across samples with different cultural backgrounds (i.e., structural invariance testing). A longitudinal model was then conducted to assess if college alcohol beliefs prospectively mediates the associations between trait impulsivity and alcohol outcomes. **Results:** College alcohol beliefs were concurrently and prospectively associated with both greater alcohol use and increased number of negative alcohol-related consequences. These internalized beliefs about college student drinking culture significantly mediated the effects of several distinct impulsivity-like traits on alcohol-related outcomes including urgency (positive and negative), sensation seeking, and perseverance. These findings were invariant across sex and across three countries (United States, Argentina and Spain). **Conclusions:** Our findings highlight the modulatory role of cognitive factors on problematic alcohol use among college students with different cultural backgrounds. Our results suggest that, despite the cultural differences exhibited by these three countries, the unique and mediational effects of college alcohol beliefs are relatively universal.

Keywords: impulsivity; college alcohol beliefs; alcohol; college students; cross-cultural

Introduction

Decades of research has identified college student drinking culture as a barrier towards effective prevention efforts (Borsari, Murphy, & Barnett, 2007; Moffat, 1991; National Advisory Council on Alcohol Abuse and Alcoholism, 2002; Wolburg, 2016). More recent research has formally operationalized the internalization of college student drinking culture, or beliefs regarding the degree to which alcohol use is considered an integral part of the college experience using the College Life Alcohol Salience Scale (CLASS; Osberg et al., 2010). Among U.S. college students, research has found these perceptions to be robustly associated with elevated levels of alcohol use ($r_s = .31$ to $.71$) and negative consequences ($r_s = .35$ to $.52$; Bravo, Prince, & Pearson, 2017; LaBrie, Kenney, Napper, & Miller, 2014; Osberg et al., 2010; Osberg, Billingsley, Eggert, & Insana, 2012), including prospective associations among first year college students (Osberg, Insana, Eggert, & Billingsley, 2011). Moreover, these internalized college alcohol beliefs have been shown to have stronger associations with negative consequences than many other established predictors of alcohol outcomes including descriptive norms, injunctive norms, and alcohol expectancies, among other factors (Hustad, Pearson, Neighbors, & Borsari, 2014; Osberg & Boyer, 2016; Pearson & Hustad, 2014; Ward, Galante, Trivedi, & Kahrs, 2015). Additionally, recent cross-cultural research has found that internal college alcohol beliefs is significantly and positively associated with various alcohol outcomes (e.g., typical quantity, binge drinking frequency, negative consequences) among college students in three countries (U.S., Argentina, and Spain) and these associations are fairly similar across countries and sex (Author et al., in press). Taken together, these findings suggest that this type of normative perception may be an important target for intervention for college students across various cultures and countries; however, to our knowledge, these normative perceptions have not been

directly targeted in any college student alcohol intervention.

To date, two cross-sectional studies have demonstrated that this internalized norm partially mediates the associations between personality traits (i.e., impulsivity and sensation seeking) and alcohol-related outcomes among college students (Hustad et al., 2014; Pearson and Hustad, 2014), indicating that personality-targeted interventions targeting the degree to which alcohol use is considered an integral part of the college experience may be appropriate (Conrod, Castellanos-Ryan, & Mackie, 2011). However, these studies were limited by their cross-sectional study design, and thus lacked the ability to examine these associations prospectively to demonstrate temporal precedence (i.e., one requisite for making causal inferences). In addition, given that the data were conducted in a single cultural milieu (i.e., a large northeastern university in the United States), it is not clear how generalizable these findings are.

The present study sought to cross-culturally replicate and extend previous findings by examining three distinct research questions: a) to what extent are the mediational effects found in previous research (Hustad et al., 2014; Pearson & Hustad, 2014) replicable when examining impulsivity multidimensionally (i.e., positive urgency, negative urgency, premeditation, perseverance, and sensation-seeking), b) to what extent does the proposed double mediation model (i.e., impulsivity-like traits → college alcohol beliefs → alcohol use → negative consequences) replicate when examining these associations prospectively (e.g., baseline sensation seeking → baseline college alcohol beliefs → follow-up alcohol use → follow-up negative consequences), and c) are these models invariant across distinct cultural contexts (i.e., across different countries) and sex (men vs women)? Based on findings from previous cross-sectional research (Hustad et al., 2014; Pearson & Hustad, 2014) and prospective research (Obsberg et al., 2011), we expected that college alcohol beliefs would prospectively predict alcohol outcomes

and mediate (both cross-sectionally and prospectively) the associations between impulsivity-like traits and alcohol outcomes.

Method

Participants & Procedures

College students from four distinct universities ($n = 1,864$) across three countries [U.S. (two universities; one located in the southeast and the other in the southwest), Argentina, and Spain] participated in the baseline online survey study regarding personality traits, alcohol beliefs, and alcohol use behaviors (for more information on recruitment procedures, see Author et al., 2017), including 1,429 students who consumed alcohol at least once in the previous month. We were not able to recruit for the follow-up at the southeastern U.S. site ($n = 545$). Of the 884 students eligible for the follow-up (i.e., drinkers), 271 completed the same survey from the baseline roughly 3 months later and were entered in raffles for cash prizes at their respective institutes. To test our proposed cross-sectional mediational model, we use baseline data from students who consumed alcohol at least once in the previous month ($n = 1,429$; [U.S. sites combined, $n = 733$, 72.3% women; Argentina, $n = 404$, 70.5% women; Spain, $n = 292$, 52.2% women]). To test our proposed prospective mediation model, we used data from students who participated in the follow-up and consumed alcohol in the previous month during the follow-up assessment ($n = 242$; [U.S., $n = 30$, 66.7% women; Argentina, $n = 120$, 66.7% women; Spain, $n = 92$, 80.4% women]). These studies were approved by the institutional review boards (or their international equivalent) at the participating universities.

Measures

Impulsivity-like traits. At the U.S. sites, we used the *UPPS-P Impulsive Behavior Scale* (Lynam, Smith, Whiteside, & Cyders, 2006). The UPPS-P is a 59-item scale devised to assess

positive urgency, negative urgency, premeditation, perseverance, and sensation-seeking. Items are assessed on a 4-point response scale (1 = *Disagree Strongly*, 4 = *Agree Strongly*). In Spain and Argentina we administered the Spanish version of the scale (Pilatti, Lozano, & Cyders, 2015; Verdejo-García, Lozano, Moya, Alcázar, & Pérez-García, 2010).

College alcohol beliefs. The College Life Alcohol Salience Scale (CLASS; Osberg et al., 2010) was used to assess alcohol beliefs of college students. Items are measured on a 5-point response scale (1 = *Strongly Disagree*, 5 = *Strongly Agree*). In Spain and Argentina, we employed the Spanish version of the CLASS (see translating and adaptation procedures in Author et al., in press). Although originally examined as a 15-item measure, Author et al. revealed that a 12-item version was scalar invariant across sex and drinker status, and metric invariant across countries (thus we use the 12-item version for the present study).

Alcohol consumption. The Daily Drinking Questionnaire (DDQ; Collins, Parks, & Marlatt, 1985) was used to measure alcohol consumption. Participants indicated the total amount of Standard Drink Units (SDUs) taken during a typical week. In order to help orient students to SDUs, they were first presented with a visual guide about typical drinks (specific to each country). The total number of SDUs consumed (summed) were transformed into grams of alcohol. In U.S. and Argentina, one SDU is equivalent to 14 grams of alcohol (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2015; International Alliance for Responsible Drinking [IARD], 2016). In Spain, one SDU is equivalent to 10 grams (Rodríguez-Martos, Gual, & Llopis, 1999; IARD, 2016).

Negative alcohol-related consequences. The 48-item YAACQ (Read, Kahler, Strong, & Colder, 2006) was administered to college students to assess negative alcohol-related consequences. Each item was scored dichotomously to reflect presence/absence of the alcohol-

related problem in the past month (0 = *no*, 1 = *yes*). The Spanish version (S-YAACQ, Pilatti, Read, & Caneto, 2016) was used at the Argentina/Spain sites, although some items were reworded to Castilian Spanish in Spain.

Statistical Analysis

To test the proposed models, structural equation modeling (cross-sectional data) and path analysis (prospective data) using *Mplus* 7.4 (Muthén & Muthén, 1998-2015) were conducted. In the cross-sectional model, a double-mediated path was examined for each impulsivity-like trait (e.g., sensation seeking → college alcohol beliefs → alcohol use → negative consequences). In the prospective model, the structural model was the same with the exception that impulsivity-like traits and college alcohol beliefs at baseline were entered as predictors of alcohol outcomes at follow-up (controlling for baseline alcohol use and negative consequences). To evaluate overall model fit in the cross-sectional model (prospective model was fully saturated), we used model fit criteria suggested by Hu and Bentler (1999) including the Comparative Fit Index (CFI) > .90 (acceptable) > .95 (optimal), Tucker-Lewis Index (TLI) > .90 (acceptable) > .95 (optimal), Root Mean Square Error of Approximation (RMSEA) < .06, and Standardized Root Mean Square Residual (SRMR) < .08. To reduce the complexity of the models, we followed the item-to-construct balance approach described by Little et al. (2002) by creating parcels for all latent study variables (exception was alcohol use). We first confirmed and then extracted a single factor in exploratory factor analyses (EFAs) for each latent construct, sorted the items from highest to lowest factor loadings, and created balanced parcels by pairing items with the highest factor loadings with items with the lowest factor loadings.

In order to test whether our cross-sectional model was culturally-specific or culturally-universal, we first conducted invariance testing of the measurement model across countries and

sex. Specifically, we tested two levels of measurement invariance: configural (test whether items load on the proposed factors) and metric (test whether item-factor loadings are equal across groups). If metric invariance is achieved (based on model fit criteria described below), then we can confidently test for structural invariance of the proposed mediation model. To test for structural invariance, we conducted χ^2 difference tests comparing a freely estimated multi-group model to a constrained multi-group model (i.e., constraining the paths of the SEM) to determine whether constraining the paths to be equivalent across countries resulted in a worst fitting model. Given that the χ^2 test statistic is sensitive to sample size (Brown, 2015), we also relied on model comparison criteria of $\Delta\text{RMSEA} \leq .015$ (Chen, 2007) and $\Delta\text{CFI}/\Delta\text{TFI} \leq .01$ (Cheung & Rensvold, 2002).

For both models, we examined the total, direct, and indirect effects of each predictor variable on alcohol outcomes using bias-corrected bootstrapped estimates (Efron & Tibshirani, 1993) based on 10,000 bootstrapped samples, which provides a powerful test of mediation (Fritz & MacKinnon, 2007) and is robust to small departures from normality (Erceg-Hurn & Mirosevich, 2008). Given our large sample size (i.e., large statistical power) in the cross-sectional model, statistical significance was determined by 99% bias-corrected bootstrapped confidence intervals that do not contain zero (we used 95% confidence intervals for the prospective model).

Results

Within the cross-sectional model, the measurement model and multi-group model (including constrained models) provided acceptable fit based on fit criteria suggested by Hu and Bentler and the minimal changes in CFI/TFI and RMSEA indicated measurement/model invariance across countries and sex (see Table 1). Based on these results, we present results of

all our models within the total sample. Bivariate correlations, descriptive statistics, and reliability coefficients of all study variables for the cross-sectional model are presented in Supplemental Table 1. It is important to note that all impulsivity-like traits and college alcohol beliefs were significantly associated with both alcohol outcomes (see Supplemental Table 1). Bivariate correlations, descriptive statistics, and reliability coefficients of all study variables for the follow-up sample are presented in Supplemental Table 2. Within this sample, positive urgency, sensation seeking, and college alcohol beliefs were significantly associated with both baseline and follow-up assessments of alcohol use and negative consequences (see Supplemental Table 2).

Cross-sectional Mediation Model

The cross-sectional mediation SEM model provided an acceptable fit to the data based on most fit indices, CFI = .944, TLI = .932, RMSEA = .057 (90% CI [.054, .060]), SRMR = .050. The significant Model χ^2 [$\chi^2(248) = 1401.91, p < .001$] would suggest poor model fit; however, the Model χ^2 is highly sensitive to sample size (Kline, 1998; Jöreskog & Sörbom, 1993). The total, total indirect, and specific indirect effects of the cross-sectional mediation model are summarized in Table 2 and direct effects are depicted in Figure 1. Among impulsivity-like traits, sensation seeking ($\beta = .13$) was uniquely associated (i.e., significant when controlling for effects of other traits and college alcohol beliefs) with higher alcohol use; and both positive ($\beta = .13$) and negative ($\beta = .19$) urgency were uniquely associated with more negative consequences. Four of the five traits were significantly associated with college alcohol beliefs (non-significant association for premeditation; see Table 2). Specifically, perseverance and negative urgency were associated with lower college alcohol beliefs, whereas sensation seeking and positive urgency were associated with higher college alcohol beliefs. College alcohol beliefs were

associated with both higher alcohol use ($\beta = .23$) and negative consequences ($\beta = .17$) and alcohol use significantly mediated the association between college alcohol beliefs and negative consequences (indirect $\beta = .09$), accounting for 35.10% of the total effect.

In examining college alcohol beliefs as a mediator of impulsivity-like traits, these beliefs uniquely mediated the effects of four impulsivity-like traits on alcohol outcomes (all mediation effects were non-significant for premeditation as a predictor). In predicting alcohol use, college alcohol beliefs accounted for: 1) 87.00% of the total effect of perseverance on alcohol use (indirect $\beta = -.05$); 2) 34.50% of the total effect of sensation seeking on alcohol use (indirect $\beta = .07$); 3) 26.90% of the total effect of positive urgency on alcohol use (indirect $\beta = .03$); and 4) 32.54% of the total effect of negative urgency on alcohol use (indirect $\beta = -.02$). In predicting negative consequences, college alcohol beliefs accounted for 12.03% of the total effect of positive urgency on negative consequences (indirect $\beta = .02$). All other effects were “fully” mediated in that the direct effects of perseverance, sensation seeking, and negative urgency were of opposite sign of the total effect (see Table 2).

In examining alcohol use as a mediator of impulsivity-like traits, alcohol use only uniquely mediated the effects of sensation seeking on negative consequences (positive indirect effect and a non-significant negative association between sensation seeking and negative consequences). Finally, four double-mediated associations were significant (i.e., perseverance/sensation seeking/positive urgency/negative urgency \rightarrow college alcohol beliefs \rightarrow alcohol use \rightarrow negative consequences). With positive urgency as a predictor, the dual mediation path accounted for an additional 6.50% of the total effect of positive urgency on negative consequences (indirect $\beta = .01$). All other double mediated effects were “fully” mediated in that the direct effect was of opposite sign of the total effect (see Table 2).

Prospective Mediation Model

The total, total indirect, specific indirect, and direct effects of the prospective mediation model are summarized in Table 3. Within this model, only perseverance ($\beta = -.22$) and sensation seeking ($\beta = .24$) were significantly associated with college alcohol beliefs. Controlling for baseline alcohol use and negative consequences, higher college alcohol beliefs was associated with increased alcohol use at follow-up ($\beta = .15$) and alcohol use significantly mediated the association between baseline college alcohol beliefs and follow-up negative consequences (indirect $\beta = .03$), accounting for 66.06% of the total effect. Consistent with these direct effects, there were two significant single mediation effects: 1) college alcohol beliefs accounted for 59.32% of the total effect between baseline perseverance and follow-up alcohol use (indirect $\beta = -.03$), and 2) college alcohol beliefs accounted for 73.27% of the total effect between baseline sensation seeking and follow-up alcohol use (indirect $\beta = .04$). Further, there were two significant double-mediation effects: 1) baseline perseverance \rightarrow baseline college alcohol beliefs \rightarrow follow-up alcohol use \rightarrow follow-up negative consequences (indirect $\beta = -.01$), which accounted for 22.67% of the total effect of baseline perseverance on follow-up negative consequences; and 2) baseline sensation seeking \rightarrow baseline college alcohol beliefs \rightarrow follow-up alcohol use \rightarrow follow-up negative consequences, indirect $\beta = .01$ (positive indirect effect and a non-significant negative association between baseline sensation seeking and follow-up negative consequences).

Discussion

Overall, our results extend previous research in several ways. First, consistent with limited previous research (Osberg et al., 2011), we showed that the internalization of college student drinking culture concurrently and prospectively predicted increased alcohol use and

negative consequences. Second, despite using a distinct operationalization of impulsivity and sensation seeking (Hustad et al., 2014; Pearson and Hustad, 2014), we found these alcohol-related beliefs to be a plausible mediator of the effects of several distinct impulsivity-like traits on alcohol-related outcomes including urgency (positive and negative), sensation seeking, and perseverance. Third, we found that these effects were consistent across sex and consistent across distinct cultural contexts in the United States, Spain, and Argentina.

Although premeditation was the only impulsivity-like trait that did not have mediated effects on alcohol outcomes across the cross-sectional and prospective models, we must note that the indirect effects of perseverance and sensation seeking on alcohol outcomes through the internalization of college student drinking culture were significant in both of these models, providing additional support that these alcohol beliefs are a promising intervention target for individuals low in perseverance or high in sensation seeking. Further, we found that some impulsivity-like traits had direct effects on alcohol-related outcomes even when controlling for the internalization of college student drinking culture, implying that additional factors need to be explored to fully account for how these facets of impulsivity-like traits transmit their effects on alcohol-related outcomes (e.g., protective behavioral strategies, Pearson, Kite, & Henson, 2012).

These findings have several implications for cross-cultural research. To our knowledge, this is one of the few studies that has assessed the effects of college alcohol beliefs on alcohol-related behaviors of students from diverse cultural contexts. Research of the mechanisms underlying heavy drinking behaviors in college students has been largely neglected in cultures other than U.S. (Bravo et al., 2017; Osberg & Boyer, 2016). Cross-cultural studies are critical to understand whether risk factors that have been identified in the U.S. population apply to patterns of alcohol use in college students with different cultural baggage. Our results suggest that the

doubled-mediated pathway involving impulsivity, college alcohol beliefs and alcohol outcomes may be universal rather than culturally specific. Spain and Argentina are two Spanish-speaking countries that exhibit a number of important cultural differences with the U.S., including the role of alcohol on daily life (e.g., wet vs. dry cultures), idiosyncratic features of college life (e.g., strong vs. weak identification with the university) and cultural patterns of interactions (e.g., individualistic vs. collectivistic). Despite these differences, our findings indicate that these risk factors are influencing alcohol drinking outcomes in a similar way across these cultural contexts.

Limitations

Our results must be contextualized given the present study's strengths and limitations. Although we obtained a relatively large sample of college students from three distinct countries, the subsample of individuals with longitudinal data was rather modest. Therefore, our prospective mediation models had limited power to detect small direct and indirect effects. Although we had previous studies to support the models that we were testing (Hustad et al., 2014; Pearson & Hustad, 2014), we were unable to examine a fully lagged model with only two time points. Additional research using additional waves of data could examine fully lagged mediation models and/or take advantage of latent growth curve modeling to examine how trajectories of these constructs are associated over time. Although we found that our model was robust across distinct countries, we were unable to examine latent mean differences in the internalization of college student drinking culture across these countries given that our previous research (Author et al., 2017) found that the CLASS measure did not have strict invariance across these countries. Thus, it is important to note that we found similar *associations* between the CLASS and other constructs across these countries, but these findings do not imply that the overall degree to which individuals internalize these beliefs about drinking in college are the

same across these countries. Additional research is needed to make such comparisons. Finally, we must acknowledge the limitations of obtaining convenience samples. Without obtaining random, nationally representative samples, it is difficult to determine the extent to which our findings will generalize to the populations in these countries.

Clinical Implications and conclusions

Perceptions about alcohol's role in the college experience have been promulgated through media depictions and other means for decades. It is only recently that these perceptions have been the subject of empirical inquiry. This study adds to the growing literature showing college alcohol beliefs to be linked with harmful alcohol outcomes, and suggests the utility of focusing not only on these beliefs themselves, but on how these beliefs may play out in the context of other individual characteristics (LaBrie et al., 2014). Our study also builds on this literature by extending the examination of beliefs about the college drinking culture to other countries outside of the United States. Our findings point to several next steps for intervention. First, given their mechanistic role in alcohol outcomes, it appears that correcting or in other ways addressing these beliefs may be the key to reducing their impact. Social norms-based interventions that seek to alter student perceptions about the drinking of others in their social milieu have been shown to be effective in reducing drinking risk (Larimer et al., 2007; Larimer & Cronce, 2002; Neighbors et al., 2010). Such interventions could be modified to address and correct misperceptions regarding college students' attitudes toward the role of alcohol in college life. Also, a discussion of these beliefs could be incorporated into an individual-based intervention such as motivational enhancement (Borsari & Carey, 2000; Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Walters & Neighbors, 2005). In this context, some of the perceived benefits and problems with a view on college life that over-values heavy drinking could be discussed in the context of a student's goals,

desires, and current concerns. Further, our mediation findings showed that higher levels of traits pertaining to impulsive action were associated with the development of college alcohol beliefs, and in turn, problem alcohol outcomes. This suggests that those higher on these characteristics may benefit from early intervention in an effort to prevent these beliefs from developing even before the student begins college. Finally, our finding that college alcohol beliefs represent a risk factor for deleterious outcomes across cultures suggests that the notion of a college drinking culture is not unique to the U.S. As such, preventive interventions are warranted even in countries with “wet” cultures, where drinking is more widely integrated into other aspects of daily life. More investigation is needed to facilitate the development of culturally-informed interventions that are tailored appropriately to those beliefs that are most relevant for a given culture.

In summary, efforts to address widely held beliefs about the role of alcohol in college life can help to prevent alcohol-related harms in the U.S. and around the world. Such efforts may also help to shift broader perceptions about the college experience away from drinking, and instead toward the myriad other rewarding and meaningful campus-based activities that constitute college life for the majority of students around the world.

Role of funding sources

Dr. Pearson is supported by a career development grant (K01-AA023233) from the National Institute of Alcohol Abuse and Alcoholism (NIAAA) and Dr. Bravo is supported by a training grant (T32-AA018108) from the NIAAA. Data collection across all sites was supported, in part, by grant T32-AA018108. NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. Data collection in Spain was also supported, in part, by grants PSI2015-67766-R

from the Spanish Ministry of Economy and Competitiveness (MINECO/FEDER) and GV/2016/158 from the Autonomous Government of Valencia.

Contributors

Dr. Bravo coordinated the efforts of the research team, conceptualized the research questions, conducted the analyses, drafted the introduction, statistical analyses, and results sections (including tables). Dr. Pearson assisted with the statistical analyses, drafted parts of the discussion section, and edited the introduction, method, and results sections of the first draft. Dr. Pilatti wrote the abstract and part of the discussion section. Dr. Read wrote the clinical implications section of the discussion section and edited the other sections of the first draft. Drs. Mezquita, Ibáñez, and Ortet drafted the method section and parts of the introduction and discussion section and edited the other sections of the first draft. The entire team selected the measures in the assessment battery and collected all data. All authors contributed to and approved of the final manuscript.

Conflict of interest

No conflict declared.

Acknowledgments

No acknowledgments declared.

References

- Bravo, A. J., Prince, M. A., & Pearson, M. R. (2017). College-related alcohol beliefs and problematic alcohol consumption: Alcohol protective behavioral strategies as a mediator. *Substance Use & Misuse, 52*, 1059-1068. doi: 10.1080/10826084.2016.1271985
- Borsari, B., Murphy, J. G., & Barnett, N. P. (2007). Predictors of alcohol use during the first year of college: Implications for prevention. *Addictive Behaviors, 32*, 2062-2086. doi: 10.1016/j.addbeh.2007.01.017
- Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). New York: Guilford Press.
- Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling, 14*, 464-504. 10.1080/10705510701301834
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*, 233-255. doi: 10.1207/S15328007SEM0902_5
- Collins, R. L., Parks, G. A., & Marlatt, G. A. (1985). Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology, 53*, 189-200. doi: 10.1037//0022-006X.53.2.189
- Conrod, P. J., Castellanos-Ryan, N., & Mackie, C. (2011). Long-term effects of a personality-targeted intervention to reduce alcohol use in adolescents. *Journal of Consulting and Clinical Psychology, 79*, 296-306. doi: 10.1037/a0022997
- Efron, B., & Tibshirani, R. J. (1993). *An introduction to the bootstrap* (Vol. 57). CRC press.

- Erceg-Hurn, D. M., & Mirosevich, V. M. (2008). Modern robust statistical methods: an easy way to maximize the accuracy and power of your research. *American Psychologist, 63*, 591-601. doi: 10.1037/0003-066X.63.7.591
- Fritz, M. S., & MacKinnon, D. P. (2007). Required sample size to detect mediated effect. *Psychological Science, 18*, 233-239. doi: 10.1111/j.1467-9280.2007.01882.x
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6*, 1-55. doi: 10.1080/10705519909540118\
- Hustad, J. T. P., Pearson, M. R., Neighbors, C., & Borsari, B. (2014). The role of alcohol perceptions as mediators between personality and alcohol-related outcomes among incoming college student drinkers. *Psychology of Addictive Behaviors, 28*, 336-347. doi: 10.1037/a0033785
- International Alliance for Responsible Drinking. (2016). *Drinking guidelines: General population. NIAAA Newsletter*. Retrieved from <http://www.iard.org/policy-tables/drinking-guidelines-general-population>
- Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: User's guide*. Chicago: Scientific Software.
- Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York, NY: Guilford Press.
- LaBrie, J. W., Kenney, S. R., Napper, L. E., & Miller, K. (2014). Impulsivity and alcohol-related risk among college students: Examining urgency, sensation seeking and the moderating influence of beliefs about alcohol's role in the college experience. *Addictive Behaviors, 39*, 159-164. doi: 10.1016/j.addbeh.2013.09.018
- Little, T. D., Cunningham, W. A., Shahar, G., & Widaman, K. F. (2002). To parcel or not to

- parcel: Exploring the question, weighing the merits. *Structural Equation Modeling*, 9, 151-173. doi: 10.1207/S15328007SEM0902_1
- Lynam, D. R., Smith, G. T., Whiteside, S. P., & Cyders, M. A. (2006). The UPPS-P: Assessing five personality pathways to impulsive behavior. *West Lafayette, IN: Purdue University*.
- Moffatt, M. (1991). College life: Undergraduate culture and higher education. *The Journal of Higher Education*, 62, 44-61. doi: 10.1080/00221546.1991.11774105
- Muthén, L.K. and Muthén, B.O. (1998-2015). *Mplus user's guide. Seventh Edition*. Los Angeles, CA: Muthén & Muthén.
- National Institute on Alcohol Abuse and Alcoholism. (2002). A call to action: Changing the culture of drinking at U.S. colleges, Final report of the Task Force on College Drinking, NIH Pub. No. 02-5010. Rockville, MD: NIAAA.
- National Institute on Alcohol Abuse and Alcoholism. (2015). *College drinking*. Retrieved from <http://pubs.niaaa.nih.gov/publications/CollegeFactSheet/Collegefactsheet.pdf>
- Osberg, T. M., Atkins, L., Buchholz, L., Shirshova, V., Swiantek, A., Whitley, J., ... & Oquendo, N. (2010). Development and validation of the College Life Alcohol Salience Scale: A measure of beliefs about the role of alcohol in college life. *Psychology of Addictive Behaviors*, 24, 1-12. doi: 10.1037/a0018197.
- Osberg, T. M., Billingsley, K., Eggert, M., & Insana, M. (2012). From animal house to old school: A multiple mediation analysis of the association between college drinking movie exposure and freshman drinking and its consequences. *Addictive Behaviors*, 37, 922–930. doi: 10.1016/j.addbeh.2012.03.030.

- Osberg, T. M., & Boyer, A. (2016). Dangerous beliefs: College alcohol beliefs are associated with increased risk of regretted sexual encounters. *Substance Use & Misuse, 51*, 1555-1565. doi: 10.1080/10826084.2016.1188953
- Osberg, T. M., Insana, M., Eggert, M., & Billingsley, K. (2011). Incremental validity of college alcohol beliefs in the prediction of freshman drinking and its consequences: A prospective study. *Addictive Behaviors, 36*(4), 333-340. doi: 10.1016/j.addbeh.2010.12.004
- Pearson, M. R., & Hustad, J. T. P. (2014). Personality and alcohol-related outcomes among mandated college students: Descriptive norms, injunctive norms, and college-related alcohol beliefs as mediators. *Addictive Behaviors, 39*, 879-884. doi: 10.1016/j.addbeh.2014.01.008
- Pearson, M. R., Kite, B. A., & Henson, J.M. (2012a). Unique direct and indirect effects of impulsivity on alcohol-related outcomes via protective behavioral strategies. *Journal of Drug Education, 42*, 425–446. doi: 10.2190/DE.42.4.d
- Pilatti, A., Lozano, O. M., & Cyders, M. A. (2015). Psychometric properties of the Spanish version of the UPPS-P Impulsive Behavior Scale: A Rasch rating scale analysis and confirmatory factor analysis. *Psychological Assessment, 27*, e10-e21. doi: 10.1037/pas0000124
- Pilatti, A., Read, J. P., & Caneto, F. (2016). Validation of the Spanish Version of the Young Adult Alcohol Consequences Questionnaire (S-YAACQ). *Psychological Assessment, 28*, e49-e61. 10.1037/pas0000140
- Read, J. P., Kahler, C. W., Strong, D. R., & Colder, C. R. (2006). Development and preliminary validation of the young adult alcohol consequences questionnaire. *Journal of Studies on*

Alcohol, 67, 169-177. doi:10.15288/jsa.2006.67.169

Rodríguez-Martos, D. A., Gual, S. A., & Llopis, L. J. (1999). The " standard drink unit" as a simplified record of alcoholic drink consumption and its measurement in Spain. *Medicina Clinica*, 112(12), 446-450.

Verdejo-García, A., Lozano, Ó., Moya, M., Alcázar, M. Á., & Pérez-García, M. (2010). Psychometric properties of a Spanish version of the UPPS–P impulsive behavior scale: reliability, validity and association with trait and cognitive impulsivity. *Journal of Personality Assessment*, 92, 70-77. doi: 10.1080/00223890903382369

Ward, R. M., Galante, M., Trivedi, R., & Kahrs, J. (2015). An examination of drunkorexia, greek affiliation, and alcohol consumption. *Journal of Alcohol and Drug Education*, 59(3), 48-66.

Wolburg, J. M. (2016). Insights for prevention campaigns: The power of drinking rituals in the college student experience from freshman to senior year. *Journal of Current Issues & Research in Advertising*, 37:1, 80-94, DOI: 10.1080/10641734.2015.1119770

Table 1

Invariance testing results of the measurement model and mediational model across countries and sex in cross-sectional sample

Measurement Model Across Countries

Models	Overall Fit Indices						Model Comparison Fit Indices				
	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	$\Delta RMSEA$
Configural	1921.24	693	.941	.929	.061 (.058, .064)	.059	133.71***	34	-.005	-.002	.001
Metric	2054.94	727	.936	.927	.062 (.059, .065)	.066					

Mediation Model across Sex

Models	Overall Fit Indices						Model Comparison Fit Indices				
	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	$\Delta RMSEA$
Configural	1642.31	462	.941	.929	.060 (.057, .063)	.054	28.06*	17	-.001	.002	-.001
Metric	1670.37	479	.940	.931	.059 (.056, .062)	.055					

Mediation Model Across Countries

Models	Overall Fit Indices						Model Comparison Fit Indices				
	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	$\Delta RMSEA$
Unconstrained	2776.60	812	.907	.897	.071 (.068, .074)	.067	69.42***	36	-.001	.003	-.001
Constrained	2846.02	848	.906	.900	.070 (.067, .073)	.073					

Mediation Model across Sex

Models	Overall Fit Indices						Model Comparison Fit Indices				
	χ^2	<i>df</i>	CFI	TLI	RMSEA	SRMR	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	$\Delta RMSEA$
Unconstrained	1767.23	530	.939	.931	.057 (.054, .060)	.054	21.61	18	-.000	.002	-.001
Constrained	1788.84	548	.939	.933	.056 (.054, .059)	.057					

Note. We used comparison criteria of $\Delta RMSEA \leq .015$ (increase indicates worst fit; Chen, 2007) and $\Delta CFI/\Delta TFI \leq .01$ (decrease indicates worst fit; Cheung & Rensvold, 2002) to test for measurement invariance. * $p < .05$. ** $p < .01$. *** $p < .001$. To ensure model convergence for the mediational model across sex, we constrained the variance of alcohol consumption to be under 10 by dividing by a constant as recommended by Muthén & Muthén (1998-2015).

Table 2
Summary of total, indirect, and direct effects of the cross-sectional mediation model

Outcome Variables: Predictor Variable: <i>Premeditation</i>	<i>College Alcohol Beliefs</i>		<i>Alcohol Use</i>		<i>Negative Alcohol-related Consequences</i>	
	β	99% CI	β	99% CI	β	99% CI
Total	-.066	-0.15, 0.05	-.081	-0.16, 0.03	-.131	-0.23, -.03
Total indirect ^a	-----	-----	-.015	-0.05, 0.01	-.042	-0.08, 0.01
College Alcohol Beliefs	-----	-----	-.015	-0.05, 0.01	-.011	-0.04, 0.01
Alcohol Use	-----	-----	-----	-----	-.025	-0.06, 0.02
College Alcohol Beliefs → Alcohol Use	-----	-----	-----	-----	-.006	-0.02, 0.004
Direct Effect	-.066	-0.15, 0.05	-.065	-0.17, 0.04	-.089	-0.18, 0.002
Predictor Variable: <i>Perseverance</i>	β	99% CI	β	99% CI	β	99% CI
Total	-.194	-0.32, -0.07	-.052	-0.18, 0.07	-.045	-0.16, 0.07
Total indirect ^a	-----	-----	-.045	-0.08, -0.02	-.053	-0.12, 0.01
College Alcohol Beliefs	-----	-----	-.045	-0.08, -0.02	-.032	-0.06, -0.01
Alcohol Use	-----	-----	-----	-----	-.003	-0.06, 0.04
College Alcohol Beliefs → Alcohol Use	-----	-----	-----	-----	-.018	-0.03, -0.01
Direct Effect	-.194	-0.32, -0.07	-.007	-0.14, 0.12	.007	-0.07, 0.10
Predictor Variable: <i>Sensation Seeking</i>	β	99% CI	β	99% CI	β	99% CI
Total	.290	0.20, 0.38	.196	0.12, 0.27	.051	-0.03, 0.13
Total indirect ^a	-----	-----	.068	0.04, 0.10	.124	0.08, 0.17
College Alcohol Beliefs	-----	-----	.068	0.04, 0.10	.048	0.02, 0.08
Alcohol Use	-----	-----	-----	-----	.050	0.02, 0.08
College Alcohol Beliefs → Alcohol Use	-----	-----	-----	-----	.026	0.02, 0.04
Direct Effect	.290	0.20, 0.38	.129	0.05, 0.21	-.074	-0.15, 0.000
Predictor Variable: <i>Positive Urgency</i>	β	99% CI	β	99% CI	β	99% CI
Total	.145	0.04, 0.25	.126	0.03, 0.22	.199	0.10, 0.29
Total indirect ^a	-----	-----	.034	0.01, 0.06	.073	0.03, 0.12
College Alcohol Beliefs	-----	-----	.034	0.01, 0.06	.024	0.01, 0.055
Alcohol Use	-----	-----	-----	-----	.035	-0.003, 0.08
College Alcohol Beliefs → Alcohol Use	-----	-----	-----	-----	.013	0.004, 0.03
Direct Effect	.145	0.04, 0.25	.092	-0.001, 0.19	.126	0.03, 0.22
Predictor Variable: <i>Negative Urgency</i>	β	99% CI	β	99% CI	β	99% CI
Total	-.095	-0.18, -0.01	-.068	-0.15, 0.02	.146	0.06, 0.23
Total indirect ^a	-----	-----	-.022	-0.05, -0.002	-.042	-0.08, -0.003
College Alcohol Beliefs	-----	-----	-.022	-0.05, -0.002	-.016	-0.04, -0.002
Alcohol Use	-----	-----	-----	-----	-.018	-0.05, 0.02
College Alcohol Beliefs → Alcohol Use	-----	-----	-----	-----	-.009	-0.02, -0.001
Direct Effect	-.095	0.30, 0.51	-.046	-0.13, 0.04	.188	0.11, 0.26

Predictor Variable: <i>College Alcohol Beliefs</i>	β	99% CI	β	99% CI	β	99% CI
Total	----	-----	.233	0.15, 0.31	.257	0.18, 0.33
Indirect via Alcohol Use	----	-----	----	-----	.090	0.06, 0.13
Direct	----	-----	.233	0.15, 0.31	.167	0.09, 0.24

Note. Significant associations are in bold typeface for emphasis and were determined by a 99% bias-corrected standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. ^a Reflects the combined indirect associations within the model.

Table 3
 Summary of total, indirect, and direct effects of prospective mediation model

Outcome Variables: Predictor Variable: <i>Premeditation T1</i>	<i>College Alcohol Beliefs T1</i>		<i>Alcohol Use T2</i>		<i>Negative Alcohol-related Consequences T2</i>	
	β	95% CI	β	95% CI	β	95% CI
Total	.094	-0.03, 0.22	-.042	-0.15, 0.07	.015	-0.08, 0.11
Total indirect ^a	-----	-----	.014	-0.001, 0.05	-.006	-0.03, 0.02
College Alcohol Beliefs T1	-----	-----	.014	-0.001, 0.05	.001	-0.01, 0.02
Alcohol Use T2	-----	-----	-----	-----	-.010	-0.04, 0.004
College Alcohol Beliefs T1 → Alcohol Use T2	-----	-----	-----	-----	.002	0.000, 0.01
Direct Effect	.094	-0.03, 0.22	-.056	-0.16, 0.05	.021	-0.07, 0.11
Predictor Variable: <i>Perseverance T1</i>	β	95% CI	β	95% CI	β	95% CI
Total	-.222	-0.34, -0.10	-.057	-0.16, 0.05	-.026	-0.15, 0.09
Total indirect ^a	-----	-----	-.034	-0.08, -0.01	-.013	-0.05, 0.01
College Alcohol Beliefs T1	-----	-----	-.034	-0.08, -0.01	-.003	-0.03, 0.02
Alcohol Use T2	-----	-----	-----	-----	-.004	-0.03, 0.02
College Alcohol Beliefs T1 → Alcohol Use T2	-----	-----	-----	-----	-.006	-0.02, -0.001
Direct Effect	-.222	-0.34, -0.10	-.023	-0.13, 0.09	-.013	-0.14, 0.11
Predictor Variable: <i>Sensation Seeking T1</i>	β	95% CI	β	95% CI	β	95% CI
Total	.239	0.12, 0.36	.050	-0.03, 0.14	-.009	-0.10, 0.08
Total indirect ^a	-----	-----	.036	0.01, 0.09	.012	-0.01, 0.05
College Alcohol Beliefs T1	-----	-----	.036	0.01, 0.09	.003	-0.02, 0.03
Alcohol Use T2	-----	-----	-----	-----	.002	-0.02, 0.02
College Alcohol Beliefs T1 → Alcohol Use T2	-----	-----	-----	-----	.006	0.001, 0.02
Direct Effect	.239	0.12, 0.36	.013	-0.08, 0.11	-.021	-0.12, 0.07
Predictor Variable: <i>Positive Urgency T1</i>	β	95% CI	β	95% CI	β	95% CI
Total	.078	-0.08, 0.23	.041	-0.09, 0.17	.043	-0.10, 0.19
Total indirect ^a	-----	-----	.012	-0.01, 0.05	.008	-0.01, 0.05
College Alcohol Beliefs T1	-----	-----	.012	-0.01, 0.05	.001	-0.01, 0.02
Alcohol Use T2	-----	-----	-----	-----	.005	-0.02, 0.04
College Alcohol Beliefs T1 → Alcohol Use T2	-----	-----	-----	-----	.002	-0.001, 0.01
Direct Effect	.078	-0.08, 0.23	.029	-0.10, 0.16	.035	-0.11, 0.18
Predictor Variable: <i>Negative Urgency T1</i>	β	95% CI	β	95% CI	β	95% CI
Total	.005	-0.15, 0.17	.015	-0.12, 0.16	.004	-0.13, 0.14
Total indirect ^a	-----	-----	.001	-0.02, 0.03	.003	-0.02, 0.05
College Alcohol Beliefs T1	-----	-----	.001	-0.02, 0.03	.000	-0.01, 0.01
Alcohol Use T2	-----	-----	-----	-----	.002	-0.02, 0.05
College Alcohol Beliefs T1 → Alcohol Use T2	-----	-----	-----	-----	.001	-0.004, 0.01
Direct Effect	.005	-0.15, 0.17	.014	-0.12, 0.16	.209	-0.13, 0.14

Predictor Variable: <i>College Alcohol Beliefs T1</i>	β	95% CI	β	95% CI	β	95% CI
Total	-----	-----	.152	0.03, 0.28	.040	-0.07, 0.15
Indirect via Alcohol Use T2	-----	-----	-----	-----	.026	0.001, 0.08
Direct	-----	-----	.152	0.03, 0.28	.014	-0.08, 0.12

Note. T1 = Baseline; T2 = Follow-up. Significant associations are in bold typeface for emphasis and were determined by a 95% bias-corrected standardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. ^a Reflects the combined indirect associations within the model. Alcohol use at T2 was significantly positively associated with higher negative alcohol-related consequences at T2, $\beta = .17$, 99% CI [0.02, 0.38]. Effects of covariates (i.e., alcohol use and negative consequences at T1) are available from the authors upon request.

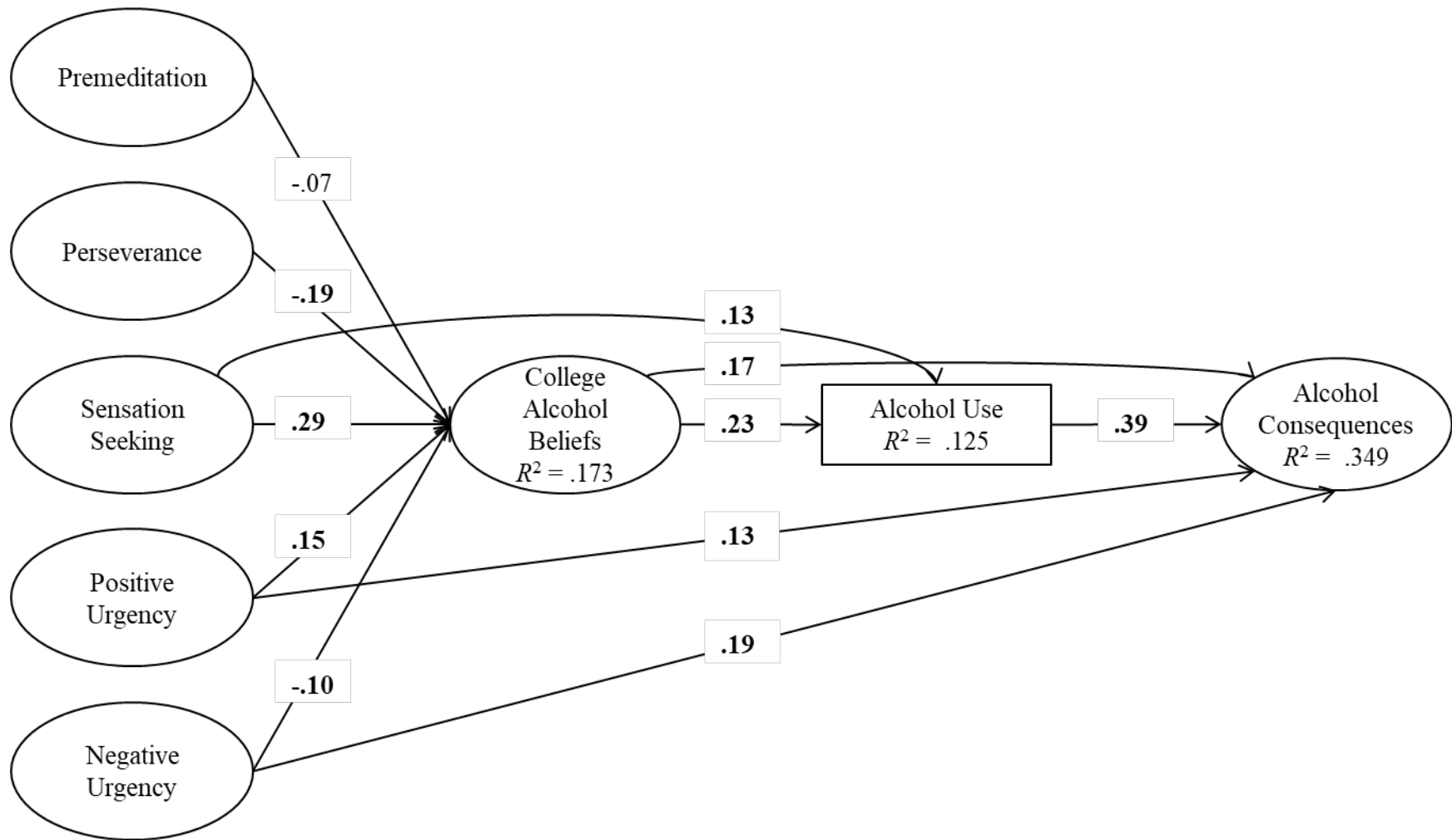


Figure 1. Depicts the standardized effects of the cross-sectional mediation structural equation model ($n=1429$). Significant associations are in bold typeface for emphasis and were determined by a 99% bias-corrected unstandardized bootstrapped confidence interval (based on 10,000 bootstrapped samples) that does not contain zero. The disturbances among impulsivity-like traits were allowed to correlate. Factor loadings to parcels and non-significant path coefficients between impulsivity-like traits and alcohol outcomes are not shown in the figure for reasons of parsimony.

Supplemental Table 1

Bivariate correlations among study variables in total cross-sectional sample

	1	2	3	4	5	6	7	8	M	SD
1. Premeditation	<u>.81</u>								3.02	0.48
2. Perseverance	.48	<u>.82</u>							3.02	1.44
3. Sensation Seeking	-.04	.11	<u>.85</u>						2.69	1.56
4. Positive Urgency	-.21	-.30	.29	<u>.90</u>					1.94	1.58
5. Negative Urgency	-.22	-.34	.16	.64	<u>.82</u>				2.35	1.50
6. College Alcohol Beliefs	-.16	-.18	.27	.25	.16	<u>.86</u>			2.46	0.98
7. Alcohol Use in Grams	-.13	-.08	.21	.18	.09	.29	---		89.73	106.51
8. Negative Alcohol-related Consequences	-.22	-.20	.12	.32	.33	.30	.45	<u>.93</u>	8.31	8.35

Note. Significant correlations ($p < .01$) are bolded for emphasis. Cronbach's alphas are underlined and shown on the diagonals.

Supplemental Table 2

Bivariate correlations among study variables in total prospective sample

	1	2	3	4	5	6	7	8	9	10	M	SD
1. Premeditation T1	<u>.80</u>										2.98	0.44
2. Perseverance T1	.35	<u>.81</u>									3.03	0.47
3. Sensation Seeking T1	-.02	.09	<u>.84</u>								2.52	0.60
4. Positive Urgency T1	-.10	-.24	.24	<u>.86</u>							1.83	0.49
5. Negative Urgency T1	-.28	-.30	.07	.61	<u>.77</u>						2.30	0.50
6. College Alcohol Beliefs T1	-.01	-.22	.30	.29	.19	<u>.85</u>					2.28	0.71
7. Alcohol Use in Grams T1	-.01	-.07	.19	.25	.10	.30	---				78.38	74.72
8. Alcohol Use in Grams T2	-.07	-.12	.16	.21	.11	.33	.62	---			71.33	71.09
9. Negative Alcohol-related Consequences T1	-.10	-.13	.24	.45	.40	.35	.44	.27	<u>.91</u>		8.48	7.56
10. Negative Alcohol-related Consequences T2	-.06	-.12	.17	.36	.29	.30	.39	.35	.69	<u>.91</u>	6.73	6.83

Note. T1 = Baseline; T2 = Follow-up. Significant correlations ($p < .05$) are bolded for emphasis. Cronbach's alphas are underlined and shown on the diagonals.