

Impulsivity increases risk for coping-motivated drinking in undergraduates with elevated social anxiety*

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Abstract

According to theory, those high in social anxiety (SA) are at risk for drinking alcohol for coping and conformity motives, which in turn lead to alcohol use and related problems. Empirical tests of this risk pathway in non-clinical samples have produced mixed results. Although those high on SA may drink to cope with anxiety and to reduce the likelihood of social rejection, they may also avoid drinking for fear of embarrassing themselves when intoxicated. Central to alcohol use by those high in SA is a temporary disregard of alcohol's potentially negative consequences. Accordingly, we hypothesized that SA would positively predict alcohol use and problems, but only at high levels of impulsivity (IMP). We expected these interactive effects to be mediated by coping and conformity motives. Undergraduates ($N = 461$) completed self-reports. Partially supporting hypotheses, IMP moderated the association between SA and alcohol-related problems (but not use), such that SA predicted problems only at high IMP. This interactive effect was mediated by coping (but not conformity) motives, such that SA positively predicted coping motives (especially at high IMP), which in turn predicted problems. Results suggest that IMP and coping motives clarify SA-related drinking. Clinical interventions may consider targeting IMP.

Keywords

Social anxiety; Impulsivity; Alcohol use; Undergraduates

1. Introduction

Motivational theories (Conger, 1956; Cooper, 1994) predict that those with elevated social anxiety (SA) are particularly responsive to alcohol's anxiolytic effects. Accordingly, through repeated drinking experience they learn that alcohol use has negatively reinforcing effects

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(i.e., reduces anxiety, decreases likelihood of social rejection) (Carrigan and Randall, 2003; Carrigan et al., 2008; Ham and Hope, 2005). However, evidence does not support a straightforward SA-alcohol use association. The adult literature demonstrates that those with (vs. without) an SA disorder are three times more likely to have a co-morbid alcohol use disorder (Merikangas and Angst, 1995). In contrast, examinations at subclinical levels earlier in the risk trajectory (i.e., students) reveal unclear support, with studies supporting positive (Kidorf and Lang, 1999), negative (Eggleston et al., 2004), and even null (Buckner et al., 2013) associations between SA and alcohol use. While evidence provides consistent statistical support for a positive association between SA and alcohol-related problems (Buckner et al., 2013), a meta-analysis revealed that the mean effect size for this association across studies is very small ($r = .053$) (Schry and White, 2013). We aimed to clarify SA as a risk factor for alcohol use and related problems early in the risk trajectory, among undergraduates.

1.1. Moderating role of impulsivity

While those high in SA may drink to reduce anxiety and likelihood of social rejection, they may also avoid drinking as alcohol is linked to potentially embarrassing disinhibited behavior. For those high in SA to drink, they must temporarily disregard the longer-term negative outcomes of drinking and focus on alcohol's immediate anxiolytic effects. Accordingly, impulsivity (IMP) may moderate the SA-alcohol use/problem relation. IMP refers to a set of individual differences that relate to biased attention to reward, and risky behavior to obtain immediate gratification, despite potential negative outcomes (Pihl and Peterson, 1995). IMP is also associated with decreased tolerance for negative emotions and increased risky behavior when emotionally distressed (Zuckerman and Kuhlman, 2000). There is some evidence pointing to a sub-group of socially anxious individuals who are behaviorally disinhibited or impulsive (Kashdan et al., 2009). This sub-group has been linked with increased risky behaviors and substance use disorder co-morbidity (Nicholls et al., 2014). We contend that high SA may be associated with risk for alcohol use and related problems, but only when IMP is high. This prediction remains untested among undergraduates.

1.2. Mediating role of drinking motives

Four drinking motives, which vary along reinforcement valence (positive, negative) and source (internal, external), have been linked with alcohol use and problems (Cooper, 1994): enhancement (positive reinforcement, internal; e.g., to increase positive mood), social (positive reinforcement, external; e.g., for social affiliation), coping (negative reinforcement, internal; e.g., to reduce anxiety), and conformity (negative reinforcement, external; e.g., avoid social rejection). Research consistently links internal drinking motives with alcohol use and related problems (Kuntsche et al., 2005). A few studies have linked conformity drinking motives to problematic drinking (e.g., Magid et al., 2007), but social drinking motives are generally unproblematic (Merrill and Read, 2010).

While theory suggests that SA should lead to alcohol use and related problems through its effects on coping and conformity drinking motives, research is mixed. Supporting theory, two studies link elevated SA to negative reinforcement-motivated drinking (coping and

conformity), which in turn predicted increased alcohol-related problems (Lewis et al., 2008; Stewart et al., 2006). In contrast, Buckner et al. (2006) found that enhancement motives mediated this effect, while Ham et al. (2009) found that coping but not conformity motives partially mediated the association between SA and two aspects of hazardous drinking. In addition, evidence does not consistently link SA with negative reinforcement motives in undergraduates. While many studies find a positive link between SA and coping motives (Buckner and Heimberg, 2010; Clerkin and Barnett, 2012; Lewis et al., 2008; Stewart et al., 2006), others have found SA to be unrelated to coping-related drinking (Ham et al., 2007). Moreover, the SA-conformity motives relation is very inconsistent (Lewis et al., 2008; Ham et al., 2007). The high intercorrelations among the drinking motives were not accounted for in extant work; this is problematic when the goal is to examine conceptually unique effects.

1.3. Mediated moderation model

Informed by the Acquired Preparedness Model (Corbin et al., 2011), we propose that the moderating role of IMP may clarify why some persons high in SA drink frequently for negative reinforcement purposes, while others do not. According to this model, personality traits related to disinhibition, like IMP, shape the learning of alcohol-related cognition (Corbin et al., 2011). Specifically, elevated IMP in socially anxious persons may enhance the salience of alcohol's immediate anxiolytic effects (i.e., reduce nervousness and fears of not fitting in) and shift attention away from alcohol's aversive outcomes. Due to biased learning, those high in SA and high in IMP may come to drink for coping and conformity motives. In turn, drinking for these motives should lead to heavy alcohol use and problems (Cooper, 1994).

1.4. The current study

We hypothesized that IMP would moderate the association between SA and problematic drinking, such that SA would be positively associated with both alcohol use and problems at high but not low IMP. Further, we expected that this effect would be mediated by coping and conformity motives.

2. Materials and methods

2.1. Participants and procedure

A total of 574 undergraduates completed online self-reports. Since drinking motives were assessed, only drinkers (1 drink in past month) were included in analyses. The final sample included $N = 461$ drinkers (376 women; $M_{age} = 22.23$ years, $SD = 4.48$, range 18–34 years). Excluded cases (i.e., abstainers) did not differ significantly from those included in terms of SA and IMP. Ethnic groups were Caucasian (77%), Asian (5%), African-American (3%), Hispanic (3%), and “Other” (12%). Students lived with family (64%), off-campus without family (34%), and on campus (2%). Participants volunteered via an online participant pool and were compensated with course credit. Participants had to be of legal drinking age (18 years old) to be eligible.

2.2. Measures

2.2.1. The Liebowitz Social Anxiety Scale (LSAS) (Liebowitz, 1987; Heimberg et al., 1999)—Participants rated their fear/anxiety (0 = none to 3 = severe) and avoidance (0 = never (0%) to 3 = usually (67–100%)) for each of the 24-items/situations. A composite score was created by averaging all items. Previous work supports good internal consistency ($\alpha = .96$) and retest reliability ($r = .83$) of the LSAS (Baker et al., 2002). Our Cronbach's alpha was .96.

2.2.2. Substance Use Risk Profile Scale — impulsivity (Woicik et al., 2009)—This subscale captures IMP globally and relates to acting without premeditation. Participants rated how true each of the 5 items (1 = strongly disagree to 4 = strongly agree) was for them. A sum score was calculated. Previous work supports acceptable internal consistency ($\alpha = .70$) and retest reliability ($r = .65$) of the IMP subscale (Woicik et al., 2009). This work also demonstrates that SURPS IMP aligns with other widely used measures of IMP (Woicik et al., 2009). Our Cronbach's alpha was .72.

2.2.3. Drinking Motives Questionnaire-Revised (DMQ-R) (Cooper, 1994)—Participants indicated how often (1 = almost never/never to 5 = almost always/always) they drink for each motive: enhancement (5-items), social (5-items), coping (5-items), and conformity (5-items). Mean subscale scores were derived. Previous work supports good subscale internal consistencies ($\alpha = .82$ –.88) (Kuntsche et al., 2006). Our Cronbach's alphas ranged from .80–.95.

2.2.4. Alcohol use (Cahalan et al., 1969)—Participants indicated frequency (0 = not at all to 7 = every day of the week) and quantity (0 = not at all to 10 = ten drinks/occasion) of drinking on a typical week in the past month. A composite score reflecting typical weekly use was derived. This is a common measure in the literature (Keough & O'Connor, 2014; Read & O'Connor, 2006) and is found to be accurate when confidentiality is ensured (Sobell & Sobell, 1990). Supporting concurrent validity, this measure correlates highly with annual drinking rates (O'Malley and Johnson, 2002) and past-90 weekly alcohol use (Read & O'Connor, 2006).

2.2.5. Young Adult Alcohol Consequences Questionnaire (YAACQ) (Read et al., 2006)—Participants indicated whether or not (1 = yes; 0 = no) they experienced each of the 48 alcohol-related problems in the past year. “Yes” responses were summed to provide a total score. The YAACQ total score has demonstrated good internal consistency ($\alpha = .89$) and validity (Read et al., 2006). Using tetrachoric correlations, our Cronbach's α was .93.

2.3. Data analytic overview

Analyses were conducted in Mplus (Muthén and Muthén, 2012). Following preliminary analyses, path analysis was used to test the proposed interactive effects of SA and IMP on alcohol use and related problems. Next, path analysis was used to test the proposed mediated moderation model from SAxIMP to alcohol outcomes via drinking motives. Predictor variables were centered and moderation effects were probed using simple slopes (Aiken and

West, 1991), conditioning the effect of SA on the alcohol outcomes at high (+1 *SD*) and low (−1 *SD*) IMP.

The initial model was saturated to examine the unique interactive effect of SAxIMP on alcohol use and problems. Model fit in the mediated moderation path model was considered excellent if the CFI and TLI were >.95, the RMSEA was .05 and the model χ^2/df ratio was <3.0 (Hu & Bentler, 1999; Kline, 2011). Covariances were estimated among motives and among drinking outcomes to control for shared variance. Bias corrected bootstrapping was used to test the presence and magnitude of indirect effects. Mediation was supported if the indirect effect *CI* did not contain zero (Fritz and MacKinnon, 2007). Consistent with Merrill and Read (2010), hypothesized and non-hypothesized indirect effects were evaluated at 95% and 99% CIs, respectively.

3. Results

3.1. Data screening

There were no outliers or missing data. We used robust maximum likelihood estimation (MLR) to calculate path coefficients and fit indices because some variables were positively skewed. MLR and bootstrapping are robust to violations of multivariate normality (Mackinnon, 2008; Muthén and Muthén, 2012).

3.2. Descriptive statistics and bivariate correlations

Relative to other Canadian undergraduates, our sample had comparable weekly alcohol use and related problems (e.g., Grant et al., 2007) (Table 1). SA positively correlated with all drinking motives, but was uncorrelated with alcohol use or related problems.

3.3. Hypothesis testing

3.3.1. Moderation analysis¹ (see Table 2)—Unexpectedly, the SAxIMP interaction was not a statistically significant predictor of alcohol use ($R^2 = .04$). However, as hypothesized, the SAxIMP interaction term was a statistically significant predictor of alcohol-related problems ($R^2 = .15$). As expected, there was a significant positive association between SA and alcohol-related problems at high, but not low, IMP (Fig. 1).

3.3.2. Mediated moderation analysis—The initial hypothesized model did not fit the data well ($\chi^2_{(6)} = 48.28, p = .00, \chi^2/df = 8.05, CFI = .95, TLI = .74, RMSEA = .12$ [90% *CI* = .09, .16]). Based on theory, previous findings on IMP and alcohol use (Krank et al., 2011), and modification indices, two direct paths were added iteratively and improvement in fit was assessed using Satorra and Bentler's (2010) χ^2 test in models estimated using MLR. Adding direct effects from IMP to problems ($\chi^2 = 37.33, p < .001$) and from IMP to alcohol use ($\chi^2 = 13.41, p < .001$) led to significant improvements in model fit. The final model fit was excellent: ($\chi^2_{(4)} = 8.10, p = .09, \chi^2/df = 2.03, CFI = .99, TLI = .96, RMSEA = .05$ [90% *CI* = .00, .09]) (see Fig. 2)

¹Residency and gender were tested initially as covariates in our model given that these demographic factors are known to influence alcohol use. However, the model results did not change. We chose to report the model without covariates, given that the model was already quite complex for the sample size.

As expected, the SAxIMP interaction term was a statistically significant predictor of coping motives, but (unexpectedly), not conformity motives. Consistent with previous work (Kuntsche et al., 2005), coping motives was a positive statistically significant predictor of alcohol-related problems, but not use. Counter to hypotheses and previous work (e.g., Merrill and Read, 2010), conformity motives was not a statistically significant predictor of alcohol use or problems.

See Table 3 for summary of all indirect effects in the unconditional path model. Partially as hypothesized, the interactive effect of SAxIMP on alcohol-related problems was mediated by coping motives. However, this effect was not mediated by conformity motives. The hypothesized indirect effect from SA to alcohol-related problems via coping motives was supported at high ($b = 1.10$, 95% $CI[0.42, 1.92]$) and to a lesser extent low ($b = 0.68$, 95% $CI[0.31, 1.29]$) IMP. While this indirect effect was not expected at low IMP, the pattern of effect sizes supports hypotheses. The first order effect of SA on alcohol-related problems was also mediated by coping motives. Consistent with extant literature on impulsivity-related drinking (Magid et al., 2007; Woicik et al., 2009), the indirect effects from IMP to alcohol-related problems via both enhancement and coping motives were supported.

4. Discussion

We aimed to clarify SA as a risk factor for alcohol use and related problems at the early end of the risk trajectory (i.e., non-clinical undergraduates). We observed null zero-order correlations between SA and alcohol use and related problems. This is not surprising, given mixed evidence supporting the association between SA and drinking behavior. Fitting with theory, however, we found that IMP moderated the SA-alcohol relation. Specifically, elevated SA increased risk for alcohol-related problems (but not elevated use), but only if IMP was high. Further, we found support that this interactive effect was mediated by coping (but not conformity) motives. Our results provide support for an integrative model of SA-related drinking — one that identifies the contributing and mechanistic roles of IMP and coping motives, respectively.

A sizable body of evidence demonstrates that IMP relates to heavy drinking and alcohol-related problems (see Dick et al., 2010). It has been consistently found that elevated IMP influences drinking outcomes both directly and indirectly (through motives) (Krank et al., 2011; Magid et al., 2007). Our results align with this work. Traditionally, theory predicts that those high in IMP drink for positive reinforcement purposes (e.g., “excitement”) (e.g., Pihl and Peterson, 1995), but emerging evidence also implicates IMP in negative reinforcement-motivated drinking (MacKinnon et al., 2014). Our results support both pathways, suggesting that elevated IMP may be linked to drinking, as a way to change internal states, be this drinking to increase positive or decrease negative affect.

Currently, little is known about how IMP operates in the SA pathway to alcohol use and related problems. Consistent with theory and emerging evidence on the co-occurrence of disinhibition and SA (Kashdan and Hofmann, 2008), our data suggest that those with elevated SA, who are also impulsive, are at risk for alcohol-related problems. Further, our data implicate coping motives as the explanatory variable in this risk pathway.

Our work sheds insight on the mixed association between SA and drinking motives found in extant studies. By testing IMP as a moderator of the SA-alcohol relation, and by considering the unique mediating roles of coping and conformity drinking motives (after controlling for overlap with other motives), our work offers some resolution to this literature. Consistent with the Acquired Preparedness Model (Corbin et al., 2011), we found that coping motives alone mediated the effect of SA on alcohol-related problems. This is consistent with extant drinking motives work (Kuntsche et al., 2005) demonstrating that these individuals are at risk for alcohol-related problems because of their coping motives for alcohol use. Of course, the cross sectional nature of our study limits us in testing the influence of IMP on the development of coping motives per se in socially anxious individuals, however.

We did not find support for conformity drinking motives as a mediator of the SA-drinking relation. There are two possible reasons for this finding. First, external motives are highly-context dependent and less stable over time than are internal motives for drinking (Kuntsche et al., 2005). Accordingly, some researchers posit that individual difference factors (like SA) may play less of a role in externally- (versus relative internally) motivated drinking (Kuntsche et al., 2006). Supporting this, several studies show that the association between conformity (and social) motives and alcohol use tends to be weak and/or not statistically significant once controlling for coping and enhancement motives (Kuntsche et al., 2006; Stewart and Devine, 2000). Second, while some work in undergraduates implicates conformity motives in problematic drinking (Stewart et al., 2006), it is possible that drinking to fit in plays a more central role in adolescence than in young adulthood. Peer alcohol use and peer attitudes about drinking are strong and consistent predictors of teenage alcohol use (Ary et al., 1993). Also, conformity-motivated drinking tends to be highly endorsed in adolescents (Brown & Finn, 1982), particularly among those with elevated anxiety (Comeau et al., 2001). Future work should examine the trajectories of conformity-motivated drinking from adolescence to young adulthood (and within this period) in those with elevated SA and IMP.

There are limitations of our study. First, the correlational design limits inferences about coping motives as causal mechanisms. Future experimental (e.g., in-lab anxious mood inductions) and longitudinal work should look at the temporal precedence of these constructs. Second, IMP is multifaceted and some aspects of IMP relate more strongly to substance use than others (Gullo et al., 2014). We measured IMP globally (i.e., acting without premeditation; MacKinnon et al., 2014); thus, future work should expand on our study by examining how different aspects of IMP link to alcohol use and problems in those with elevated SA. This may help to clarify the lack of results for alcohol use in the present study. Specifically, negative urgency (acting rashly when emotionally distressed) may be particularly relevant to SA-related drinking (Cyders and Smith, 2008). Third, our gender imbalance prohibited testing gender effects. One recent finding (Buckner and Shah, 2015) is that conformity motives uniquely explained the SA-alcohol problem association among men, whereas, coping with anxiety motives uniquely mediated this association in women. Future studies should integrate IMP into gender-specific models of SA-related alcohol use. Fourth, like much of work in the literature, we used the broad coping motives subscale from the DMQ-R; however, recent work shows that it is valuable to differentiate between coping with anxiety versus coping with depression motives (Grant et al., 2007). Future work should

integrate this distinction. Fifth, some of our measures had different timeframes of measurement (e.g., past month alcohol use and past year alcohol problems). However, it should be noted that past 30-day alcohol use correlates highly with annual drinking (O'Malley and Johnson, 2002) and yearly alcohol-related problems (Read and O'Connor, 2006). Finally, the lack of psychiatric history for participants is an additional limitation.

5. Conclusions

Our study contributes to the current understanding of the moderating and mediating roles of IMP and coping motives, respectively, in the SA-pathway to alcohol-related problems. Our work advances risk models, such that those who study SA-risk should consider the contributing role of IMP in coping-related drinking and ultimately alcohol-related problems. Also, our work suggests that clinical interventions for coping-motivated drinking by those high in SA should consider targeting IMP.

References

- Aiken, LS., West, SG. Multiple regression: Testing and interpreting interactions. California: Sage; 1991.
- Ary DV, Tildesley E, Hops H, Andrews J. The influence of parent, sibling, and peer modeling and attitudes on adolescent use of alcohol. *Substance Use & Misuse*. 1993; 28(9):853–880.
- Brown J, Finn P. Drinking to get drunk: Findings of a survey of junior and senior high school students. *Journal on Alcoholism Drug Education*. 1982; 27:13–25.
- Baker SL, Heinrichs N, Kim H-J, Hofmann SG. The Liebowitz social anxiety scale as a self-report instrument: A preliminary psychometric analysis. *Behaviour Research and Therapy*. 2002; 40:701–715. [PubMed: 12051488]
- Buckner JD, Eggleston AM, Schmidt NB. Social anxiety and problematic alcohol consumption: The mediating role of drinking motives and situations. *Behavior Therapy*. 2006; 37:381–391. [PubMed: 17071215]
- Buckner JD, Heimberg RG, Ecker AH, Vinci C. A biopsychosocial model of social anxiety and substance use. *Depression and Anxiety*. 2013; 30:276–284. [PubMed: 23239365]
- Buckner JD, Heimberg RG. Drinking behaviors in social situations account for alcohol-related problems among socially anxious individuals. *Psychology of Addictive Behaviors*. 2010; 24:640–648. [PubMed: 21198225]
- Buckner, JD., Shah, SM. Fitting in and feeling fine: conformity and coping motives differentially mediate the relationship between social anxiety and drinking problems for men and women. *Addiction Research and Theory*. 2015. <http://dx.doi.org/10.3109/16066359.2014.978304>
- Cahalan, D., Cisin, IH., Crossley, HM. American drinking practices: A national study of drinking behavior and attitudes. 1969. Monographs of the Rutgers Center of Alcohol Studies
- Carrigan MH, Randall CL. Self-medication in social phobia: A review of the alcohol literature. *Addictive Behaviors*. 2003; 28:269–284. [PubMed: 12573678]
- Carrigan MH, Ham LS, Thomas SE, Randall CL. Alcohol outcome expectancies and drinking to cope with social situations. *Addictive Behaviors*. 2008; 33:1162–1166. [PubMed: 18550293]
- Clerkin EM, Barnett N. The separate and interactive effects of drinking motives and social anxiety symptoms in predicting drinking outcomes. *Addictive Behaviors*. 2012; 37:674–677. [PubMed: 22365887]
- Comeau N, Stewart SH, Loba P. The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors*. 2001; 26:803–825. [PubMed: 11768546]
- Conger JJ. Alcoholism: Theory, problem and challenge. II. Reinforcement theory and the dynamics of alcoholism. *Quarterly Journal of Studies on Alcohol*. 1956; 17:296–305. [PubMed: 13336262]

- Corbin WR, Iwamoto DK, Fromme K. A comprehensive longitudinal test of the Acquired Preparedness Model for alcohol use and related problems. *Journal of Studies on Alcohol and Drugs*. 2011; 72:602–610. [PubMed: 21683042]
- Cooper ML. Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment*. 1994; 6:117–128.
- Cyders MA, Smith GT. Emotion-based dispositions to rash action: Positive and negative urgency. *Psychological Bulletin*. 2008; 134(6):807–828. [PubMed: 18954158]
- Dick DM, Smith G, Olausson P, Mitchell SH, Leeman RF, O'Malley SS, Sher K. Understanding the construct of impulsivity and its relationship to alcohol use disorders. *Addiction Biology*. 2010; 15:217–226. [PubMed: 20148781]
- Eggleston AM, Woolaway-Bickel K, Schmidt NB. Social anxiety and alcohol use: Evaluation of the moderating and mediating effects of alcohol expectancies. *Journal of Anxiety Disorders*. 2004; 18:33–49. [PubMed: 14725867]
- Fritz MS, MacKinnon DP. Required sample size to detect the mediated effect. *Psychological Science*. 2007; 18:233–239. [PubMed: 17444920]
- Grant VV, Stewart SH, O'Connor RM, Blackwell E, Conrod PJ. Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire-Revised in undergraduates. *Addictive Behaviors*. 2007; 32:2611–2632. [PubMed: 17716823]
- Gullo MJ, Loxton NJ, Dawe S. Impulsivity: Four ways five factors are not basic to addiction. *Addictive Behaviors*. 2014; 39:1547–1556. [PubMed: 24576666]
- Ham LS, Bonin M, Hope DA. The role of drinking motives in social anxiety and alcohol use. *Journal of Anxiety Disorders*. 2007; 21:991–1003. [PubMed: 17275253]
- Ham LS, Hope DA. Incorporating social anxiety into a model of college student problematic drinking. *Addictive Behaviors*. 2005; 30:127–150. [PubMed: 15561454]
- Ham LS, Zamboanga BL, Bacon AK, Garcia TA. Drinking motives as mediators of social anxiety and hazardous drinking among college students. *Cognitive Behaviour Therapy*. 2009; 38:133–145. [PubMed: 19306146]
- Heimberg RG, Horner KJ, Juster HR, Safren SA, Brown EJ, Schneier FR, Liebowitz MR. Psychometric properties of the Liebowitz Social Anxiety Scale. *Psychological Medicine*. 1999; 29:199–212. [PubMed: 10077308]
- Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*. 1999; 6:1–55.
- Kashdan TB, Hofmann SG. The high novelty-seeking, impulsive subtype of generalized social anxiety disorder. *Depression and Anxiety*. 2008; 25:235–241.
- Kashdan TB, McKnight PE, Richey JA, Hofmann SG. When social anxiety disorder co-exists with risk-prone, approach behavior: Investigating a neglected, meaningful subset of people in the National Comorbidity Survey-Replication. *Behaviour Research and Therapy*. 2009; 47:559–568. [PubMed: 19345933]
- Keough MT, O'Connor RM. Clarifying the measurement and the role of the behavioral inhibition system in alcohol misuse. *Alcoholism, Clinical and Experimental Research*. 2014; 38:1470–1479.
- Kidorf M, Lang AR. Effects of social anxiety and alcohol use on stress-induced drinking. *Psychology of Addictive Behaviors*. 1999; 13:134–142.
- Kline, RB. Principles and practice of structural equation modeling. New York: Guilford Press; 2011.
- Krank M, Stewart SH, O'Connor R, Woicik PB, Wall AM, Conrod PJ. Structural, concurrent, and predictive validity of the Substance Use Risk Profile Scale in early adolescence. *Addictive Behaviors*. 2011; 36:37–46. [PubMed: 20826056]
- Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. *Clinical Psychology Review*. 2005; 25:841–861. [PubMed: 16095785]
- Kuntsche E, Knibbe R, Gmel G, Engels R. Who drinks and why? A review of socio-demographic, personality, and contextual issues behind the drinking motives in young people. *Addictive Behaviors*. 2006; 31:1844–1857. [PubMed: 16460883]
- Lewis MA, Hove MC, Whiteside U, Lee CM, Kirkeby BS, Oster-Aaland L, ... Larimer ME. Fitting in and feeling fine: Conformity and coping motives as mediators of the relationship between social

- anxiety and problematic drinking. *Psychology of Addictive Behaviors*. 2008; 22:58–67. [PubMed: 18298231]
- Liebowitz MR. Social phobia. *Modern Problems of Pharmacopsychiatry*. 1987; 22:141–173. [PubMed: 2885745]
- Mackinnon SP, Kehayes I-LL, Clark R, Sherry SB, Stewart SH. *Psychol. Addictive Behaviors*. 2014; 28(4):1000–1012.
- MacKinnon, DP. *Introduction to statistical mediation analysis*. New York: Lawrence Erlbaum Associates; 2008.
- Magid V, MacLean MG, Colder CR. Differentiating between sensation seeking and impulsivity through their mediated relations with alcohol use and problems. *Addictive Behaviors*. 2007; 32:2046–2061. [PubMed: 17331658]
- Merikangas K, Angst J. Comorbidity and social phobia: Evidence from clinical, epidemiologic, and genetic studies. *European Archives of Psychiatry and Clinical Neuroscience*. 1995; 244:297–303. [PubMed: 7772612]
- Merrill JE, Read JP. Motivational pathways to unique types of alcohol consequences. *Psychology of Addictive Behaviors*. 2010; 24:705. [PubMed: 20822194]
- Muthén, LK., Muthén, BO. *Mplus user's guide: Version 7*. Los Angeles, CA: Muthén and Muthén; 2012.
- Nicholls J, Staiger PK, Williams JS, Richardson B, Kambouropoulos N. When social anxiety co-occurs with substance use: Does an impulsive social anxiety subtype explain this unexpected relationship? *Psychiatry Research*. 2014; 220:909–914. [PubMed: 25261335]
- O'Malley PM, Johnston LD. Epidemiology of alcohol and other drug use among American college students. *Journal of Studies on Alcohol. Supplement*. 2002; 14:23–39.
- Pihl RO, Peterson JB. Alcoholism: the role of different motivational systems. *Journal of Psychiatry & Neuroscience*. 1995; 20:372–396. [PubMed: 8527424]
- Read JP, Kahler CW, Strong DR, Colder CR. Development and preliminary validation of the Young Adult Alcohol Consequences Questionnaire. *Journal of Studies on Alcohol*. 2006; 67:169–177. [PubMed: 16536141]
- Read JP, O'Connor RM. High- and low-dose expectancies as mediators of personality dimensions and alcohol involvement. *Journal of Studies on Alcohol*. 2006; 67:204–214. [PubMed: 16562402]
- Satorra A, Bentler PM. Ensuring positiveness of the scaled difference chi-square test statistic. *Psychometrika*. 2010; 75:243–248. [PubMed: 20640194]
- Schry AR, White SW. Understanding the relationship between social anxiety and alcohol use in college students: A meta-analysis. *Addictive Behaviors*. 2013; 38:2690–2706. [PubMed: 23906724]
- Sobell LC, Sobell MB. Self-report issues in alcohol abuse: State of the art and future directions. *Behavioral Assessment*. 1990; 12:91–106.
- Stewart SH, Devine H. Relations between personality and drinking motives in young adults. *Personality and Individual Differences*. 2000; 29:495–511.
- Stewart SH, Morris E, Mellings T, Komar J. Relations of social anxiety variables to drinking motives, drinking quantity and frequency, and alcohol-related problems in undergraduates. *Journal of Mental Health*. 2006; 15:671–682.
- Woicik PB, Conrod PJ, Stewart SH, Pihl RO. The Substance Use Risk Profile Scale: A scale measuring traits linked to reinforcement-specific substance use profiles. *Addictive Behaviors*. 2009; 34(12): 1042–1055. [PubMed: 19683400]
- Zuckerman M, Kuhlman MD. Personality and risk-taking: Common biosocial factors. *Journal of Personality*. 2000; 68:999–1029. [PubMed: 11130742]

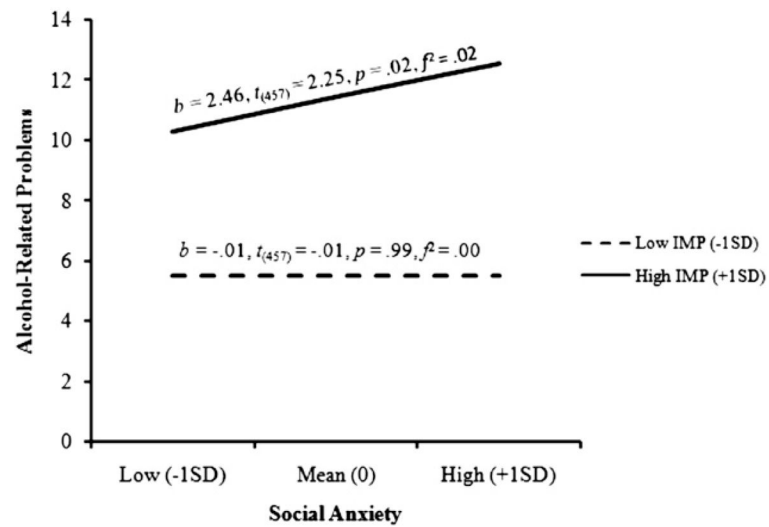


Fig. 1. Simple slopes of social anxiety predicting alcohol-related problems at high (+1 *SD*) and low (-1 *SD*) levels of impulsivity (title). Alcohol use was a covariate.

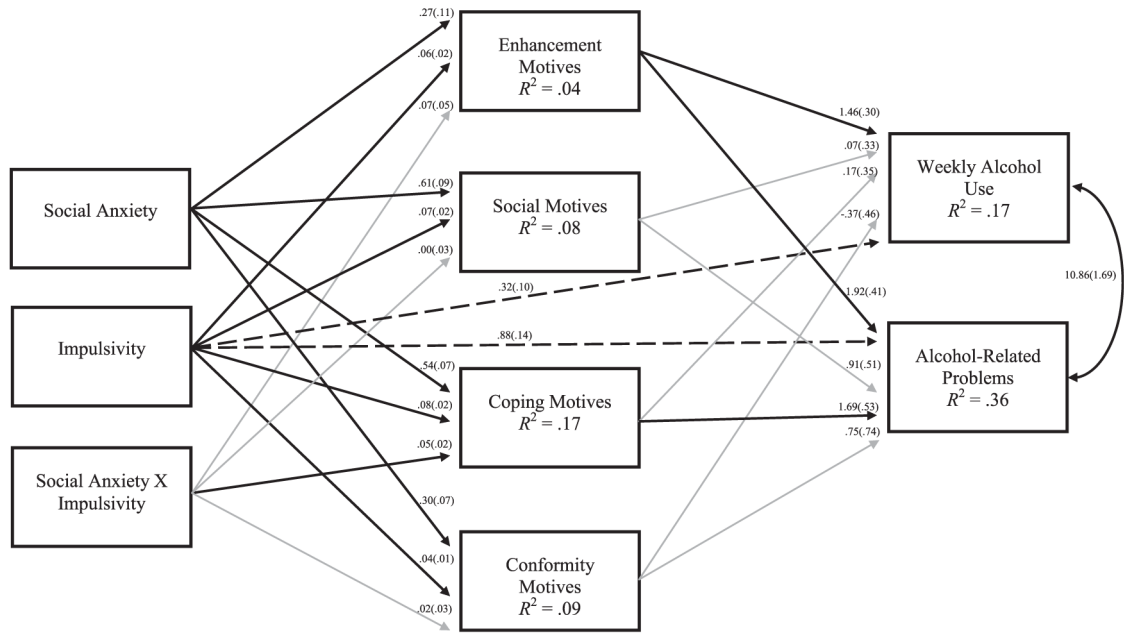


Fig. 2. Full mediated moderation path model from social anxiety by impulsivity to drinking outcomes via motives (title). Unstandardized coefficients with standard errors (in brackets) are presented. Solid lines are statistically significant paths ($p < .05$) and gray lines are non-statistically significant paths ($p > .05$). Broken lines are non-hypothesized, but theoretically consistent direct effects that were significant ($p < .05$). Covariances were estimated among the drinking motives ($b = 0.09-0.58$, $ps < .001$) but are not presented for clarity.

Table 1

Descriptive statistics and bivariate correlations.

	1	2	3	4	5	6	7	8
1. Social anxiety	1.00	.11*	.14**	.32**	.34**	.25**	-.02	.07
2. Impulsivity		1.00	.14**	.20**	.26*	.19**	.21	.37**
3. Enhancement motives			1.00	.64**	.43**	.20**	.37**	.46**
4. Social motives				1.00	.56**	.50**	.26**	.56**
5. Coping motives					1.00	.45**	.21**	.44**
6. Conformity motives						1.00	.07	.29**
7. Alcohol use							1.00	.52**
8. Alcohol-related problems								1.00
<i>M</i>	0.73	8.26	2.57	2.61	1.81	1.40	4.11	8.47
<i>SD</i>	0.47	2.35	1.06	0.93	0.82	0.60	4.59	7.82
Skew	5.15	2.79	2.75	0.79	10.85	15.96	14.64	10.48
Kurtosis	-0.17	0.19	-3.81	-3.50	5.24	11.96	9.03	4.27

Note.

* $p < .05$ ** $p < .001$.

Table 2

Testing IMP as a moderator of the effect of SA on problematic drinking outcomes.

Predictors	B	SE	β	R ²	t	p
<i>Alcohol use (criterion)</i>						
Social anxiety	-0.02	0.45	0.00		-0.05	.96
Impulsivity	0.41	0.10	0.20		3.98	<.001
Social anxiety × impulsivity	-0.15	0.16	-0.04		-0.95	.34
				.04[.01-.07] ^a		
<i>Alcohol-related problems (criterion)</i>						
Social anxiety	1.22	0.76	0.07		1.60	.11
Impulsivity	1.25	0.16	0.37		8.10	<.001
Social anxiety × impulsivity	0.52	0.28	0.08		1.88	.05
				.15[.09-.21] ^a		

Note. There was a statistically significant covariance among alcohol use and related problems ($b = 16.33$, $SE = 1.94$, $p < .001$).

^a.95% confidence interval.

Table 3

Summary of indirect effects in the unconditioned model.

Effect	Indirect effect	95% CI	99% CI
SA → Enhancement motives → Use	0.40	(0.11, 0.81)	(−0.01, 0.93)
SA → Enhancement motives → Problems	0.52	(0.13, 1.00)	(−0.02, 1.11)
IMP → Enhancement motives → Use	0.09	(0.02, 0.17)	(0.00, 0.20)
IMP → Enhancement motives → Problems	0.12 ^b	(0.02, 0.17)	(0.01, 0.29)
SA × IMP → Enhancement motives → Use	0.10	(−0.02, 0.24)	(−0.08, 0.28)
SA × IMP → Enhancement motives → Problems	0.13	(−0.03, 0.36)	(−0.09, 0.43)
SA → Social motives → Use	0.04	(−0.37, 0.46)	(−0.49, 0.62)
SA → Social motives → Problems	0.55	(−0.06, 1.23)	(−0.23, 1.53)
IMP → Social motives → Use	0.01	(−0.04, 0.05)	(−0.06, 0.07)
IMP → Social motives → Problems	0.06	(0.00, 0.15)	(−0.02, 0.16)
SA × IMP → Social motives → Use	0.00	(−0.03, 0.02)	(−0.05, 0.04)
SA × IMP → Social motives → Problems	0.00	(−0.09, 0.06)	(−0.13, 0.09)
SA → Coping motives → Use	0.09	(−0.25, 0.46)	(−0.38, 0.59)
SA → Coping motives → Problems	0.91 ^a	(0.38, 1.59)	(0.21, 1.78)
IMP → Coping motives → Use	0.01	(−0.04, 0.08)	(−0.05, 0.10)
IMP → Coping motives → Problems	0.14 ^b	(0.06, 0.26)	(0.04, 0.29)
SA × IMP → Coping motives → Use	0.01	(−0.02, 0.07)	(−0.03, 0.10)
SA × IMP → Coping motives → Problems	0.08 ^a	(0.01, 0.22)	(−0.02, 0.30)
SA → Conformity motives → Use	−0.11	(−0.48, 0.16)	(−0.63, 0.27)
SA → Conformity motives → Problems	0.23	(−0.15, 0.76)	(−0.29, 0.91)
IMP → Conformity motives → Use	−0.02	(−0.06, 0.02)	(−0.10, 0.04)
IMP → Conformity motives → Problems	0.03	(−0.02, 0.13)	(−0.04, 0.16)
SA × IMP → Conformity motives → Use	−0.01	(−0.09, 0.01)	(−0.15, 0.03)
SA × IMP → Conformity motives → Problems	0.02	(−0.02, 0.12)	(−0.05, 0.18)

Note. SA = social anxiety; IMP = impulsivity. Unstandardized parameter estimates are presented.

^a indicates mediation for hypothesized indirect effects at 95% CIs and

^b represents mediation for non-hypothesized indirect effects at 99% CIs.