

Anxiety sensitivity, drinking motives, alcohol expectancies, and alcohol use and problems: A
prospective state-trait analysis among emerging adults

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Abstract

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Alcohol use and problems increase during adolescence and peak in early adulthood. Tension reduction theories suggest that those high in anxiety sensitivity (AS) may be at risk for misusing alcohol for its anxiolytic effects. Cognitive theories point to drinking motives and alcohol expectancies as explanatory mechanisms of this risk pathway. The goal of the current study was to examine AS risk for prospective alcohol misuse, as explained by an unfolding cognitive process, among those transitioning out of ‘Collège d’enseignement général et professionnel’ (CEGEP). We hypothesized that AS, drinking for coping motives, tension reduction alcohol expectancies, and alcohol use and problems would be positively associated (across three time-points) at the ‘trait level’. Further, we hypothesized that AS would lead to a bidirectional and positive association between alcohol cognitions and outcomes at the ‘state level’. CEGEP students in their final year of study ($N = 193$ at baseline) completed 3 online questionnaires at 6-month intervals (third time point post-graduation). Confirmatory factor analyses were used to test measurement invariance of constructs (all but AS) across 3 time points, and state-trait modeling was used for hypothesis testing. Consistent with hypotheses, at the trait level, drinking motives and alcohol expectancies were positively associated, and alcohol problems were positively associated with drinking motives and sociability/liquid courage expectancies. At the state level, (1) AS was positively associated with cope motives, (2) positive expectancies were positively associated, and (3) enhancement motives were positively associated with sociability/liquid courage expectancies. The results suggest that AS is a risk factor for

coping-motivated drinking, and that there is interplay between motives and expectancies that needs to be considered in understanding alcohol risk pathways in emerging adults.

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Anxiety Sensitivity, Drinking Motives, Alcohol Expectancies, and Alcohol Use and Problems: A Prospective State-Trait Analysis Among Emerging Adults

Patterns of alcohol use and associated problems fluctuate over the course of development, peaking in early adulthood (O'Malley, 2004). In high school, alcohol is reported as the most used substance (Johnson et al., 2015), and in university, rates of alcohol use continue to increase. Indeed, the vast majority of undergraduates drink, and of those who do, 72% drink at hazardous levels (Adlaf et al., 2005). Heavy alcohol use during the transition from adolescence into emerging adulthood (i.e., 18-29 years old) has the potential to lead to a host of problems (e.g., poor academic performance, risky sexual encounters; Miller et al., 2007), and can presage risk for long-term alcohol misuse, including the development of alcohol use disorder (Grant & Dawson, 1997; Grant et al., 2006; Hanson et al., 2011; Marshall, 2014; McCambridge et al., 2011; Merline et al., 2008). As such, identifying risk factors and mechanisms that influence alcohol use and problems during emerging adulthood is imperative.

Anxiety Sensitivity and Alcohol Use and Problems

Anxiety has been linked with alcohol misuse and problems across the lifespan (Burns & Teesson, 2002; Schulte & Hser, 2013). Indeed, alcohol use disorder (AUD) and anxiety disorders are highly comorbid (Grant et al., 2004; Kushner et al., 2000); 13.02% of individuals with AUD have a comorbid anxiety disorder (Grant et al., 2004). Specifically, AUD is comorbid with panic disorder (15.29-18.81%), social phobia (13.05%), specific phobia (12.34%) and generalized anxiety disorder (14.82%; Grant et al., 2004). Evidence indicates that those with comorbid alcohol and anxiety disorders drink to cope or to reduce tension, and this puts them at risk for alcohol related problems (e.g., Park & Levenson, 2002; Thomas et al., 2003). Anxiety sensitivity (AS) – the fear of experiencing anxious symptoms and the belief that these symptoms will lead

to negative health, social, and cognitive consequences – is related to several anxiety disorders across the lifespan. In particular, panic disorder and generalized anxiety disorder are associated with the highest levels of AS (Reiss & McNally, 1985; Allan et al., 2016; Knapp et al., 2016; Taylor et al., 1992).

Tension reduction theories of alcohol use (e.g., Cappell & Herman, 1972; Greeley & Oei, 1999; Logue et al., 1978; MacAndrew, 1982) suggest that those high in AS drink to reduce symptoms of anxiety or social and emotional distress (i.e., drink to cope; e.g., Cappell & Herman, 1972; Greeley & Oei, 1999; Logue et al., 1978; MacAndrew, 1982; Baker et al., 2004). Similarly, negative reinforcement models (e.g., Austin & Smith, 2008; Cooper et al., 1995; Cox & Klinger, 1988) suggest that individuals high in AS drink to *avoid* distress (e.g., anxiety symptoms). Together, these theoretical frameworks suggest that those high in AS use alcohol for its anxiolytic effects, or to temporarily reduce/eliminate their sensitivity to tension, arousal, and anxious thoughts and sensations (Pihl & Peterson, 1995; Reiss, 1991; Stewart et al., 1999). Indeed, research has shown that those high (vs. low) in AS have a greater tendency to seek out the arousal-dampening effects of alcohol. In turn, these subjective effects reinforce alcohol use (Lewis & Vogeltanz-Holm, 2002; Zack et al., 2007), thus leading to increased risk for long term alcohol misuse (Stewart et al., 1999). Further, AS has been linked to increased risk for alcohol misuse and problems over and above manifest anxiety and negative affect (Howell et al., 2010). Thus, AS is an affective mechanism underlying drinking, regardless of the severity of anxious symptoms, making it a significant transdiagnostic factor that bridges the anxiety and alcohol use literatures.

Developmentally, empirical evidence suggests that AS is a personality trait that emerges during adolescence. In high school, self-reported levels of AS appear to be variable (Allan et al., 2016; Weems et al., 2002), but tend to stabilize in young adulthood and reliably predict the

development of anxiety disorders (Schmidt et al., 2007, 2010). As such, AS could differentially affect alcohol use patterns during the transition from adolescence to adulthood, putting those high in AS at particular risk for alcohol misuse and problems. Examining AS during this critical period could inform targeted interventions to mitigate long-term risk.

Mechanisms of Risk

Cognitive theories of alcohol use posit that beliefs about the effects of alcohol influence drinking behaviour (Maisto et al., 1999; Kuntsche et al., 2007). Drinking motives (i.e., reason for drinking) and alcohol expectancies (i.e., beliefs about the positive and negative effects of drinking) are conceptually different cognitions that are embedded in personality traits (e.g., impulsivity) and in historical (e.g., genetics), sociocultural (e.g., drinking customs), environmental (e.g., availability of alcohol), and situational (e.g., reinforcement from past drinking) factors (Kuntsche et al., 2007). Social cognitive theories of behaviour propose that both motives and expectancies are mechanisms of risk for alcohol misuse and problems.

Drinking Motives

Drawing on motivational theory, Cox and Klinger (1988) posited that drinking motives could be conceptualized using a two-dimensional model mirroring the valence and source of the motive. Accordingly, Cooper (1994) proposed four types of drinking motives: enhancement (internally sourced) and social (externally sourced) positive reinforcement motives, and coping (with anxiety or depression; internally sourced) and conformity (externally sourced) negative reinforcement motives. These theoretically and empirically distinct drinking motives are linked to unique patterns of alcohol misuse and related problems (Cooper et al., 1995); those that relate to affect regulation have been found to be particularly risky (Comeau et al., 2001; Merrill et al., 2014). Relevant to the current study, the cope anxiety motive for drinking aligns with tension reduction theory as alcohol is used to avoid, regulate, or decrease negative affect (e.g., drinking

to relax). A significant body of empirical research demonstrates that drinking for coping motives puts emerging adults at risk for alcohol misuse and problems (Carey & Correia, 1997; Cooper et al., 1995; Grant et al., 2007; Hasking & Oei, 2007; Kassel et al., 2000; McNally et al., 2003).

Specific to AS risk for alcohol misuse and problems, extant evidence supports the link between AS and negative reinforcement drinking motives, such that studies have found that those high in AS (vs. low) are more likely to drink to cope with negative affect (Conrod et al., 1998; Stewart et al., 1997). Moreover, cope anxiety motives have been found to mediate the association between AS and alcohol problems (Allan et al., 2015). Previous empirical evidence investigating specific drinking motives often control for the motive of opposite valence. Thus, enhancement motives – which are internally sourced and have a *positive* valence – could be relevant to the AS-alcohol use/problems association, given that individuals who drink to cope are looking to regulate their affect. Indeed, both enhancement and coping motives have been found to be associated with heavy alcohol use (Cooper, 1994). Thus, given that AS is a personality trait associated with alcohol misuse (Stewart et al., 1995) *and* a tendency to drink to regulate affect (Comeau et al., 2001; Conrod et al., 1998; Stewart et al., 1995), cope anxiety and enhancement motives could be two particularly significant mechanisms through which AS leads to alcohol misuse and problems. Yet, how they differentially impact drinking behaviour over time in emerging adults remains unclear.

Alcohol Expectancies

Alcohol expectancy theory and cognitive theories of alcohol use posit that beliefs about the effects of alcohol influence drinking behaviour (Abrams & Niaura, 1987; Maisto et al., 1999). Alcohol expectancies – which can be positive or negative – are part of one’s long-term memory, reflect automatic and controlled cognitive processes that surround current and future alcohol use (Jones et al., 2001), and emerge primarily through the interaction between social

influences (i.e., of friends, family, peers) and individual differences (e.g., AS; Oei & Morawska, 2004). Positive expectancies, or the anticipation that alcohol will have positive outcomes such as alleviating negative affect, have been categorized into four facets: tension reduction, sociability, liquid courage, and sexuality (Fromme et al., 1993; Jones et al., 2001).

Extant research has shown that positive alcohol expectancies are related to increased alcohol use, whereas negative alcohol expectancies are related to decreased use (Hasking et al., 2011). In addition, positive alcohol expectancies have been shown to lead to drinking initiation and elevated alcohol use, whereas negative expectancies have been shown to predict decreases in the amount of alcohol consumed or drinking abstinence (Anthenien et al., 2017; Jones & McMahon, 1993; Lee et al., 1999). Specific to AS, holding positive expectations that alcohol will reduce tension should, theoretically, promote risk. Indeed, empirical evidence links high AS with increased likelihood of holding tension reduction alcohol expectancies (Cooper, 1994; Karp, 1993; Stewart et al., 1999; Watt et al., 2006). Moreover, evidence suggests that holding tension reduction alcohol expectancies puts individuals high in AS at risk for alcohol misuse and problems (MacDonald et al., 2001; O'Connor et al., 2008; Stewart et al., 1999), similar to cope anxiety motives. Further investigation into the mechanistic complexities of positive alcohol expectancies could help better characterize the AS-alcohol misuse pathway for emerging adults. Given the mechanistic complexity, looking at sociability and liquid courage expectancies (in addition to tension reduction) in particular could help clarify the AS-alcohol use/problem risk pathway, given their link with risky alcohol use and their conceptual similarity to enhancement motives.

Interplay Between Drinking Motives and Alcohol Expectancies

Motivational models of alcohol use posit that expectancies about alcohol-related outcomes are reflected in one's drinking motives (i.e., expectancies influence motives; Kuntsche

et al., 2005; Leigh & Stacy, 1993). Additionally, expectancy theory represents the structure and process through which drinking motives lead to use (Jones et al., 2001); if an individual believes that consuming alcohol will regulate or alleviate negative affect, then they will likely expect alcohol to have tension reduction effects at future drinking occasions. As such, drinking motives and alcohol expectancies should theoretically influence one another and impact the trajectory of drinking behaviour over time. In particular, the bidirectional association between motives and expectancies should impact the AS-alcohol use/problem risk trajectory. As individuals high in AS gain drinking experience over time, drinking motives and alcohol expectancies should be positively associated with alcohol use and problems, given their tendency to drink for coping-motivated reasons and hold tension reduction expectancies (Allan et al., 2015; O'Connor et al., 2008; Stewart & Zeitlin, 1995).

Extant research associating motives and expectancies has generally been cross-sectional, wherein the unidirectional effects of expectancies on motives are tested in isolation or in succession, or observed levels of motives and expectancies are correlated (Cooper et al., 1995; Cox & Klinger, 1988; Kuntsche et al., 2005; Urbán et al., 2008; Williams & Clark, 1998). For example, Hasking and colleagues (2011) found that tension reduction expectancies positively predicted drinking to cope in a sample of undergraduate students, and Anthenien and colleagues (2017) found that coping motives and negative expectancies were positively correlated. However, what remains to be investigated is how overall, average levels of motives and expectancies are associated over time (i.e., at the 'trait' level), and how motives and expectancies reciprocally impact each other across time (i.e., at the 'state' level). These trait and state level investigations could be particularly fruitful in furthering our understanding of AS risk for alcohol misuse and problems.

The Current Study

This study used a longitudinal design with three assessments (online questionnaires) spaced at approximately 6-month intervals. The study goal was to examine associations between AS, drinking motives (cope anxiety, enhancement), alcohol expectancies (tension reduction, sociability/liquid courage), and alcohol use and problems at the trait (average across three time points) and state (occasion-specific) levels among Collège d'enseignement général et professionnel (CEGEP) students. CEGEP is specific to the province of Quebec and represents either a terminal (3-year technical diploma) or transitional (2-year general diploma leading to university) post-high school level of education. It is a time when emerging adults are faced with making critical decisions regarding their future career and education goals, and thus can be a period of high anxiety for some. Indeed, CEGEP provides a snapshot of emerging adulthood in Canada.

As a first step, we tested the measurement invariance of all constructs across time, except for AS, which was only measured at baseline. We hypothesized that (1) baseline levels of AS would be positively associated with initial levels of cope anxiety motives, tension reduction expectancies, and alcohol use and problems; [Note. We had no a priori hypotheses for the role of enhancement motives and sociability/liquid courage expectancies as they related to AS] (2) cope anxiety and enhancement motives would be positively associated at the *trait* and *state* levels; (3) tension reduction and sociability/liquid courage expectancies would be positively associated at the *trait* and *state* levels; (4) conceptually similar motives and expectancies would be positively associated at the *trait* and *state* levels. For example, we expected that cope anxiety motives would be positively correlated with (trait) and predictive of (state) tension reduction expectancies, and vice-versa. Further, we hypothesized that (5) motives and expectancies would be positively associated with alcohol use and problems at the *trait* and *state* levels. For example,

we expected cope anxiety motives to be correlated with (trait) and predictive of (state) increased alcohol use and problems, and vice-versa.

Method

Participants

Two hundred and twenty-one students ($M_{age}=18.87$, $SD_{age}=2.87$) were recruited from English-language CEGEPs in the greater Montreal area. At baseline, 137 (66.8%) participants identified as women, 67 (28.5%) as men, and one (0.5%) as other. Ninety-two (44.9%) identified as white/Caucasian, 49 (23.9%) as East Asian, South-East Asian, or Pacific Islander, 25 (12.2%) as South Asian, and 24 (11.7%) as Middle Eastern, North African, or Central Asian. The remainder identified as Hispanic/Latino, Black, or “Other.”

Procedure

Participants were recruited from local area CEGEPs via online ads (e.g., Kijiji, Craigslist) and flyers posted around Montreal. Interested participants were emailed a link to a questionnaire to determine eligibility. To be eligible, participants had to be over the age of 18 (i.e., legal drinking age in Quebec) and in their final year of CEGEP. Eligible participants completed a baseline assessment comprised of a battery of questionnaires (T1) and received follow-up questionnaires six months (T2) and twelve months (T3; after graduating from CEGEP) later. Upon completion of each time-point, participants were emailed a \$20 gift card.

Measures

Anxiety Sensitivity Index (T1)

The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) is a 16-item self-report questionnaire assessing sensitivity to anxiety-related symptoms and fear of possible negative consequences (e.g., “it scares me when I am nauseous”). Participants rated how well each item

described them on a five-point scale (0 = very little to 4 = very much). The ASI was completed once at baseline. A single composite mean score was derived for each participant. This was included as a manifest variable in the analyses. Higher ASI scores reflected elevated AS. The ASI has adequate scale score reliability with Cronbach's α s ranging from .86 (Schmidt & Joiner, 2002) to .88 (Peterson & Heilbronner, 1987), as well as adequate retest reliability ($r = .71-.75$; Peterson & Heilbronner, 1987). In the current study, ASI demonstrated adequate score reliability (see Table 1).

Drinking Motives (T1 to T3)

The Modified Drinking Motives Questionnaire-Revised (DMQ-R; Grant et al., 2007) is a 28-item questionnaire assessing motives for drinking alcohol. Two subscales were of interest in the current study: cope anxiety, 4 items (e.g., "you drink because it helps you when you feel nervous") and enhancement, 5 items (e.g., "you drink because it is exciting"). Participants indicated how often they drank for each motive during the past three months on a five-point scale (1 = almost never/never to 5 = almost always/always). The Modified DMQ-R was completed at each of the three timepoints. Latent cope anxiety (4 indicators) and enhancement (5 indicators) scores were derived for each participant at each timepoint. Previous research supports the concurrent validity of these subscales, showing correlations between cope anxiety and enhancement motives and heavy drinking ($r = .42$ and $r = .56$, respectively) and drinking problems ($r = .34$ and $r = .34$, respectively; Cooper et al., 2000).

Alcohol Expectancies (T1 to T3)

The Comprehensive Effects of Alcohol (CEOA) questionnaire (Fromme et al., 1993) is a 38-item questionnaire assessing the positive and negative effects of alcohol. The positive subscales were of interest in the current study: tension reduction, 3 items (e.g., "I would feel relaxed"), sociability, 8 items (e.g., "I would act sociable"), and liquid courage, 5 items (e.g., "I

would feel brave and daring”). Using the stem “if I were to drink alcohol right now,” participants responded to each situation (e.g., “if I were to drink alcohol right now, I would feel calm”) on a 5-point scale (1 = strongly disagree to 5 = strongly agree). For the purposes of the present study, the sociability and liquid courage subscales were combined due to significant conceptual overlap. The CEOA was completed at each of the three time points. Latent scores were derived for each participant at each timepoint; seven items from the sociability and liquid courage subscale were indicators of the sociability/liquid courage latent factor, and three items from the tension reduction subscale were indicators of the tension reduction latent factor. Previous research has demonstrated the construct and criterion-related validity of these subscales (Ham, et al., 2005).

Alcohol Use (T1 to T3)

Alcohol use was assessed using five items assessing (1) frequency of alcohol use during the past 30 days (answered on an 11-point scale, 1 = 0 days to 11 = 28-30 days), (2) amount of alcohol consumed on a typical drinking day in the past 30 days (answered on a 10-point scale, 1 = 1 drink to 10 = 25 drinks or more), (3) the largest number of alcoholic drinks consumed within a 24-hour period in the past 30 days (answered on a 10-point scale, 1 = 1 drink to 10 = 36 drinks or more), (4) frequency of binge drinking (i.e., 4 or more drinks for women and 5 or more drinks for men within a two-hour period) in the past 30 days (answered on an 8-point scale, 1 = never to 8 = every day), and (5) peak alcohol use (i.e., largest number of alcoholic drinks consumed in a 24-hour period) in one’s lifetime (answered on a 10-point scale, 1 = 1 drink to 10 = 36 drinks or more). The alcohol use questions were completed at each of the three timepoints. A single alcohol use latent score (5 indicators) was derived for each participant at each timepoint from the five alcohol use questions. The items were selected from the National Institute on Alcohol Abuse and Alcoholism’s (NIAAA) recommended alcohol questions (NIAAA, 2003).

Alcohol Problems (T1 to T3)

The Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler et al., 2005) is a 24-item self-report questionnaire assessing alcohol problem severity in university students. Using a dichotomous response format (yes/no), participants indicated whether or not they had experienced a particular alcohol-related problem in the past 30 days (e.g., “I have felt very sick to my stomach or thrown up after drinking”). The B-YAACQ was administered at each of the three timepoints. A single composite sum score was derived for each participant at each time, which was included as a manifest variable in hypothesis testing. The B-YAACQ has very good scale score reliability ($\alpha = .83$; Read et al., 2007). In the current study, the B-YAACQ demonstrated good scale score reliability (see Table 1).

Data Analytic Overview

Data Integrity

Prior to analyses, all data were screened for violations of the assumptions of state-trait modeling (i.e., regression). First, data were screened for missing data and multivariate outliers. Though there were no multivariate outliers, there were missing data across the three time points. Accordingly, Full Information Maximum Likelihood (FIML) estimation was utilized for hypothesis testing. FIML utilizes all available information and is ideal for analyses where there is missing data (Enders, 2001; Enders & Bandalos, 2001). Next, multicollinearity was assessed by examining bivariate correlations, tolerance values, conditioning indexes, and variance proportions. Bivariate correlations between variables greater than 0.9 and tolerance values lower than 0.1 were indicative of multicollinearity, and a conditioning index greater than 30 with two variance proportions greater than .5 was indicative of multicollinearity (Tabachnick & Fidell, 2007). All collinearity diagnostics were in the normal range, suggesting the absence of multicollinearity. Last, although MLR is robust to non-normality, distributions were examined to

ascertain that variables were continuous. Indeed, they were continuous and relatively normally distributed (skewness < .30; kurtosis < 10; Kline, 2009).

Measurement Invariance Testing

Confirmatory factor analysis (CFA) using robust maximum likelihood (MLR) procedures in Mplus 8.4 (Muthén & Muthén, 1998-2017) was used to test the longitudinal invariance of our latent factors (i.e., cope anxiety, enhancement, tension reduction, sociability/liquid courage, and alcohol use). When interpreting model fit, a comparative fit index (CFI) and Tucker-Lewis Index (TLI) over 0.95 indicated excellent model fit, values over 0.90 indicated adequate fit, and values below 0.90 indicated poor fit (Hu & Bentler, 1999; Marsh et al., 2005). Furthermore, a root-mean-square error of approximation (RMSEA) below 0.05 indicated excellent fit, values below 0.08 indicated adequate fit, and values larger than 0.08 indicated poor fit (Hu & Bentler, 1999; Marsh et al., 2005).

First, CFAs were estimated for each latent factor of interest to see if the factor structures were invariant across the three time points. For each latent factor, we tested configural, weak, strong, and strict invariance using the referent indicator approach (Millsap, 2011). This process was done iteratively, with added constraints at each level of invariance testing. In the configural invariance models, across all time points, all factor loadings, intercepts, and uniquenesses were freely estimated, factor variances were fixed to one, and factor means fixed to zero. In the weak invariance models, the factor loadings were constrained to invariance across time points. Factor variances were fixed to one at T1 and were freely estimated at T2 and T3. In the strong invariance models, intercepts were constrained to invariance across time points and factor means were fixed to zero at T1 and free to vary at T2 and T3. In the strict invariance models, uniquenesses were constrained to invariance across time points. The configural, weak, strong, and strict invariance models are nested models, and were compared using changes in CFI, TLI,

and RMSEA. A drop of 0.01 in CFI or TLI was considered significant, and an increase of 0.015 in RMSEA was considered significant (Chen, 2007). From our measurement models, we extracted latent scores for hypothesis testing.

State-Trait Modeling

Next, state-trait modeling was conducted within a structural equation modeling (SEM) framework, using MLR and FIML procedures in Mplus 8.4 (Muthén & Muthén, 1998-2017). State-trait models determine whether a behavioural outcome is due to stable individual differences in an underlying characteristic of interest or a temporary change in the characteristic due to situational factors at the time of measurement. Within this framework, observational measurement does not occur in a situational vacuum; rather the interaction between individuals and their current situation also contributes to outcome variance. Indeed, state-trait models partition the variance of a given construct into a trait factor that captures variation across multiple time points and a state factor that characterises occasion-specific variability (Schmitt & Steyer, 1993; Sher & Wood, 2004; Steyer et al., 2012; Windle, 1997). The trait factor reflects the average level observed over time in the repeated measure (i.e., the trait), and the time specific residual reflects the time-specific deviation from this trait (i.e., the state). These types of models account for the influence of trait factors (i.e., intercept-intercept associations), auto-regressive cross-lagged carryover from the immediately previous time point (state factors), as well as measurement error. Furthermore, state-trait models allow the stable trait and fluid state to be utilized in regression models to predict future behaviour. In the current study, state-trait modeling was used to examine trait and state associations between manifest and latent variables (AS, cope anxiety, enhancement, tension reduction, sociability/liquid courage, alcohol use, alcohol problems) across three measurement points (T1-T3). Further, the effect of T1 AS on T1 alcohol-related cognitions and alcohol use and problems was examined using linear regression

within the larger state-trait model. Understanding the extent to which constructs are associated at the trait versus the state level can shed light on the causal nature of the associations across time.

Results

Descriptive Statistics

Descriptive statistics of all variables in the model are presented in Table 1.

Missing Data

Participants were assessed at baseline, and at 6-month and 12-month (post-graduation) follow-up. The overall sample consisted of 221 participants. Of this sample, 193 completed at least one questionnaire at one time point. One-hundred-and-ninety-three participants completed T1, but 16.06% did not complete at least one measure. One-hundred-and-sixty-two participants completed T2, but 17.25% were missing at least one measure. One-hundred-and-fifty-two participants completed T3, but 15.79% were missing at least one measure. One-hundred-and-forty-one of the original 221 participants (64%) had complete data for all time points. A dichotomous dummy variable was created to differentiate those who did and did not complete all data points and a series of *t*-tests were conducted on the baseline variables of interest. Results indicated that those with complete data did not differ statistically significantly at baseline from those with incomplete data in terms of cope anxiety ($t_{(160)} = .96, p = .70$), enhancement ($t_{(161)} = 1.26, p = .55$), tension reduction ($t_{(192)} = .49, p = .36$), sociability/liquid courage ($t_{(191)} = 4.05, p = .66$), alcohol use ($t_{(160)} = -.08, p = .69$), and alcohol problems ($t_{(161)} = .91, p = .18$). However, those with complete data were lower at baseline from those with incomplete data in terms of AS ($t_{(189)} = -.10, p = .00$).

Measurement Invariance Testing

We tested configural, weak, strong, and strict invariance of each latent construct to see if our factor structure held up across our three time points. Fit indices for these models were all adequate-to-excellent, CFIs ≥ 0.920 , TLIs ≥ 0.910 , RMSEAs ≤ 0.076 . See Table 2 for fit indices for retained invariance models. Partial strict, partial strong, partial weak invariance was achieved for alcohol use by freeing item “during the last 30 days, how often did you have 5 or more (males) or 4 or more (females) drinks containing any kind of alcohol in within a two-hour period?” across time (BINGET1, BINGET2, BINGET3), and by freeing item “during the last 30 days, what is the largest number of drinks containing alcohol that you drank within a 24-hour period?” at T3 (PEAKT3). Partial strict invariance was achieved for cope anxiety by freeing item “you drink to reduce your anxiety” at T3 (DMQR19). Strict, partial strong invariance was achieved for enhancement, by freeing items “you drink because it’s fun” at T1 (DMQR12) and “you drink because it’s exciting” at T3 (DMQR6). Last, strict invariance was achieved for both tension reduction and sociability/liquid courage. The referent indicator method was used to test our most invariant models, and latent factor scores were extracted for hypothesis testing.

Hypothesis Testing: State-Trait Modeling

The state-trait model (see Figure 1) was specified with six latent variables: the trait of the tendency to drink to cope with anxiety, to drink for enhancement, to hold tension reduction expectancies, to hold sociability/liquid courage expectancies, to consume alcohol, and to experience alcohol-related problems. The model included first-order paths from AS (T1) to all T1 latent and manifest variables (e.g., T1 AS to T1 cope anxiety; T1 AS to T1 tension reduction). Further, the model included first-order autoregressive paths (e.g., T1 cope anxiety to T2 cope anxiety to T3 cope anxiety; T1 tension reduction to T2 tension reduction to T3 tension reduction) and directional, cross-lagged paths (e.g., T1 cope anxiety to T2 enhancement; T2

tension reduction to T3 alcohol use). In our model, factor loadings were all fixed to 1, and means were fixed to 0 for all our latent variables. The means and variances of our intercepts were estimated. For the tension reduction and alcohol use variables, variance was constrained to be above 0 and time-specific residuals were specified to be equal across time. We also computed correlations between trait factors and time-specific correlations between the state factors. Model fit was excellent (CFI = 0.988, TLI = 0.957, RMSEA = 0.045). Each measurement occasion of cope anxiety, enhancement, tension reduction, sociability/liquid courage, alcohol use, and alcohol problems significantly loaded onto its respective trait factor ($\lambda = .58-.93$; see Table 3). A significance level of $p < .10$ was used for hypothesis testing (Schumm et al., 2013).

AS Effects

See Table 4 for unstandardized estimates, standard errors, and p -values for statistically significant parameters. Consistent with hypotheses, T1 AS positively predicted T1 cope anxiety. AS also negatively predicted enhancement motives. Contrary to what was expected, AS was not associated with tension reduction alcohol expectancies, alcohol use, or alcohol-related problems.

Trait Associations

See Table 5 for correlation coefficients of all latent trait variables. As expected, trait cope anxiety motives positively correlated with trait enhancement motives ($p < .01$), supporting an association between internally sourced motives, and trait tension reduction expectancies positively correlated with sociability/liquid courage expectancies ($p = .03$), supporting an association between positive alcohol expectancies. Also, as expected, trait cope anxiety motives positively correlated with conceptually similar trait tension reduction expectancies ($p = .01$) and trait enhancement motives positively correlated with conceptually similar trait sociability/liquid courage expectancies ($p < .01$). Though not hypothesized, trait cope anxiety motives were

positively correlated with trait sociability/liquid courage expectancies ($p < .01$), and trait enhancement motives were positively correlated with trait tension reduction expectancies ($p = .06$). Together, the correlations support consistency in use of alcohol for positive motives and expectancies, wherein the tendency to drink to cope with anxiety and for enhancement is associated with the tendency to hold tension reduction and sociability/liquid courage expectancies.

Further, as hypothesized, trait cope anxiety motives, trait enhancement motives ($p < .01$), and sociability/liquid courage alcohol expectancies positively correlated with trait alcohol problems ($ps < .05$). However, trait tension reduction expectancies were not a statistically significant correlate of trait alcohol problems ($p = .10$). These results suggest that elevated use of alcohol for internally sourced motives is associated with increased alcohol related problems, but only anticipating sociability/liquid courage (and not tension reduction) effects of alcohol is associated with increased alcohol related problems. Contrary to hypotheses, trait AS was not associated with cope anxiety motives, tension reduction expectancies, or alcohol use and problems ($ps = .24-.89$). Moreover, contrary to hypotheses, trait alcohol use was not associated with any of the cognitive constructs ($ps = .55-.99$). Trait alcohol use was not a statistically significant correlate of trait alcohol related problems ($p = .48$).

State Associations

See Table 4 for unstandardized estimates, standard errors, and p -values for statistically significant parameters.

Auto-Regressive Associations. T1 cope anxiety positively predicted T2 cope anxiety, and in turn, T2 cope anxiety positively predicted T3 cope anxiety. However, the auto-regressive paths for enhancement and sociability/liquid courage were not supported. While T2 alcohol use

positively predicted T3 alcohol use, the path from T1 to T2 was not supported. The autoregressive associations for alcohol problems across time were not supported.

Cross-Lagged Associations between Motives. T1 cope anxiety negatively predicted T2 enhancement motives; similarly, T2 cope anxiety negatively predicted T3 enhancement motives. Further, T1 enhancement motives negatively predicted T2 cope anxiety motives, and similarly, T2 enhancement motives negatively predicted T3 cope anxiety motives. Though these associations were hypothesized, the direction of the associations were opposite (i.e., negative instead of the hypothesized positive).

Cross-Lagged Associations between Expectancies. While not supported from T1 to T2, T2 sociability/liquid courage expectancies positively predicted T3 tension reduction expectancies; this was consistent with hypotheses. However, tension reduction did not predict sociability/liquid courage across time.

Cross-Lagged Associations between Motives and Expectancies. As hypothesized, T2 cope anxiety predicted T3 tension reduction expectancies, but the direction of the association was opposite (i.e., negative contrary to the hypothesized positive). Tension reduction expectancies did not predict cope anxiety motives across time. Consistent with hypotheses, T2 enhancement motives positively predicted T3 sociability/liquid courage expectancies. Sociability/liquid courage expectancies did not predict enhancement motives. T2 cope anxiety motives negatively predicted T3 sociability/liquid courage expectancies, and T2 tension reduction expectancies positively predicted T3 enhancement motives.

Cross-Lagged Association between Motives and Expectancies and Alcohol Use and Problems. Contrary to what we expected, motives and expectancies were not prospectively associated with alcohol use or problems. However, T1 alcohol use positively predicted T1 cope anxiety motives and negatively predicted T2 tension reduction expectancies. Alcohol problems

did not predict motives or expectancies. Thus, there was only partial support for our hypothesis that motives and expectancies would be associated with alcohol use and problems, and that alcohol use and problems in turn would be associated with motives and expectancies. There were no significant associations between alcohol use and problems across time.

Discussion

The goal of the current study was to better characterize AS risk for alcohol use and problems in emerging adulthood, by examining the impact of alcohol cognitions (drinking motives and alcohol expectancies) as they unfold and influence one another over time. Alcohol use tends to increase during adolescence and peak in the early twenties (O'Malley, 2004). During emerging adulthood, individuals who drink to cope with anxiety and hold tension reduction expectancies may be at risk for alcohol misuse and as they use alcohol for its anxiolytic effects (e.g., Anthenien et al., 2017; Catanzaro & Laurent, 2004; Cooper et al., 1995; Hasking et al., 2011; McNally et al., 2003; Pabst et al., 2014; Richton et al., 2017). Negative reinforcement models and tension reduction theories of alcohol use posit that those high in AS may be at *particular* risk for alcohol misuse as a way to cope, specifically as a way to reduce emotional and social distress (Baker et al., 2004). Thus, having a better understanding of how cognitive mechanisms impact the AS-alcohol use/problem risk trajectory as emerging adults gain experience with drinking could help mitigate long term risk.

Anxiety Sensitivity Risk

The results of the current study suggest an association between AS and internally sourced drinking motives. Indeed, increases in AS lead to increases in cope anxiety (as expected), and decreases in enhancement motives. Contrary to what we expected, there was no association between AS and tension reduction expectancies. Our findings are partially consistent with the

large body of theoretical and empirical research linking AS with the tendency to drink for negative reinforcement reasons (i.e., to cope and reduce tension; Chandley et al., 2014; Kushner, et al., 2001; Stewart & Zeitlin, 1995). Inconsistent with this literature (e.g., Karp, 1993; Watt et al., 2006), our study found no association between AS and alcohol use and problems. However, the association between AS, alcohol cognitions, and alcohol use and problems is not well-defined; though some studies have found AS to directly predict alcohol use and problems (e.g., Schmidt et al., 2007; Stewart et al., 1999), several studies have found that motives and expectancies impact this association (Kushner et al., 1994; O'Connor et al., 2008). Thus, it is not surprising that AS-tension reduction and AS-alcohol use/problem associations were not supported.

Another reason could be the developmental period of the sample. It has been well established that emerging adulthood marks a period associated with high levels of alcohol use and problems – higher than in any other age group (e.g., Gates et al, 2016). Thus, it may be more difficult to delineate who is at risk for alcohol misuse and problems given that all are drinking at high levels – not just those high in AS. However, where individuals low vs. high in AS may differ is in their drinking motives and expectancies. Consequently, focus should be shifted toward reasons for drinking and expected outcomes, as these cognitions are what predict impeded *maturing out* of alcohol use in later adulthood (Littlefield et al., 2010). Indeed, studies have found that coping motives predict alcohol problems, and in turn are associated with impeded maturing out of alcohol use during the transition into adulthood (Gates et al., 2016; Littlefield et al., 2009, 2010; Patrick & Schulenberg, 2011). Thus, coping-motivated drinking puts emerging adults at increased risk for alcohol misuse and problems later on in the life span, as they do not mature out normative heavy drinking. The research focus should therefore shift to the mechanisms of risk (i.e., motives and expectancies) of emerging adults high in AS.

Alcohol Cognitions

Consistent with hypotheses, our results support trait-level positive associations within (e.g., motive-motive) and between (i.e., motive-expectancy) internally sourced drinking motives and positive alcohol expectancies. These findings are consistent with cross-sectional research in undergraduates (e.g., Diep et al., 2016; Engels et al., 2005). For example, research has shown that coping and enhancement motives are associated, and that both are associated with positive expectancies (Hasking et al., 2011). Though cross-sectional studies corroborate our findings, they may be more likely than longitudinal studies to show high correlations among constructs due to method biases or self-perception at a single measurement point (Stacy et al., 1990). Thus, the current study adds to the extant literature by examining trait-level associations instead of single-occasion observed levels that are predominately reported in the literature.

In addition to trait-level associations, several state-level associations were found. As hypothesized, cope anxiety and enhancement motives were associated, but the direction was contrary to what we expected. Indeed, increases in cope anxiety led to decreases in enhancement at subsequent timepoints, and increases in enhancement led to decreases in cope anxiety at subsequent time points. This is partially consistent with Labhart and colleagues' (2017) findings, wherein – across two time points in a sample of young adult men – increases in cope anxiety motives led to decreases in enhancement motives (consistent with our study), but increases in enhancement motives led to increases in coping motives (opposite finding). These disparate findings could, however, be due to methodological differences (e.g., sample, time points), so replication is advised to clarify the direction of the association. Consistent with hypotheses, positive expectancies were positively associated; increases in sociability/liquid courage led to increases in tension reduction. These within-motive and within-expectancy associations across time are consistent with extant literature; motives have been found to predict motives (e.g.,

Crutzen et al., 2013; Labhart et al., 2017; Schelleman-Offermans et al., 2011), and expectancies to predict expectancies (e.g., Aas et al., 1998; Corbin et al., 2011; Sher et al., 1996).

Looking at state-level associations between motives and expectancies, as expected, increases in enhancement motives led to increases in sociability/liquid courage expectancies at subsequent time points. This makes conceptual sense given that both cognitions are driven by positive reinforcement. Contrary to hypotheses, no association was found between cope anxiety motives and tension reduction expectancies. There is a significant gap in the literature associating motives *with* expectancies across time, thus there is nothing against which to compare our findings. Typically, studies have looked at motives and expectancies cross-sectionally, in isolation or succession, and have overlooked cross-lagged effects (e.g., Anthenien et al., 2017; Engels et al., 2005). The lack of longitudinal data is problematic, given that emerging adulthood marks a particularly transitional and volatile developmental period. The current study significantly adds to the literature by examining the interplay between motives and expectancies to better understand how alcohol-related risk unfolds over time.

Alcohol Cognitions and Alcohol Use and Problems

The findings of the current study suggest that increases in drinking for internally sourced motives is associated with increases in alcohol problems, but that, in terms of expectations, only sociability/liquid courage (and not tension reduction) alcohol expectancies are associated with alcohol-related problems. With the exception of the null tension reduction-alcohol problem association, these findings were consistent with hypotheses and the extensive literature linking drinking motives (e.g., Bradizza et al., 1999; Carey & Correia, 1997; Cooper et al., 1992) and alcohol expectancies (e.g., Johnson & Gurin, 1994; Patrick et al., 2009) to alcohol problems in adolescents and young adults. Surprisingly, no motives or expectancies were associated with alcohol use. In the anxiety and alcohol use literature, however, drinking to cope is often *only*

linked with problems, and *not* use. Indeed, several longitudinal studies examining the association between drinking motives, alcohol use (quantity and frequency), and alcohol-related problems have found that drinking to cope was only associated with problems – not use – in both adolescents and emerging adults (e.g., Armeli et al., 2010; Labhart et al., 2017; Schelleman-Offermans et al., 2011).

When looking at occasion-specific associations, however, the associations between drinking motives and alcohol expectancies with alcohol use and problems were no longer supported. Contrary to what was hypothesized, drinking motives and alcohol expectancies did not predict alcohol use and problems. This is inconsistent with most extant literature (Aas et al., 1998; Carey & Correia, 1997; Cooper, 1994; Kuntsche et al., 2005; Merrill et al., 2014). However, some studies have found that tension reduction expectancies do *not* predict alcohol use and problems in young adulthood, but rather are linked later on in the life span (e.g., Nicolai et al., 2012). Further, Pabst and colleagues (2014) found that positive alcohol expectancies tend to predict alcohol use and problems later on in the lifespan, whereas negative expectancies are more predictive in young adults. Given that the current study only looked at positive expectancies, future research should also investigate negative expectancies in emerging adults. Last, research has shown that coping motives might affect alcohol use less strongly in emerging adulthood (compared to other developmental periods) as a function of heavy drinking being normative (Kong & Bergman, 2010). Thus, drinking to cope may have a less salient influence on alcohol use in emerging adults, instead having adverse impacts on the process of *maturing out* of alcohol use as people age, as previously discussed.

Though cognitions did not predict alcohol use or problems, there was some support for use predicting motives and expectancies; in particular, increased use predicted increases in cope anxiety motives and decreases in tension reduction expectancies. These findings are partially

consistent with the literature, which shows mixed support for alcohol use and problems predicting certain motives and expectancies. For example, alcohol problems have been shown to predict internally sourced motives, but alcohol use to only predict enhancement motives (Labhart et al., 2017), and number of drinking days at baseline has been found to predict internally sourced motives at follow-up, but alcohol quantity had no predictive effects (Crutzen et al., 2013). However, in another study, alcohol use *has* been found to positively predict negative reinforcement motives in emerging adults (Anderson et al., 2013). The support is more consistent for alcohol expectancies. Indeed, alcohol use and problems seem to be predictive of alcohol expectancies in both adolescents (Aas, et al., 1998) and emerging adults (Sher et al., 1996).

The findings of the current study provide compelling support for the overall associations between alcohol cognitions and alcohol problems, but weak support for occasion-specific effects across time of cognitions on use and problems (and vice-versa). Indeed, cognitions did not appear to influence alcohol use and problems at subsequent time points, but alcohol use did appear to influence cognitions. Though the findings are mixed (and hypotheses only partially supported), they are an accurate reflection of the variability in the extant literature. However, the current study adds between-cognition associations – not just within as typically done – which helps clarify the mechanisms at play in emerging adult alcohol misuse risk trajectories.

Limitations & Future Directions

Despite the notable strengths of this study, there are some limitations that need to be acknowledged. First, several participants were missing at least one measure at any given timepoint, and several did not complete all time points. However, the method of estimation used for data analyses (FIML) mitigated any issues due to missing data, as all available information was utilized. Nonetheless, future research should seek to address this methodological issue, creating safeguards against high attrition rates and incomplete questionnaires.

Second, though the current study had three waves – which is an improvement from extant two-wave studies – including additional measurement points would help characterize the longevity of the associations found in the current study. Indeed, developmental literature (e.g., Merline et al., 2008; Schulenberg & Maggs, 2002) suggests that emerging adulthood is an important stage in the aetiology of alcohol use and problems – a time when risky alcohol use may set the stage for lifelong difficulties – making it important to rely on longer time spans and more frequent measurement occasions to better understand stability and change in the observed patterns of associations. Nonetheless, participants in the current study were followed during the transition out of CEGEP, which marks a significant transitional point in a young adult’s life. Thus, though we cannot delineate long-term risk beyond emerging adulthood, the current study helps characterize risk during a critical window during which long-term risk can be mitigated. Additionally, given that CEGEP is unique to the province of Quebec, it could be interesting to see if the results hold up in mixed samples of senior high school and junior college or university students in other regions.

Third, the lack of expected associations and inconsistencies in supported associations across time points could be clarified by including moderators in the analysis. For example, the current study found a negative association between cope anxiety and enhancement motives – opposite of what was expected – suggesting that the association is more complex than it implies and perhaps moderators would help clarify the association. The investigation of moderators acknowledges the complexity of cognitions (i.e., drinking motives and alcohol expectancies) and behaviours (i.e., alcohol use and problems) and could have therefore better characterized the risk pathway while increasing generalizability of results. Indeed, several studies have examined different moderators of the complex associations between AS, motives, expectancies, and alcohol use/problems in emerging adulthood, such as negative urgency (Keough et al., 2015;

Menary et al., 2015), psychological distress (Cable & Sacker, 2007), and emotion dysregulation (e.g., Chandley et al., 2014). Future research should examine moderators of these associations to better characterize AS risk for alcohol misuse in emerging adults.

Implications and Conclusion

Overall, the results of the current study contribute meaningfully to the body of literature investigating the associations between AS, drinking motives, alcohol expectancies, and alcohol use and problems in emerging adulthood. Though some studies have investigated certain of these associations longitudinally (but with fewer time points), the majority have been cross-sectional. This is the first study (to our knowledge) that looked at all these associations both across time and reciprocally, and at both the state and trait levels. In summary, our findings provide support for the association between AS and drinking to cope with anxiety and for enhancement, as well as for associations within motives and expectancies, between motives and expectancies, and between motives and expectancies and alcohol use and problems at both the state (e.g., between cope anxiety and enhancement; between alcohol use and tension reduction) and trait (e.g., between cope anxiety and alcohol problems) levels.

Beyond adding to the aetiological empirical literature, the study's findings can inform clinical interventions for alcohol misuse and problems during the critical developmental period of emerging adulthood. Indeed, targeting specific drinking motives and alcohol expectancies in cognitive behaviour therapy could help young adults transition out of heavy alcohol use, and mitigate risk for long-term problems. CEGEP marks a critical transitional period from adolescence to adulthood during which alcohol-related cognitions can be solidified. This could lead to long-term risk for alcohol misuse and problems later on in the life span, particularly for those high in AS who drink to cope and hold tension-reduction expectancies. Detection and support for these individuals, such as screening and interventions, should be included in

prevention and mitigation strategies to prevent coping-motivated drinking and alcohol misuse and problems in emerging adults.

References

- Aas, H. N., Leigh, B. C., Anderssen, N., Jakobsen, R. (1998). Two-year longitudinal study of alcohol expectancies and drinking among Norwegian adolescents. *Addiction*, *93*(3), 373–384.
- Abrams, D. B., & Niaura, R. S. (1987). Social Learning Theory. In H. T. Blane & K. E. Leonard (Eds.), *Psychological theories of drinking and alcoholism* (pp. 131–178). Guilford Press.
- Adlaf, E. M., Demers, A., & Gliksman, L. (2005). *Canadian Campus Survey 2004*.
http://www.camh.net/research/population_life_course.html
- Allan, N. P., Albanese, B. J., Norr, A. M., Zvolensky, M. J., & Schmidt, N. B. (2015). Effects of anxiety sensitivity on alcohol problems: Evaluating chained mediation through generalized anxiety, depression and drinking motives. *Addiction*, *110*(2), 260–268.
<https://doi.org/10.1111/add.12739>
- Allan, N. P., Felton, J. W., Lejuez, C. W., MacPherson, L., & Schmidt, N. B. (2016). Longitudinal investigation of anxiety sensitivity growth trajectories and relations with anxiety and depression symptoms in adolescence. *Development and Psychopathology*, *28*(2), 459–469. <https://doi.org/10.1017/S0954579415000590>
- Anderson, K. G., Briggs, K. E. L., & White, H. R. (2013). Motives to Drink or Not to Drink: Longitudinal Relations Among Personality, Motives, and Alcohol Use Across Adolescence and Early Adulthood. *Alcoholism: Clinical and Experimental Research*, *37*(5), 860–867.
<https://doi.org/10.1111/acer.12030>
- Anthenien, A. M., Lembo, J., & Neighbors, C. (2017). Drinking motives and alcohol outcome expectancies as mediators of the association between negative urgency and alcohol consumption. *Addictive Behaviors*, *66*, 101–107.
<https://doi.org/10.1016/j.addbeh.2016.11.009>

- Armeli, S., Conner, T. S., Cullum, J., & Tennen, H. (2010). A longitudinal analysis of drinking motives moderating the negative affect-drinking association among college students. *Psychology of Addictive Behaviors, 24*(1), 38–47. <https://doi.org/10.1037/a0017530>
- Austin, J. L., & Smith, J. E. (2008). Drinking for negative reinforcement: The semantic priming of alcohol concepts. *Addictive Behaviors, 33*(12), 1572–1580. <https://doi.org/10.1016/j.addbeh.2008.07.016>
- Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction Motivation Reformulated: An Affective Processing Model of Negative Reinforcement. *Psychological Review, 111*(1), 33–51. <https://doi.org/10.1037/0033-295X.111.1.33>
- Bradizza, C. M., Reifman, A., & Barnes, G. M. (1999). Social and coping reasons for drinking: Predicting alcohol misuse in adolescents. *Journal of Studies on Alcohol, 60*(4), 491–499. <https://doi.org/10.15288/jsa.1999.60.491>
- Burns, L., & Teesson, M. (2002). Alcohol use disorders comorbid with anxiety, depression and drug use disorders: Findings from the Australian National Survey of Mental Health and Well Being. *Drug and Alcohol Dependence, 68*(3), 299–307. [https://doi.org/10.1016/S0376-8716\(02\)00220-X](https://doi.org/10.1016/S0376-8716(02)00220-X)
- Cable, N., & Sacker, A. (2007). The role of adolescent social disinhibition expectancies in moderating the relationship between psychological distress and alcohol use and misuse. *Addictive Behaviors, 32*(2), 282–295. <https://doi.org/10.1016/j.addbeh.2006.04.001>
- Cappell, H., & Herman, C. P. (1972). Alcohol and Tension Reduction. A Review. *Quarterly Journal of Studies on Alcohol, 33*, 33–64. <https://pubmed.ncbi.nlm.nih.gov/4551021/>
- Carey, K. B., & Correia, C. J. (1997). Drinking motives predict alcohol-related problems in college students. *Journal of Studies on Alcohol, 58*(1), 100–105. <https://doi.org/10.15288/jsa.1997.58.100>

- Catanzaro, S. J., & Laurent, J. (2004). Perceived family support, negative mood regulation expectancies, coping, and adolescent alcohol use: Evidence of mediation and moderation effects. *Addictive Behaviors, 29*(9), 1779–1797.
<https://doi.org/10.1016/j.addbeh.2004.04.001>
- Chandley, R. B., Luebke, A. M., Messman-Moore, T. L., & Rose, M. W. (2014). Anxiety sensitivity, coping motives, emotion dysregulation, and alcohol-related outcomes in college women: A moderated-mediation model. *Journal of Studies on Alcohol and Drugs, 75*(1), 83–92. <https://doi.org/10.15288/jsad.2014.75.83>
- Chen, F. F. (2007). Sensitivity of Goodness of Fit Indexes to Lack of Measurement Invariance. *Structural Equation Modeling: A Multidisciplinary Journal, 14*(3), 464–504.
<https://doi.org/10.1080/10705510701301834>
- Comeau, N., Stewart, S. H., & Loba, P. (2001). The relations of trait anxiety, anxiety sensitivity, and sensation seeking to adolescents' motivations for alcohol, cigarette, and marijuana use. *Addictive Behaviors, 26*(6), 803–825. [https://doi.org/10.1016/S0306-4603\(01\)00238-6](https://doi.org/10.1016/S0306-4603(01)00238-6)
- Conrod, P. J., Pihl, R. O., & Vassileva, J. (1998). Differential sensitivity to alcohol reinforcement in groups of men at risk for distinct alcoholism subtypes. *Alcoholism, Clinical and Experimental Research, 22*(3), 585–597.
<http://www.ncbi.nlm.nih.gov/pubmed/9622436>
- Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment, 6*(2), 117–128.
<https://doi.org/10.1037/1040-3590.6.2.117>
- Cooper, M. Lynne, Agocha, V. B., & Sheldon, M. S. (2000). A Motivational Perspective on Risky Behaviors: The Role of Personality and Affect Regulatory Processes. *Journal of Personality, 68*(6), 1059–1088. <https://doi.org/10.1111/1467-6494.00126>

- Cooper, M. Lynne, Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *Journal of Personality and Social Psychology*, *69*(5), 990–1005. <http://www.ncbi.nlm.nih.gov/pubmed/7473043>
- Cooper, M.L., Russell, M., Skinner, J. B., & Windle, M. (1992). Development and Validation of a Three-Dimensional Measure of Drinking Motives. *Psychological Assessment*, *4*(2), 123–132. <https://doi.org/10.1037/1040-3590.4.2.123>
- Corbin, W. R., Iwamoto, D. K., & Fromme, K. (2011). A Comprehensive Longitudinal Test of the Acquired Preparedness Model for Alcohol Use and Related Problems*. *Journal of Studies on Alcohol and Drugs*, *72*(4), 602–610. <https://doi.org/10.15288/jsad.2011.72.602>
- Cox, W. M., & Klinger, E. (1988). A motivational model of alcohol use. *Journal of Abnormal Psychology*, *97*(2), 168–180. <http://www.ncbi.nlm.nih.gov/pubmed/3290306>
- Crutzen, R., Kuntsche, E., & Schelleman-Offermans, K. (2013). Drinking motives and drinking behavior over time: A full cross-lagged panel study among adults. *Psychology of Addictive Behaviors*, *27*(1), 197–201. <https://doi.org/10.1037/a0029824>
- Diep, P. B., Schelleman-Offermans, K., Kuntsche, E., De Vries, N., & Knibbe, R. A. (2016). Direct and indirect effects of alcohol expectancies through drinking motives on alcohol outcomes among students in Vietnam. *Addictive Behaviors*, *52*, 115–122. <https://doi.org/10.1016/j.addbeh.2015.09.009>
- Enders, C. K. (2001). The impact of nonnormality on full information maximum-likelihood estimation for structural equation models with missing data. *Psychological Methods*, *6*(4), 352–370. <https://doi.org/10.1037/1082-989x.6.4.352>
- Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling*, *8*(3), 430–457. https://doi.org/10.1207/S15328007SEM0803_5

- Engels, R. C. M. E., Wiers, R., Lemmers, L., & Overbeek, G. (2005). Drinking Motives, Alcohol Expectancies, Self-Efficacy, and Drinking Patterns. *Journal of Drug Education, 35*(2), 147–166. <https://doi.org/10.2190/6q6b-3lma-vmva-l312>
- Fromme, K., Stroot, E. A., & Kaplan, D. (1993). Comprehensive effects of alcohol: Development and psychometric assessment of a new expectancy questionnaire. *Psychological Assessment, 5*(1), 19–26. <https://doi.org/10.1037/1040-3590.5.1.19>
- Gates, J. R., Corbin, W. R., & Fromme, K. (2016). Emerging adult identity development, alcohol use, and alcohol-related problems during the transition out of College. *Psychology of Addictive Behaviors, 30*(3), 345–355. <https://doi.org/10.1037/adb0000179>
- Grant, B. F., Stinson, F. S., Dawson, D. A., Chou, S. P., Dufour, M. C., Compton, W., Pickering, R. P., & Kaplan, K. (2004). Prevalence and Co-occurrence of Substance Use Disorders and Independent Mood and Anxiety Disorders. *Archives of General Psychiatry, 61*(8), 807. <https://doi.org/10.1001/archpsyc.61.8.807>
- Grant, Bridget F., & Dawson, D. A. (1997). Age at onset of alcohol use and its association with DSM-IV alcohol abuse and dependence: Results from the national longitudinal alcohol epidemiologic survey. *Journal of Substance Abuse, 9*(1), 103–110. [https://doi.org/10.1016/S0899-3289\(97\)90009-2](https://doi.org/10.1016/S0899-3289(97)90009-2)
- Grant, J. D., Scherrer, J. F., Lynskey, M. T., Lyons, M. J., Eisen, S. A., Tsuang, M. T., True, W. R., & Bucholz, K. K. (2006). Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: evidence from a twin design. *Psychological Medicine, 36*(01), 109. <https://doi.org/10.1017/S0033291705006045>
- Grant, V. V., Stewart, S. H., O'Connor, R. M., Blackwell, E., & Conrod, P. J. (2007). Psychometric evaluation of the five-factor Modified Drinking Motives Questionnaire — Revised in undergraduates. *Addictive Behaviors, 32*(11), 2611–2632.

<https://doi.org/10.1016/J.ADDBEH.2007.07.004>

Greeley, J., & Oei, T. (1999). Alcohol and tension reduction. In K. E. Leonard & B. H. T. (Eds.), *Psychological theories of drinking and alcoholism* (pp. 14–53). Guilford Press.

Ham, L. S., Stewart, S. H., Norton, P. J., & Hope, D. A. (2005). Psychometric Assessment of the Comprehensive Effects of Alcohol Questionnaire: Comparing a Brief Version to the Original Full Scale. *Journal of Psychopathology and Behavioral Assessment*, 27(3), 141–158. <https://doi.org/10.1007/s10862-005-0631-9>

Hanson, K. L., Medina, K. L., Padula, C. B., Tapert, S. F., & Brown, S. A. (2011). Impact of Adolescent Alcohol and Drug Use on Neuropsychological Functioning in Young Adulthood: 10-Year Outcomes. *Journal of Child & Adolescent Substance Abuse*, 20(2), 135–154. <https://doi.org/10.1080/1067828X.2011.555272>

Hasking, P. A., & Oei, T. P. S. (2007). Alcohol expectancies, self-efficacy and coping in an alcohol-dependent sample. *Addictive Behaviors*, 32(1), 99–113. <https://doi.org/10.1016/j.addbeh.2006.03.024>

Hasking, P., Lyvers, M., & Carlopio, C. (2011). The relationship between coping strategies, alcohol expectancies, drinking motives and drinking behaviour. *Addictive Behaviors*, 36(5), 479–487. <https://doi.org/10.1016/j.addbeh.2011.01.014>

Howell, A. N., Leyro, T. M., Hogan, J., Buckner, J. D., & Zvolensky, M. J. (2010). Anxiety sensitivity, distress tolerance, and discomfort intolerance in relation to coping and conformity motives for alcohol use and alcohol use problems among young adult drinkers. *Addictive Behaviors*, 35(12), 1144–1147. <https://doi.org/10.1016/j.addbeh.2010.07.003>

Hu, L., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6, 1-55.

- Johnson, L. D., Miech, R. A., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. E. (2015). *Use of ecstasy, heroin, synthetic marijuana, alcohol, cigarettes declined among US teens in 2015*. <http://bit.ly/1TXvK3E>
- Johnson, P. B., & Gurin, G. (1994). Negative affect, alcohol expectancies and alcohol-related problems. *Addiction*, *89*(5), 581–586. <https://doi.org/10.1111/j.1360-0443.1994.tb03334.x>
- Jones, B T, Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction (Abingdon, England)*, *96*(1), 57–72. <https://doi.org/10.1080/09652140020016969>
- Jones, B T, & McMahon, J. (1993). Alcohol motivations as outcome expectancies. In W. R. Miller & N. Heather (Eds.), *Treating Addictive Behaviors* (pp. 75–91). Plenum Press.
- Jones, Barry T., Corbin, W., & Fromme, K. (2001). A review of expectancy theory and alcohol consumption. *Addiction*, *96*(1), 57–72. <https://doi.org/10.1046/j.1360-0443.2001.961575.x>
- Kahler, C. W., Strong, D. R., & Read, J. P. (2005). Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: the brief young adult alcohol consequences questionnaire. *Alcoholism, Clinical and Experimental Research*, *29*(7), 1180–1189. <http://www.ncbi.nlm.nih.gov/pubmed/16046873>
- Karp, J. (1993). *The interaction of alcohol expectancies, personality, and psychopathology among inpatient alcoholics*. <https://elibrary.ru/item.asp?id=5776157>
- Kassel, J. D., Jackson, S. I., & Unrod, M. (2000). Generalized expectancies for negative mood regulation and problem drinking among college students. *Journal of Studies on Alcohol*, *61*(2), 332–340. <https://doi.org/10.15288/jsa.2000.61.332>
- Keough, M., Hines, S., Winslade, A., & O'Connor, R. (2015). Negative urgency and gender moderate the association between anxiety sensitivity and alcohol-related problems. *Journal of Addiction and Prevention*, *3*(1), 1–7.

- Kline, R. B. (2009). *Becoming a behavioral science researcher: A guide to producing research that matters*. New York: Guilford Press.
- Knapp, A. A., Blumenthal, H., Mischel, E. R., Badour, C. L., & Leen-Feldner, E. W. (2016). Anxiety sensitivity and its factors in relation to generalized anxiety disorder among adolescents. *Journal of Abnormal Child Psychology*, *44*(2), 233–244.
<https://doi.org/10.1007/s10802-015-9991-0>
- Kong, G., & Bergman, A. (2010). A motivational model of alcohol misuse in emerging adulthood. *Addictive Behaviors*, *35*(10), 855–860.
<https://doi.org/10.1016/j.addbeh.2010.06.005>
- Kuntsche, E., Knibbe, R., & Gmel, G. (2007). Drinking motives as mediators of the link between alcohol expectancies and alcohol use among adolescents. *Journal of Studies on Alcohol and Drugs*, *68*(1), 76-85.
- Kuntsche, E., Knibbe, R., Gmel, G., & Engels, R. (2005). Why do young people drink? A review of drinking motives. *Clinical Psychology Review*, *25*(7), 841–861.
<https://doi.org/10.1016/J.CPR.2005.06.002>
- Kushner, M. G., Thuras, P., Abrams, K., Brekke, M., & Stritar, L. (2001). Anxiety mediates the association between anxiety sensitivity and coping-related drinking motives in alcoholism treatment patients. *Addictive Behaviors*, *26*(6), 869–885. [https://doi.org/10.1016/S0306-4603\(01\)00240-4](https://doi.org/10.1016/S0306-4603(01)00240-4)
- Kushner, M. G., Sher, K. J., Wood, M. D., & Wood, P. K. (1994). Anxiety and drinking behavior: Moderating effects of tension-reduction alcohol outcome expectancies. *Alcoholism: Clinical and Experimental Research*, *18*(4), 852–860.
<https://doi.org/10.1111/j.1530-0277.1994.tb00050.x>
- Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders

- and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review*, 20(2), 149–171. [https://doi.org/10.1016/S0272-7358\(99\)00027-6](https://doi.org/10.1016/S0272-7358(99)00027-6)
- Labhart, F., Kuntsche, E., Wicki, M., & Gmel, G. (2017). Reciprocal influences of drinking motives on alcohol use and related consequences: A full cross-lagged panel study among young adult men. *Behavioral Medicine*, 43(4), 277–284. <https://doi.org/10.1080/08964289.2016.1157057>
- Lee, N. K., Greely, J., & Oei, T. P. S. (1999). The relationship of positive and negative alcohol expectancies to patterns of consumption of alcohol in social drinkers. *Addictive Behaviors*, 24, 359–369.
- Leigh, B. C., & Stacy, A. W. (1993). Alcohol outcome expectancies: Scale construction and predictive utility in higher order confirmatory models. *Psychological Assessment*, 5(2), 216–229. <https://doi.org/10.1037/1040-3590.5.2.216>
- Lewis, B. A., & Vogeltanz-Holm, N. D. (2002). The effects of alcohol and anxiousness on physiological and subjective responses to a social stressor in women. *Addictive Behaviors*, 27(4), 529–545. <http://www.ncbi.nlm.nih.gov/pubmed/12188590>
- Littlefield, A. K., Sher, K. J., & Wood, P. K. (2009). Is “maturing out” of problematic alcohol involvement related to personality change? *Journal of Abnormal Psychology*, 118(2), 360–374. <https://doi.org/10.1037/a0015125>
- Littlefield, A. K., Sher, K. J., & Wood, P. K. (2010). Do changes in drinking motives mediate the relation between personality change and “maturing out” of problem drinking? *Journal of Abnormal Psychology*, 119(1), 93–105. <https://doi.org/10.1037/a0017512>
- Logue, P. E., Gentry, W. D., Linnoila, M., & Erwin, C. W. (1978). Effect of alcohol consumption on state anxiety changes in male and female nonalcoholics. *American Journal of Psychiatry*, 135(9), 1079–1081. <https://doi.org/10.1176/ajp.135.9.1079>

- MacAndrew, C. (1982). An examination of the relevance of the individual differences (a-trait) formulation of the tension-reduction theory to the etiology of alcohol abuse in young males. *Addictive Behaviors*, 7(1), 39–45. [https://doi.org/10.1016/0306-4603\(82\)90023-5](https://doi.org/10.1016/0306-4603(82)90023-5)
- MacDonald, A. B., Stewart, S. H., Hutson, R., Rhyno, E., & Loughlin, H. L. (2001). The roles of alcohol and alcohol expectancy in the dampening of responses to hyperventilation among high anxiety sensitive young adults. *Addictive Behaviors*, 26(6), 841–867. [https://doi.org/10.1016/S0306-4603\(01\)00239-8](https://doi.org/10.1016/S0306-4603(01)00239-8)
- Maisto, S. A., Carey, K. B., & Bradizza, C. M. (1999). Social Learning Theory. In K. E. Leonard & H. T. Blane (Eds.), *Psychological theories of drinking and alcoholism* (2nd ed., pp. 106–163). Guilford Press.
- Marsh, H.W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit evaluation in structural equation modeling. In A. Maydeu-Olivares & J. McArdle (Eds.), *Contemporary psychometrics*. Mahwah, NJ: Erlbaum.
- Marshall, E. J. (2014). Adolescent alcohol use: Risks and consequences. *Alcohol and Alcoholism*, 49(2), 160–164. <https://doi.org/10.1093/alcalc/agt180>
- McCambridge, J., McAlaney, J., & Rowe, R. (2011). Adult consequences of late adolescent alcohol consumption: A systematic review of cohort studies. In *PLoS Medicine* (Vol. 8, Issue 2). Public Library of Science. <https://doi.org/10.1371/journal.pmed.1000413>
- McNally, A. M., Palfai, T. P., Levine, R. V., & Moore, B. M. (2003). Attachment dimensions and drinking-related problems among young adults: The mediational role of coping motives. *Addictive Behaviors*, 28(6), 1115–1127. [https://doi.org/10.1016/S0306-4603\(02\)00224-1](https://doi.org/10.1016/S0306-4603(02)00224-1)
- Menary, K. R., Corbin, W. R., Leeman, R. F., Fucito, L. M., Toll, B. A., Demartini, K., & O'Malley, S. S. (2015). Interactive and indirect effects of anxiety and negative urgency on

- alcohol-related problems. *Alcoholism: Clinical and Experimental Research*, 39(7), 1267–1274. <https://doi.org/10.1111/acer.12762>
- Merline, A., Jager, J., & Schulenberg, J. E. (2008). Adolescent risk factors for adult alcohol use and abuse: Stability and change of predictive value across early and middle adulthood. *Addiction*, 103(SUPPL. 1), 84–99. <https://doi.org/10.1111/j.1360-0443.2008.02178.x>
- Merrill, J. E., Wardell, J. D., & Read, J. P. (2014). Drinking motives in the prospective prediction of unique alcohol-related consequences in college students. In *Stud. Alcohol Drugs* (Vol. 75).
- Miller, J. W., Naimi, T. S., Brewer, R. D., & Jones, S. E. (2007). Binge drinking and associated health risk behaviors among high school students. *Pediatrics*, 119(1).
- Millsap, R.E. (2011). *Statistical approaches to measurement invariance*. New York: Taylor & Francis.
- Muthén, L.K., Muthén, B. O. (1998-2017). *Mplus User's Guide* (Eighth). Muthén & Muthén.
- National Institute on Alcohol Abuse and Alcoholism (2003). Recommended Alcohol Questions. Retrieved from: <http://www.niaaa.nih.gov/research/guidelines-and-resources/recommendedalcohol-questions>
- Nicolai, J., Moshagen, M., & Demmel, R. (2012). Patterns of alcohol expectancies and alcohol use across age and gender. *Drug and Alcohol Dependence*, 126(3), 347–353. <https://doi.org/10.1016/j.drugalcdep.2012.05.040>
- O'Connor, R. M., Farrow, S. & Colder, C. R. (2008). Clarifying the anxiety sensitivity and alcohol use relation: Considering alcohol expectancies as moderators. *Journal of Studies on Alcohol and Drugs*, 69(5), 765-772. DOI: 10.15288/jsad.2008.69.765
- O'Malley, P. M. (2004). Maturing out of problematic alcohol use. *Alcohol Research & Health*, 28(4), 202–204.

- Oei, T. P. S., & Morawska, A. (2004). A cognitive model of binge drinking: The influence of alcohol expectancies and drinking refusal self-efficacy. *Addictive Behaviors, 29*(1), 159–179. [https://doi.org/10.1016/S0306-4603\(03\)00076-5](https://doi.org/10.1016/S0306-4603(03)00076-5)
- Pabst, A., Kraus, L., Piontek, D., Mueller, S., & Demmel, R. (2014). Direct and indirect effects of alcohol expectancies on alcohol-related problems. *Psychology of Addictive Behaviors, 28*(1), 20–30. <https://doi.org/10.1037/a0031984>
- Park, C. L., & Levenson, M. R. (2002). Drinking to cope among college students: Prevalence, problems and coping processes. *Journal of Studies on Alcohol, 63*(4), 486–497. <https://www.jsad.com/doi/pdf/10.15288/jsa.2002.63.486>
- Patrick, M. E., Wray-Lake, L., Finlay, A. K., & Maggs, J. L. (2009). The long arm of expectancies: Adolescent alcohol expectancies predict adult alcohol use. *Alcohol and Alcoholism, 45*(1), 17–24.
- Patrick, M. E., & Schulenberg, J. E. (2011). How trajectories of reasons for alcohol use relate to trajectories of binge drinking: National panel data spanning late adolescence to early adulthood. *Developmental Psychology, 47*(2), 311–317. <https://doi.org/10.1037/a0021939>
- Peterson, R. A., & Heilbronner, R. L. (1987). The anxiety sensitivity index: Construct validity and factor analytic structure. *Journal of Anxiety Disorders, 1*(2), 117–121. [https://doi.org/10.1016/0887-6185\(87\)90002-8](https://doi.org/10.1016/0887-6185(87)90002-8)
- Pihl, R. O., & Peterson, J. B. (1995). Alcoholism: the role of different motivational systems. *Journal of Psychiatry & Neuroscience, 20*(5), 372–396. <http://www.ncbi.nlm.nih.gov/pubmed/8527424>
- Ployhart, R. E., & Vandenberg, R. J. (2010). Longitudinal research: The theory, design, and analysis of change. *Journal of Management, 36*(1), 94–120. <https://doi.org/10.1177/0149206309352110>

- Read, J. P., Merrill, J. E., Kahler, C. W., & Strong, D. R. (2007). Predicting functional outcomes among college drinkers: Reliability and predictive validity of the Young Adult Alcohol Consequences Questionnaire. *Addictive Behaviors, 32*(11), 2597–2610.
- Reiss, S., & McNally, R. J. (1985). The expectancy model of fear. In S. Reiss & R. R. Bootzin (Eds.), *Theoretical issues in behavior therapy* (pp. 107–121). Academic Press.
- Reiss, Steven. (1991). Expectancy model of fear, anxiety, and panic. *Clinical Psychology Review, 11*(2), 141–153. [https://doi.org/10.1016/0272-7358\(91\)90092-9](https://doi.org/10.1016/0272-7358(91)90092-9)
- Reiss, Steven, Peterson, R. A., Gursky, D. M., & McNally, R. J. (1986). Anxiety sensitivity, anxiety frequency and the prediction of fearfulness. *Behaviour Research and Therapy, 24*(1), 1–8. [https://doi.org/10.1016/0005-7967\(86\)90143-9](https://doi.org/10.1016/0005-7967(86)90143-9)
- Richton, N., Armeli, S., & Tennen, H. (2017). A multiyear daily process examination of social anxiety, alcohol-outcome expectancies and alcohol use Among College Students. *Journal of Social and Clinical Psychology, 36*(6), 486–505. <https://doi.org/10.1521/jscp.2017.36.6.486>
- Schelleman-Offermans, K., Kuntsche, E., & Knibbe, R. A. (2011a). Associations between drinking motives and changes in adolescents' alcohol consumption: A full cross-lagged panel study. *Addiction, 106*(7), 1270–1278. <https://doi.org/10.1111/j.1360-0443.2011.03423.x>
- Schmidt, N. B., Buckner, J. D., & Keough, M. E. (2007). Anxiety sensitivity as a prospective predictor of alcohol use disorders. *Behavior Modification, 31*(2), 202–219. <https://doi.org/10.1177/0145445506297019>
- Schmidt, N. B., & Joiner, T. E. (2002). Structure of the Anxiety Sensitivity Index psychometrics and factor structure in a community sample. *Journal of Anxiety Disorders, 16*(1), 33–49. [https://doi.org/10.1016/S0887-6185\(01\)00087-1](https://doi.org/10.1016/S0887-6185(01)00087-1)
- Schmidt, N. B., Keough, M. E., Mitchell, M. A., Reynolds, E. K., Macpherson, L., Zvolensky,

- M. J., & Lejuez, C. W. (2010). Anxiety sensitivity: Prospective prediction of anxiety among early adolescents. *Journal of Anxiety Disorders*, *24*(5), 503–508.
<https://doi.org/10.1016/j.janxdis.2010.03.007>
- Schmitt, M. J., & Steyer, R. (1993). A latent state-trait model (not only) for social desirability. *Personality and Individual Differences*, *14*(4), 519–529. [https://doi.org/10.1016/0191-8869\(93\)90144-R](https://doi.org/10.1016/0191-8869(93)90144-R)
- Schulenberg, J. E., & Maggs, J. L. (2002). A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *Journal of Studies on Alcohol*, *63*(SUPPL. 14), 54–70. <https://doi.org/10.15288/jsas.2002.s14.54>
- Schulte, M. T., & Hser, Y.-I. (2013). Substance use and associated health conditions throughout the Lifespan. *Public Health Reviews*, *35*(2), 3. <https://doi.org/10.1007/BF03391702>
- Schumm, W. R., Pratt, K. K., Hartenstein, J. L., Jenkins, B. A., & Johnson, G. A. (2013). Determining statistical significance (alpha) and reporting statistical trends: Controversies, issues, and facts. *Comprehensive Psychology*, *2*(1), Article 10.
<https://doi.org/10.2466/03.cp.2.10>
- Sher, K. J., Wood M. D., Wood, P. K., & Raskin, G. (1996). Alcohol outcome expectancies and alcohol use: A latent variable cross-lagged panel study. *Journal of Abnormal Psychology*, *105*(4), 561–574.
- Sher, K. J., & Wood, P. K. (2004). Methodological issues in conducting prospective research on alcohol-related behavior: A report from the field. In *The science of prevention: Methodological advances from alcohol and substance abuse research*. (pp. 3–41). American Psychological Association. <https://doi.org/10.1037/10222-001>
- Stacy, A. W., Widaman, K. F., & Marlatt, G. A. (1990). Expectancy models of alcohol use. *Journal of Personality and Social Psychology*, *58*(5), 918–928.

<https://doi.org/10.1037/0022-3514.58.5.918>

- Stewart, S. H., Karp, J., Pihl, R. O., & Peterson, R. A. (1997). Anxiety sensitivity and self-reported reasons for drug use. *Journal of Substance Abuse*. [https://doi.org/10.1016/S0899-3289\(97\)90018-3](https://doi.org/10.1016/S0899-3289(97)90018-3)
- Stewart, S. H., Peterson, J. B., & Pihl, R. O. (1995). Anxiety sensitivity and self-reported alcohol consumption rates in university women. *Journal of Anxiety Disorders*, 9(4), 283–292. [https://doi.org/10.1016/0887-6185\(95\)00009-D](https://doi.org/10.1016/0887-6185(95)00009-D)
- Stewart, S. H., Samoluk, S. B., & MacDonald, A. B. (1999). *Anxiety sensitivity and substance use and abuse*. In S. Taylor (Ed.), *The LEA series in personality and clinical psychology. Anxiety sensitivity: Theory, research, and treatment of the fear of anxiety* (p. 287–319). Lawrence Erlbaum Associates Publishers.
- Stewart, S. H., & Zeitlin, S. B. (1995). Anxiety sensitivity and alcohol use motives. *Journal of Anxiety Disorders*, 9(3), 229–240. [https://doi.org/10.1016/0887-6185\(95\)00004-8](https://doi.org/10.1016/0887-6185(95)00004-8)
- Steyer, R., Geiser, C., & Fiege, C. (2012). Latent state-trait models. In *APA handbook of research methods in psychology, Vol 3: Data analysis and research publication*. (pp. 291–308). American Psychological Association. <https://doi.org/10.1037/13621-014>
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (3rd ed.). Harper Collins.
- Taylor, S., Koch, W. J., & McNally, R. J. (1992). How does anxiety sensitivity vary across the anxiety disorders? *Journal of Anxiety Disorders*, 6(3), 249–259. [https://doi.org/10.1016/0887-6185\(92\)90037-8](https://doi.org/10.1016/0887-6185(92)90037-8)
- Thomas, S. E., Randall, C. L., & Carrigan, M. H. (2003). Drinking to cope in socially anxious individuals: A controlled study. *Alcoholism: Clinical & Experimental Research*, 27(12), 1937–1943. <https://doi.org/10.1097/01.ALC.0000100942.30743.8C>
- Urbán, R., Kökönyei, G., & Demetrovics, Z. (2008). Alcohol outcome expectancies and drinking

- motives mediate the association between sensation seeking and alcohol use among adolescents. *Addictive Behaviors*, 33(10), 1344–1352.
<https://doi.org/10.1016/j.addbeh.2008.06.006>
- Watt, M., Stewart, S., Birch, C., & Bernier, D. (2006). Brief CBT for high anxiety sensitivity decreases drinking problems, relief alcohol outcome expectancies, and conformity drinking motives: Evidence from a randomized controlled trial. *Journal of Mental Health*, 15(6), 683–695. <https://doi.org/10.1080/09638230600998938>
- Weems, C. F., Hayward, C., Killen, J., & Taylor, C. B. (2002). A longitudinal investigation of anxiety sensitivity in adolescence. *Journal of Abnormal Psychology*, 111(3), 471–477.
<https://doi.org/10.1037/0021-843X.111.3.471>
- Williams, A., & Clark, D. (1998). Alcohol consumption in university students: The role of reasons for drinking, coping strategies, expectancies, and personality traits. *Addictive Behaviors*, 23(3), 371–378. [https://doi.org/10.1016/S0306-4603\(97\)80066-4](https://doi.org/10.1016/S0306-4603(97)80066-4)
- Windle, M. (1997). *Alternative latent-variable approaches to modeling change in adolescent alcohol involvement*. In K. J. Bryant, M. Windle, & S. G. West (Eds.), *The science of prevention: Methodological advances from alcohol and substance abuse research* (p. 43–78). American Psychological Association. <https://doi.org/10.1037/10222-002>
- Zack, M., Poulos, C. X., Aramakis, V. B., Khamba, B. K., & MacLeod, C. M. (2007). Effects of Drink-Stress Sequence and Gender on Alcohol Stress Response Dampening in High and Low Anxiety Sensitive Drinkers. *Alcoholism: Clinical and Experimental Research*, 31(3), 411–422. <https://doi.org/10.1111/j.1530-0277.2006.00322.x>

Table 1*Descriptive Statistics for all Variables in the Model.*

Variable	<i>N</i>	Mean	<i>SD</i>	Skewness	Kurtosis	Cronbach's α
Baseline AS	190	1.663	.884	.603	.103	.923
Cope Anxiety Motives						
T1	162	2.100	.942	.644	-.241	.734
T2	134	2.052	.915	.708	-.170	.753
T3	128	2.029	.882	.690	-.095	.713
Enhancement Motives						
T1	162	2.777	1.150	.068	-1.101	.874
T2	134	2.615	1.094	.209	-.963	.870
T3	128	2.771	1.169	.019	-1.110	.882
Tension Reduction						
Expectancies						
T1	193	2.637	.653	-.471	.637	.731
T2	162	2.613	.712	-.339	.109	.774
T3	152	2.546	.671	-.118	.158	.788
Sociability Expectancies						
T1	193	2.609	.586	-.549	.861	.916
T2	162	2.572	.619	-.376	.600	.898
T3	152	2.598	.627	-.507	.342	.902
Liquid Courage						
Expectancies						
T1	193	2.664	.681	-.759	.507	.891
T2	162	2.675	.680	-.586	.423	.909
T3	152	2.609	.643	-.607	.590	.899
Alcohol Use						
T1	167	2.923	1.215	.293	-.751	.854
T2	141	2.927	1.374	1.046	1.194	.872
T3	135	3.149	1.273	.618	-.013	.837
Alcohol-Related						
Problems						
T1	165	1.672	2.978	2.604	8.047	.869
T2	137	1.824	3.530	2.695	7.897	.909
T3	134	1.961	3.521	2.855	9.596	.897

Note. AS = Anxiety Sensitivity; *N* = sample size; *SD* = Standard Deviation; α = alpha; T1 = baseline; T2 = 6-month follow-up; T3 = 12-month follow-up.

Table 2

Model Fit Indices for Longitudinal Measurement Invariance of Factors of Interest (i.e., Alcohol Use, Cope Anxiety, Enhancement, Tension Reduction, and Sociability/Liquid Courage).

	Chi Squared	df	RMSEA	CFI	TLI
<i>Alcohol Use</i>					
Configural	164.157	72	0.084	0.926	0.892
Weak	193.429	80	0.088	0.909	0.881
Partial Weak (PEAKT1*)	185.791	79	0.086	0.914	0.886
Partial Weak (BINGET2*)	179.626	79	0.083	0.919	0.893
Strong Partial Weak (BINGET2*)	194.078	87	0.082	0.914	0.896
Partial Strong (PEAKT3*), Partial Weak (BINGET2*)	191.032	86	0.082	0.916	0.897
Partial Strong (PEAKT3*, BINGET1*), Partial Weak (BINGET2*)	185.336	85	0.080	0.920	0.901
Strict Partial Strong (PEAKT3*, BINGET1*), Partial Weak (BINGET2*)	213.631	95	0.083	0.905	0.895
Partial Strict (BINGET3*), Partial Strong (PEAKT3*, BINGET1*), Partial Weak (BINGET2*)	194.092	94	0.076	0.920	0.910
<i>Cope Anxiety</i>					
Configural	59.080	39	0.054	0.959	0.931
Weak	67.699	45	0.054	0.954	0.933
Strong	73.806	51	0.050	0.954	0.940
Strict	86.770	59	0.052	0.944	0.937
Partial Strict (DMQR11*, DMQR11_T2*, DMQR_T3*)	84.740	57	0.053	0.944	0.935
Partial Strict (DMQR11 T1*)	85.183	58	0.052	0.945	0.937

Partial Strict (DMQR19T3*)	80.987	58	0.047	0.953	0.947
<i>Enhancement</i>					
Configural	123.939	72	0.064	0.953	0.932
Weak	139.430	80	0.065	0.946	0.930
Strong	161.242	88	0.069	0.934	0.921
Partial Strong (DMQR12*)	151.183	87	0.065	0.942	0.930
Strict Partial Strong (DMQR12*)	172.693	97	0.067	0.932	0.926
Strict Partial Strong (DMQR12*, DMQR6T3*)	166.515	96	0.065	0.936	0.930
<i>Tension Reduction</i>					
Configural	28.037	15	0.066	0.968	0.923
Weak	30.651	19	0.055	0.971	0.946
Strong	31.475	23	0.043	0.979	0.967
Strict	35.597	29	0.034	0.984	0.980
<i>Sociability/Liquid Courage</i>					
Configural	290.952	165	0.062	0.920	0.899
Weak	306.863	177	0.060	0.918	0.903
Strong	319.227	189	0.059	0.918	0.909
Strict	327.815	203	0.055	0.921	0.918

Note. Bold indicates the models that were retained for factor extraction and used for hypothesis testing. df = degrees of freedom; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index.

Table 3

Factor Loadings of the Time-Specific Measures of the Latent Trait Variables.

Latent Factor	Loading
Cope Anxiety Motives	
Cope Anxiety_T1	0.576
Cope Anxiety_T2	0.608
Cope Anxiety_T3	0.672
Enhancement Motives	
Enhancement_T1	0.866
Enhancement_T2	0.927
Enhancement_T3	0.855
Tension Reduction Expectancies	
Tension Reduction_T1	0.774
Tension Reduction_T2	0.724
Tension Reduction_T3	0.786
Sociability/Liquid Courage Expectancies	
Sociability/Liquid Courage_T1	0.794
Sociability/Liquid Courage_T2	0.892
Sociability/Liquid Courage_T3	0.930
Alcohol Use	
Alcohol Use_T1	0.790
Alcohol Use_T2	0.753
Alcohol Use_T3	0.722
Alcohol Problems	
Alcohol Problems_T1	0.657
Alcohol Problems_T2	0.585
Alcohol Problems_T3	0.600

Note. T1 = baseline; T2 = 6-month follow-up; T3 = 12-month follow-up.

Table 4

All Linear and Cross-Lagged Regression Paths for AS, Drinking Motives (Cope Anxiety, Enhancement), Alcohol Expectancies (Tension Reduction, Sociability/Liquid Courage), Alcohol Use, and Alcohol-Related Problems Indicators in the State-Trait Model.

		T1-T2			T2-T3		
		Unstandardized Estimate	Standard Error	<i>p</i> -value	Unstandardized Estimate	Standard Error	<i>p</i> -value
Anxiety Sensitivity							
AS	→ CANX	0.685	0.361	0.058	-	-	-
AS	→ ENH	-0.151	0.074	0.042	-	-	-
AS	→ TR	-0.002	0.065	0.975	-	-	-
AS	→ SLC	0.001	0.049	0.985	-	-	-
AS	→ USE	0.092	0.084	0.276	-	-	-
AS	→ PROB	0.227	0.289	0.432	-	-	-
Autoregressive paths							
CANX	→ CANX	0.854	0.309	0.006	1.145	0.459	0.013
ENH	→ ENH	0.125	0.150	0.404	0.263	0.198	0.183
TR	→ TR	0.104	0.091	0.254	-0.054	0.090	0.543
SLC	→ SLC	-0.051	0.067	0.448	-0.040	0.064	0.534
USE	→ USE	0.084	0.061	0.167	0.132	0.060	0.029
PROB	→ PROB	0.229	0.220	0.298	0.146	0.201	0.468
Cross-lagged paths							
<i>Motives</i>							
CANX	→ ENH	-0.517	0.263	0.049	-0.848	0.350	0.015
ENH	→ CANX	-0.324	0.100	0.001	-0.437	0.129	0.001
<i>Expectancies</i>							
TR	→ SLC	0.059	0.067	0.384	0.051	0.062	0.405
SLC	→ TR	0.006	0.071	0.929	0.178	0.076	0.019

Motives and expectancies

CANX	→ TR	- 0.059	0.113	0.602	-0.333	0.158	0.035
TR	→ CANX	- 0.066	0.093	0.482	-0.001	0.077	0.988
ENH	→ SLC	0.031	0.050	0.528	0.093	0.056	0.095
SLC	→ ENH	0.102	0.103	0.322	0.105	0.156	0.501
CANX	→ SLC	- 0.086	0.087	0.320	-0.173	0.101	0.088
SLC	→ CANX	0.013	0.071	0.857	-0.139	0.122	0.252
ENH	→ TR	0.047	0.081	0.564	0.092	0.102	0.365
TR	→ ENH	0.089	0.147	0.544	0.249	0.133	0.062

Motives and alcohol use

CANX	→ USE	-0.003	0.003	0.987	0.187	0.145	0.198
USE	→ CANX	0.066	0.040	0.095	0.050	0.037	0.178
ENH	→ USE	-0.038	0.080	0.631	-0.064	0.082	0.433
USE	→ ENH	-0.031	0.065	0.630	0.019	0.072	0.788

Expectancies and alcohol use

TR	→ USE	-0.054	0.114	0.634	-0.050	0.100	0.617
USE	→ TR	-0.084	0.035	0.017	0.010	0.043	0.811
SLC	→ USE	0.039	0.107	0.715	-0.064	0.096	0.507
USE	→ SLC	0.022	0.033	0.510	0.011	0.033	0.737

Motives and alcohol problems

CANX	→ PROB	-0.452	1.025	0.659	0.821	1.082	0.448
PROB	→ CANX	0.008	0.014	0.563	0.001	0.010	0.933
ENH	→ PROB	0.110	0.584	0.850	-0.220	0.654	0.737
PROB	→ ENH	-0.008	0.029	0.785	-0.036	0.030	0.222

Expectancies and alcohol problems

TR	→ PROB	-0.711	0.616	0.249	-0.684	0.653	0.295
PROB	→ TR	-0.006	0.020	0.754	0.006	0.018	0.718
SLC	→ PROB	0.576	0.500	0.249	0.287	0.401	0.475
PROB	→ SLC	-0.005	0.012	0.684	0.017	0.011	0.118

Note. AS = anxiety sensitivity; CANX = cope anxiety motives; ENH = enhancement motives; TR = tension reduction expectancies; SLC = sociability/liquid courage expectancies; USE = alcohol use; PROB = alcohol-related problems; p = calculated probability; T1 = baseline; T2 = 6-month follow-up; T3 = 12-month follow-up.

Table 5

Correlation Matrix of Anxiety Sensitivity, Drinking Motives, Alcohol Expectancies, and Alcohol Use and Problems.

Latent Trait Variable	1	2	3	4	5	6	7
1. Anxiety Sensitivity	-						
2. Cope Anxiety Motives	-.045						
3. Enhancement motives	.025	.342**	-				
4. Tension Reduction Expectancies	.030	.058**	.119†	-			
5. Sociability/Liquid Courage Expectancies	.023	.105**	.246**	.050*	-		
6. Alcohol use	-.009	-.001	.047	.018	.001	-	
7. Alcohol Problems	.042	.477*	.346**	.253	.408**	-.130	-

Note. AS = anxiety sensitivity; CANX = cope anxiety motives; ENH = enhancement motives;

TR = tension reduction expectancies; SLC = sociability/liquid courage expectancies; USE =

alcohol use; PROB = alcohol problems. † $p < .1$; * $p < .05$; ** $p < .01$.

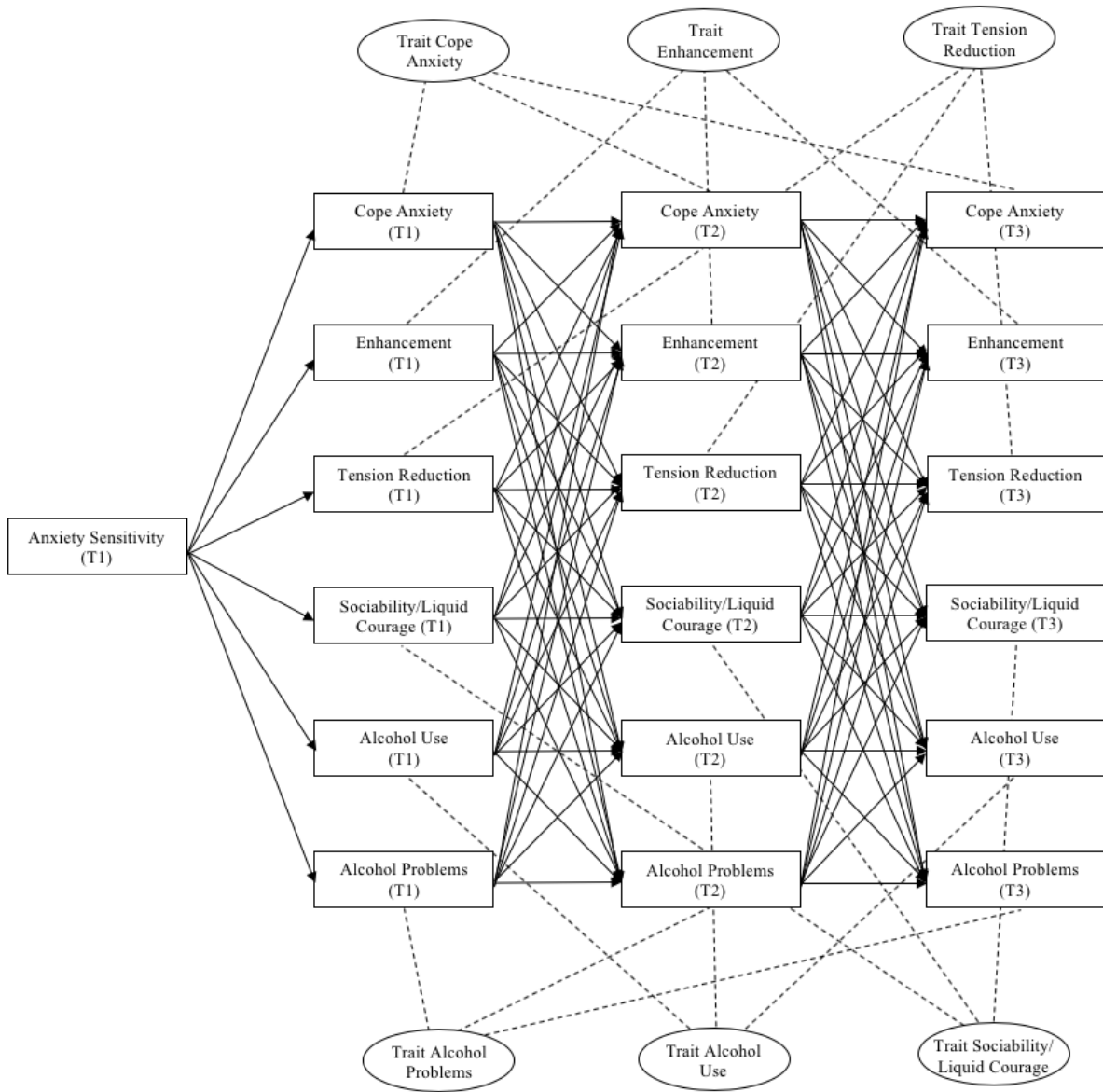


Figure 1. Hypothesized state-trait model relating AS risk (T1), cope-anxiety motives (T1-T3), enhancement motives (T1-T3), tension reduction alcohol expectancies (T1-T3), sociability/liquid courage alcohol expectancies (T1-T3), alcohol use (T1-T3) and alcohol-related problems (T1-T3). T1 = baseline; T2 = 6-month follow-up; T3 = 12-month follow-up.