

Testing the Four-Factor Model of Personality Vulnerability to Alcohol Misuse: A Three-Wave, One-Year Longitudinal Study

Sean P. Mackinnon, Ivy-Lee L. Kehayes, Roderick Clark, Simon B. Sherry, and Sherry H. Stewart
Dalhousie University

The 4-factor model of personality vulnerability identifies 4 personality risk factors for alcohol misuse: hopelessness, anxiety sensitivity, impulsivity, and sensation seeking. These personality traits are associated with distinct mechanisms and motivations for alcohol misuse. Individuals high in hopelessness drink to regulate dysphoric affect, while those high in anxiety sensitivity drink to reduce anxiety and to conform to peer expectations. Individuals high in sensation seeking are highly sensitive to the rewarding properties of alcohol, and misuse alcohol to maximize enjoyment. Impulsivity is a broad risk factor contributing to all drinking motives. We hypothesized that personality vulnerabilities would indirectly predict alcohol quantity and problems through specific drinking motives theorized by the 4-factor model. The present study tested hypotheses using a 3-wave, 1-year longitudinal study of undergraduate drinkers ($N = 302$). Data were analyzed using multilevel path analysis. Hopelessness and impulsivity were positively related to drinking motives in the expected fashion. Anxiety sensitivity was related to coping-anxiety and conformity motives only in the between-subjects model (partially supporting hypotheses), while sensation seeking was generally unrelated to all drinking motives and alcohol outcomes (failing to support hypotheses). Enhancement motives predicted alcohol quantity and problems at both levels, coping-depression motives predicted alcohol problems at the between-subjects level only, and coping-anxiety, conformity, and social motives failed to predict alcohol outcomes beyond other motives. Overall, this study partially supports the 4-factor model, with the strongest support emerging for impulsivity and hopelessness. This study suggests that personality traits such as impulsivity and hopelessness may be important targets in prevention and treatment with undergraduate drinkers.

Keywords: sensation seeking, hopelessness, impulsivity, anxiety sensitivity, drinking motives

Alcohol misuse among young adults is common, with 16.1% of Canadian undergraduates reporting they are frequent, heavy drinkers, and 43.9% of undergraduates reporting at least one negative consequence due to alcohol use (i.e., alcohol problems), such as injury or memory loss (Adlaf, Demers, & Gliksman, 2004). Moreover, an estimated 18.0–27.0% of undergraduates will experience

an alcohol use disorder in their lifetime (Vergés, Littlefield, & Sher, 2011). The harmful effects of alcohol are well established, with at least 60 medical conditions linked to heavy alcohol consumption (e.g., heart disease, liver cirrhosis, cancer; Room, Babor, & Rehm, 2005). Due to its deleterious effects on health and lifestyle, our study focuses on personality factors and motivations underlying alcohol consumption and problems in undergraduates.

Drinking Motives Theory

Motivational models of drinking (Cox & Klinger, 1988) contend individuals drink to achieve desired outcomes. Drinking motives may be categorized not only by their valence (i.e., positively or negatively reinforcing), but also by their source (i.e., internal or external; Cooper, 1994). Crossing these two dimensions led to the four-factor model of drinking motives: Conformity motives (negative and external; drinking to reduce social rejection), social motives (positive and external; drinking to increase social affiliation), enhancement motives (positive and internal; drinking to increase pleasurable emotions), and coping motives (negative and internal; drinking to reduce negative emotions). This four-factor model explains drinking behavior at all ages (Crutzen, Kuntsche, & Schelleman-Offermans, 2013; Kuntsche, Knibbe, Gmel, & Engels, 2005). Because anxiety and depression are different affective states with differential links to alcohol misuse, Grant, Stewart, O'Connor, Blackwell, and Conrod (2007) split coping motives into coping-anxiety (i.e., drinking to reduce anxious mood) and coping-depression (drinking to reduce depressed mood). Grant et al.

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Ivy-Lee L. Kehayes, Department of Psychology and Neuroscience, Dalhousie University; Sean P. Mackinnon, Sherry H. Stewart, and Simon B. Sherry, Departments of Psychiatry, and Psychology and Neuroscience, Dalhousie University; Roderick Clark, Department of Medicine, Dalhousie University.

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Correspondence concerning this article should be addressed to Sean P. Mackinnon, Department of Psychology and Neuroscience, Dalhousie University, Life Sciences Centre, 1355 Oxford Street, PO Box 15000, Halifax, Nova Scotia, Canada, B3H 4R2. E-mail: mackinnon.sean@gmail.com

(2007) found this five-factor model was a better fit to the data, and offered better predictive validity than the original four-factor model. The present study relies on Grant et al.'s (2007) five-factor model. Research shows drinking motives are important predictors of alcohol use and problems in adolescents and undergraduates (Simons, Gaher, Correia, Hansen, & Christopher, 2005). Coping and enhancement motives tend to be the most strongly associated with alcohol consumption and alcohol problems. Social motives are theorized to represent a nonpathological motivation for drinking; indeed, while they are related to increased drinking behavior, they appear unrelated to alcohol problems (Kuntsche et al., 2005).

Four-factor Model of Personality Vulnerability to Alcohol Misuse

Certain personality traits confer vulnerability to earlier drinking onset, binge drinking, and alcohol problems (Castellanos-Ryan, O'Leary, Barrett, Sully, & Conrod, 2013; Krank et al., 2011). Castellanos-Ryan and Conrod's (2012) four-factor model of personality vulnerability to alcohol misuse emerged from Pihl and Peterson's (1995) theoretical work. This model summarizes existing research, and makes predictions regarding the interplay of personality and drinking motivations in explaining alcohol misuse. In this model, four personality traits linked to alcohol misuse—hopelessness, anxiety sensitivity, impulsivity, and sensation seeking—each correspond to a particular pattern of drinking motivations, biological underpinnings, and propensity for alcohol misuse. The four-factor model is well-supported in the literature (Conrod, Pihl, Stewart, & Dongier, 2000; Krank et al., 2011; Woicik, Stewart, Pihl, & Conrod, 2009). In what follows, we define each trait, and summarize research supporting this model as it pertains to alcohol misuse.

Hopelessness

Hopelessness is a personality trait including bleak expectations about oneself and the future, perceived inability to change future outcomes, and chronic feelings of despondency (Woicik et al., 2009). It is related to—but distinct from—broad-band personality traits such as neuroticism (i.e., the dispositional tendency to experience negative affect; see Castellanos-Ryan & Conrod, 2012). Individuals high in hopelessness are theorized to misuse alcohol by drinking to manage or reduce their feelings of depression (i.e., coping-depression motives). Cross-sectional research shows hopelessness is positively correlated with general coping motives and alcohol problems in adolescents and undergraduates (Stewart, McGonnell, Wekerle, & Adlaf, 2011; Woicik et al., 2009), and coping motives may mediate the relationship between hopelessness and excessive drinking in Aboriginal youth (Stewart, Sherry et al., 2011). Further, preliminary longitudinal evidence suggests hopelessness may confer vulnerability to increased alcohol problems in a four-wave, 18-month study (Castellanos-Ryan, O'Leary-Barrett, Sully, & Conrod, 2013) and in a two-wave, 1-year study (Krank et al., 2011). However, another four-wave, 32-month study of adolescents failed to find support for this vulnerability model (Malmberg et al., 2013). Though longitudinal mediation models of hopelessness, coping motives, and alcohol problems are largely untested, research does show coping motives mediate the relationship between neuroticism and alcohol problems in cross-sectional

studies (Cooper, Agocha, & Sheldon, 2000; Kuntsche, von Fischer, & Gmel, 2008; Stewart, Loughlin, & Rhyno, 2001; Willem, Bijttebier, Claes, & Uytterhaegen, 2012) and in an eight-wave, 17-year longitudinal study (Littlefield, Sher, & Wood, 2010).

Anxiety Sensitivity

Anxiety sensitivity represents a fear of anxiety-related physical sensations due to an unrealistic expectation they could lead to catastrophic consequences or loss of control (Reiss, Peterson, Gursky, & McNally, 1986). The four-factor model (Pihl & Peterson, 1995; Castellanos-Ryan & Conrod, 2012) suggests individuals high in anxiety sensitivity are susceptible to both alcohol withdrawal symptoms and the arousal-dampening effects of alcohol. Indeed, research shows young adults high in anxiety sensitivity are at greater risk for developing alcohol problems because they are more sensitive to alcohol's anxiety-dampening effects (Macdonald, Baker, Stewart & Skinner, 2000; Stewart, Samoluk, & MacDonald, 1999). This susceptibility to the negatively reinforcing properties of alcohol suggests people high in anxiety sensitivity will drink to reduce their heightened anxiety (coping-anxiety motives) and to reduce a perceived sense of social rejection (conformity motives). Anxiety sensitivity has sometimes been related to increased alcohol consumption, but inconsistently (Castellanos-Ryan et al., 2013; Krank et al., 2011; Stewart, McGonnell et al., 2011; Woicik et al., 2009). However, anxiety sensitivity is more clearly linked to coping and conformity motives, negative reinforcement motives which are well-known correlates of alcohol problems in cross-sectional studies (Kushner, Thuras, Abrams, Brekke, & Stritar, 2001; Stewart, Zvolensky, & Eifert, 2002; Woicik et al., 2009). Anxiety sensitivity was a risk factor for alcohol use disorders in a 2-year prospective study (Schmidt, Buckner, & Keough, 2007), but not in another 32-month, four-wave study (Malmberg et al., 2013). Another four-wave, 18-month study found participants high in both anxiety sensitivity and anxiety experienced greater increases in alcohol use over time (Mackie, Castellanos-Ryan, & Conrod, 2011). Despite these important exceptions, there are only a few longitudinal studies of anxiety sensitivity and alcohol (Castellanos-Ryan & Conrod, 2012), and the literature is somewhat mixed overall (DeMartini & Carey, 2011), suggesting anxiety sensitivity's relationships to alcohol misuse may be more complex than other personality risk factors (Stewart & Kushner, 2001).

Impulsivity

The term *impulsivity* is frequently used to describe a diverse construct with many competing definitions and conceptualizations, with single studies typically focusing on only one or a few of the possible facets. In a meta-analytic review, Stautz and Cooper (2013) suggest that impulsivity is a broad construct comprised of many subdimensions, including lack of premeditation (the tendency to act without forethought), lack of perseverance (reduced capacity to persist on tasks and heightened boredom), negative/positive urgency (tendency to act rashly when in a negative/positive mood), and reward sensitivity (increased susceptibility to the positively reinforcing qualities of stimuli). We focus on the facet of impulsivity captured by the Substance Use Profile Scale (SURPS; Woicik et al., 2009), which measures lack of premedi-

tation (Stautz & Cooper, 2013). A meta-analysis of 66 cross-sectional and 21 longitudinal studies found all facets of impulsivity are positively related to alcohol consumption and problems, with lack of premeditation emerging as one of the most commonly studied facets (Stautz & Cooper, 2013). Though the SURPS subscale for impulsivity only measures a single facet of a larger, latent impulsivity construct, from this point onward in the manuscript, we operationalize *impulsivity* as the impulsivity subscale of the SURPS, which captures the “lack of premeditation” facet of a broader impulsivity construct.

Individuals high in impulsivity have difficulties with emotion regulation and response inhibition, and thus are at higher risk to misuse alcohol. Impulsivity is thought to confer a more generalized risk for problematic alcohol use, and is thought to be related to all types of drinking motivations (Castellanos-Ryan & Conrod, 2012). Research indicates impulsivity is positively associated with drinking quantity, heavy episodic drinking, and alcohol problems across a variety of studies (Simons et al., 2005; Stewart, McGonnell, et al., 2011; Woicik et al., 2009). Moreover, impulsivity is positively related to coping, conformity, and enhancement motives in adolescent, undergraduate, and clinical samples, with both coping and enhancement motives emerging as consistent mediators of the impulsivity-alcohol problems relationship in cross-sectional studies (Adams, Kaiser, Lynam, Charnigo, & Milich, 2012; Magid, MacLean, & Colder, 2007; Settles, Cyders, & Smith, 2010). Longitudinal research also suggests impulsivity and positive/negative urgency are risk factors for earlier age of drinking onset, heavy episodic drinking, and increased alcohol problems (Castellanos-Ryan et al., 2013; Krank et al., 2011; Littlefield et al., 2010; Malmberg et al., 2013; Quinn, Stappenbeck, & Fromme, 2011). In sum, impulsivity is a robust predictor for a wide range of alcohol use motivations and problematic drinking behaviors.

Sensation Seeking

Although some models consider sensation seeking to be a facet of a higher-order impulsivity latent variable (Stautz & Cooper, 2013), the four-factor model (Castellanos-Ryan & Conrod, 2012), like the five-factor model of personality (McCrae & John, 1992), proposes that sensation seeking is a distinct construct, which is a facet of a higher-order extraversion trait (i.e., the tendency to direct positive energy outward to the social world). Sensation seeking represents the need for intense, novel, and exciting experiences (Zuckerman, 1994). Individuals high in sensation seeking are theorized to be sensitive to the rewarding properties of alcohol, and often attempt to maximize their enjoyment of alcohol (i.e., enhancement motives) through binge drinking or other risky drinking behaviors (Castellanos-Ryan & Conrod, 2012). Sensation seeking is significantly related to alcohol consumption, heavy episodic drinking, enhancement motives, and social motives, and predicts these outcomes beyond impulsivity, suggesting it is important to consider impulsivity and sensation seeking as separate constructs (Adams et al., 2012). Moreover, sensation seeking is thought to have an indirect effect on alcohol problems: Specifically, sensation seeking leads to increased enhancement and social motives, which in turn leads to increased consumption,

leading to increased alcohol problems in cross-sectional research (Magid et al., 2007; Simons et al., 2005). A meta-analysis of longitudinal studies found that sensation seeking is a risk factor for future alcohol consumption ($r = .25$; $k = 9$; $N = 5762$) and alcohol problems ($r = .26$; $k = 6$; $N = 4292$) in longitudinal research (Stautz & Cooper, 2013). However, though longitudinal research generally supports sensation seeking as a risk factor for alcohol use quantity and alcohol problems (Krank et al., 2011; Malmberg et al., 2013; Quinn et al., 2011), some studies report inconsistent (Castellanos-Ryan et al., 2013) or null results (Read, Wood, Kahler, Maddock, & Palfai, 2003) when data are analyzed longitudinally. Overall, sensation seeking appears to confer sensitivity to the positively reinforcing properties of alcohol, differentiating it from the susceptibility to negative reinforcement conferred by hopelessness and anxiety sensitivity, and the more generalized risk for alcohol misuse conferred by impulsivity.

Advancing Prior Research

Though there are numerous longitudinal studies examining personality as a longitudinal risk factor for increased alcohol consumption and problems, the bulk of the research thus far has used cross-sectional designs (Castellanos-Ryan & Conrod, 2012; Stautz & Cooper, 2013) and, to our knowledge, no studies have included all four SURPS personality traits, drinking motives, and alcohol variables together in a single longitudinal study. Longitudinal research permits stronger causal inferences compared to cross-sectional research by reducing temporal confounding among variables, and by allowing researchers to examine predictors and mediators of change over time. Our study addresses this gap by using a three-wave, 1-year longitudinal design with each questionnaire asking participants to report on their experiences in the past 6 months. The present research also takes advantage of recent psychometric advances in the measurement of drinking motives (Grant et al., 2007) and personality vulnerability (Woicik et al., 2009). Until recently, there was no single standardized scale to measure all four personality traits as proposed by the four-factor model, making findings from prior research occasionally difficult to interpret and compare (e.g., Read et al., 2003 used a measure conflating sensation seeking and impulsivity; Willem et al., 2012 used a measure conflating hopelessness and anxiety sensitivity). Use of the SURPS (Woicik et al., 2009) to measure these personality traits will facilitate better comparison and interpretation as this literature moves forward.

Research using the Drinking Motives Questionnaire-Revised (Cooper, 1994) confounds coping-anxiety and coping-depression motives into a single generic coping motives construct. By disentangling these two subscales using the modified questionnaire validated by Grant et al. (2007), it will be easier to interpret the different pathways by which impulsivity, anxiety sensitivity, sensation seeking, and hopelessness confer risk. Finally, our study includes data analytic advances. By including all personality traits and motives into a single multilevel path analytic model (Preacher, Zyphur, & Zhang, 2010), we can better gauge the individual contribution of each variable to quantity of alcohol consumption and alcohol problems, as well as the relative stability of these variables over one year by partitioning variance into within- and

between-subjects components. This approach also helps minimize the retrospective recall biases in most self-reports by aggregating across multiple measurements (Schwarz, 2004).

Hypotheses

Prior theory suggests four pathways to alcohol problems (Castellanos-Ryan & Conrod, 2012). Hopelessness is thought to have an indirect effect on alcohol problems through coping-depression motives. That is, people high in hopelessness drink to cope with their strong feelings of depression, which in turn leads to alcohol problems (Stewart, Sherry, et al., 2011). Anxiety sensitivity is thought to have an indirect effect on alcohol problems through coping-anxiety and conformity motives. That is, people high in anxiety sensitivity are especially prone to feelings of anxiety and perceived social rejection, so they often drink to cope with anxiety or to conform to group expectations, both of which often lead to alcohol problems (Kushner et al., 2001). Impulsivity (operationalized as “lack of premeditation”) is thought to be a broad risk factor for disinhibited drinking, without any single motive responsible for this behavior. Thus, impulsivity is theorized to be related to all five drinking motives (Woicik et al., 2009), which leads to alcohol problems. People high in sensation seeking are more sensitive to the rewarding properties of alcohol, and are

theorized to drink for social and enhancement motives (Castellanos-Ryan & Conrod, 2012). Social motives are associated with increased quantity of drinking, but not necessarily alcohol problems (Kuntsche et al., 2005). Enhancement motives are generally associated not only with increased quantity, but also increased alcohol problems; thus, sensation seeking is thought to be associated with high drinking quantity and alcohol problems (Stautz & Cooper, 2013).

This model divides into seven hypotheses (see Figure 1).

Hypothesis 1: Hopelessness will be positively related to coping-depression motives.

Hypothesis 2: Anxiety sensitivity will be positively related to coping-anxiety and conformity motives.

Hypothesis 3: Impulsivity will be positively related to all motives.

Hypothesis 4: Sensation seeking will be positively related to enhancement and social motives.

Hypothesis 5: Enhancement and social motives will be positively related to quantity of alcohol consumed.

Hypothesis 6: All drinking motives (except social motives) will be positively related to alcohol problems.

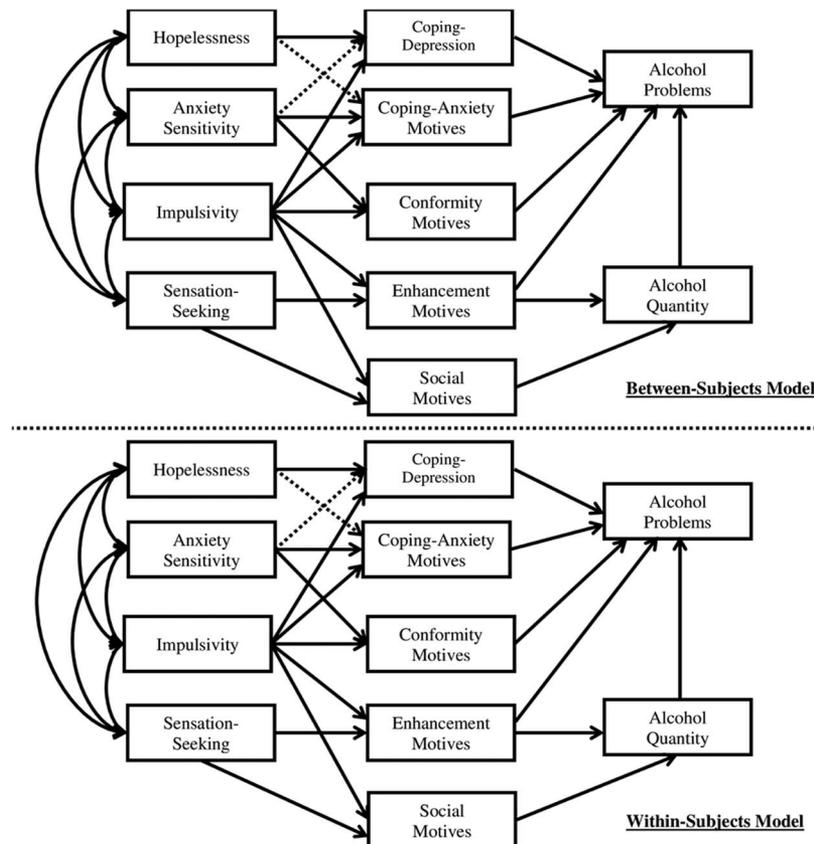


Figure 1. Hypothesized multilevel path model. Rectangles represent measured variables. Black double-headed arrows represent correlations. Black arrows represent hypothesized paths. Dotted arrows represent additional paths added to test specificity of hypotheses. Residual error terms are not shown. Although not shown, intercorrelations among all four motives variables were specified a priori.

Hypothesis 7: Quantity of alcohol consumed will be positively related to alcohol problems.

Based on theory (Castellanos-Ryan & Conrod, 2012), we predicted hopelessness would be related to coping-depression motives, while anxiety sensitivity would be related to coping-anxiety motives. We also included paths from hopelessness to anxiety-coping motives and from anxiety sensitivity to depression-coping motives to test the specificity of these predictions. Hypotheses were tested using multilevel path analysis, which partitions the variance into between-subjects (i.e., the “trait-like” variance that does not vary over 18 months) and within-subjects components (i.e., the “state-like” variance that varies across measurement occasions). Our hypotheses were identical for between- and within-subjects analyses.

Method

Participants

We recruited 302 undergraduates through the participant pool at Dalhousie University and via poster advertising at local universities. At baseline, participants averaged 20.84 years ($SD = 3.95$) and had completed an average of 2.38 years of university; 34.6% of students were in their first year of university, 23.9% in their second year, 21.9% in their third year and 19.6% were in their fourth year or higher; 90.1% identified as Caucasian and 72.5% were female.

Instruments

Substance Use Risk Profile Scale (SURPS). The SURPS (Woicik et al., 2009) is a 23-item self-report measure measuring four different personality characteristics related to alcohol misuse: The 7-item hopelessness subscale (“I am very enthusiastic about my future” [reverse coded]), the 5-item anxiety sensitivity subscale (“It is frightening to feel dizzy or faint”), the 5-item impulsivity subscale (“I usually act without stopping to think”), and the 6-item sensation-seeking subscale (“I enjoy new and exciting experiences even if they are unconventional”). Participants responded on a 5-point scale from 1 (*strongly disagree*) to 5 (*strongly agree*), and were asked to consider their experiences over the past 6 months. The SURPS has good internal consistency, test-retest reliability, and factorial validity in adolescents and young adults (Castellanos-Ryan et al., 2013; Krank et al., 2011; Woicik et al., 2009).

Modified Drinking Motives Questionnaire-Revised (Modified DMQ-R). The Modified DMQ-R (Grant et al., 2007) is a 28-item self-report measure modified from the original DMQ-R (Cooper, 1994). Participants indicate how often they drank for the presented reasons over the past 6 months, using a 5-point scale from 1 (*almost never/never*) to 5 (*almost always/always*). The Modified DMQ-R has five subscales: The 5-item social motives subscale (“to be sociable”), the 5-item enhancement motives subscale (“because it is exciting”), the 5-item conformity subscale (“so I won’t feel left out”), the 4-item coping-anxiety subscale (“to reduce my anxiety”), the 9-item coping-depression subscale (“because it helps me when I’m feeling depressed”), and the 5-item social motives subscale (“to be sociable”). The Modified-DMQ-R

has good test-retest reliability, internal consistency, and factorial validity (Grant et al., 2007).

Rutgers Alcohol Problem Index (RAPI). Alcohol problems were assessed using the 23-item Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989). This instrument asks participants to report how often the experiences (e.g., “caused shame or embarrassment to someone”) occurred in the past 6 months during or because of their alcohol use, with responses ranging on a 5-point scale from 0 (*never*) to 4 (*more than 6 times*). The RAPI has good test-retest reliability, internal consistency, and concurrent validity in undergraduates (Miller, Miller, Verhegge, Linville, & Pumariega, 2002).

Quantity. Quantity of alcohol consumption was measured with a single item: “During the past 6 months, how much did you typically drink when you drank alcohol?” Participants responded on an open-ended scale, providing any number of drinks that was applicable for them. An alcoholic drink was defined for participants as one bottle of beer, one cooler, one small [4-ounce] glass of wine, or one shot/mixed drink containing one ounce of hard liquor. This question was embedded within the demographics questionnaire alongside filler items inquiring about caffeine and exercise to reduce social desirability biases (see Babor, Brown, & del Boca, 1990).

Procedure

Our study was approved by the Health Sciences Research Ethics Board at Dalhousie University. Participants completed prescreening through mass screening protocols or via telephone prescreening interviews. Because the study investigated drinking motives as mediating variables, participants were required to be drinkers (since nondrinkers cannot report on drinking motives). We defined drinkers as those who had consumed alcohol on at least four separate occasions in the past month, as in prior research (e.g., Grant, Stewart, & Mohr, 2009). Participants completed baseline questionnaires in the lab. Baseline questionnaires consisted of demographics, the SURPS (Woicik et al., 2009), Modified DMQ-R (Grant et al., 2007), quantity of alcohol consumption, and RAPI (White & Labouvie, 1989). Participants completed the same questionnaires at 6- and 12-month time intervals via an online survey. Participants were compensated either with 3.0 bonus credit points toward a psychology class, or with \$10 for the first two sessions and \$15 for completion of the third session.

Results

Data Analytic Strategy

At the 6-month follow-up, 251 participants remained (83.1% retention), with 220 participants remaining at the 12-month follow-up (72.8% retention). Overall, 17.7% of data was missing with covariance coverage ranging from .52 to 1.00. Missing data was handled using a full information maximum likelihood (FIML) approach in Mplus 7.0. FIML approaches are superior to single imputation and listwise deletion (Graham, 2009).

Several variables were positively skewed, as often occurs for drinking variables (Miller et al., 2002). To correct for non-normality, we \log_{10} transformed the following variables at all measurement occasions prior to analysis: Coping-depression mo-

tives, coping-anxiety motives, conformity motives, and alcohol problems. We also used robust maximum likelihood estimation (MLR) in Mplus 7.0 to calculate path coefficients and fit indices. MLR estimation is robust to violations of multivariate normality (Muthén & Muthén, 2012).

Our dataset is multilevel, with measurement occasions (within-subjects) nested within people (between-subjects). To examine whether it was appropriate to use multilevel path analysis to test the hypothesized relationships in Figure 1, we first calculated intraclass correlations (ICCs) for each variable. ICCs can range from 0 to 1.00, and indicate the proportion of the variance to be explained at the between-subjects level. Generally speaking, ICCs above .05 are suitable candidates for multilevel path analysis (Preacher et al., 2010). Next, we examined internal consistency at the between-subjects and within-subjects levels using a multilevel adaptation of Cronbach's alpha (see Geldhof, Preacher, & Zyphur, 2014). Then, we examined bivariate correlations at the between-subjects and within-subjects levels to see if hypothesized relationships existed at the zero-order level prior to testing the larger path model.

Following these basic descriptive statistics, we tested the model in Figure 1 via multilevel path analysis. This approach uses all available data (i.e., all variables at all waves). In multilevel path analysis, the between-subjects and within-subjects models are run simultaneously in a single model. In this kind of multilevel approach, the between-subjects and within-subjects variables are orthogonal; that is, between-subjects variables cannot predict within-subjects variables and vice versa (Preacher et al., 2010). The between-subjects portion models the trait-like component of measured variables that does not change across measurement occasions. The between-subjects model is analogous to conducting a cross-sectional study where all variables were measured as stable traits referring to "the past 18 months." However, it improves upon a cross-sectional model by partialing out the situational influences unique to each measurement occasion. Relationships at the between-subjects level answer the question: "Is the trait-like component of X correlated with trait-like component of Y?" The within-subjects model represents the state-like component of measured variables that changes across measurement occasions. The within-subjects model looks at change in all variables, and asks the question "When X changes, does Y also systematically change with it?" (e.g., a positive within-subjects correlation suggests that when X increases over 6 months, Y also increases in a similar fashion over 6 months).

A Monte Carlo method was used to test indirect effects (Selig & Preacher, 2008). Simulation studies suggest the Monte Carlo method produces similar results to bootstrapping, and is preferred in situations where bootstrapping is difficult, or impossible to implement, as is the case for multilevel models (Preacher & Selig, 2012). When interpreting overall model fit, a χ^2/df around 2.00, a comparative fit index (CFI) and Tucker-Lewis Index (TLI) around .95, a root-mean-square error of approximation (RMSEA) around 0.05, and a standardized root-mean-square residual (SRMR) around .08, suggest a well-fitting model (Kline, 2011).

Means, ICCs, and internal consistency. Means and standard deviations are presented in Table 1. Baseline means in Table 1 were compared to a sample seeking treatment for substance use disorder (Battista, Pencer, McGonnell, Durdle, & Stewart, 2013), a sample of adults seeking treatment for an alcohol use disorder

Table 1
Means and Standard Deviations

	Baseline		6 Months		12 Months	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Hopelessness	12.93	3.76	13.40	3.96	13.46	4.19
Anxiety sensitivity	10.89	3.13	10.51	3.30	10.10	3.38
Impulsivity	10.74	2.71	10.38	2.77	10.17	2.84
Sensation seeking	17.27	3.43	16.38	3.74	16.53	3.72
Coping-depression motives	12.48	5.40	12.24	5.34	12.41	5.37
Coping-anxiety motives	7.79	3.12	7.67	3.14	7.78	3.16
Conformity motives	6.55	2.67	6.36	2.38	6.40	2.53
Enhancement motives	13.58	4.37	13.32	4.97	13.01	4.97
Social motives	15.48	3.89	15.21	4.38	15.04	4.27
Alcohol problems	10.07	9.39	8.93	10.71	8.65	10.93
Quantity	5.12	2.53	4.81	2.67	5.11	3.12

Note. Subscale means were calculated by summing the component items. Means and standard deviations before \log_{10} transformations are presented for ease of interpretation.

(Mezquita et al., 2011) and an at-risk sample of college students seeking treatment for high-risk drinking behaviors (Schaus, Sole, McCoy, Mullett, & O'Brien, 2009). These clinical samples tended to have higher means on hopelessness ($d = 0.73$), impulsivity ($d = 1.01$), coping-depression motives ($d = 1.19$), coping-anxiety motives ($d = 0.86$), conformity motives ($d = 0.35$), and RAPI totals ($d = 0.32$), with $ps < .05$ using t tests. Thus, this nonclinical sample scores lower on these variables than comparison samples with more severe drinking problems. Sample means were similar to clinical samples ($ps > .05$) for social motives, enhancement motives, anxiety sensitivity and sensation seeking (ds from $-.22$ to $.10$). In addition, observed means were within one standard deviation of means from similarly recruited, nonclinical student samples (Grant et al., 2007; Stewart & Kushner, 2001; Woicik et al., 2009).

ICCs ranged from .51 to .72 (see Table 2), suggesting the majority of the variance is at the between-subjects level, with substantial variance left over to explain at the within-subjects level. Lowenthal (1996) suggests internal consistencies $> .60$ are acceptable for scales of 10 items or less. At the between-subjects level, internal consistencies for variables ranged from .77 to .97, suggesting variables had adequate to excellent reliability (see Table 2). At the within-subjects level, internal consistencies for variables ranged from .55 to .85, with impulsivity emerging as the only variable with an internal consistency lower than .60 (see Table 2). Within-subjects reliability estimates will be underestimated when cluster sizes are small (Geldhof et al., 2014), and cut-off scores for reliability are not as clearly established for this approach; thus, we decided to continue with hypothesis testing despite one low alpha.

Bivariate correlations. A complete matrix of between- and within-subjects correlations is in Table 2. When examining the intercorrelations among the SURPS subscales, the pattern of correlations was mixed: Most were positive correlations (4 of 6 between; 3 of 6 within), some were negative correlations (1 of 6 between; 1 of 6 within), and some were null correlations (1 of 6 between; 2 of 6 within). All drinking motive variables were positively intercorrelated at both levels with medium-small to large effect sizes (rs from .20 to .71). Anxiety sensitivity was positively correlated with

Table 2

Correlation Matrix, Intraclass Correlations, and Reliability Analyses at Between- and Within-Subjects Levels

	1	2	3	4	5	6	7	8	9	10	11
1. Hopelessness	—	-.14	-.08	-.30**	.15*	.01	-.09*	-.03	.16**	-.02	.04
2. Anxiety sensitivity	.36***	—	.37***	.24***	.11*	.01	.06	.09	.02	.24***	.04
3. Impulsivity	.32***	.33***	—	.24***	.16*	.16**	.10	.12*	.19***	.33***	.11*
4. Sensation seeking	-.06	-.15*	.32***	—	.02	.01	.03	.10	.12*	.19**	.00
5. Coping-depression	.50***	.33***	.39***	-.00	—	.51***	.35***	.38***	.20***	.20***	.05
6. Coping-anxiety	.37***	.34***	.32***	.03	.71***	—	.27***	.41***	.40***	.21***	.06
7. Conformity	.24***	.37***	.20**	.03	.40***	.45***	—	.24***	.26***	.12*	.02
8. Enhancement	.01	.05	.20**	.14	.31***	.51***	.22**	—	.43***	.24***	.30***
9. Social	.03	.27**	.19*	.06	.21**	.46***	.43***	.63***	—	.17***	.24***
10. Alcohol problems	.13	.15*	.33***	.13	.42***	.40***	.35***	.54***	.34***	—	.12*
11. Quantity	-.08	-.08	.20**	.19**	.05	.08	.17**	.42***	.24**	.53***	—
ICC	.71	.66	.65	.72	.65	.56	.60	.61	.51	.63	.66
α (within-subjects)	.73	.63	.55	.61	.85	.60	.73	.70	.63	.81	—
α (between-subjects)	.96	.90	.81	.77	.97	.81	.93	.90	.83	.97	—

Note. Between-persons correlations are below the diagonal; within-subjects correlations are above the diagonal. ICC = intraclass correlations; α = Cronbach's alpha. Alpha cannot be calculated for quantity because it is not a multi-item scale.

* $p < .05$. ** $p < .01$. *** $p < .001$.

alcohol problems at both levels, impulsivity was positively correlated with quantity and alcohol problems at both levels, and sensation seeking was positively correlated with quantity at the between-subjects level and alcohol problems at the within-subjects level; other SURPS-alcohol outcome correlations were null. At the between-subjects level, SURPS personality traits and drinking motives were generally positively correlated in the expected fashion with mostly medium effect sizes (r s from .19 to .50). However, contrary to predictions, sensation seeking was uncorrelated with enhancement and social motives. At the within-subjects level, SURPS personality traits and drinking motives tended to be positively correlated in the expected fashion, albeit with smaller effect sizes (r s from .01 to .19) and a few null correlations. Generally speaking, impulsivity emerged as the most consistent predictor of drinking motives at both the between- and within-subjects levels. Finally, all five motives were mostly positively correlated with alcohol problems at both the between- and within-subjects levels (r s from .12 to .54). In contrast, only enhancement and social motives consistently and positively predicted quantity across both levels. Overall, there were smaller effect sizes at the within-subjects level when compared to the between-subjects level. In sum, these correlations are generally consistent with prior research (Stewart & Kushner, 2001; Stewart & Devine, 2000) and they support moving forward with the multilevel path analysis.

Multilevel path analysis. The multilevel path model fit the data well: $\chi^2(39, N = 302) = 79.90, p < .001, \chi^2/df = 2.05$; CFI = .97; TLI = .92; RMSEA = .04. SRMR_{within} = .03, SRMR_{between} = .05.¹ Standardized path coefficients and R^2 values appear in Figure 2.

In the between-subjects model, hypothesized paths from personality to motives and from motives to drinking outcomes were generally supported, with caveats. Hopelessness predicted coping-depression motives, supporting Hypothesis 1. Anxiety sensitivity predicted coping-anxiety and conformity, supporting Hypothesis 2. Impulsivity predicted all motives except for conformity motives, supporting 4 of the 5 hypothesized paths for Hypothesis 3. Sensation seeking did not predict enhancement or social motives, contrary to Hypothesis 4. Enhancement (but not social) motives

predicted quantity of alcohol consumption, partially supporting Hypothesis 5. Of the five motives measured, only coping-depression and enhancement motives significantly predicted alcohol problems, partially supporting Hypothesis 6. Moreover, Quantity of alcohol consumption strongly predicted alcohol problems, supporting Hypothesis 7. In our test of specificity, hopelessness also positively predicted coping-anxiety motives, suggesting it is a nonspecific predictor of coping motives. In contrast, anxiety sensitivity did not predict coping-depression motives, suggesting it is more specific to drinking to cope with feelings of anxiety.

In the within-subjects model, hopelessness predicted coping-depression, but not coping-anxiety motives, supporting Hypothesis 1. Anxiety sensitivity did not predict either coping-anxiety, coping-depression, or conformity motives, contrary to the between-subjects model results and Hypothesis 2. Impulsivity predicted all motives except for conformity motives, replicating the results from the between-subjects model and mostly supporting Hypothesis 3. Sensation seeking did not predict social motives or enhancement motives, which matches results from the between-subjects model, but is contrary to Hypothesis 4. Enhancement and social motives predicted quantity of alcohol consumption, supporting Hypothesis 5. However, of the five motives measured, only enhancement motives significantly predicted alcohol problems, differing from the between-subjects model, and partially supporting Hypothesis 6. Quantity of alcohol consumption did not predict alcohol problems in the within-subjects model, suggesting that changes in quantity did not predict changes in alcohol problems

¹ When testing model fit, we explored whether direct effects (i.e., predictor to outcome) improved model fit. We included additional paths if the Δ CFI > .01 (Cheung & Rensford, 2002). We found that including a direct effect from impulsivity to alcohol problems in the within-subjects model improved model fit (Δ CFI = .028), and thus included this path in our final model presented in Figure 2. Other direct effects were not necessary to improve model fit.

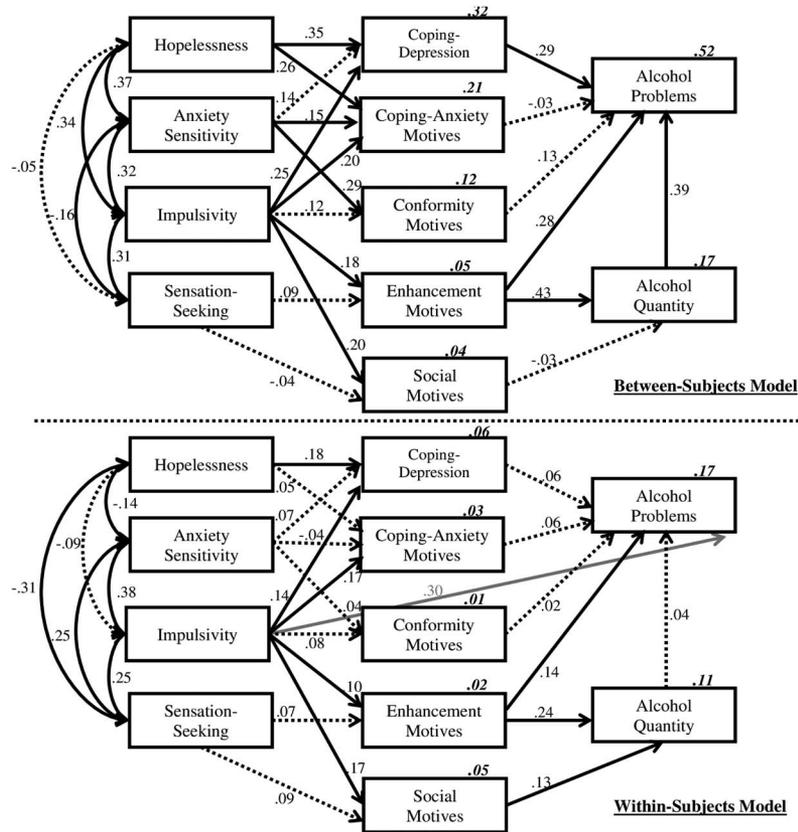


Figure 2. Multilevel path model. Black arrows represent hypothesized paths and correlations. The gray arrow was added to improve model fit. Solid lines are significant at $p < .05$; dotted lines are nonsignificant ($p > .05$). Numbers beside paths and correlations are standardized coefficients. Bold, italicized numbers in the upper right-hand corner of variables are R^2 values.

beyond impulsivity and drinking motives, failing to support Hypothesis 7.²

Paths from motives to alcohol outcomes suggest enhancement and social motives are most relevant at the within-subjects level: Social motives predicted quantity, and enhancement predicted quantity and alcohol problems. None of the other three motives significantly predicted alcohol outcomes in the within-subjects model, though impulsivity exerted a direct effect on alcohol problems beyond all other predictors in the within-subjects model. In sum, the within-subjects model failed to support most hypotheses, with a few caveats. Moreover, the effect sizes for the within-subjects model are generally much smaller than the between-subjects effects, suggesting the between-subjects model is generally better at predicting outcomes than the within-subjects model. That is, the trait-like components of personality, motives, and alcohol outcomes tended to covary together in the theorized fashion; however, state-like changes in each variable did not tend to covary as strongly once the trait-like variance was partialled out. This said, the ICCs showed there is more variance to explain at the between-subjects level (56% to 71% of the variance), so the small effect sizes at the within-subjects level might simply reflect the relative stability of measured variables over an 18-month period.

Indirect effects. We tested indirect effects using unstandardized 95% confidence intervals derived using a Monte Carlo

method (see Table 3). At the between-subjects level, there were five significant indirect effects. Hopelessness had an indirect effect on alcohol problems through coping-depression motives, but not coping-anxiety motives. Anxiety sensitivity did not indirectly predict alcohol problems through any drinking motives. Impulsivity had an indirect effect on alcohol quantity and problems through enhancement motives, and an additional indirect effect on alcohol problems through coping-depression motives. Impulsivity did not indirectly predict alcohol problems through coping-anxiety, conformity or social motives. Sensation seeking did not have an indirect effect on quantity or alcohol problems through enhancement or social motives. Finally, enhancement motives (but not social motives) had an indirect effect on alcohol problems through quantity.

At the within-subjects level, there were three significant indirect effects. Impulsivity indirectly affected alcohol problems via enhancement motives. Impulsivity also had an indirect effect on

² This null relationship does not imply that quantity and alcohol problems are unrelated. Indeed, bivariate correlations show there is a significant relationship between these variables at the between- and within-subjects levels. Instead, this null result shows quantity did not predict alcohol problems at the within-subjects level over and above impulsivity and drinking motives.

Table 3
Bootstrap Analyses of Indirect Effects Predicting Alcohol Problems

Predictor (X)	Mediator (M)	Outcome (Y)	Between 95% CI for standardized indirect effect	Within 95% CI for standardized indirect effect
Hopelessness	Coping-depression	Alcohol problems	 [.03, .19]*	[−.01, .04]
Hopelessness	Coping-anxiety	Alcohol problems	[−.07, .05]	[−.01, .02]
Anxiety sensitivity	Coping-depression	Alcohol problems	[−.01, .10]	[−.004, .02]
Anxiety sensitivity	Coping-anxiety	Alcohol problems	[−.05, .03]	[−.01, .004]
Anxiety sensitivity	Conformity	Alcohol problems	[−.002, .09]	[−.01, .01]
Impulsivity	Coping-depression	Alcohol problems	 [.02, .14]*	[−.01, .03]
Impulsivity	Coping-anxiety	Alcohol problems	[−.06, .04]	[−.01, .03]
Impulsivity	Conformity	Alcohol problems	[−.01, .05]	[−.01, .01]
Impulsivity	Enhancement	Alcohol problems	 [.01, .11]*	 [.0006, .03]*
Impulsivity	Enhancement	Quantity	 [.01, .16]*	 [.001, .05]*
Impulsivity	Social	Quantity	[−.05, .04]	 [.01, .05]*
Sensation seeking	Enhancement	Alcohol problems	[−.01, .07]	[−.01, .04]
Sensation seeking	Enhancement	Quantity	[−.02, .10]	[−.02, .06]
Sensation seeking	Social	Quantity	[−.02, .02]	[−.002, .03]
Enhancement	Quantity	Alcohol problems	 [.09, .26]*	[−.01, .03]
Social	Quantity	Alcohol problems	[−.09, .06]	[−.01, .02]

Note. Confidence intervals were derived using a Monte Carlo method with 20,000 resamples.

* Indirect effect is statistically significant at $p < .05$.

quantity via enhancement and social motives. All other indirect effects at the within-subjects level were null (see Table 3). In sum, hypotheses were partly supported, with the between-subjects model showing results more consistent with theory, and the impulsivity-enhancement-alcohol outcome indirect effects emerging as the most robust indirect effects across both levels.³

Discussion

Results provided mixed support for theory (Castellanos-Ryan & Conrod, 2012). Hopelessness and impulsivity were mostly related to drinking motives in the hypothesized manner at the between- and within-subjects levels. Anxiety sensitivity was related to conformity and coping-anxiety motives only in the between-subjects model, and was unrelated to coping-depression motives in the between- and within-subjects models (partially supporting hypotheses). Sensation seeking was unrelated to drinking motives in the between- and within-subjects models (failing to support hypotheses). Enhancement motives emerged as the strongest predictor of alcohol outcomes, while the other motives (coping-depression, coping-anxiety, conformity, and social) received mixed support. Specifically, enhancement motives predicted alcohol problems and quantity of alcohol consumption at both levels, coping-depression motives predicted alcohol problems at the between-subjects level only, social motives predicted quantity at the within-subjects level only, and all other motives did not predict alcohol problems or quantity at either level. In sum, impulsivity and enhancement motives emerge as key predictors in our study. This said, there was also partial support for all other predictors (except sensation seeking) when predicting alcohol outcomes. Finally, there was more variance to explain, and results were more consistent with hypotheses, for the between-subjects results compared to the within-subjects results. That is, relationships are more consistent with theory when all variables are viewed as stable, unchanging personality traits.

Though prior theory conceptualizes SURPS personality—and arguably, drinking motives—as trait-like individual differences (Pihl & Peterson, 1995), our intraclass correlations suggest all variables had both trait-like (between-subjects) and state-like (within-person) variance. A larger within-subjects component might be expected in emerging adults, as personality tends to change significantly during this period (e.g., Littlefield et al., 2010). When interpreting our results, it is helpful to view the between-subjects portion of the model as “personality traits” attributable to the person (e.g., in the between-subjects model, coping-depression motives are a stable tendency to drink to cope with depression across all situations in the past 18 months). In contrast, it is helpful to see variables in the within-subjects model as “state-like fluctuations” which are attributable to the situation (e.g., the impact of unique situations and events that occurred in a given 6-month period that altered whether or not a person drank to cope). Given the young age of the sample, these state-like fluctuations might also reflect developmental changes in personality and drinking habits. Thus, between-subjects correlations are inter-

³ We also tested a model where we controlled for gender. Controlling for gender may be desirable, as research shows men tend to drink greater quantities of alcohol and have more alcohol problems than women (Nolen-Hoeksema, 2004). Thus, gender is a potential confounding variable. Gender was entered as a between-subjects variable, correlated with all exogenous variables (i.e., SURPS personality) with a path to all endogenous variables (i.e., motives and alcohol outcomes). This model fit the data well: $\chi^2(39, N = 302) = 79.40, p < .001, \chi^2/df = 2.04; CFI = .97; TLI = .91; RMSEA = .03. SRMR_{within} = .03, SRMR_{between} = .05$. The patterns of significance using the $p < .05$ criterion for paths in Figure 2 were exactly the same when controlling for gender. Men had higher rates of between-subjects hopelessness, anxiety-coping, and quantity, and women had higher rates of anxiety sensitivity. However, the gender effects were small (i.e., standardized correlations and paths ranged from .14 to .17) and models with fewer parameters are generally more replicable (Kline, 2011). Thus, we preferred the more parsimonious model excluding gender to present in Figure 2.

preted as the shared variance in personality traits, and within-subjects correlations are interpreted as co-occurring changes in a given 6-month period (e.g., when hopelessness changes, do coping-depression motives change in the same direction?). This interpretation differs from autoregressive or parallel process models (Littlefield et al., 2010) which test whether personality predates outcomes (i.e., does personality at an earlier wave predict outcomes at future waves?).

Hopelessness

Though hopelessness was unrelated to alcohol problems in bivariate correlations, it was an indirect predictor of alcohol problems through coping-depression motives in the between-subjects model. Modern theories of mediation do not require a zero-order relationship between predictor and criterion when testing for indirect effects (i.e., “inconsistent mediation”; MacKinnon, Fairchild, & Fritz, 2007). This finding is consistent with cross-sectional studies suggesting hopelessness is related to coping motives (Castellanos-Ryan et al., 2013; Woicik et al., 2009), coping motives are related to increased alcohol problems (Kuntsche et al., 2005), and coping motives mediate the relation between hopelessness and alcohol outcomes (Stewart, Sherry, et al., 2011). We advanced this literature by showing the specificity and predictive validity of this relationship. Undergraduates high in hopelessness drank to regulate negative affect generally (i.e., anxiety and depression); however, consistent with theory (Pihl & Peterson, 1995), only coping-depression motives emerged as a significant mediator of the relation of hopelessness to alcohol problems at the between-subjects level. Future research may want to consider the hopelessness pathway to alcohol misuse as specific to coping with depressed mood, rather than coping with negative affect in general. However, coping-depression motives did not predict alcohol problems in the within-subjects model. That is, changes in coping-depression motives did not predict simultaneous changes in alcohol problems, even though the trait-like tendencies to experience hopelessness, coping-depression motives, and alcohol problems tended to co-occur.

Anxiety Sensitivity

Anxiety sensitivity predicted conformity and coping-anxiety motives in the between-subjects model consistent with prior research (Howell, Leyro, Hogan, Buckner, & Zvolensky, 2010; Stewart et al., 2002; Woicik et al., 2009), and was positively related to alcohol problems in the bivariate correlations. However, neither coping-anxiety nor conformity motives predicted alcohol problems in the path model above other motives; thus, the hypothesized indirect effects broke down at the link between motives and alcohol problems. Future research might examine under what conditions (and at what developmental stages) coping-anxiety and conformity motives are associated with alcohol problems. Some research finds anxiety sensitivity leads to increased anxiety, which in turn leads to increased coping motives (Kushner et al., 2001), suggesting it may be important to incorporate anxious mood into future models (e.g., Mackie et al., 2011). Anxiety sensitivity may also exert a more immediate impact on momentary fluctuations in drinking motivations and mood. Our three-wave, 1-year longitudinal design

used may be too insensitive to detect these changes and using daily measurement may clarify shorter-term temporal relations. Further, our operationalization of anxiety sensitivity using the SURPS differs from research using the Anxiety Sensitivity Index (Reiss et al., 1986), which has three subdomains (physical, psychological, and social concerns; Stewart, Taylor, & Baker, 1997), which may each be differentially related to drinking motives and alcohol problems (Stewart & Kushner, 2001). Moreover, the coping-anxiety subscale of the modified DMQ-R (Grant et al., 2007) may capture drinking to cope with more generalized anxiety than to the anxiety problems more closely related to anxiety sensitivity (e.g., panic symptoms). Finally, anxiety sensitivity may predict increased risk for only some types of alcohol problems (e.g., sensitivity to alcohol withdrawal), which may be lost when examining global alcohol problems (Stewart, McGonnell, et al., 2011). In sum, the mechanisms and conditions under which anxiety sensitivity predicts escalations in alcohol problems remain elusive, despite theory (Castellanos-Ryan & Conrod, 2012; Conrod et al., 2000; DeMartini & Carey, 2011; Stewart et al., 1999) and longitudinal findings suggesting anxiety sensitivity is a risk factor for alcohol use disorders (Schmidt et al., 2007).

Impulsivity

In general, impulsivity was the most consistent predictor of drinking motives, drinking quantity, and alcohol problems of all the personality measures used in our study. Impulsivity was positively related to all motives except conformity motives in both the between- and within-subjects models. Impulsivity indirectly predicted alcohol problems through coping-depression motives in the between-subjects model, consistent with theory (Castellanos-Ryan & Conrod, 2012) and prior cross-sectional findings (Adams et al., 2012; Magid et al., 2007). Impulsivity also indirectly predicted quantity and alcohol problems through enhancement motives in both models. Thus, impulsivity was a strong predictor of all motives and alcohol outcomes; however, while impulsive individuals drank for a variety of reasons, it is their drinking for internal motives of enhancement and coping with depression that resulted in adverse alcohol outcomes. This is consistent with longitudinal research suggesting impulsivity is a risk factor for alcohol misuse (Castellanos-Ryan et al., 2013; Krank et al., 2011; Littlefield et al., 2010; Quinn et al., 2011). However, impulsivity continued to exert a direct effect on alcohol problems at the within-subjects model, even after accounting for all other variables in the model. This direct effect is consistent with prior research (e.g., Littlefield et al., 2010), and may suggest there are other mediators of this process aside from drinking motives. Nonetheless, results of our study continue to support theory suggesting impulsivity is correlated with various motives and for alcohol problems. Impulsive people are characterized by general inability to control or regulate behavior and emotional responses (Dawe & Loxton, 2004), so it is reasonable that people with this personality vulnerability are more likely to drink and to have problems when drinking. Our research incrementally advances prior research by integrating personality, motives, and alcohol use into a single model, and lends further support to the importance of impulsivity as a personality factor involved in risky alcohol use.

Sensation Seeking

Individuals high in sensation seeking are thought to be particularly sensitive to the rewarding properties of alcohol, and seek to maximize enjoyment by engaging in risky drinking (Castellanos-Ryan & Conrod, 2012). Sensation seeking was inconsistently related to both drinking quantity and alcohol problems. Moreover, sensation seeking was unrelated to enhancement motives, and thus did not indirectly predict quantity and alcohol problems through this motivational pathway, contrary to cross-sectional studies (Magid et al., 2007; Simons et al., 2005), but consistent with longitudinal research (Quinn et al., 2011). This suggests the 6-month time lags used in our study may not be the ideal time-frame for sensation seeking to predict within-subjects change in alcohol quantity or problems, or that the effect size is small at both the between- and within-subjects levels once other predictors are taken into account. Future research might try shorter (e.g., daily) or longer (e.g., 1-year) time lags and/or larger sample sizes to better understand the temporal relationships between these variables. Future research might also focus more specifically on heavy-episodic drinking, which may be more closely linked to sensation seeking (Castellanos-Ryan & Conrod, 2012).

Clinical Implications

The four-factor model of personality risk (Castellanos-Ryan & Conrod, 2012) proposes multiple subtypes of people who abuse alcohol, each with a different set of traits and drinking motives. Given the heterogeneity of pathways to alcohol misuse, clinicians have begun to tailor interventions to specific personality profiles. Conrod, Stewart, Comeau, and Maclean (2006) developed, and Conrod, Castellanos-Ryan, and Mackie (2011) expanded, an intervention targeted at adolescents in four categories: (a) high hopelessness; (b) high sensation seeking; (c) high anxiety sensitivity; and (d) high impulsivity. Adolescents were given a brief selective intervention that provided psychoeducation and targeted maladaptive coping and behavioral skills specific to their personality type. By teaching participants how to better regulate their personality vulnerabilities, this intervention reduced risky alcohol consumption in the first study (Conrod et al., 2006) and significantly reduced problem drinking, enhancement motives, and coping motives 24-months posttreatment in the later study (Conrod et al., 2011). Thus, tailoring interventions to match clients' personality factors can reduce risky internal drinking motives and provide lasting benefits for their drinking outcomes. The results of the present study contribute to this emerging line of intervention work by specifying the particular motives that should be of primary focus within these preventative interventions (i.e., primarily enhancement and coping-depression for the impulsivity intervention vs. coping-depression for the hopeless intervention).

Limitations and Future Directions

Our study used an undergraduate sample of drinkers which was primarily young, female, and Caucasian. Though alcohol problems peak during emerging adulthood (Adlaf et al., 2004), future research might test these hypotheses in community or clinical samples. Although still generally within acceptable guidelines (Loewenthal, 1996), the internal consistencies of some baseline

measures were somewhat low, which could have increased Type II error rates. Given evidence suggesting poor internal consistency often has little biasing effect on the validity of results involving personality variables (McCrae, Kurtz, Yamagata, & Terracciano, 2011), this is unlikely to be a major concern. Nonetheless, readers should be cautious when interpreting results at the within-subjects level, as there is less variance to explain and lower levels of internal consistency. Future research might use larger sample sizes, include more measurement occasions, and/or measure each construct with multiple scales to facilitate the use of structural equation modeling with latent variables, which can better account for unreliability of measurement. The 6-month time lags in our study are consistent with prior work (Castellanos-Ryan et al., 2013), but are ultimately arbitrary. Conclusions of our study may not generalize to other time lags. Our study also used retrospective self-reports, which may be prone to memory biases. Self-report measures may also be prone to social desirability, where participants alter their responses to look favorable. Future research should consider using informant reports (e.g., peer reports) or implicit measures to circumvent self-report biases. There remains a considerable amount of unexplained variance in drinking motives, suggesting personality alone is insufficient to fully explain drinking motives. Future research might explore other processes, such as social influence (Kuntsche & Stewart, 2009). Finally, though longitudinal analyses are more rigorous than cross-sectional studies in the presence of strong theoretical predictions, without experimental manipulation our ability to infer causality among variables remains limited.

Conclusion

Partial support was found for predictions of the four-factor model of personality risk (Castellanos-Ryan & Conrod, 2012; Pihl & Peterson, 1995). The indirect effect from impulsivity to both quantity and alcohol problems through enhancement motives was a robust finding. Problematic drinking behavior in undergraduates is a growing concern for researchers and clinicians. Developing a greater understanding of the different pathways leading to alcohol problems is important for developing targeted interventions (Conrod et al., 2006), and ultimately for teaching young people to use alcohol responsibly based on their unique personality.

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