A Comprehensive Longitudinal Test of the Acquired Preparedness Model for Alcohol Use and Related Problems*

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ABSTRACT. Objective: According to the acquired preparedness model (APM), personality traits related to disinhibition (i.e., impulsivity and sensation seeking) may influence the learning process, contributing to individual differences in cognitions (e.g., expectations about outcomes) that may contribute to engagement in and consequences of risk behaviors, including alcohol use. Although there is strong support for the APM, longitudinal studies have involved short-term follow-ups, and the relevance of the APM for alcohol-related consequences has not been clearly established. **Method:** Participants were 2,245 (59.9% female) incoming freshmen who completed the first of eight web-based surveys during the summer before college matriculation. Structural equation modeling was used to test a comprehensive longitudinal APM for both alcohol use and related consequences. Multigroup models were used to examine measurement and structural invariance by gender. **Results:** Positive (but not negative) alcohol expectancies during freshman year of college partially mediated the relation between senior year of high school disinhibition and both alcohol use and related problems during the fourth year of college, and multigroup models suggested that the relationships proposed in the APM operated similarly for women and men. **Conclusions:** This study demonstrates the temporal relations proposed in the APM across a longer period (4 years) than in previous studies among a large sample of ethnically diverse students. Further, the results are the first to validate the APM with respect to drinking consequences while controlling for levels of alcohol use. The results lend support for brief interventions targeting positive alcohol expectancies, particularly for individuals high in trait disinhibition. (*J. Stud. Alcohol Drugs, 72,* 602–610, 2011)

ALCOHOL USE DISORDERS PEAK DURING emerging adulthood (ages 18–25 years) and are a widespread and serious public health problem in the United States (Grant et al., 2004; Knight et al., 2002). Heavy episodic drinking (defined as consuming five or more drinks on one occasion for men and four or more for women) has been shown to dramatically increase the risk of alcohol use disorders, and this pattern of drinking peaks at roughly 40% among college students (Wechsler and Nelson, 2008). In addition to increasing risk for alcohol use disorders, heavy episodic drinking is associated with a host of negative consequences, including alcohol-related injuries, risky sexual behavior, violence, and driving under the influence (Hingson et al., 2005). Given the significant public health consequences of heavy episodic drinking, it is important to identify both intrapersonal and interpersonal characteristics that contribute to the high rates observed among emerging adults.

Although it is now clear that there is no single "addictive personality," there are well-established personality characteristics that place individuals at risk for alcohol-related problems. Trait disinhibition is perhaps the most consistently identified personality risk related to alcohol abuse and dependence (Fu et al., 2007; McCarthy et al., 2001b). Trait disinhibition has been conceptualized in the literature as a combination of impulsivity and sensation seeking (Anderson et al., 2003; Read et al., 2003). Impulsivity is characterized by a lack of planning and the tendency to seek immediate gratification (Magid et al., 2007), whereas sensation seeking is generally associated with a strong preference for novel and physiologically arousing experiences (Borsari et al., 2007). Although these two traits appear to be conceptually distinct (Magid et al., 2007), research suggests that they are closely related and together form a higher-order trait of disinhibition (Anderson et al., 2003; McCarthy et al., 2001b).

Individuals who are high in trait disinhibition have difficulties with behavioral control or self-regulatory processes. These individuals are more likely to act on their impulses and are less likely to consider the negative consequences of their actions or to learn from punishment (Read et al., 2003). As a consequence, they are more susceptible to engagement in socially proscribed behaviors including heavy drinking. Although trait disinhibition may contribute directly to heavy drinking and related risk taking, there is also evidence that levels of disinhibition influence an individual's perception of his or her environment, thereby affecting learning processes (Allport, 1961; Anderson et al., 2003; McCarthy et al., 2001b). These differences in the learning process may

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represent important mechanisms through which personality traits contribute to behavioral outcomes (Patterson and Newman, 1993).

According to the acquired preparedness model (APM), certain personality traits (e.g., disinhibition) may bias and influence the learning process with respect to the outcomes of alcohol consumption (Anderson et al., 2003; Barnow et al., 2004). Specifically, individuals who display high disinhibition tend to focus on positive alcohol cues in their environment (McCarthy et al., 2001a; Patterson and Newman, 1993). In addition to attending more to the rewarding and pleasant effects of alcohol, these individuals may be less likely to consider the potential adverse effects or to learn from previous negative consequences of alcohol use (Meier et al., 2007). As a consequence, these individuals may develop more positive alcohol expectancies and fewer negative alcohol expectancies, which, in turn, influence their drinking behavior (Anderson et al., 2003; McCarthy et al., 2001b). In other words, alcohol expectancies may serve as a mechanism through which disinhibition affects drinking behavior. Alcohol expectancies are certainly a plausible mechanism of influence because beliefs about both the positive and negative behavioral, physiological, and cognitive effects of alcohol have been shown to develop before drinking experience and are considered strong proximal determinants of heavy drinking among emerging adults (Borsari et al., 2007; Jones et al., 2001).

There is considerable support for the APM among adolescents and emerging adults. For example, McCarthy et al. (2001a) found that disinhibition indirectly affected drinking by influencing positive expectancies among both African American and White college students. Barnow et al. (2004) found similar results in an adolescent population, although they used a measure of behavioral problems rather than a measure of trait disinhibition. The APM was extended by Anderson and colleagues (2003), who found that both positive and negative alcohol expectancies mediated the relation between disinhibition and drinking behavior among college women. When alcohol-related problems have been examined as the outcome, results of the APM have been less consistent. For example, using a two-wave longitudinal design among Chinese college students, Fu et al. (2007) found that positive expectancies mediated the relationship between disinhibition and alcohol-related problems among women but not men. In contrast, McCarthy and colleagues (2001b) found that positive expectancies did not mediate the relation between disinhibition and alcohol-related problems.

Although there is evidence to support the APM, there remain gaps in our knowledge of the relations among disinhibition, alcohol expectancies, and alcohol-related behaviors. First, many of the previous studies have focused only on positive or negative expectancies. In addition, there is limited research examining the APM with respect to alcohol-related problems. Most importantly, all but three of the studies testing the APM have been cross-sectional, and two of these studies had significant limitations (Barnow et al., 2004; Fu et al., 2007). Neither the Barnow and colleagues study nor the Fu et al. study provided a truly longitudinal test of the APM. In both studies, baseline drinking was not controlled in the models, and the links from expectancies to alcohol use and problems were cross-sectional, preventing any definitive conclusions about expectancies as a mechanism of influence. In addition, the Fu et al. (2007) study did not use an established measure of alcohol expectancies and had a very high attrition rate over 1 year (62%). Given previous research demonstrating reciprocal relations between expectancies and drinking behavior (Aas et al., 1998; Sher et al., 1996), it is quite possible that disinhibition leads to heavier drinking, which contributes to the development of stronger positive and weaker negative expectancies.

The most compelling evidence in support of the tenets of the APM comes from a recent study by Settles and colleagues (2010). This study found that positive and negative urgency affected later drinking behavior through increases in positive expectancies. Despite the strengths of this study, it left several unanswered questions about the operation of the APM across time. The study did not include negative expectancies and evaluated only drinking behavior (not alcohol-related problems) as an outcome. In addition, although the demonstration of mediation was fully longitudinal, it operated over a relatively short period (1 year). Thus, additional studies are needed to replicate the results of the Settles et al. (2010) study over a longer period and to expand the model to include negative expectancies and alcohol-related problems.

The current study tests a comprehensive APM that includes both positive and negative expectancies and both alcohol use and related consequences. By simultaneously evaluating alcohol use and related problems, the model provides the opportunity to identify both direct and indirect effects (through increased drinking) of expectancies on alcohol-related problems. We hypothesized that the APM would be relevant to both alcohol use and related problems and would operate through increases in positive expectancies and decreases in negative expectancies among individuals higher in trait disinhibition. Support for the proposed model would provide support for the potential of expectancy challenges (Darkes and Goldman, 1993, 1998) to reduce alcohol-related consequences and indicate that efforts to increase negative expectancies might be a useful adjunct to positive expectancy challenges.

Method

Participants

Participants were 2,245 incoming freshmen at a southwestern university who were between the ages of 17 and 19 and unmarried. Consenting participants completed the

first of eight biannual surveys (senior year of high school through college) during the summer before matriculation. They retrospectively reported on their alcohol use during the spring of their senior year of high school. Additional surveys were completed during each semester of college through the fall of the fourth year. Among participants completing the first survey, 59.9% were women, and the ethnic/racial distribution consisted of 53.9% White, 18.0% Asian American, 15.2% Hispanic/Latino(a), 6.7% multiethnic, 4.1% African American, 0.4% Native Hawaiian, and 0.1% American Indian students, which was representative of the population from which it was drawn. The remaining 1.6% of participants declined to report their ethnicity. The current study used data from Wave 1 (senior year of high school), Wave 3 (spring of freshman year of college), and Wave 8 (senior year of college). These time points were chosen because we expected the greatest variability in expectancies during the initial transition to college, a time during which significant increases in alcohol use have been consistently observed (LaBrie et al., 2009; White et al., 2006). Further, we wanted to demonstrate the predictive utility of changes in expectancies over a longer time course because prior longitudinal studies of the APM have not examined the prospective prediction of drinking behavior and consequences by expectancies beyond 1 year (Barnow et al., 2004; Fu et al., 2007; Settles et al., 2010).

Measures

Demographics. The demographic information of relevance to the current study included sex and race/ethnicity.

Alcohol-related problems. The Rutgers Alcohol Problem Index (RAPI) was used to assess problems due to alcohol use over the previous 3 months (White and Labouvie, 1989). The RAPI comprises 23 items that measure the frequency of problems resulting from an individual's alcohol consumption. Sample items are "passed out or fainted suddenly," "got into fights," "acted bad or did mean things," and "suddenly found yourself in a place that you could not remember getting to." The reliability estimates for the RAPI across Waves 1 and 8 ranged from .91 to .92.

Alcohol use. Four indicators were used to measure alcohol use. Frequency and quantity of alcohol use in the past 3 months were based on a revised version of the Daily Drinking Questionnaire (Collins et al., 1985). The revised Daily Drinking Questionnaire was used because it more closely approximates interview-based assessments of typical drinking like the Timeline Followback interview (Sobell and Sobell, 1992) by better differentiating frequency and quantity of alcohol use (Kruse et al., 2005). The two other alcohol use indicators assessed frequency of intoxication (Jackson et al., 2001) and heavy episodic drinking, defined as consuming five or more drinks on one occasion for men and four or more for women (Wechsler and Isaac, 1992). The internal consistency estimates for the four items ranged from .92 to .93 across Waves 1 and 8.

Disinhibition. Sensation seeking, impulsivity, and novelty seeking are believed to tap into the latent personality trait of disinhibition (Anderson et al., 2003; Borsari et al., 2007). Thus, the current study used the Zuckerman–Kuhlman Personality Questionnaire (Zuckerman et al., 1993) to assess sensation seeking and impulsivity and the short form of the Tridimensional Personality Questionnaire to assess novelty seeking (Sher et al., 1995). The sensation seeking and impulsivity scales consist of 19 true–false items that have been validated with both men and women as well as with different ethnic/racial groups (Anderson et al., 2003). Sensation seeking is reflective of the desire to seek out experiences and activities that are physiologically arousing. Impulsivity is the tendency to act without planning or foresight (Anderson et al., 2003). The novelty seeking scale (Tridimensional Personality Questionnaire) was based on Cloninger and colleagues' (1991) conceptualization and is characterized as being drawn to and engaging in exciting and novel experiences and activities. In this study, internal consistency reliability for the sensation seeking and impulsivity scales at the senior high school assessment were both $\alpha = .73$. The internal consistency estimate for the 13-items novelty seeking scale was moderate ($\alpha = .64$).

Positive and negative alcohol expectancies. Alcohol expectancies were measured using Ham and colleagues' (2005) 15-item brief Comprehensive Effects of Alcohol Questionnaire (B-CEOA). The B-CEOA is based on the full-scale CEOA developed by Fromme et al. (1993) but comprises only four factors (three positive and one negative). Ham et al. (2005) found that two of the CEOA positive expectancy factors (tension reduction, sexuality) and one of the negative expectancy factors (risk and aggression) loaded together, whereas the other two CEOA negative expectancy scales (self-perception and cognitive and behavioral impairment) formed a single negative expectancy factor. We used this four-factor structure with three indicators of a latent positive expectancy factor and a single measure of negative expectancies. The reliability estimates for the three positive expectancy subscales were good (ranging from .81 to .93) during both high school and freshman year of college.

Recruitment and data collection procedures

A total of 6,390 incoming freshmen were invited to participate in the summer of 2004. Participants were recruited during freshman orientation; those who did not attend orientation were recruited by mail. Eligible students had to be first-time college students between the ages of 17 and 19. Seventy-five percent (n = 4,832) of the recruited students expressed interest in the study and were screened for general demographics and minimal information about their alcohol consumption. Of the 4,832 students who agreed

to participate and met the additional inclusion criterion of being unmarried, 3,095 were assigned to the longitudinal condition on which the current analyses are based. A total of 2,245 participants completed the first survey in the summer before matriculation, retrospectively reporting on their alcohol use and other behavioral risks during the spring of their senior year of high school. Biannual surveys in college were administered at the end of each academic semester in Years 1–3 and once during the fall semester of Year 4, for a total of eight surveys (one in high school and seven in college). Over the 4-year period, attrition across consecutive waves ranged from 2.1% (Wave 6–Wave 7) to 7.5% (Wave 1–Wave 2), with an average of 5.2% (*SD* = 2.1). Of the participants who completed the high school assessment, 68.6% also completed the assessment in Year 4 of college (Wave 8). Chi-square tests indicated that women and Asian American students were more likely to be retained through Wave 8, and analysis of variance indicated that noncompleters reported more frequent binge drinking and more alcohol-related problems than those who completed the Wave 8 assessment.

DatStat Inc. (Seattle, WA) formatted and hosted the online surveys. Participants were not required to complete the surveys in one sitting, to increase the likelihood of survey completion (Richman et al., 1999). If a participant did not complete the survey within 10 days, email reminders were sent by the web administrator. Participants were paid $30 for the initial survey and $20 (fall surveys) and $25 (spring surveys) during Years 1–3 of college. Participants were paid $40 for the fall survey in Year 4 of college. More in-depth details about the recruitment and sampling are reported in previous studies from this sample (Corbin et al., 2008; Fromme et al., 2008).

Data management and data analytic plan

The distributions of all variables were inspected before conducting analyses. Distributions that were nonnormal were log-transformed, including all indicators of alcohol consumption (high school and senior year of college) and alcohol-related problems (high school and senior year of college). After the transformations, all of the variables had skewness values less than 1.63.

AMOS 16.0 (Arbuckle, 2007) was used to conduct structural equation modeling analyses. Three waves of data were used in the models: high school (Wave 1), spring of freshman year (Wave 3), and fall of senior year (Wave 8). The structural equation models incorporated both autoregressive and cross-lagged paths. The autoregressive paths signified the stability of the constructs over time, whereas the cross-lagged paths provided the opportunity to test the indirect effects of disinhibition on the distal outcomes of alcohol use and alcohol-related problems through the mediators of positive and negative alcohol expectancies. The program PRODCLIN2 (MacKinnon et al., 2007) was used to test for the indirect effects of high school disinhibition on senior year of college alcohol use and alcohol-related problems through spring of freshman year positive and negative expectancies. PRODCLIN2 uses the product of coefficient method to obtain asymmetric confidence intervals using the 95% standard normal confidence limits. Simulation studies have revealed that this procedure yields more accurate confidence limits than symmetric confidence intervals and is the most robust test for mediation (MacKinnon et al., 2004, 2007). A significant indirect effect is detected when the lower and upper 95% confidence limits do not contain the value zero.

Full-information maximum likelihood (FIML) estimation was used to handle missing data. FIML is a procedure that uses information from all participants, including those with missing values for one or more of the variables in the analysis, to calculate and estimate the parameters and standard errors (Enders, 2001). FIML assumes that the data are missing completely at random or missing at random; see Little and Rubin (1987) for a discussion of missing completely at random and missing at random. The attrition analyses reported previously suggest that the data were not missing completely at random, and there are no well-established measures for determining if data meet the assumptions of missing at random. We decided to use FIML despite our inability to demonstrate that the data were missing at random because previous simulations have suggested that FIML is likely to produce less-biased estimates than listwise deletion, even when this condition is not met; see Enders (2006) for a discussion of this issue. To assess the fit of the measurement and structural models, the comparative fit index (CFI), Tucker–Lewis index (TLI), and root mean square error of approximation (RMSEA) were used. Conventional standards suggest that CFI and TLI values greater than .95 and RMSEA values of .05 indicate near model-to-data fit (Quintana and Maxwell, 1999), with RMSEA values of .08 suggesting fair fit (Browne and Cudeck, 1993).

Multigroup models were used to examine measurement and structural invariance across gender (Byrne, 2001). In the first step, measurement weights were constrained to be equal across groups (e.g., for men and women), and the fit of the constrained model was compared with that of the unconstrained model. Given the very large sample size, we used criteria outlined by Chen (2007) for making determinations about invariance of the factor loadings (ΔCFI $\geq$ -.01 and ΔRMSEA $\geq$ .015 or Δstandardized root mean square residual (SRMR) $\geq$ .030) and intercepts (ΔCFI $\geq$ -.01 and ΔRMSEA $\geq$ .015 or ΔSRMR $\geq$ .010). If there was a decrement in model fit, critical ratios were inspected to identify individual parameters that differed across groups, and these parameters were freed as necessary in an effort to identify a partially invariant measurement model. This model was then compared to a model in which the structural weights were also constrained to be equal across groups. A decrement in model fit at this stage indicates that the directional paths (e.g., disinhibition predicting expectancies) differ signifi-

cantly by group. When a decrement in model fit was identified after constraining the structural weights, critical ratios were examined to determine the specific paths that differed by group.

Results

Measurement Acquired Preparedness Model

The latent constructs in the measurement model included trait disinhibition, alcohol use in high school and senior year of college, and positive alcohol expectancies in high school and freshman year of college (Figure 1). Means and standard deviations for each of the variables among women and men are presented in Table 1. Because the same alcohol and positive expectancy indicators were measured across time (i.e., quantity of alcohol use in high school and quantity of alcohol use in senior year of college), the errors of these indicator variables were allowed to correlate across time (e.g., the error terms for intoxication in high school and senior year of college). The measurement model in which all latent variables were allowed to freely covary provided excellent fit to the data, $\chi^2(102) = 550$, $p < .001$, CFI = .98, TLI = .97, and RMSEA = .04.

To test for measurement invariance across gender, factor loadings and intercepts for the indicator variables were constrained to be equal for men and women. Using Chen's (2007) criteria, there was no significant decrement in model fit when constraining either the factor loadings, CFI (.978 vs. .977) and RMSEA (.032 vs. .031), or the intercepts, CFI (.978 vs. .973) and RMSEA (.032 vs. .033), providing evidence for invariance of the measurement model by gender.

Structural Acquired Preparedness Model

In the structural model, high school variables were treated as exogenous (predictor variables not predicted by other variables in the model) and allowed to freely covary. All autoregressive and cross-lagged longitudinal paths were directional (Figure 1). The error disturbances for the positive and negative expectancy measures during freshman year were allowed to covary because there was no theoretical basis for a directional path between these two constructs. The structural model provided good fit to the data, $\chi^2(97) = 1189.60$, $p < .001$, CFI = .96, TLI = .95, and RMSEA = .05. The autoregressive paths were all significant (ranging from .30 to .47), indicating that the latent constructs were moderately stable over time (Figure 1). In terms of the cross-lagged paths, high school disinhibition was significantly and positively associated with changes in positive expectancies from high school to freshman year (standardized coefficient = .12, $p < .01$) and changes in alcohol use from high school to senior year of college (.06, $p < .05$). Disinhibition did not predict changes in negative expectancies from high school to freshman year, although there was a trend toward significance (standardized coefficient = .05, $p < .06$), with higher levels of disinhibition associated with increases in negative expectancies. Positive expectancies in freshman year of college were associated with changes in both alcohol use (.25, $p < .01$) and alcohol-related problems from high school to senior year of college (.17, $p < .01$), whereas negative expectancies (-.10, $p < .001$) in freshman year were associated with changes in alcohol use from high school to senior year of college but not significantly related to changes in alcohol problems (-.03, $p = .36$).

Tests of indirect effects indicated that high school disinhibition had significant indirect effects on senior year alcohol use (95% CI [.004, .010], $p < .05$) and alcohol-related problems (95% CI [.0025, .0077], $p < .05$) through freshman year positive expectancies but not through freshman year negative expectancies. Thus, freshman year positive alcohol expectancies partially mediated the relationship between disinhibition and alcohol use and fully mediated the association between disinhibition and alcohol-related problems. Constraining the structural weights to be equal across gender did not lead to a decrement in model fit, CFI (.95 vs. .95) and RMSEA (.04

Table 1. Descriptive statistics for all study variables

Variable	Women *M* (*SD*)	Men *M* (*SD*)
Wave 1		
Impulsivity	1.86 (1.95)	2.38 (2.07)
Sensation seeking	5.32 (2.72)	5.97 (2.60)
Novelty seeking	4.36 (2.58)	4.61 (2.46)
Frequency	0.47 (0.76)	0.51 (0.89)
Quantity	1.86 (3.05)	2.01 (2.88)
HED	2.04 (5.29)	2.32 (5.59)
Drunk	1.61 (4.14)	1.86 (4.88)
RAPI	1.89 (4.08)	2.06 (5.72)
BCEOA-TR	2.87 (1.15)	3.00 (1.17)
BCEOA-RA/LC/SOC	3.31 (0.98)	3.22 (1.00)
BCEOA-SEX	2.53 (1.15)	2.48 (1.14)
N-BCEO	3.29 (0.99)	3.08 (1.04)
Wave 3		
BCEOA-TR	2.91 (1.13)	3.04 (1.20)
BCEOA-RA/LC/SOC	3.34 (1.04)	3.31 (1.06)
BCEOA-SEX	2.54 (1.19)	2.67 (1.18)
N-BCEO	3.09 (0.98)	2.92 (1.02)
Wave 8		
Frequency	1.14 (1.15)	1.33 (1.39)
Quantity	2.53 (2.13)	3.05 (2.87)
HED	3.84 (6.94)	4.63 (7.78)
Drunk	3.25 (6.47)	3.93 (7.78)
RAPI	2.52 (5.28)	2.73 (5.70)

Notes: Wave 1 is senior year of high school, Wave 3 is spring of freshman year of college, and Wave 8 is senior year of college. Frequency = number of drinking days per week in the past 3 months; quantity = number of alcoholic beverages per drinking day in the past 3 months; HED = heavy episodic drinking; drunk = times drunk in the past 3 months; RAPI = Rutgers Alcohol Problem Index, number of reported problems in past 3 months; BCEOA = Brief Comprehensive Effects of Alcohol Questionnaire; TR = tension reduction expectancies; RA = risk and aggression/liquid courage/sociability expectancy; SEX = sex expectancies; N-BCEO = negative expectancies based on the Brief Comprehensive Effects of Alcohol.

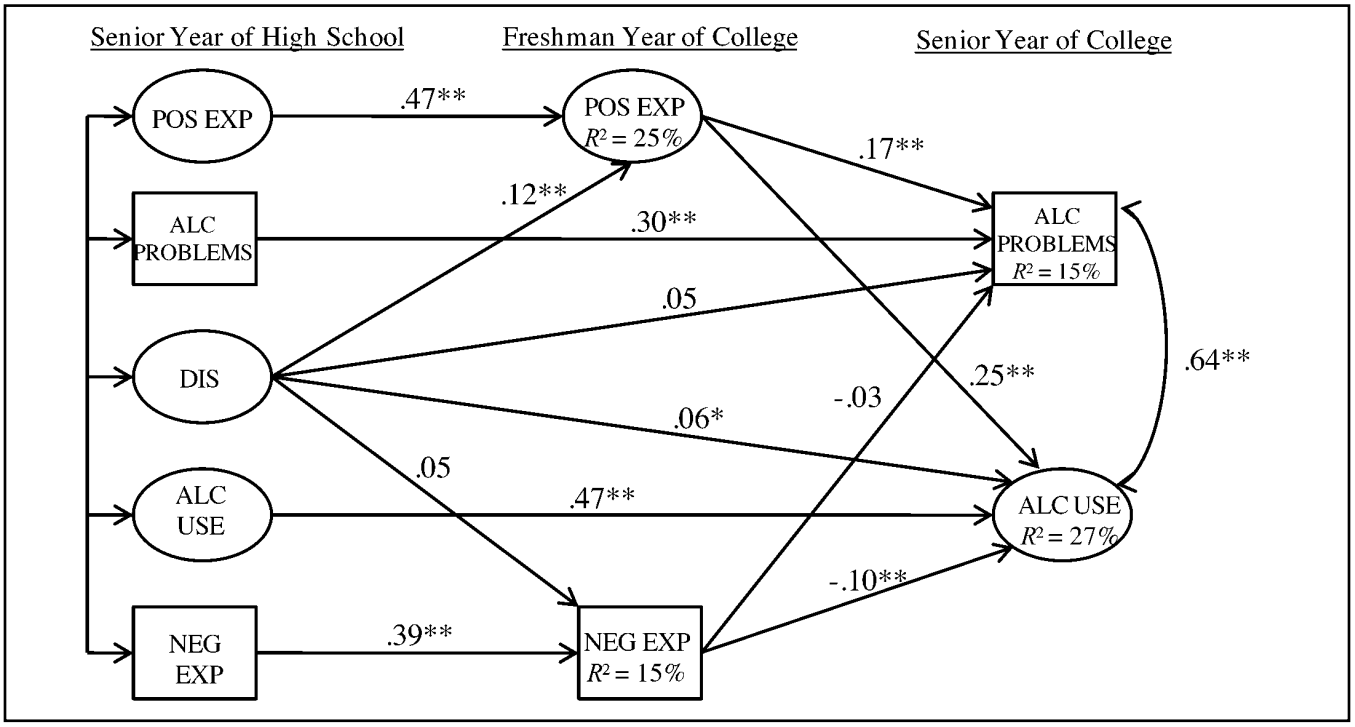

FIGURE 1. Acquired Preparedness Model for alcohol use and alcohol-related problems. Notes: The nondirectional arrow between alcohol-related problems and alcohol use during senior year of college represents the correlation between the error terms for these two variables. Gender is included as a covariate in the model but is not depicted in the figure. POS EXP = positive expectancies; ALC PROBLEMS = alcohol problems; DIS = disinhibition; ALC USE = alcohol use; NEG EXP = negative expectancies.
*$p < .05$; **$p < .01$.

vs. .04), $\chi^2(12) = 9.62$, $p < .65$, suggesting that the APM for alcohol use and related problems operated similarly for women and men.

Discussion

Although there is strong support for the APM, until quite recently, research testing it has been cross-sectional or has only used two waves of data, making it difficult to confirm the direction of influence among variables (Anderson et al., 2003). Although a recent study provided a true test of mediation for the APM using three waves of data (Settles et al., 2010), that study did not address the role of negative expectancies or examine alcohol-related consequences as an outcome measure. Although we did not find evidence for mediation through negative expectancies, we found indirect effects of trait disinhibition on both alcohol use and alcohol-related problems operating through positive expectancies. In addition, the indirect effect for alcohol-related problems was independent of the effects of trait disinhibition and positive expectancies on alcohol use, suggesting a direct contribution of these constructs to the experience of alcohol-related problems. Additional strengths of the current study include the use of a large sample of diverse students across a longer period (4 years) than has been examined in previous studies and demonstration of measurement invariance by gender. The results indicate that the APM operates across all years of college, a time during which many young people substantially increase their levels of alcohol use.

It is important to note that the magnitude of the observed effects was not large. Based on the size of the standardized regression coefficients (which are comparable to correlation coefficients), the path from trait disinhibition to positive expectancies was small in magnitude, and the paths from expectancies to alcohol use and problems represented small to medium effect sizes (Cohen, 1992). These effect sizes are not inconsistent with what might be predicted because the APM is not meant to be a comprehensive model that accounts for all influences on drinking behavior. It is clear that factors other than trait disinhibition (e.g., media portrayals, drinking experience) affect the development of alcohol expectancies and that many factors other than expectancies (e.g., family history of alcoholism, subjective response to alcohol) affect drinking behavior and related problems. Thus, given the complexity of a behavior like alcohol use, it is perhaps unrealistic to expect very large effects of any one predictor variable. Further, despite the small magnitude of the effects, it is noteworthy that they were statistically reliable, even in the context of a very rigorous examination of the model. The relatively long time frame over which the model was assessed (4 years) and the inclusion of Wave 1 drinking in the model (effectively assessing changes in

drinking over time) should serve to reduce the magnitude of effects relative to less rigorous models. Thus, we believe that the current model provides quite strong evidence in support of the APM, at least with respect to positive expectancies.

In contrast to the results for positive expectancies, results for negative expectancies were not consistent with our hypotheses. In fact, there was a trend toward stronger negative expectancies among individuals high in disinhibition. This effect may reflect greater risk taking among individuals high in trait disinhibition, which could contribute to more negative consequences and related expectations of negative drinking outcomes. The current findings add to a conflicting body of research regarding negative expectancies as a mediator of the relation between disinhibition and drinking behavior. Although Anderson et al. (2003) found that negative expectancies mediated the relation between disinhibition and alcohol-related problems, Fu et al. (2007) found no evidence for mediation by negative expectancies. It is worth noting that both our study and the Fu et al. study used longitudinal data, whereas the Anderson et al. study relied on cross-sectional data. Thus, although the type of individual who is high in trait disinhibition may also have weaker negative alcohol expectancies, there may not be a causal effect of disinhibition on negative expectancies. Alternatively, it is possible that the latent factor of disinhibition used in the present investigation is more sensitive to heightened reward and nonpunishment (behavioral activation systems), than it is to a lack of sensitivity to punishment (behavioral inhibition system). To this end, future studies should consider using behavioral assessments of inhibition that may be more sensitive in detecting individuals who attend to signs of nonreward and punishment (Carver and White, 1994; Smith et al., 2006). Regardless of the explanation for the findings in the current study, the results do not argue against bolstering negative expectancies as a prevention/intervention approach because negative expectancies were significantly and inversely associated with changes in drinking. Rather, the results suggest that this may not be an approach that has special utility among individuals high in trait disinhibition.

An important secondary aim of the current investigation was to test for gender invariance in the APM because previous studies found that the relations among variables in the APM operated differently for men and women (McCarthy et al., 2001a, 2001b). To the contrary, we generally found that the relationships proposed in the APM operated similarly for women and men. This does not imply that no gender differences exist—men in this sample did engage in heavier drinking and reported more alcohol-related problems. However, these findings do illustrate the similarities between women and men regarding expectancies as a mechanism of risk. Specifically, these findings illustrate that, regardless of gender, personality factors appear to bias the learning process, which consequently confers risk of developing heavy drinking patterns and related problems.

These findings provide important insight with resultant implications for heavy drinking prevention and intervention efforts in college samples. In particular, these findings lend support for screening and targeting individuals who display high trait disinhibition. A recent prevention study conducted with high school students found that a brief integrative motivational, psychoeducational, and cognitive-behavioral intervention targeting individuals with personality characteristics such as sensation seeking effectively decreased heavy drinking and related problems (Conrod et al., 2006). This intervention taught adolescents behavioral and cognitive coping strategies to better manage their personality risk. Accordingly, this prevention strategy might also be useful for college-age individuals, although more research is needed to investigate whether the intervention is feasible and effective with emerging adult populations.

In addition, given the strong associations between positive expectancies, heavy drinking, and alcohol-related problems, study findings lend support for expectancy challenge, particularly for those high in disinhibition, because they are likely to have elevated levels of positive expectancies. Previous studies have shown that experimental multi-session expectancy challenges reduce positive expectancies in men but not women (Wiers and Kummeling, 2004). Although expectancy challenge works well with most men (Dunn et al., 2000), this type of intervention may not be as effective for women, who tend to have lower levels of disinhibition. Taken together, disinhibition might be a moderator of the efficacy of expectancy challenge for women, such that women higher in trait disinhibition (but not those lower in trait disinhibition) will uniquely benefit from this approach.

Although this study identified important distal and proximal predictors of heavy drinking and related problems over 4 years among a large and diverse sample, we should note a number of limitations to consider when interpreting the results. First, even though our design was longitudinal, given the correlational nature of the data, causation cannot be clearly established. Experimental studies that seek to change explicit expectancies about the effects of alcohol (e.g., Darkes and Goldman, 1993, 1998) and include measurement of trait disinhibition are needed to confidently determine causality. Results of attrition analyses indicated that the heaviest drinkers were most likely to be lost to follow-up, calling into question the generalizability of the results to the full sample. Although this is clearly a limitation, it seems likely that the loss of heavier drinkers would serve to weaken the associations examined in the current study, thus providing a more conservative test of study hypotheses. Our sample consisted of college students from a single campus in the Southwest United States, which limits generalizing to other populations in other regions. It would also be interesting to see if these findings can be replicated with non–college-attending emerging adults. Perhaps even more critical are studies that seek to explicate the etiological mechanisms of risk in children,

because this type of research can help inform primary prevention efforts (Cruz and Dunn, 2003) targeting at-risk youth who exhibit trait disinhibition and thereby may have elevated alcohol expectancies. A recent study by Gunn and Smith (2010) provided support for the APM in a cross-sectional sample of fifth graders, with positive expectancies mediating the effects of several aspects of trait disinhibition (e.g., urgency, sensation seeking). To provide additional support for the APM during childhood and adolescence, longitudinal studies are needed to determine if expectancies assessed before the onset of drinking mediate the relation between trait disinhibition and drinking onset.

Despite the aforementioned limitations, the use of cross-lagged and autoregressive models with fully longitudinal data allowed us to make stronger inferences about the temporal ordering of the relationships proposed in the APM compared with most previous studies. In addition, the inclusion of positive and negative expectancies as simultaneous predictors provides a more comprehensive test of the role of expectancies as a mediator of the influence of trait disinhibition. Perhaps most important, the results provide the strongest evidence to date that the APM contributes directly to the experience of alcohol-related problems, even when controlling for concurrent alcohol use. Our findings suggest that there is potential utility of screening for and targeting individuals high in trait disinhibition given that they are at higher risk for developing positive expectancies and, thus, experiencing negative alcohol-related consequences.

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