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Alcohol-Induced Disinhibition Expectancies and Impaired Control as Prospective Predictors of Problem Drinking in Undergraduates

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Abstract

Trait disinhibition is associated with problem drinking and alcohol drinking itself can bring about a state of disinhibition. It is unclear however, if expectancies of alcohol-induced disinhibition are unique predictors of problem drinking. Impaired control (i.e., difficulty in limiting alcohol consumption) may be related to disinhibition expectancies in that both involve issues of control related to alcohol use. Data from a prospective survey of undergraduates assessed during freshman ($N = 337$) and senior year ($N = 201$) were analyzed to determine whether subscales of the Drinking-Induced Disinhibition Scale and the Impaired Control Scale predicted unique variance in heavy episodic drinking and alcohol-related problems. In Time 1 cross-sectional models, dysphoric disinhibition expectancies predicted alcohol-related problems and impaired control predicted both alcohol-related problems and heavy episodic drinking. In prospective models, Time 1 impaired control predicted Time 2 alcohol-related problems and Time 1 euphoric/social disinhibition expectancies predicted Time 2 heavy episodic drinking. These findings suggest that expectancies of alcohol-induced disinhibition and impaired control predict unique variance in problem drinking cross-sectionally and prospectively and that these phenomena should be targeted in early intervention efforts.

Keywords

alcohol; college drinking; disinhibition; impaired control; prospective models

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Introduction

Heavy episodic drinking among undergraduates is highly prevalent and deleterious. A recent national survey showed that approximately two-fifths of undergraduates engage in heavy episodic drinking at least once every 2 weeks (Wechsler, Lee, Nelson, Kuo, 2002). This level of consumption has been found to increase risk of negative consequences such as academic failure, unsafe sexual practices and legal complications (Jennison, 2004; Perkins, 2002; Wechsler & Nelson, 2001). While many undergraduates will “mature out” of heavy alcohol use after graduation, a considerable minority will continue to experience clinically significant problems (Jackson, Sher, Gotham, & Wood, 2001). Research is needed to predict which young adults may be at heightened risk and to identify mechanisms underlying problem drinking. Disinhibition is likely relevant both as a risk factor for and as a mechanism contributing to problem drinking.

Trait disinhibition (e.g., impulsivity, sensation seeking) is an established predictor of alcohol consumption and problem drinking in young adults (Anderson, Smith, & Fischer, 2003; Grekin & Sher, 2006; Mezzich, Tarter, Feske, Kirisci, McNamee, & Day, 2007). Sensation seeking, which has been widely implemented as a proxy for trait disinhibition (McCarthy, Miller, Smith, & Smith, 2001), has been associated with heavy drinking (e.g., Katz, Fromme, & D’Amico, 2000) and thus is a construct of importance in the prediction of problem drinking.

Not only is trait disinhibition relevant to drinking behavior, alcohol is known to induce a disinhibitory state, in which individuals engage in behaviors and/or express affect that they typically restrict (Goldstein & Volkow, 2002; Jentsch & Taylor, 1999; Lyvers, 2000). Impaired control over alcohol use is a phenomenon that may be related to alcohol-induced disinhibition in that both concern a weakening of “control” associated with drinking. As a hallmark of addiction (Levine, 1978), impaired control is of interest for its relationship to problem drinking.

Alcohol-induced disinhibition expectancies may predict unique variance in undergraduate problem drinking and/or overlap with impaired control or relevant aspects of participants’ everyday lives. The goal of this study was to assess impaired control and 3 types of alcohol-induced disinhibition expectancies as cross-sectional and prospective predictors of problem drinking in a sample of undergraduates with prior exposure to alcohol. Specifically, impaired control and disinhibition expectancies were tested in models including both key demographics and 2 variables (i.e., sensation seeking and depression), capturing tendencies in everyday life that are analogous to the types of disinhibition expectancies tested in the present study.

Alcohol-Induced Disinhibition Expectancies

There is evidence to support alcohol as a disinhibiting agent (Fillmore, 2003). Disinhibition has been defined as a “loss of restraint over some form of behaviour” (Bond, 1998, p. 42) and is characterized by an increase in the salience of reinforcers and/or a decrease in the ability to inhibit impulses (Goldstein & Volkow, 2002; Jentsch & Taylor, 1999; Lyvers, 2000).

According to expectancy theory, however, effects of alcohol, such as disinhibition, are not believed to influence subsequent consumption behavior directly. Rather, “*direct and indirect* experience with alcohol and alcohol paraphernalia” (Jones, Corbin, & Fromme, 2001, p. 59) form expectancies, or expectations, of the effects that occur as a result of alcohol use, which then influence subsequent drinking behavior. As Jones et al. stated, “they (drinkers) appear to consume alcohol in a way that delivers the effects they expect” (p. 59).

Given alcohol’s disinhibiting effects and given links between expectancies and alcohol use, disinhibition expectancies are potentially valuable in the prediction of problem drinking. Investigations related to disinhibition expectancies and motives have been rare, though. Limited self-report findings have shown positive correlations between expectancies of

disinhibition and frequency of intoxication (Nagoshi, Noll, & Wood, 1992) and alcohol-related problems (Wood, Nagoshi, & Dennis, 1992) in undergraduates. Also, disinhibition motives for drinking have been moderately associated with alcohol-related problems (Labouvie & Bates, 2002).

The Drinking-Induced Disinhibition Scale (DIDS; Leeman, Toll & Volpicelli, 2007) captures expectancies that behaviors, thoughts or feelings that are restricted in everyday life will occur while drinking. Accordingly, 7 of the 9 items were worded to make explicit a distinction between drinking and non-drinking states (e.g., “feelings of greater personal freedom than when not drinking”). To avoid awkward phrasing and wording that might suggest promiscuity, two items of a sexual nature were not worded with this type of explicit contrast. The DIDS differs from other alcohol expectancy measures (e.g., Brown, Goldman, Inn, & Anderson, 1980; Fromme, Stroot, & Kaplan, 1993) in the explicitness with which drinking and non-drinking states are contrasted and in its exclusive focus on disinhibition. Given the recognition that substance-induced disinhibition is a heterogeneous state (Bond, 1998), the DIDS assesses expectancies regarding 3 types of disinhibiting effects (i.e., sexual, euphoric/social and dysphoric), which are grounded in the literature. Perceived risk associated with sex has been found to decrease when alcohol is consumed (e.g., Fromme, D'Amico & Katz, 1999), suggesting sexual disinhibition when drinking. Disinhibition has been traditionally considered to be a euphoric, excitatory state (e.g., Wood et al., 1992) and heavy drinkers have been found to endorse expectancies that they will be more socially assertive after drinking (e.g., Connors et al., 1986). Dysphoric items were written to capture the “sad drunk” phenomenon in which depressive feelings are expressed while drinking to a greater extent than in everyday life. High scores on an affective change subscale—including items about expectancies of depression, feelings of failure and disappointment—have been reported (Young, Connor, Ricciardelli, & Saunders, 2006), suggesting some undergraduates have depressive expectancies from drinking.

Since euphoric/social and sexual disinhibition are positively valenced, we predicted that reports of these expectancies would increase over time due to their reinforcing quality and that both would be associated with problem drinking. These predictions are supported by evidence of positive, cross-sectional associations between positive expectancies and both alcohol consumption (e.g., Fromme et al., 1993) and alcohol-related problems (Werner, Walker, & Greene, 1993). These variables were expected to be particularly strong prospective predictors, based on findings that positive expectancies had stronger utility in prospective than in cross-sectional models (Jones, Corbin, & Fromme, 2001; Sher, Wood, Wood, & Raskin, 1996). Expectancy formation depends upon learning (Jones et al.). It is possible that undergraduates, who are relatively inexperienced drinkers as of freshman year, require a learning period before they form clear associations between positively-valenced expectancies and heavy alcohol use.

In contrast, reports of dysphoric disinhibition expectancies were expected to decrease over time due to its negative valence and resulting lack of reinforcing quality. Given that the experience of depressive symptoms in everyday life has been associated with alcohol-related problems cross-sectionally (Martens et al., 2008; Patock-Peckham, Hutchinson, Cheong, & Nagoshi, 1998), we expected that expectancies of dysphoric effects from drinking would also predict alcohol-related problems cross-sectionally. We hypothesized, however, that this association would diminish prospectively. The lack of reinforcing value also led us to predict that dysphoric disinhibition would not be associated with heavy drinking. These predictions are supported by prior findings. A depression expectancies subscale with low reliability has been significantly correlated cross-sectionally with alcohol-related problems, but not with quantity-frequency of consumption (Patock-Peckham et al.; Wood et al., 1992), nor with frequency of getting drunk (Patock-Peckham et al.). An inverse association between severity of alcohol use and expectancies of alcohol's negative effects has also been reported (Werner et al., 1993).

Impaired Control

Impaired control represents another phenomenon resulting from alcohol use that concerns issues of control and as such, is potentially relevant to disinhibition. Impaired control is “a breakdown of an intention to limit consumption in a particular situation” (Heather et al., 1993, p. 701). The centrality of impaired control to addiction is reflected in 2 of the dependence criteria in the 4th edition of the Diagnostic and Statistical Manual (DSM-IV): “The substance is often taken in larger amounts or over a longer period than was intended” and “There is a persistent desire or unsuccessful efforts to cut down or control substance use” (APA, 1994, p. 181). Impaired control is relevant to young adults given its early emergence. Heavy drinking adolescents often report impaired control (Chung & Martin, 2002), as do adults asked to recount which aspects of their problem drinking developed earliest (Chick & Duffy, 1979; Langenbucher & Chung, 1995). In cross-sectional models, scores on a subscale of the Impaired Control Scale (Heather et al., 1993) have been associated with alcohol-related problems in undergraduates (e.g., Nagoshi, 1999).

Impaired control would likely be predictive of heavy episodic drinking, given that impaired control is associated with difficulties in limiting alcohol use. It was expected that impaired control would predict alcohol-related problems cross-sectionally given the shared clinical implications of these constructs. Due to the aforementioned reports that impaired control was an early developing indicator of dependence, it was hypothesized that impaired control would also predict alcohol-related problems prospectively. To our knowledge, impaired control has not been examined as a prospective predictor of problem drinking in young adults.

Analogous Tendencies in Everyday Life: Sensation seeking and depression

A critical question concerns the extent to which alcohol-induced disinhibition expectancies are unique phenomena, which represent the disinhibiting effects of *alcohol*, rather than mere manifestations of everyday tendencies in the drinking context. A consideration of disinhibition expectancies alongside sensation seeking and depression would help to address this issue. These constructs are valuable not only because they represent everyday tendencies that are conceptually analogous to the DIDS subscales, but also because they have been linked with problem drinking. Evidence and conceptual arguments support links between sensation seeking and the euphoric/social subscale; between sensation seeking and the sexual subscale and between depression and the dysphoric subscale. There is also evidence and conceptual arguments to support disinhibition expectancies as unique predictors of problem drinking, though.

Alcohol use is one of many ways in which a tendency toward sensation seeking may be expressed and represents only one example of a behavior that could result from depression. In contrast, by definition, alcohol-induced disinhibition expectancies are tied strictly to alcohol use. Therefore, we predicted that the DIDS subscales would be better predictors of problem drinking than either sensation seeking or depression. Similarly, Anderson et al. (2003) found that positive expectancies had stronger associations than sensation seeking with a problem drinking variable. We expected that this pattern would be particularly pronounced in prospective models, considering findings that alcohol expectancies have particular utility in predicting changes in drinking patterns over time (Jones et al. 2001; Sher et al., 1996). Brief overviews of sensation seeking and depression and proposed relations to disinhibition expectancies are outlined below.

Sensation seeking—Zuckerman (1994, p. 27) defined sensation seeking as “the seeking of varied, novel, complex, and *intense* sensations and experiences, and the willingness to take physical, social, *legal*, and *financial* risks for the sake of such experiences” (emphasis in original). Zuckerman stated that some sensation seekers drink alcohol for its arousing

properties and will consume until they reach optimal arousal. Accordingly, there are findings linking sensation seeking with frequency and quantity of consumption (Fischer & Smith, 2008; Grau & Ortet, 1998; McDaniel & Zuckerman, 2003). These same investigators reported weaker associations with alcohol-related problems, perhaps because sensation seeking is not necessarily antisocial, nor associated with frequent risk taking (Zuckerman). Accordingly, we hypothesized that sensation seeking would predict heavy episodic drinking, but not alcohol-related problems.

Depression—Depressive symptoms have been positively associated with negative consequences of drinking in college samples (Martens et al., 2008; Patock-Peckham et al., 1998). While there are a number of findings linking depression with heavy drinking in adults (e.g., Manninen, Poikolainen, Vartanen, Laatikainen, 2006), no similar evidence was found in the college drinking literature. Therefore, we expected that depressive symptoms would predict alcohol-related problems, but no prediction was made concerning heavy episodic drinking.

Depressive symptoms and dysphoric disinhibition are both sedative and negatively valenced. Induction of sad, distressed moods has been found to lead to reduced impulse control (Tice, Bratslavsky & Baumeister, 2001), suggesting a link between depression and alcohol-induced disinhibition. Given these findings and associations between depression and alcohol-related problems, some drinkers who experience depression may also report dysphoric disinhibition (i.e., even stronger depressed mood while drinking). Baumeister (1990), however, argued that people experiencing intense sadness will often seek states of lower self-awareness, sometimes through alcohol use. In contrast, dysphoric disinhibition is characterized by high self-awareness (e.g., “expressing more disappointment in yourself or others than when not drinking”). Thus, while some drinkers may experience both depressive symptoms and dysphoric disinhibition, others will not, suggesting dysphoric disinhibition is a unique phenomenon.

The present study

A sample of undergraduates first assessed during freshman year (Time 1) was re-assessed during senior year (Time 2). Due to findings that alcohol use and related problems tend to be predicted by different variables (e.g., Magid, MacLean, & Colder, 2007; O’Neill, Parra, & Sher, 2001; Simons, Gaher, Correia, Hansen, Christopher, 2005), heavy episodic drinking and alcohol-related problems were analyzed separately. The main objective was to assess the extent to which alcohol-induced disinhibition expectancies and impaired control predicted unique variance in problem drinking cross-sectionally and prospectively in models including sensation seeking and depression. Cross-sectional models offered the opportunity to identify characteristics of students who engaged in problem drinking during freshman year, while prospective models identified which variables predicted subsequent problem drinking, an issue of clinical importance. Prior reports (Leeman, Fenton, & Volpicelli, 2007; Leeman, Toll, & Volpicelli, 2007) did not include models in which the DIDS, impaired control, sensation seeking and depression were all entered. These reports included cross-sectional analyses and prospective analyses 1 year later and did not cover the entire undergraduate experience. These limitations were addressed in the present study.

We hypothesized that euphoric/social and sexual disinhibition expectancies would predict both problem drinking variables cross-sectionally and prospectively, with the latter findings being particularly strong. We also hypothesized that dysphoric disinhibition expectancies would predict alcohol-related problems in cross-sectional but not in prospective models and that these expectancies would not be predictive of heavy episodic drinking. We hypothesized that impaired control would predict both problem drinking indices, cross-sectionally and prospectively.

Method

Participants

Details regarding the design of this study can be found in Leeman, Toll and Volpicelli (2007). At Time 1, participants were freshmen at the University of Pennsylvania ($N = 337$, 59% female), who were at least 18 years of age and had consumed alcohol at least one time since matriculating. Students took part in the Time 1 survey in exchange for partial credit toward the completion of introductory psychology research participation requirements. Subsequent data collection among a portion of the sample took place during sophomore year. Given that the entire sample was not re-contacted and some key measures were not included, the sophomore year wave is not included in this report. The entire sample was invited to participate in a follow-up survey during their senior year, referred to as Time 2. The only requirement for participation was that participants still be enrolled at the university at the time of assessment.

Procedures

At Time 1, written informed consent was obtained, after which a pencil-and-paper survey was administered. Participants were asked to provide electronic mail addresses so that they could be contacted for future follow-up surveys. During their senior year, participants were invited via email to complete the follow-up survey in the semester when they originally participated in exchange for a \$10 gift certificate. The message included a link to a secure website, a user name and password to access the survey. Participants were initially invited to participate approximately 1 month after the beginning of the semester and reminder emails were sent every 2 weeks until the end of the semester. After providing informed consent on the website, participants completed the survey. All surveys were approved by the Institutional Review Board (IRB) for the protection of human subjects at the University of Pennsylvania and the follow-up survey was also approved by the IRB at Yale University School of Medicine.

Measures

Alcohol-induced disinhibition—The *Drinking-Induced Disinhibition Scale* (DIDS; Leeman, Toll, & Volpicelli, 2007) is a 9-item measure designed to assess expectancies that 3 types of disinhibiting thoughts, feelings and behaviors (i.e., euphoric/social, sexual and dysphoric) occur to a greater extent when drinking than when not drinking. At Time 1, the 3 subscales were found to have criterion, convergent and discriminant validity, with good internal consistency and adequate 30-day test-retest reliability: euphoric/social ($\alpha = 0.76$), dysphoric ($\alpha = 0.80$) and sexual ($\alpha = 0.70$). The following question and instructions are given: “How likely are you to experience each of these occurrences either while drinking or as a direct result of consuming alcohol? Please rate each occurrence according to a typical drinking experience for you.” Items are rated on a 6-point scale ranging from 1 (“highly unlikely”) to 6 (“highly likely”). Subscale scores are calculated by taking a mean of the three items.

Impaired control—Part 2 of the *Impaired Control Scale* (ICS; Heather et al., 1993) is a reliable ($\alpha = .79$ at Time 1 in this sample) and valid measure of the frequency with which participants have engaged in 10 behaviors pertaining to control over alcohol consumption, including attempts to limit, cut down and stop drinking. A 3-month time frame was used. The 10 items were rated on a 0 (never) to 4 (always) scale and summed for a maximum score of 40 with high scores indicating greater difficulty in controlling alcohol use.

Sensation seeking—The disinhibition subscale of the *Sensation Seeking Scale, Form V* (SSS; Zuckerman, 1994) was used to assess sensation seeking. Based on a meta-analysis, Hittner and Swicker (2006) concluded that the disinhibition subscale had the strongest associations with alcohol use of any of the subscales in the Zuckerman measure. The items

presented 2 descriptions and participants were asked to report which pertained most closely to them (e.g., “I like wild, uninhibited parties” or “I prefer quiet parties with good conversation”). Each response indicating sensation seeking was scored “1” and the sum of these scores was taken. To prevent criterion contamination (Darkes, Greenbaum, & Goldman, 1998), 2 items directly pertaining to alcohol use were removed, leaving an 8-item measure ($\alpha = .61$ at Time 1).

Other predictor variables—Participants were asked to report a series of demographics including their *gender* and *race*. To assess *family history of alcohol and drug problems*, participants were asked whether any of their relatives ever “had a significant problem with alcohol or drugs, one that either led to treatment or should have led to treatment,” as in the Addiction Severity Index (McLellan et al., 1992). Those reporting that at least one biological parent had a significant problem with alcohol were classified as family history positive. *Depressive symptoms* were assessed using the depression subscale of the 32-item Psychological Symptom Inventory (PSI-32; Volpicelli, Pettinati, McLellan, & O’Brien, 2001), which is based on the Symptom Checklist (SCL-90; Derogatis, Lipman, & Covi, 1973). Items were rated on a 5-point scale as to the extent to which they bothered the respondent in the past week. The depression subscale of the PSI-32 contains 11 of the 13 items in the SCL-90 depression subscale. The PSI-32, administered only at Time 1, had good internal consistency reliability ($\alpha = .88$).

Problem drinking—Participants were asked to report their monthly frequency of *heavy episodic drinking*, (i.e., 5 or more drinks in a day for males, 4 or more for females). These levels exceed the National Institute on Alcohol Abuse and Alcoholism’s (2005) maximum daily drinking guidelines. These figures were then converted to estimates of weekly heavy episodic drinking frequency. *Alcohol-related problems* were assessed using the *Rutgers Alcohol Problem Index* (RAPI; White & Labouvie, 1989). The RAPI is a unidirectional scale on which participants report the frequency with which they have experienced a series of negative alcohol-related consequences (e.g., “not able to do your homework or study for a test”). Consequences reported to have occurred at least once in the past 3 months were scored as “1” and summed to yield an overall score. To prevent criterion contamination, 4 items thought to relate to impaired control were removed, leaving 19 items ($\alpha = .80$ at Time 1; Leeman, Fenton, & Volpicelli, 2007).

Analyses

Normality among continuous variables was assessed prior to analysis. Outliers were winsorized by reducing these values to a figure 3 standard deviations greater than the mean. For variables with distributions that were still non-normal following winsorizing (i.e., skew and/or kurtosis greater than 3), multiple transformations were attempted and the one that reduced skew and kurtosis the most was adopted. Correlation coefficients were used to assess associations between continuous variables included in the statistical models described below. Paired samples *t*-tests were used to assess changes in variables between Time 1 and Time 2. Independent samples *t*-tests were used to make comparisons by gender and between Time 1 participants who did and did not participate at Time 2.

The main mode of analysis was hierarchical multiple regression. Analyses were conducted to predict 2 problem drinking indices: weekly frequency of heavy episodic drinking and alcohol-related problems in the prior 3 months (i.e., RAPI score). Both cross-sectional models predicting Time 1 problem drinking using Time 1 predictor variables and prospective models predicting Time 2 problem drinking using Time 1 predictor variables were conducted. In the cross-sectional model predicting alcohol-related problems, overall weekly alcohol consumption was entered in the first step, which was omitted in the model predicting heavy

episodic drinking. This was done with the expectation that this variable would be the most centrally related to alcohol-related problems. We considered it important to determine which variables predict variance in alcohol-related problems holding level of alcohol consumption constant. Gender was then entered given that its impact is pervasive and begins early in development. Depression and sensation seeking, the measures of aspects of everyday life that are analogous to the DIDS, were then entered given the importance of determining whether the DIDS subscales would predict variance in problem drinking holding these variables constant. Impaired control was entered subsequently, but before the DIDS subscales, given that the Impaired Control Scale is a more established measure than the DIDS and in order to assess whether the predictive utility of the DIDS was unique from that of impaired control. The models predicting Time 2 problem drinking were similar except that the same problem drinking variable at Time 1 was entered in the first step of the model. It was essential to evaluate all other variables in the model for their predictive validity above and beyond the problem drinking variable being predicted at Time 1. Listwise deletion was employed with these models, therefore participants' data was eliminated from the analysis if they had missing data for any variable in the model. A similar approach, using hierarchical multiple regression to assess prospective alcohol data involving 2 time points was implemented by Sher and Routledge (2007).

Results

Description of Sample

All continuous variables other than sensation seeking were found to have outliers and/or skewed distributions. Frequency of heavy episodic drinking, alcohol-related problems (i.e., RAPI scores) and overall quantity of drinks consumed per week were winsorized and then log transformed. Impaired control scores were winsorized and then square root transformed. Depression, dysphoric disinhibition and sexual disinhibition scores were log transformed and euphoric/social disinhibition scores were squared. The same transformations were performed for Time 1 and Time 2 data. For ease of interpretation, means and standard deviations in Table 1 are from the original raw scores, rather than the transformed versions.

The original Time 1 sample ($N = 337$) was comprised of 58.6% females, 12.5% family history positive individuals and had the following racial/ethnic composition: 75.4% White, 8.6% East/Southeast Asian, 4.2% African American, 3.6% Hispanic/Latin, 2.1% South Asian/Indian; .3% Native American and 5.9% "other."

The Time 2 survey was completed by 201 participants for a 59.6% retention rate. Independent samples t -tests determined that there were no significant differences at Time 1 between participants who completed the Time 2 survey and those who did not. There was one comparison with a p value of .067. Other comparisons ranged from $p = .22$ to .77. The sample retained at Time 2 was 61% female, 12.2% family history positive, 78.1% White, 9.5% Asian, 5.5% Hispanic/Latin, 2.5% African-American and 4.5% "other." Descriptive characteristics for the sample retained at Time 2 and changes from Time 1 to Time 2 are provided in Table 1. Alcohol-related problems (i.e., RAPI scores) [$t(191) = -2.39, p = .018$] and impaired control (i.e., ICS) scores [$t(176) = -2.30, p = .022$] decreased significantly from Time 1 to Time 2. Dysphoric [$t(191) = 2.30, p = .023$] and sexual disinhibition scores [$t(192) = 5.65, p < .001$] significantly increased from Time 1 to Time 2. There were no significant changes for any other variables.

It was reported previously that males exhibited significantly higher sexual disinhibition expectancies, weekly heavy episodic drinking, overall weekly alcohol consumption, alcohol-related problems and sensation seeking scores compared to females at Time 1 (Leeman, Fenton, & Volpicelli, 2007; Leeman, Toll, & Volpicelli, 2007). At Time 2, men again reported more

frequent weekly heavy episodic drinking [(male $M = 1.28$, $SD = 1.23$; female $M = 0.84$, $SD = 1.01$), $t(198) = 2.93$, $p = .004$], more overall drinks per week [(male $M = 16.73$, $SD = 16.99$; female $M = 10.32$, $SD = 10.66$), $t(198) = 3.43$, $p = .001$] and higher sensation seeking scores [(male $M = 4.17$, $SD = 1.71$; female $M = 3.54$, $SD = 1.72$), $t(179) = 2.41$, $p = .017$]. There were no longer any significant gender differences in sexual disinhibition or alcohol-related problems at Time 2. Given these significant differences, gender was included in all regression models.

Cross-Sectional Analyses to Predict Time 1 Problem Drinking

Correlations among variables in the entire sample at Time 1 are reported in Table 2. Impaired control and all 3 DIDS subscales were significantly correlated with both heavy episodic drinking and alcohol-related problems at Time 1, with the exception of a non-significant correlation between the dysphoric subscale and heavy episodic drinking. Sensation seeking was significantly correlated with the sexual subscale and had a smaller, but still significant correlation with the euphoric/social subscale. Depression was significantly correlated with the dysphoric subscale only.

Results of hierarchical multiple regressions predicting Time 1 problem drinking are shown in Table 3. For this and for all other regressions, the sample included in the model was smaller than the overall sample as a result of listwise deletion of those who had missing data for one or more of the variables included in the model. In the final model of alcohol-related problems, in addition to overall drinks consumed per week, there were significant main effects of impaired control and dysphoric disinhibition expectancies but there were no significant main effects of sensation seeking, euphoric/social or sexual disinhibition expectancies. Depression was a significant predictor upon first entry in the model but was non-significant in the final model.

In the final model of heavy episodic drinking, in addition to gender (males higher) and depression (those with greater depression were *less* likely to drink heavily), there were significant main effects of sensation seeking and impaired control. There were no significant main effects for any of the DIDS subscales.

Prospective Analyses to Predict Time 2 Problem Drinking

Correlations among Time 1 and Time 2 problem drinking variables and predictors in the sample retained at Time 2 are shown in Table 4. Time 1 impaired control was positively correlated with both problem drinking indices at Time 2, particularly with alcohol-related problems (i.e., RAPI score, $r = .47$, $p < .001$). Time 1 euphoric/social and dysphoric disinhibition expectancies were also modestly correlated with Time 2 RAPI score ($r = .16$, $p = .023$; $r = .19$, $p = .008$, respectively). Time 1 euphoric/social ($r = .29$, $p < .001$) and sexual disinhibition expectancies ($r = .21$, $p = .003$) were significantly correlated with Time 2 heavy episodic drinking, as was sensation seeking ($r = .26$, $p < .001$). Other correlations were not significant.

Results of prospective, hierarchical multiple regressions using Time 1 variables to predict Time 2 problem drinking are shown in Table 5. Along with Time 1 alcohol-related problems and Time 1 overall drinks per week, Time 1 impaired control was a significant predictor of Time 2 alcohol-related problems in the final model. Other than a 50% decline in the regression coefficient for Time 1 alcohol-related problems, no other notable changes occurred between first entry and the final model.

In the final model, Time 1 euphoric/social disinhibition expectancies were the only significant predictor of Time 2 heavy episodic drinking other than Time 1 heavy drinking. There were no notable changes observable between first entry and the final model.

Discussion

The present findings offer some evidence that alcohol-induced disinhibition expectancies and impaired control over alcohol drinking predict problem drinking not only cross-sectionally, but prospectively, even when controlling for problem drinking at Time 1. Given that impaired control predicted both indices of problem drinking cross-sectionally at Time 1 and predicted alcohol-related problems at Time 2, there was clear evidence that this construct predicts unique variance in problem drinking. It is notable that impaired control predicted alcohol-related problems in models that included estimates of typical alcohol consumption and that the Time 2 model also included alcohol-related problems at Time 1. To our knowledge, this study is the first to demonstrate that impaired control is a prospective predictor of alcohol-related problems in young adults. These results concur with prior evidence suggesting that impaired control is highly relevant to young drinkers (Chick & Duffy, 1979; Chung & Martin, 2002; Langenbucher & Chung, 1995; Patock-Peckham et al., 1998; Patock-Peckham & Morgan-Lopez, 2006). Given these prior findings, the strength of the current findings and its well-established clinical ramifications as a hallmark of addiction (Levine, 1978), impaired control might be one of the most powerful predictors of problem drinking in young adults. However, assessment of impaired control in studies of young adult drinking is not widespread.

Regarding alcohol-induced disinhibition expectancies, one DIDS subscale (i.e., dysphoric) predicted alcohol-related problems cross-sectionally and another (i.e., euphoric/social) predicted heavy episodic drinking prospectively in regression models including sensation seeking, depression and other predictors. Contrary to predictions, euphoric/social disinhibition expectancies were weak predictors of problem drinking cross-sectionally at Time 1. The finding that euphoric/social predicted heavy episodic drinking prospectively at Time 2 was in line with expectations, though. Recalling the learning processes that underlie the formation of expectancies (Jones et al., 2001), it is possible that while expectancies of frequent euphoric/social disinhibition may not be highly problematic in college freshmen, they can become so later on as learning creates a link over time between heavy drinking and positive expectancies, which are rewarding and reinforcing. Along similar lines, positively-valenced expectancies have been frequently associated with quantity of alcohol consumption in prior studies both cross-sectionally (e.g., Fromme et al., 1993) and prospectively (Sher et al., 1996). While sexual disinhibition expectancies were significantly correlated with both problem drinking indices at Time 1 and with heavy episodic drinking at Time 2, they did not predict unique variance in any of the regression models. The finding that dysphoric disinhibition expectancies predicted alcohol-related problems cross-sectionally had been hypothesized, based on cross-sectional associations between depressive symptoms and alcohol-related problems (Martens et al., 2008; Patock-Peckham et al., 1998) and between depression expectancies and alcohol-related problems (Patock-Peckham et al.; Wood et al., 1992). The lack of a prospective association with alcohol-related problems and lack of any association with heavy drinking had been predicted due to the negative valence and resulting lack of reinforcing quality for dysphoric disinhibition.

We also hypothesized that the DIDS subscales would be better predictors of problem drinking than measures capturing relevant tendencies in everyday life (i.e., sensation seeking for the euphoric/social and sexual subscales and depression for the dysphoric subscale). While some evidence was in line with this prediction, other findings were not.

Overall, there was stability from Time 1 to Time 2. While there were significant changes for 4 of the variables analyzed, only 1 variable—sexual disinhibition—showed a substantial and significant change over time. The increase in reports of sexual disinhibition expectancies over time was predicted due to the reinforcing quality of sexual activity. The degree of change

observable in sexual disinhibition may also help to explain the lack of utility of Time 1 sexual disinhibition as a predictor of Time 2 problem drinking.

There were a number of limitations to the present study. The rate of retention from Time 1 to Time 2 was not high, although other prospective studies in undergraduate samples have reported similar, modest rates of retention. Goudriaan, Grekin and Sher (2007) reported retention rates between 61% and 68% in waves of their prospective survey. There were no statistically significant differences at Time 1 between those who were and were not retained at Time 2 and with one exception, the *p* values for these comparisons were large. Despite this limitation, this study offered an opportunity to evaluate alcohol-induced disinhibition expectancies and impaired control as prospective predictors of problem drinking. The inclusion of only 2 time points limited the ability to model change over time and the infrequent assessments in this study may have contributed to the percentage of participants lost to follow-up. A prospective study in which problem drinking, impaired control and alcohol-induced disinhibition expectancies are assessed more frequently would contribute to the literature. Lastly, given that this study involved only undergraduates, the extent to which the findings apply to older adults is uncertain.

In conclusion, the present findings suggest that impaired control is a powerful predictor of problem drinking in young drinkers. This construct is under-assessed in alcohol research with young adults and should be included as a routine measure in future studies. Findings regarding euphoric/social disinhibition expectancies concur with prior findings suggesting that positively-valenced expectancies are particularly effective at predicting problem drinking prospectively (Jones et al., 2001; Sher et al., 1996), perhaps due to the role of learning in expectancy formation (Jones et al). Specifically, the present findings suggest the possibility that euphoric/social disinhibition expectancies may not be problematic initially, but can become so later in the undergraduate years. Though expectancies of alcohol's negative effects (i.e., dysphoric disinhibition) were found to be problematic cross-sectionally, this effect did not carry over into the prospective findings, possibly due to learning over time encouraging individuals to avoid these negatively-valenced effects. While it is known that alcohol can induce a state of disinhibition (Goldstein & Volkow, 2002; Jentsch & Taylor, 1999; Lyvers, 2000), disinhibition expectancies have been infrequently addressed as risk factors for negative outcomes. Thus, this study's findings suggest a novel set of predictors of problem drinking risk in undergraduates. Efforts should be taken to make undergraduate drinkers aware of their tendencies toward impaired control over their alcohol drinking and their expectations regarding alcohol-induced disinhibition in the hope that these tendencies would be reduced, in turn leading to reductions in problem drinking.

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Table 1

Descriptives for the sample retained at Time 2 and change from Time 1 to Time 2

	Time 1	Time 2
Frequency of weekly heavy episodic drinking ¹	0.90 (0.84)	1.01 (1.12)
Rutgers Alcohol Problem Index (RAPI) Score ¹ (out of 19) ²	4.71 (3.41)*	4.37 (3.88)
Overall quantity of drinks consumed per week ¹	12.20 (10.97)	12.92 (13.86)
Sensation seeking (out of 8) ³	3.81 (1.86)	3.75 (1.75)
Depression (out of 44) ¹	9.89 (8.02)	n/a
Impaired control over alcohol use (out of 10) ¹	9.15 (6.23)*	8.03 (5.49)
Euphoric/social disinhibition (out of 6) ¹	3.85 (1.07)	3.97 (1.13)
Dysphoric disinhibition (out of 6) ¹	1.92 (0.89)	2.19 (1.21)*
Sexual disinhibition (out of 6) ¹	2.14 (1.08)	2.81 (1.40)***

¹ Indicates that the analysis was based on transformed values, but the raw, untransformed values are presented here

² out of 19 rather than the standard 23 because of removal of 4 items to avoid criterion contamination with impaired control measure

³ out of 8 rather than the standard 10 because of removal of 2 items to avoid criterion contamination with alcohol consumption items

asterisks indicate significant differences as follows: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table 2
Correlations among outcome and predictor variables included in multiple regression analyses at Time 1

	RAPI	heavy drinking	overall drinks/wk.	impaired control	euphoric/ social dis.	dysphoric dis.	sexual dis.	depression	sensation seeking
Time 1 RAPI score	1	.51***	.52***	.49***	.32***	.34***	.29***	.15**	.26***
Time 1 heavy episodic drinking		1	.84***	.38***	.23***	.07	.36***	-.12*	.48***
Time 1 overall quantity of drinks/week			1	.37***	.32***	.17**	.42***	-.04	.54***
Time 1 impaired control score				1	.34***	.27***	.21***	.18***	.18**
Time 1 euphoric/social disinhibition					1	.28***	.30***	.09	.25***
Time 1 dysphoric disinhibition						1	.16**	.25***	.07
Time 1 sexual disinhibition							1	-.07	.52***
Time 1 depression								1	-.10
Time 1 sensation seeking									1

* $p \leq .05$,

** $p \leq .01$,

*** $p \leq .001$

Table 3

Summaries of cross-sectional regression analyses predicting time 1 problem drinking

Time 1 predictor variables	Time 1 Alcohol-related problems (N = 301)						Time 1 Heavy episodic drinking (N = 302)					
	First entry in model			Final model			First entry in model			Final model		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
<i>Step 1, R squared change = .28***</i>												
Overall drinks per week	0.40	0.04	.53***	0.27	0.05	0.36***	n/a			n/a		
<i>Step 2, R squared change = .00</i>												
Gender (male coded 1, female 2)	-0.01	0.03	-0.02	-0.05	0.03	-0.08						
							<i>R squared change = .06***</i>					
							-0.10	0.02	-0.25***	-0.07	0.02	-0.18***
<i>Step 3, R squared change = .03**</i>												
Depression	0.14	0.04	0.16***	0.06	0.04	0.06						
							<i>R squared change = .20***</i>					
							-0.04	0.03	-0.07	-0.08	0.03	-0.13**
Sensation seeking	-0.01	0.01	-0.04	-0.01	0.01	-0.06						
							0.05	0.01	0.45***	0.03	0.01	0.33***
<i>Step 4, R squared change = .09***</i>												
Impaired control	0.11	0.02	0.34***	0.09	0.02	0.29***						
							<i>R squared change = .11***</i>					
							0.07	0.01	0.35***	0.06	0.01	0.33***
<i>Step 5, R squared change = .03***</i>												
Euphoric/social disinhibition	n/a			0	0	0.05						
							<i>R squared change = .01</i>					
							n/a			0	0	0.02
Dysphoric disinhibition	n/a			0.24	0.07	0.16***				0.02	0.05	0.02
							<i>R squared change = .01</i>					
							n/a			0.07	0.05	0.08
Sexual disinhibition	n/a			0.10	0.08	0.07						
							<i>R squared change = .01</i>					
							n/a					
							Model <i>R squared</i> = 0.38					

Note. B indicates the unstandardized regression coefficient and β indicates the standardized coefficient.* $p \leq .05$,** $p \leq .01$,*** $p \leq .001$

Table 4
 Predictors among outcome and predictor variables included in multiple regression analyses for the sample retained at Time 2

	Time 1										Time 2						
	RAPI	heavy drinking	overall drinks/wk.	impaired control	euphoric/ social dis.	dysphoric dis.	sexual dis.	depression	sensation seeking	RAPI	heavy drinking	overall drinks/wk.	impaired control	euphoric/ social dis.	dysphoric dis.	sexual dis.	sensation seeking
1	1	.50***	.49***	.54***	.31***	.28***	.24***	.12	.25***	.47***	.35***	.38***	.30***	.21**	.23**	.22**	.23**
heavy drinking		1	.82***	.41***	.22**	-.06	.31***	-.05	.46***	.34***	.59***	.62***	.28***	.06	.15*	.29***	.36***
overall of drinks/			1	.40***	.26***	.05	.37***	.03	.55***	.39***	.53***	.61***	.23**	.11	.23***	.38***	.43***
impaired score				1	.38***	.22**	.25***	.19*	.24***	.47***	.29***	.28***	.42***	.23**	.32***	.29***	.22**
euphoric/					1	.21**	.34***	.03	.27***	.16*	.29***	.23***	.24***	.33***	.23***	.25***	.18*
dis. dysphoric						1	.11	.19*	.04	.19**	.02	.03	.15*	.17*	.40***	.11	-.01
dis. sexual							1	-.04	.50***	.13	.21**	.19**	.09	.10	.04	.29***	.28***
dis. depression								1	-.08	.13	-.08	-.03	.14	.12	.20**	-.06	.04
sensation									1	.12	.26***	.30***	.06	.03	.14	.22**	.52***
RAPI										1	.53***	.55***	.58***	.31***	.35***	.46***	.33***
heavy drinking											1	.84***	.46***	.18*	.20**	.44***	.50***
overall of drinks/												1	.47***	.17*	.21**	.45***	.53***
impaired score													1	.37***	.32***	.42***	.34***
euphoric/														1	.31***	.44***	.15*
dis. dysphoric															1	.35***	.14

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	Time 1					Time 2											
	RAPI	heavy drinking	overall drinks/wk.	impaired control	euphoric/ social dis.	dysphoric dis.	sexual dis.	depression	sensation seeking	RAPI	heavy drinking	overall drinks/wk.	impaired control	euphoric/ social dis.	dysphoric dis.	sexual dis.	sensation seeking
sexual itation																1	.47***
sensation																	1

Table 5
Summaries of prospective regression analyses predicting time 2 problem drinking

Time 1 predictor variables	Time 2 Alcohol-related problems (N = 169)					Time 2 Heavy episodic drinking (N = 178)				
	First entry in model		Final model			First entry in model		Final model		
	B	SE B	β	B	SE B	β	B	SE B	β	B
<i>Step 1, R squared change = .23***</i>										
Time 1 problem drinking variable	0.52	0.07	0.48***	0.26	0.09	0.24**	0.64	0.07	0.56***	0.09
<i>Step 2, R squared change = .04***</i>										
Overall drinks per week	0.19	0.07	0.22**	0.22	0.08	0.25**		n/a		n/a
<i>Step 3, R squared change = .00</i>										
Gender (male coded 1, female 2)	0	0.05	0.01	-0.04	0.05	-0.05	-0.03	0.03	-0.07	0.03
<i>Step 4, R squared change = .02</i>										
Depression	0.07	0.07	0.07	0.02	0.07	0.02	-0.04	0.04	-0.07	0.04
Sensation seeking	-0.03	0.02	-0.14	-0.03	0.02	-0.14	0	0.01	0	0.01
<i>Step 5, R squared change = .05***</i>										
Impaired control	0.09	0.03	0.26***	0.09	0.03	0.27***	0.03	0.02	0.12	0.02
<i>Step 6, R squared change = .01</i>										
Euphoric/social disinhibition	n/a	n/a		0	0	-0.02		n/a		0
Dysphoric disinhibition	n/a	n/a		0.13	0.12	0.08		n/a		0.07
Sexual disinhibition	n/a	n/a		-0.07	0.13	-0.04		n/a		0.08
Model R squared = 0.34										
Model R squared = 0.38										

Note. B indicates the unstandardized regression coefficient and β indicates the standardized coefficient.

*
 $p \leq .05$,

**
 $p \leq .01$,

 $p \leq .001$