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Not the Same Old Thing: Establishing the Unique Contribution of Drinking Identity as a Predictor of Alcohol Consumption and Problems Over Time

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Abstract

Drinking identity – how much individuals view themselves as drinkers– is a promising cognitive factor that predicts problem drinking. Implicit and explicit measures of drinking identity have been developed (the former assesses more reflexive/automatic cognitive processes; the latter more reflective/controlled cognitive processes): each predicts unique variance in alcohol consumption and problems. However, implicit and explicit identity’s utility and uniqueness as a predictor relative to cognitive factors important for problem drinking screening and intervention has not been evaluated. Thus, the current study evaluated implicit and explicit drinking identity as predictors of consumption and problems over time. Baseline measures of drinking identity, social norms, alcohol expectancies, and drinking motives were evaluated as predictors of consumption and problems (evaluated every three months over two academic years) in a sample of 506 students (57% female) in their first or second year of college. Results found that baseline identity measures predicted unique variance in consumption and problems over time. Further, when compared to each set of cognitive factors, the identity measures predicted unique variance in consumption and problems over time. Findings were more robust for explicit, versus, implicit identity and in models that did not control for baseline drinking. Drinking identity appears to be a unique predictor of problem drinking relative to social norms, alcohol expectancies, and drinking motives. Intervention and theory could benefit from including and considering drinking identity.

Keywords

drinking identity; implicit drinking identity; drinking motives; social norms; alcohol expectancies

Recent studies have found support for a cognitive factor, drinking identity – the extent to which individuals view or associate themselves with drinking – as a robust predictor of problem drinking among college students (e.g., Gray, LaPlante, Bannon, Ambady, & Shaffer 2011; Lindgren et al., 2013a, 2013b). Those findings are important because of the continued societal and individual burden of problems associated with college student drinking (see Hingson & White, 2014; Johnston, et al., 2015; Nelson, Xuan, Lee, Weitzman, & Wechsler, 2009). To that end, identifying additional factors that could be used to predict problem drinking and/or improve existing interventions is critical. Thus, drinking identity has the potential to be a novel cognitive factor that could be exploited to reduce the burden of college student drinking. A critical next step is to establish whether identity is a *novel* factor – that is, one that is not redundant with longstanding, important predictors of college student problem drinking. Therefore, the purpose of the current study was to evaluate whether measures of drinking identity predicted unique variance in alcohol consumption and problems after controlling for three, well-established cognitive factors (i.e., social norms, alcohol expectancies, and drinking motives) that are important in the assessment of and intervention in college student problem drinking.

Drinking Identity

Evaluating the extent to which individuals identify with drinking (i.e., their drinking identity) is an emergent line of research. Assessing drinking identity draws on a long-standing tradition in multiple areas of psychology (e.g., social/personality psychology, cognitive psychology, and developmental psychology) that emphasizes the importance of the self, how one thinks of one's self, and the multiplicity of one's identities (e.g., Bem, 1972; Crocker & Wolfe, 2001; Greenwald & Pratkanis, 1984; James, 1890/1950; Steele, 1988). With regard to the study of risky behavior, it has been argued that including assessment of the extent to which one identifies with a problem behavior would improve the prediction of that problem behavior, and there has been some preliminary evidence to that effect (see Fekadu & Kraft, 2001).

With respect to assessing drinking identity, researchers have used two different strategies to do so. The first relies on self-report and the resulting assessment is thought to capture more reflective/controlled cognitive processes. This strategy is used in the alcohol self-concept scale (Lindgren et al., 2013b; adapted from Shadel & Mermelstein, 1996), which evaluates the extent to which drinking plays a role in an individual's life and personality, and which we refer to as *explicit* drinking identity. The second relies on indirect assessment – in this case, reaction time – and is thought to capture more reflexive/automatic cognitive processes. This strategy is used in the drinking identity IAT (Implicit Association Test; see Lindgren et al., 2013b; adapted from Greenwald, McGhee, & Schwartz, 1998), which evaluates how quickly an individual categorizes stimuli representing different constructs (me, not me, drinker, non-drinker) and which is thought to reflect the strength of those associations in the individual's memory (i.e., a stronger drinker identity would equate to stronger associative connections between drinker + me). We refer to this measure of drinking identity as *implicit* drinking identity.

Both implicit and explicit drinking identity have been found to be robust predictors of drinking. When evaluated simultaneously in studies (e.g., Lindgren et al., 2013b; in press), explicit and implicit drinking identity are weakly correlated and predict unique variance in a number of key college student drinking behaviors, including consumption, problems, risk of alcohol use disorders, and craving. These findings provide evidence that implicit and explicit drinking identity are related but distinct (which is consistent with findings from alcohol-specific and general meta-analyses of implicit and explicit measures, see Greenwald, Poehlman, Uhlmann, & Banaji, 2009; Reich, Below, & Goldman, 2010), and that each one makes a unique contribution to predicting important outcomes. Implicit drinking identity has also been evaluated relative to other, established implicit alcohol associations (i.e., alcohol approach associations, alcohol coping associations, alcohol excitement associations; all of which were also measured using the IAT). In those studies (Lindgren et al., 2013a, 2013b; in press), implicit drinking identity consistently predicted unique variance in drinking outcomes relative to those associations. Thus, there is also support for the unique contribution of implicit drinking identity relative to other implicit alcohol-related associations.

While these studies provide some evidence for the distinctiveness of drinking identity, critical gaps remain. First, although implicit drinking identity has been evaluated relative to other implicit alcohol-related associations, explicit drinking identity has not, to our knowledge, been evaluated relative to other explicit alcohol-related cognitive factors. This gap leaves open questions about explicit drinking identity's novelty as a cognitive factor – a gap that is particularly problematic because alcohol research, like most research domains, commonly assesses cognitive factors using self-report (or explicit) measures. Moreover, the extant literature has identified a number of explicit cognitive factors – social norms, alcohol expectancies, and drinking motives – that are robust predictors of college student problem drinking (Ham & Hope, 2003; Kuntsche, Knibbe, Gmel, & Engels, 2005; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007) and important intervention targets (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Darkes & Goldman, 1993; 1998; Miller et al., 2013; Wurdak, Wolstein, & Kuntsche, 2016). These three factors were also evaluated relative to one another in a cross-sectional study (Neighbors et al., 2007), the aims of which were to draw together largely separate literatures and to provide clarity regarding each construct's uniqueness. Each construct predicted unique variance in consumption and/or problems relative to one another, with norms having the largest effect sizes for consumption and coping motives and negative alcohol expectancies having the largest effect sizes for problems. The current study sought to follow in that tradition – that is, to compare explicit drinking identity head-to-head with those factors in order to evaluate its novelty and clinical potential. Second, implicit drinking identity has also not been evaluated relative to established explicit cognitive factors. Implicit identity measures have been found to be distinct predictors of drinking relative to explicit identity measures, but whether implicit identity would also predict unique variance in problem drinking relative to other explicit cognitive factors is, as far as we know, unknown. Finally, to date most drinking identity research (e.g., Gray et al., 2011; Lindgren et al., in press are among the exceptions) and comparative cognitive factor research (e.g., Neighbors et al., 2007) has been cross-sectional. Thus, there is a need to establish the unique contribution of the drinking identity measures over time.

Social Norms

Among cognitive factors that have been examined in relation to drinking, perceived social norms have been among the most widely studied and have been found to be among the strongest predictors of drinking among college students (Neighbors et al., 2007; Pederson, LaBrie, & Hummer, 2009; Perkins, 2002). Two types of social norms have been most often examined in relation to drinking: descriptive drinking norms refer to perceptions of the prevalence of drinking among peers whereas perceived injunctive norms refer to perceptions of the approval or disapproval of drinking among peers. Descriptive norms have been more consistently associated with drinking whereas injunctive norms' association with drinking is more variable (e.g., LaBrie, Hummer, Neighbors, & Larimer, 2010; Neighbors et al., 2008). Furthermore, reducing perceived drinking norms is a common and effective intervention strategy for reducing drinking (Martens, Smith, & Murphy, 2013; Miller et al., 2014; Prince, Maisto, Rice, & Carey, 2014). Thus, social norms are an important cognitive factor for evaluating and treating college student drinking.

Alcohol Expectancies

Alcohol expectancies have been extensively examined as predictors of college student alcohol consumption and problems and targeting them has become integral to intervention efforts. Alcohol expectancies are perceptions of the consequences likely to occur as a result of consuming alcohol, and can reflect either positive (e.g., feeling relaxed) or negative (e.g., blacking out) alcohol effects. Social learning theory (Bandura, 1977) posits that the decision to consume alcohol should at least be in part driven by expectancies that doing so will result in desirable outcomes. In support of this theory, considerable research has demonstrated a positive association between college students' positive alcohol expectancies and their alcohol consumption and related problems (Fromme & D'Amico, 2000; Ham et al., 2005; Young, Connor, Ricciardelli, & Saunders, 2006). Research with regard to negative expectancies is mixed: although some studies have found that individuals with stronger negative expectancies drink less (Fromme & D'Amico, 2000), others have found that negative expectancies are positively associated with heavier drinking (Zamboanga et al., 2010) and alcohol-related problems (Neighbors et al., 2007), and some have found no relationship with alcohol consumption (Neighbors et al., 2007; Young et al., 2006). Nonetheless, research demonstrating a link between positive expectancies and drinking outcomes have given rise to expectancy challenge interventions (Darkes & Goldman, 1993; 1998), which aim to reduce an individual's positive expectancies by having that individual interact with others who have either drunk alcohol or placebo, and guess who consumed alcohol. Further, other empirically-supported interventions (i.e., the Brief Alcohol Screening and Intervention for College Students; BASICS; Dimeff, Baer, Kivlahan, & Marlatt, 1999) also focus on providing corrective information about alcohol expectancies.

Drinking Motives

The assessment of drinking motives, or reasons for drinking, is based on the idea that people drink alcohol to obtain a particular desired outcome (Cooper, 1994; Cox & Klinger, 1988). Although the perception of alcohol's likely effects reflect expectancies, endorsement of an

outcome expectancy does not necessarily mean that an individual will drink to obtain that expected effect. In that sense, motives may be distinguished from expectancies, in that motives represent the outcomes from alcohol that are desired and underlie the decision to drink. Most frequently, motives for drinking are grouped into separate categories, with the most commonly used assessment recognizing four separate domains: enhancement (e.g., because it's exciting), coping (e.g., to forget your worries), social (e.g., because it helps you enjoy a party) and conformity (e.g., to be liked) domains (Drinking Motives Questionnaire-Revised; Cooper, 1994). Overall, college students and other young adults most frequently report drinking for enhancement and social motives, which in turn, are positively associated with alcohol consumption (Kuntsche et al., 2005; Wicki, Kuntsche, & Gmel, 2010), with enhancement motives, in particular, predicting alcohol consumption after controlling for alcohol expectancies and social norms (Neighbors et al., 2007). Although coping motives are less frequently endorsed, they appear to be the class of motives most strongly associated with alcohol-related problems (Kuntsche et al., 2005), also after controlling for alcohol expectancies and social norms (Neighbors et al., 2007). Given the prevalence of these motives and their association with alcohol consumption and related problems, some interventions have been tailored to take into account an individual's motives for drinking (e.g., Wurdak et al., 2016). With respect to drinking motives and drinking identity, a weak correlation was observed with coping and enhancement motives and drinking identity in a single study (Lindgren et al., 2013b), but to our knowledge, neither implicit nor explicit identity has ever been evaluated as a unique predictor of alcohol consumption and problems relative to motives.

Study Overview

The purpose of this study was, therefore, to evaluate whether drinking identity makes a unique contribution in predicting problem drinking relative to three cognitive factors (i.e., social norms, alcohol expectancies, and drinking motives), which have been evaluated relative to one another previously (see Neighbors et al., 2007), and which have a long and strong history of predicting and being targets for reducing problem drinking in college students. Both implicit and explicit measures of drinking identity were included since they have been shown to predict unique variance in problem drinking relative to one another (e.g., Lindgren et al., 2013b). Because they are distinct predictors of problem drinking relative to one another and because implicit drinking identity was found to be a distinct predictor of problem drinking relative to other implicit alcohol associations, we reasoned they would, likewise, be distinct predictors of alcohol consumption and alcohol-related problems relative to each of the established cognitive factors. This hypothesis was evaluated using data from a larger, longitudinal, two year study of college students in their first or second year of college (Lindgren et al., in press). Drinking identity, social norms, alcohol expectancies, and drinking motives were assessed at baseline (T1); consumption and problems were assessed at every time point (T1–T8). One set of models evaluated drinking identity and the other cognitive factors as predictors of future drinking and problems; the second set evaluated them as predictors of drinking and problems controlling for baseline drinking. Additional analyses investigated the drinking identity variables by themselves.

Methods

Participants

Participants included 506 undergraduates (215 men, 289 women, two declined to answer) in their first or second year (aged 18–20, $M = 18.58$, $SD = 0.69$) at a large public university in the Pacific Northwest. Eight percent of participants identified as Hispanic or Latino. Fifty-two percent of participants identified as White, 32% as Asian American, 11% as multiracial and the remaining 5% as Black or African American, American Indian or Alaskan Native, unknown or declined to answer. Due to the study's longitudinal nature, there were participants who did not complete assessments or withdrew as the study went on. All 506 completed T1, 90% completed T2, 76% completed T3, 76% completed T4, 77% completed T5, 72% completed T6, 67% completed T7, and 66% completed T8. To evaluate possible factors associated with attrition, a variable was created that represented the number of missing assessments, which ranged from 0 to 7; that variable fit a negative binomial distribution. This variable was examined as a function of three sets of baseline variables. First, it was examined as a function of demographics (sex, age, race [White/Caucasian reference], ethnicity). Results revealed no significant associations except that Asian/Asian Americans had fewer missing assessments relative to White/Caucasians ($Z = -4.14$, $p < .001$). Next, missingness was examined as a function of alcohol consumption, and problems; there were no significant associations with those outcomes ($ps > .05$). Finally, missingness was examined as a function of the identity measures. Neither was significantly associated with the number of missing assessments.

Measures

Timeline of Study Measures—The current study includes T1 assessments of drinking identity, social norms, alcohol expectancies, and drinking motives and T1–T8 assessments of alcohol consumption and problems.

Implicit Drinking Identity—The IAT (Greenwald et al., 1998) is a computer-based reaction time measure that assesses the relative strength of associations between two sets of concepts, defined as target and attribute categories. In the case of the drinking identity IAT, the two target categories refer to identity (i.e., “me” and “not me”) and the two attribute categories refer to drinking (i.e., “drinker” and “non-drinker”) (Lindgren et al., 2013b). The stimuli for this IAT include: *drinker*: drinker, partier, drunk, drink; *nondrinker*: nondrinker, abstainer, sober, abstain; *me*: me, my mine, self; and *not me*: they, them, theirs, other (category labels are italicized). The drinking identity IAT uses the traditional seven-block structure. Each block contains multiple trials (blocks 4 & 7 have 40 trials; all other blocks have 20 trials) in which participants are presented with a single stimulus item at the center of the screen, and are asked to classify it according to the categories listed on the left or right side of the screen as quickly as they can. During blocks 1, 2 and 5, participants practice classifying stimuli into one of the two target categories (i.e., classifying words as referring to “me” or “not me”) or one of the two attribute categories (i.e., classifying words as referring to a “drinker” or “non-drinker”) using two keys on the keyboard, *e* for left and *i* for right. Each practice block is then followed by two blocks that pair each target category with an attribute category (these are the critical blocks for the IAT). During such blocks, participants

classify stimuli according to the pairings. For example, in the first pairing (Blocks 3 and 4), words representing “me” must be classified using the same key as words representing “drinker” while words representing “not me” are classified using the same key as words representing “non-drinker.” The second pairing (Blocks 6 and 7) reverses this pattern, pairing “not me” with “drinker” and “me” with “non-drinker.” IAT scores, calculated using the D score algorithm (i.e., the “improved algorithm,” see Greenwald, Nosek, & Banaji, 2003, p. 214, Table 4), indicate the standardized difference in average response time (i.e., latency) across the two pairing conditions. This standardized difference indicates the relative strength of a participant’s association with me and drinker, with higher scores indicating stronger me-drinker associations or a stronger drinking identity. Consistent with the improved algorithm, trials with response times (latencies) above 3000 ms were truncated to 3000 ms; on average, truncation affected less than 1% of a participant’s trials. To avoid order effects, the presentation of the two target-attribute pairings was counterbalanced across participants. Note also that this assessment included other IATs in addition to the drinking identity IAT. The order of these IATs was also randomized across participants. In addition, to reduce fatigue, these IATs were interspersed among the self-report measures in the assessment.

Internal consistency for the IAT was calculated by creating two D scores, one for blocks 3 and 6 and one for blocks 4 and 7, and correlating them (see Greenwald et al., 2003). Typically, such correlations range from .5 to .6 (see Lindgren et al., 2013b), $r = .58$ for the current study. Based on Nosek and colleagues’ (2007) recommendations, IAT scores were screened out for individuals for whom 10% or more trials were faster than 300 milliseconds or 30% or more trials had errors. Scores from 29 participants (6% of the sample) were excluded based on these criteria.

Explicit Drinking Identity—The Alcohol Self-Concept Scale (ASCS) assessed explicit drinking identity (Lindgren et al., 2013). It is a 5-item measure examining the extent to which drinking plays a role in an individual’s life and personality as well as others’ perceptions of the role of alcohol in that individual’s life. Participants rated their agreement on a 7-point scale ($-3 = \textit{strongly disagree}$ and $3 = \textit{strongly agree}$) with statements about the role of drinking in their lives and personalities (e.g., “Drinking is part of ‘who I am’”). Cronbach’s alpha was .92.

Social Norms—Descriptive norms were assessed with the Drinking Norms Rating Form (Baer, Stacy, & Larimer, 1991). Participants were asked to report the perceived number of drinks the typical student at (name of university) consumed on each day of a typical week during the last three months. Responses were summed and represent the perceived number of drinks consumed per week by the typical student on campus. The Lewis et al. (2010) injunctive norms measure assessed the perceived approval of 15 individual drinking behaviors among students (e.g., “How acceptable do you think the typical student at [name of university] finds each of the following behaviors? Drinking alcohol, drinking to get drunk, playing drinking games...”). Participants rated their perceptions of approval on a 7-point scale ($1 = \textit{Unacceptable}$ and $7 = \textit{Acceptable}$). Cronbach’s alpha was .89.

Alcohol Expectancies—The Brief-Comprehensive Effects of Alcohol Scale (Brief CEOA; development: Addictive Behaviors Research Center, 1997; validation: Ham et al., 2005) was used to assess participants' expectancies or beliefs about alcohol. It includes 15 items that participants are asked to rate on a 4-point scale (1 = *disagree* and 4 = *agree*) regarding whether they would expect a variety of positive and negative outcomes while under the influence of alcohol. These items can be broken down into four subscales. The first includes six items assessing expectancies about risk and aggression, liquid courage and sociability (e.g., "If I were under the influence from drinking alcohol, I would be brave and daring"), Cronbach's alpha = .86. The second includes four items assessing expectancies about self-perception and cognitive and behavioral impairment (e.g., "If I were under the influence from drinking alcohol, I would feel clumsy"), Cronbach's alpha = .67. The third subscale includes three items regarding expectancies about sexuality (e.g., "If I were under the influence from drinking alcohol, I would enjoy sex more"), Cronbach's alpha = .55. Finally, there were two items regarding expectancies about tension reduction (e.g., "If I were under the influence from drinking alcohol, I would be peaceful"), Cronbach's alpha = .72.

Drinking Motives—The Drinking Motives Questionnaire (DMQ; Cooper, 1994) evaluated individuals' reasons for drinking alcohol using 20 items rated on a 5-point scale (1 = *Never/almost never* and 5 = *Almost always/always*). The items can be separated into four subscales looking at four types of motives: drinking to cope (e.g., "Thinking of all the times you drink, how often would you say that you drink to forget your worries?"), conform (e.g., "Thinking of all the times you drink, how often would you say that you drink because your friends pressure you to drink?"), be social (e.g., "Thinking of all the times you drink, how often would you say that you drink because it helps you enjoy the party?") or enhance one's experience (e.g., "Thinking of all the times you drink, how often would you say that you drink because you like the feeling?"). Each subscale included five items. Cronbach's alphas were .87 coping, .89 for conformity, .96 social, and .93 for enhancement motives subscale, respectively.

Alcohol Consumption—The Daily Drinking Questionnaire (DDQ; Collins, Parks & Martlatt, 1985) examined participants' typical alcohol consumption in the last three months. Participants are asked to report the number of standard drinks they consumed on each day of a typical week in the last three months. Responses are summed to represent total drinks per week. Standard drink equivalencies were provided (12 oz. beer, 10 oz. microbrew beer, 5 oz. wine, 1.5 oz. 80-proof hard liquor).

Alcohol Related Problems—The Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989) assessed participants' alcohol-related problems. Using a 5-point scale (0 = *never* and 4 = *more than 10 times*), participants rated how often they had experienced 23 negative consequences from drinking over the last three months (e.g., "Suddenly you found yourself in a place that you could not remember getting to"). Two additional items evaluated driving after drinking (Larimer et al., 2007). Cronbach's alphas were above .91 at all timepoints.

Procedures

The data for this study come from a larger study (Lindgren et al., in press). All procedures were approved by the university's Institutional Review Board. Students were invited via email to participate in a longitudinal study that included eight assessments, occurring at three-month intervals, and spanned two academic years (a 21-month period). Participants were required to be full-time students between 18- and 20-years-old and in their first or second undergraduate year. Contact information for students who fit these criteria was provided by the university's registrar's office. Each assessment lasted approximately 50 minutes and could be completed on the computer (and location) of participants' choosing. Assessments included multiple reaction time (two additional IATs) and self-report measures (in addition to those listed above), as well as four accuracy check questions to ensure that participants were reading self-report questions before responding (a list of additional measures is available from the first author). At each assessment, less than 2% of participants missed more than one accuracy check question. Participants received \$25 for the T1–T3 assessments and \$30 for T4–T8 assessments. An additional \$5 was paid to T4 participants who completed all of the first four assessments; an additional \$10 was paid to T8 participants who completed all of the final four assessments. As the study drew to a close, participants were offered an additional \$5 incentive to complete T8.

Results

Descriptive Statistics

First, the zero-order correlations between the drinking identity variables, the other cognitive factors (social norms, alcohol expectancies, and drinking motives), and the alcohol consumption and problems variables were examined. Please see Table 1 for the correlations, means, and standard deviations for T1 (baseline), T4 (9 months/end of year 1), and T8 (21 months/end of year 2) variables (these time points were included to provide a concise picture of the variables' associations and values over time). Implicit drinking identity was weakly correlated with social norms and alcohol expectancies and moderately correlated with drinking motives, with the exception of conformity motives. Correlations with consumption and problems ranged from moderate to small. The pattern of findings was similar for explicit drinking identity.

Evaluating Drinking Identity as Unique Predictors

Data analytic plan—A series of regressions models were planned to evaluate T1 implicit and explicit drinking identity as unique predictors of alcohol consumption and problems over time. The consumption and problem variables had a large number of zeros and were positively skewed. The countfit package in Stata13 was used to identify the appropriate distributions comparing fits for four count distributions (zero-inflated negative binomial [ZINB], zero-inflated Poisson, negative binomial, and Poisson). AIC and BIC values and significant Vuong tests indicated the ZINB distribution was preferred for modelling consumption and problems.

Briefly, ZINB models address the stack of zeros and positive skew in distributions. They essentially consist of two regression models that are run simultaneously (for a primer, see

Atkins & Gallop, 2007). The first model – the “count” portion – evaluates the full range of the distribution, including some of the zeros, but models that distribution as a negative binomial (vs. a normal) distribution. The second model – the “logistic” portion – is a logistic regression that evaluates the likelihood of being an “excess” or “always” zero (i.e., the likelihood of always abstaining or always having no alcohol problems). Note that zeros are included in both portions of the model – the count portion includes some zeros, which can be likened to individuals who drink occasionally (i.e., “sometimes” zeros) and the zero-inflated portion includes the excess zeros, which can be likened to individuals who never drink (i.e., the “always” zeros).

Longitudinal ZINB models could be estimated using generalized linear mixed models (GLMMs), where correlated outcomes would be estimated, and thus controlled for, by random effects. We instead fit ZINB models using a clustered sandwich estimator to adjust for within person correlated outcomes. This approach is similar to GEE and provides an acceptable alternative to GLMMs when random effects are not of substantive interest (e.g., Lindgren et al., in press). Moreover, with longitudinal ZINB data, the clustered sandwich estimation approach is practically superior because GLMM models of longitudinal ZINB data with random effects and any degree of complexity seldom converge (Atkins, Baldwin, Zheng, Gallop, & Neighbors, 2013).

To test study hypotheses, a series of ZINB models were conducted. Each model contained T1 implicit and explicit drinking identity and sex (to control for known sex differences in drinking behaviors). The explicit drinking identity variable was highly positively skewed: when used as-is, some models did not converge; others had impossible values. Accordingly, it was recoded into a binary variable, with 0’s indicating individuals who endorsed absolutely no drinking identity (a mean score of -3) and 1’s indicating individuals who endorsed any drinking identity (a mean score greater than -3). The first set of models only consisted of those variables and evaluated both drinking identity variables as unique predictors of consumption over time.

Then, these models were repeated with the addition of one set of cognitive factors (baseline norms, expectancies, or motives) at a time to evaluate whether the identity variables accounted for unique variance after controlling for that factor.¹ Because the purpose of the study was to evaluate the contribution of the identity variables, the text below focuses on the identity variables’ results.² For each set of predictors, we examined alcohol consumption (drinks per week) and alcohol problems (RAPI scores) with and without controlling for

¹Fitting models that simultaneously evaluated drinking identity, all of the cognitive factors, time, and all of the resulting 2-way interactions with time was considered. Since the study’s primary purpose was not to make claims about drinking identity as the “best” predictor overall but rather to determine whether it was unique or relative to each of these theoretically and clinically important factors, we did not do so. In addition, there were substantial concerns about the reliability and interpretation of such a combined model: it would have at least 52 predictors (26 in the logit and 26 in the count portions), which, in ZINB models, makes multicollinearity difficult to detect and parameter estimates less reliable. Statistical power also becomes a concern.

²Models were run with and without individuals who failed more than one check question. The pattern of results for the identity measures and the identity x time interactions was unchanged. Further, the models evaluating identity only or identity + norms were unchanged. There were minor differences (for variables other than identity) in a few of the identity + expectancies and identity + motives models. The most common differences were an expectancy subscale x time or motive subscale x time interaction becoming significant (three instances) or dropping out as significant (one instance) in the logit or count portion of a model. There was also one instance of a motive subscale and one instance of an expectancy subscale becoming significant in the count portion of a model. Finally, there was also one instance of baseline drinking becoming significant in the count portion of a model. Because these

baseline consumption. For consumption, these two sets of analyses distinguish prediction of future consumption from prediction of changes in consumption. The rationale for controlling for baseline consumption when predicting problems was to test whether the identity variables were redundant with consumption measures.

Model Set 1: Implicit and Explicit Identity—First, models evaluated the T1 drinking identity variables as predictors of consumption over time. Please see Table 2 for the complete regression results. As expected, implicit and explicit identity emerged as significant positive predictors of consumption in the count portion of the models, indicating that stronger T1 implicit and explicit drinking identity predict greater alcohol consumption over time. In the logistic portion of the model, which essentially predicts the likelihood of never drinking (or always abstaining), implicit and explicit identity were, as expected, significant, negative predictors. There was also a significant implicit identity x time interaction, which indicated that the negative association between baseline implicit identity and consumption weakened over time (i.e., became less negative at more distal assessments of consumption). Consistent with previous studies (Lindgren et al., 2013b) and meta-analyses (Greenwald et al., 2009), effect sizes were typically in the small to medium range for implicit identity and moderate to large range for explicit identity. The next model, which controlled for baseline consumption (providing a test of whether identity measures predicted changes in drinking over time), indicated that only explicit identity, and only in the count portion, remained a significant predictor.

Next, the drinking identity measures were evaluated as predictors of problems over time. Explicit identity, the explicit identity x time interaction, and the implicit identity x time interaction emerged as significant predictors of problems over time in the count portion of the model. In addition, both identity measures emerged as significant predictors of problems in the logistic model. The direction of the main effects were as expected: stronger explicit drinking identity predicted reporting more alcohol-related problems (count portion) and stronger implicit and explicit identity predicted a lower likelihood of never having any alcohol-related problems (logistic portion). Interactions with time in the count portion suggested that the positive association with explicit identity and problems weakened over time, whereas the positive association with explicit identity and problem strengthened over time. Controlling for baseline consumption did not affect the pattern of results in the count portion, but did in the logistic portion. In the logistic portion, explicit identity dropped out, but the implicit main effect remained significant. Also, the implicit identity x time interaction became significant; the negative association between implicit identity and problems appears to weaken over time.

Model Set 2: Implicit and Explicit Drinking Identity After Controlling for Social Norms—The ZINB models were repeated, but this time, they included descriptive and injunctive social norms and evaluated the relative contribution of identity. Please see Table 3 for the complete results. Results for the model predicting consumption indicated that

differences were limited to (some of) the motive and expectancies models, were relatively rare and inconsistent, and did not affect any of the identity measures or their interactions, we elected to report the analyses that did not exclude participants based on their accuracy check performance.

implicit and explicit drinking identity were significant predictors of consumption over time in the expected direction in the count and logistic portions. There were also significant implicit identity x time and explicit identity x time interactions in the logistic portion, indicating that the negative association between the identity measures and consumption weakened over time. After controlling for baseline drinking, the identity-related effects became non-significant with the exception of explicit identity in the count portion—that is, only baseline explicit identity was a unique predictor of changes in drinking.

Results for the models predicting problems after controlling for norms indicated that implicit and explicit drinking identity were positive predictors of future problems in the count portion; the explicit identity x time interaction was also significant, indicating that the positive association between baseline explicit identity and problems attenuated over time. Explicit identity also predicted future problems in the logistic portion and in the expected direction. After controlling for baseline consumption, only the explicit identity and explicit identity x time interaction in the count portion remained significant predictors of future alcohol problems.

Model Set 3: Implicit and Explicit Drinking Identity After Controlling for Alcohol Expectancies

—Next, the models were repeated but included alcohol expectancies in lieu of social norms. Please see Table 4 for the complete results. The models predicting consumption indicated that implicit and explicit drinking identity uniquely predicted future alcohol consumption in the count and logistic portions. The implicit identity x time interaction also emerged as a predictor in the logistic portion. Here, too, the negative association between implicit identity and consumption weakened over time. After controlling for baseline drinking, only the explicit identity effect (and only in the count portion) remained a significant predictor.

Results for the models predicting problems after controlling for expectancies indicated that implicit and explicit drinking identity were unique predictors of future problems in the count portion and logistic portions. There was also a significant explicit identity x time interaction in the count portion. As found previously, the positive association between baseline explicit identity and problems weakened over time. After controlling for baseline drinking, only the explicit identity and the explicit identity x time interaction (and only in the count portion) remained significant predictors of future problems.

Model Set 4: Implicit and Explicit Drinking Identity After Controlling for Drinking Motives

—Finally, the contribution of drinking identity after controlling for drinking motives was evaluated by including drinking motives in lieu of alcohol expectancies in the models. Because the drinking motives measures specifically asked how often individuals drink for specific reasons, these analyses only included individuals who reported having at least one alcoholic drink in their lifetime at T1 ($n = 388$). Please see Table 5 for the complete results.

Results for the models predicting consumption indicated that implicit and explicit drinking identity were positive, unique predictors of the count portion; there was also a significant explicit identity x time interaction. In the logistic portion, only the implicit identity x time

interaction was significant. Both interactions indicated a weakening of the identity-consumption association over time. After controlling for baseline consumption, only explicit identity remained a significant predictor and only in the count portion. In the model predicting future problems (with and without controlling for consumption), only the explicit identity and the explicit identity x time interactions were significant predictors and only in the count portion. The interaction again indicated an attenuation of the identity – problem associations over time.

Discussion

The purpose of the current study was to evaluate whether drinking identity was a unique predictor of problem drinking. Accordingly, implicit and explicit measures of drinking identity were evaluated as predictors of alcohol consumption and problems over time relative to established cognitive factors (social norms, alcohol expectancies, and drinking motives) that have strong track records in college student problem drinking research and have been shown to predict consumption and problems even when evaluated simultaneously (see Neighbors et al., 2007). Results generally revealed baseline measures of drinking identity, especially explicit drinking identity, to be unique predictors over time even after controlling for those factors.

The Unique Contributions of Drinking Identity

When considering the contribution of the drinking identity variables after controlling for each of the three cognitive factors, the pattern of findings was similar across the factors. Generally, implicit and explicit identity variables predicted unique variance in alcohol consumption over time, both in the logistic and count portions of the models. The exception was in models evaluating identity relative to drinking motives: there, the identity variables were significant predictors in the count portion only. Further, in models predicting consumption that also controlled for baseline consumption (essentially, providing a test of whether the identity variables predicted *changes* in drinking), explicit, but not implicit, identity was a significant predictor. Explicit identity's contribution as a predictor of changes in drinking was specific to the count portion of the models, suggesting that it may have greater utility as a predictor of changes in drinking for those who drink at least occasionally versus for those who are complete abstainers.

With respect to alcohol problems, drinking identity emerged as a significant predictor over time, but the patterns of findings varied depending on the factor to which it was compared. For example, the identity variables made the most distinct contribution relative to expectancies (implicit and explicit identity predicted problems in the count and logistic portions) and the least distinct contribution relative to drinking motives (explicit, but not implicit, identity predicted problems and only in counts). The identity variables' contribution relative to norms fell in-between these two extremes. There was, however, consistency across models after controlling for baseline consumption: explicit, but not implicit, identity continued to emerge as a predictor of future problems in counts. Identity's association with problems is, thus, not entirely explained by its association with consumption.

Finally, two aspects of the findings in the models controlling for the cognitive factors are important to highlight. First, whether considering models predicting consumption or problems, there was drop-off in the drinking identity variables' utility as predictors once consumption was controlled for. Critically, this drop-off was not unique to identity. There were also drop-offs for social drinking norms, alcohol expectancies, and drinking motives. Thus, we caution against using drop-off as an indicator that drinking identity is not a novel, or potentially useful, factor. Second, there were a number of identity x time interactions, which indicated attenuations in drinking identity's association with drinking over time. These attenuations reveal limits to baseline identity measures' predictive utility over the course of the (21-month) study.

Taken together, these findings lead us to the conclusion that the contribution of drinking identity is novel and not redundant with social drinking norms, alcohol expectancies, and drinking motives. Some qualification is needed with respect the relative contribution of each measure of drinking identity: overall, explicit identity was a stronger and more consistent predictor. Further, the effect sizes associated with the drinking identity variables, especially explicit drinking identity, were similar in magnitude and often larger than those observed with the norms, motives, and expectancies variables. The effect sizes of implicit identity were often smaller than for the explicit identity or the other cognitive factors, which is true for implicit measures generally (see Greenwald et al., 2009). Note also the smaller effect sizes could reflect differences in shared method variance (see Nosek & Smyth, 2007): implicit identity is a behavioral measure [of reaction time] whereas explicit identity, the other cognitive factors, and the drinking outcomes were all measured via self-report. We, therefore, view implicit identity's ability to predict unique variance in outcomes even after controlling for explicit identity and each set of cognitive factors to be an important demonstration of its robustness.

With respect to evaluating implicit and explicit drinking identity alone (i.e., Model Set 1), this study is the first we know of to establish that baseline implicit and explicit identity can predict unique variance in consumption and problems over time. Those findings were certainly less robust after controlling for baseline drinking. For example, implicit and explicit identity predicted alcohol consumption in the count and logistic portions, but only explicit identity remained significant (and only in counts) after controlling for baseline consumption. The reduction in robustness extended to problems, too. However, it is important to underscore that the models controlling for baseline drinking are testing different, and more complex, questions. The models that do not control for baseline drinking are testing whether baseline identity variables can predict drinking and problems over time (both can). The models that control for baseline drinking are testing whether baseline identity variables can predict changes in drinking over time (explicit can) and whether the baseline identity – problems associations are not entirely redundant with the identity variables' association with drinking (they are not).

The identity main effects in Model Set 1 were also accompanied by time x identity interactions. They were mostly consistent with those observed in models with the other cognitive factors and indicated that the identity—problem drinking associations weakened over time. However, implicit identity's positive association with problems was found to

increase over time even when controlling for consumption. It may be that the implicit measure's predictive utility does go up over time (i.e., perhaps it can predict escalation of problems). However, we caution against over-interpretation of this interaction: it was found rarely and multiple models were tested. It seems more likely that a measure's predictive utility would decrease over time, and that was a more common finding. The identity measures, like all measures, have genuine limitations, including measurement error. That will put an upper bound on how well and for how long they can predict. Moreover, the drop-off in prediction could be due to changes in participants' drinking behaviors and/or drinking identities. These factors are not mutually exclusive, and future research would benefit from addressing them.

Clinical Implications

A number of well-established interventions for college student drinking target the cognitive factors evaluated in the present study: social norms are targeted in normative feedback interventions, alcohol expectancies are targeted in expectancy challenges and in BASICS, and drinking motives are targeted in BASICS. More generally, a 2007 meta-analysis of individual-level interventions to reduce college student drinking found that 73% of interventions included normative comparisons and 34% included feedback on expectancies and/or motives (see Carey et al., 2007). As far we know, there are no interventions that directly target drinking identity. The results of the current study – namely, that the drinking identity measures not only predict over time and that those measures are not redundant with social norms, alcohol expectancies, or drinking motives – suggest that developing strategies to do so could have the potential to improve existing interventions or possibly serve as stand-alone interventions. We note also that it may be (and seems likely) that the relationship between drinking identity and problem drinking is bi-directional. It may be particularly advantageous to consider novel strategies that target changes to drinking identity among college student drinkers. Such strategies could involve developing adaptations of implicit measures like the IAT that aim to strengthen implicit associations between sobriety and the self, or could involve having students directly considering their identities and how to strengthen other important (and competing) aspects of their identity. Regardless, these findings suggest that changing drinking identity has the potential to reduce consumption and problems and that doing so would not be redundant with efforts to changing norms, motives, or expectancies.

Theory Implications

Study findings also have important implications for theory. While cognitive factors related to identity and the self – whether measured by explicit or implicit measures – have a long history in psychological theory (Greenwald & Banaji, 1995; Greenwald & Pratkanis, 1984; James, 1890/1950), there is a relative dearth of theorizing related to identity in the field of alcohol. For example, dual process formulations of hazardous drinking, which consider the role of implicit and explicit cognitive factors, make no mention of identity (e.g., Wiers et al., 2007) nor do classic texts about psychological theories of drinking and alcoholism (e.g., Leonard & Blane, 1999). This gap suggests an important opportunity to advance the field by extending theory to consider how identification with drinking could be important for the initiation, escalation, and cessation of drinking. Along such lines, Frings and Albery (2015)

have recently proposed a model of substance use recovery that posits that identification with recovery (i.e., a recovery identity) may be critical for ceasing substance use behaviors and have found some preliminary support for this model (Buckingham, Albery, & Frings, 2013). The results of the present study, which has a sample of “early career” drinkers as well as those who rarely or have not yet started to drink, suggests that drinking identity is also important for the initiation and escalation of drinking and the potential for improvement in current theoretical conceptualizations.

Limitations and Future Directions

Although the results of the study provide additional evidence that drinking identity is a novel cognitive factor, the study is not without limitations. First, the study sample consisted of students in the early college years. Whether findings would generalize to their non-college peers and/or to older adults will need to be established. Second, although the measures of consumption and problems are reliable and widely used by researchers, they are self-report measures and as such, are subject to the limitations of self-report. Third, this study focused on how baseline assessments of identity, norms, motives, and expectancies predict consumption and problems over time but did not focus on changes in identity, the other cognitive factors, or the outcomes measures. It also did not evaluate all of the factors, including identity, simultaneously. Fourth, the distribution of the explicit drinking identity was highly positively skewed and needed to be recoded as a binary variable to be used in analyses. On the one hand, even with that recoding strategy, explicit drinking identity was a consistent, strong predictor, frequently having the largest effect sizes, and it may be that the measure is an accurate reflection of the drinking identity of this sample (i.e., early college students, many of whom were non- or light- drinkers). On the other hand, the skewness in the distribution coupled with fact that the measure relies on self-report, could be a reflection of self-presentation concerns, and there is likely room for improvement in the measurement of explicit drinking identity. Finally, there was missing data in the study, particularly in later assessments, and we elected not to replace it using missing data strategies. The missingness was due to a number of factors, ranging from having an invalid implicit identity score to not completing a measure to not completing an entire follow up assessment. It resulted in an overall drop-off and variability in the number assessments per participant that could be included in analyses. Although the smaller numbers make the tests for drinking identity more conservative (due to less power), they may also limit the generalizability of findings.

Conclusion

The current study evaluated the contribution of implicit and explicit measures of identity as predictors of alcohol consumption and problems over time in a sample of students in their early college years. Even after controlling for important, well-established cognitive factors that predict problem drinking (i.e., social norms, alcohol expectancies, and drinking motives), both measures of identity generally predicted unique variance in consumption and problems. Stronger, more consistent effects were found for explicit identity. The identity measures, like nearly all of the cognitive factors, were less consistent at predicting consumption or problems over time after controlling for baseline drinking. Collectively, these findings provide further evidence that drinking identity is a novel cognitive factor and robust predictor of college student problem drinking. Further, they suggest that both

intervention efforts and theoretical formulations of problem drinking could respectively benefit from targeting and considering drinking identity.

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Table 1

Descriptive Statistics and Zero-order Correlations for Study Variables

	<i>M</i>	<i>SD</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.
1. Implicit ID	-0.08	0.45	--	.31	-.13	.11	.16	.14	-.21	.05	.11	.30	.41	.41	.18	.38	.29	.31	.29	.32	.32
2. Explicit ID	1.42	0.91	--	--	-.02	.27	.18	.22	-.05	.21	-.01	.43	.46	.42	.41	.54	.54	.33	.40	.53	.38
3. Sex	0.57	0.50	--	--	--	.18	.06	.05	.07	.01	-.08	.08	.06	.05	-.02	<.01	.03	.08	.01	.03	<.01
4. Norm-Des	15.95	14.55	--	--	--	--	.25	.13	.03	.11	-.04	.27	.27	.29	.24	.34	.29	.27	.15	.33	.19
5. Norm-Inj	4.48	1.03	--	--	--	--	--	.28	.03	.13	.05	.18	.27	.27	.22	.20	.17	.14	.09	.09	.12
6. Risk Exp	2.99	0.67	--	--	--	--	--	--	.27	.53	.03	.33	.37	.36	.22	.26	.26	.19	.09	.20	.09
7. Imp Exp	2.67	0.65	--	--	--	--	--	.28	--	.18	-.05	-.18	-.23	.07	-.23	.07	-.23	-.05	-.24	-.08	-.22
8. Sex Exp	2.10	0.72	--	--	--	--	--	--	--	-.03	.28	.21	.17	.27	-.16	.21	.11	.11	.10	.09	.15
9. Tense Exp	2.28	0.77	--	--	--	--	--	--	--	--	.08	.10	.07	-.07	.04	-.07	.01	-.01	-.01	.05	.01
10. Coping	7.93	4.08	--	--	--	--	--	--	--	--	--	.68	.67	.56	.40	.51	.30	.33	.36	.36	.25
11. Enhance	11.24	6.21	--	--	--	--	--	--	--	--	--	--	--	.88	.48	.51	.49	.48	.35	.57	.39
12. Social	12.60	6.73	--	--	--	--	--	--	--	--	--	--	--	--	.55	.54	.51	.48	.30	.51	.32
13. Conform	7.74	4.05	--	--	--	--	--	--	--	--	--	--	--	--	--	.24	.42	.19	.28	.28	.28
14. T1 Cons	5.10	8.54	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.66	.35	.55	.29	.29
15. T1 Prob	3.00	6.13	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.50	.62	.47	.45
16. T4 Cons	4.02	6.33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.51	.58	.43
17. T4 Prob	2.56	6.99	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.33	.68
18. T8 Cons	4.75	6.32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	.55
19. T8 Prob	2.51	5.83	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Note. T1 N = 506, T4 N = 380, T8 N = 325. Bolded values indicate statistically significant correlations ($p < .05$). Sex was coded 0 = men, women = 1. Implicit ID = scores on the drinking identity IAT; higher scores = stronger implicit drinking identity, Explicit ID = scores on the alcohol self-concept scale; higher scores indicate stronger drinking identity. Norms-Des = descriptive drinking norms (perceived number of weekly drinks consumed by a typical college student), Norms-Inj = injunctive drinking norms (average perceived approval for student drinking behaviors). Risk Exp = scores on the risk & aggression/liquid courage/sociability factor of the Brief Comprehensive Effects of Alcohol Questionnaire (B-CEOA), higher scores = greater agreement with the expectancy. Imp Exp = scores on the B-CEOA self-perception/cognitive & behavioral impairment factor. Sex Exp = scores on the B-CEOA sexuality factor. Tense Exp = scores on the B-CEOA tension reduction factor. Coping, enhance, social, and conformity = scores on the coping, enhancement, social, and conformity subscales of the Drinking Motives Questionnaire. Consumption = typical weekly drinks as measured by the Daily Drinking Questionnaire. Problems = scores on the Rutgers Alcohol Problem Index; higher scores = more problems.

Table 2
Evaluating T1 Drinking Identity as Predictors of Consumption and Problems Over Time

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Sex	0.62	-2.36*	0.22	0.94	-0.75	0.07	0.61	-1.87	0.18	0.89	-0.76	0.07
Time	0.93	-3.54***	0.33	0.99	-1.08	0.10	0.86	-2.67**	0.25	1.01	0.23	0.02
Implicit ID	0.27	-5.18***	0.49	1.55	3.73***	0.35	0.24	-3.56***	0.33	1.54	1.85	0.17
Explicit ID	0.12	-7.54***	0.71	2.23	7.77***	0.73	0.05	-4.56***	0.43	2.86	5.79***	0.54
Implicit ID x Time	1.19	3.70***	0.35	1.00	-0.08	0.01	1.21	1.86	0.17	1.09	2.00*	0.19
Explicit ID x Time	1.10	1.88	0.18	0.96	-1.86	0.17	1.15	0.84	0.08	0.87	-3.49***	0.33

<i>Controlling for Baseline Consumption</i>	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Baseline Consumption	0.35	-3.95***	0.39	1.03	5.66***	0.56	0.58	-3.94***	0.39	1.02	2.76**	0.27
Sex	0.66	-1.74	0.17	0.92	-0.97	0.10	0.70	-1.15	0.11	0.86	-0.89	0.09
Time	0.86	-3.75***	0.37	1.00	0.23	0.02	0.77	-4.08***	0.40	1.01	0.39	0.04
Implicit ID	0.56	-1.42	0.14	1.17	1.32	0.13	0.30	-2.05*	0.20	1.35	1.10	0.11
Explicit ID	0.64	-0.68	0.07	1.51	3.42**	0.34	0.54	-1.03	0.10	2.61	4.24***	0.42
Implicit ID x Time	1.17	1.87	0.18	1.02	0.89	0.09	1.37	2.13*	0.21	1.09	2.00*	0.20
Explicit ID x Time	0.99	-0.81	0.08	0.98	-0.81	0.08	0.98	-0.13	0.01	0.87	-3.31**	0.33

Note. Bolded values indicate statistically significant identity variables. Sex was coded 0 = men, women = 1. Implicit ID = scores on the drinking identity IAT; higher scores = stronger implicit drinking identity. Explicit ID = scores on the alcohol self-concept scale; higher scores indicate stronger drinking identity. Alcohol consumption = typical weekly drinks as measured by the Daily Drinking Questionnaire. Alcohol problems = scores on the Rutgers Alcohol Problem Index; higher scores = more problems. e^b = the exponentiated coefficient. Cohen's *d* = (2/*df*).

p < .001.

**
p < .01.

*
p < .05.

Table 3
Evaluating T1 Drinking Identity as Predictors of Consumption and Problems Over Time After Controlling for Social Drinking Norms

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Sex	0.67	-1.91	0.18	0.89	-1.50	0.14	0.73	-0.95	0.09	0.89	-0.71	0.07
Time	0.93	-3.39**	0.32	1.00	-0.25	0.02	0.84	-2.00*	0.19	1.02	0.76	0.07
Implicit ID	0.31	-4.34***	0.41	1.58	4.02***	0.38	0.35	-1.94	0.18	1.94	2.72**	0.26
Explicit ID	0.13	-6.97***	0.67	1.92	6.67***	0.64	0.08	-3.52***	0.34	3.09	5.59***	0.53
Norms - Descrip	0.99	-0.70	0.07	1.02	4.90***	0.47	0.92	-2.21*	0.21	1.00	-0.46	0.04
Norms - Injunct	0.79	-2.22*	0.21	0.96	-0.65	0.06	0.79	-0.81	0.08	1.03	0.23	0.02
Implicit ID x Time	1.18	3.33**	0.32	0.98	-0.59	0.06	1.20	1.50	0.14	1.04	0.77	0.07
Explicit ID x Time	1.12	2.30*	0.22	0.98	-0.87	0.08	1.07	0.31	0.03	0.87	-3.74***	0.36
Norms - Descrip x Time	1.00	-1.61	0.15	1.00	-2.47*	0.24	1.00	-0.28	0.03	1.00	0.55	0.05
Norms - Injunct x Time	1.03	1.55	0.15	1.00	0.26	0.02	1.06	1.07	0.10	1.02	0.71	0.07

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Baseline Consumption	0.34	-3.90***	0.39	1.03	4.88***	0.49	0.59	-3.45**	0.34	1.01	1.94	0.19
Sex	0.72	-1.30	0.13	0.89	-1.30	0.13	0.78	-0.70	0.07	0.85	-0.87	0.09
Time	0.85	-3.83***	0.38	1.01	0.42	0.04	0.78	-4.14***	0.41	1.01	0.41	0.04
Implicit ID	0.60	-1.22	0.12	1.14	1.09	0.11	0.34	-1.70	0.17	1.40	1.18	0.12
Explicit ID	0.69	-0.55	0.05	1.50	3.41**	0.34	0.57	-0.94	0.09	2.58	4.03***	0.40
Norms - Descrip	1.00	0.01	0.00	1.02	2.35*	0.23	1.01	0.75	0.07	1.02	1.70	0.17
Norms - Injunct	0.88	-0.94	0.09	0.93	-0.97	0.10	0.65	-1.63	0.16	0.85	-1.12	0.11
Implicit ID x Time	1.15	1.64	0.16	1.02	0.88	0.09	1.31	1.68	0.17	1.07	1.30	0.13
Explicit ID x Time	1.01	0.04	0.00	0.99	-0.58	0.06	1.00	0.02	0.00	0.88	-3.28**	0.33
Norms - Descrip x Time	1.00	-1.23	0.12	1.00	-1.52	0.15	0.99	-0.92	0.09	1.00	-0.82	0.08

	DV = Alcohol consumption			DV = Alcohol problems		
	Logistic Portion	Count Portion	Count Portion	Logistic Portion	Count Portion	Count Portion
Norms - Injunct x Time	e^b 1.03	t 1.07	d 0.11	e^b 1.01	t 0.68	d 0.07
				e^b 1.07	t 0.78	d 0.08
				e^b 1.05	t 1.49	d 0.15

Note: Bolded values indicate statistically significant identity variables. Sex was coded 0 = men, women = 1. Implicit ID = scores on the drinking identity IAT; higher scores = stronger implicit drinking identity. Explicit ID = scores on the alcohol self-concept scale; higher scores indicate stronger drinking identity. Norms-Descript = descriptive drinking norms; perceived number of drinks consumed by a typical student. Norms-Injunct = injunctive drinking norms; average perceived approval for problematic alcohol behaviors among students. Alcohol consumption = typical weekly drinks as measured by the Daily Drinking Questionnaire. Alcohol problems = scores on the Rutgers Alcohol Problem Index; higher scores = more problems. e^b = the exponentiated coefficient. Cohen's $d = (2t / df)$.

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

Table 4
Evaluating T1 Drinking Identity as Predictors of Consumption and Problems Over Time After Controlling for Expectancies

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Sex	0.56	-2.70**	0.25	0.91	-1.05	0.10	0.48	-2.35*	0.22	0.77	-1.53	0.14
Time	0.92	-3.06**	0.29	1.00	0.18	0.02	0.90	-2.07*	0.19	1.02	0.92	0.09
Implicit ID	0.32	-3.71 ***	0.35	1.44	3.17 **	0.30	0.33	-2.44 *	0.23	1.75	2.31 *	0.22
Explicit ID	0.16	-5.53 ***	0.52	1.87	5.96 ***	0.56	0.07	-5.41 ***	0.51	2.25	4.38 ***	0.41
Risk/LiqC/Soc	0.66	-1.36	0.13	1.68	4.26***	0.40	0.60	-1.37	0.13	1.48	2.12*	0.20
Impair/Self-perc	4.84	5.61***	0.53	0.76	-2.44*	0.23	4.25	3.58***	0.34	1.08	0.49	0.05
Sexuality	0.85	-0.88	0.08	1.07	0.99	0.09	1.20	0.61	0.06	1.46	2.72**	0.26
Tension Reduce	0.84	-0.99	0.09	0.92	-1.07	0.10	0.62	-1.77	0.17	0.64	-3.69***	0.35
Implicit ID x Time	1.20	3.30 **	0.31	0.99	-0.49	0.05	1.11	0.92	0.09	1.05	0.87	0.08
Explicit ID x Time	1.10	1.75	0.16	0.97	-1.24	0.12	1.24	1.60	0.15	0.91	-2.08 *	0.20
Risk/LiqC/Soc x Time	0.99	-0.17	0.02	0.96	-1.74	0.16	1.01	0.06	0.01	0.95	-1.47	0.14
Impair/Self-perc x Time	0.89	-2.00*	0.19	1.00	0.17	0.02	0.78	-2.70**	0.25	0.98	-0.58	0.05
Sexuality x Time	1.04	1.19	0.11	0.99	-0.50	0.05	0.92	-1.09	0.10	0.98	-0.76	0.07
Tension Reduce x Time	0.99	-0.33	0.03	1.00	0.01	0.00	1.11	1.47	0.14	1.08	2.56*	0.24

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Baseline DV	0.41	-5.37***	0.53	1.03	4.99***	0.49	0.52	-5.09***	0.50	1.01	1.78	0.18
Sex	0.59	-2.18*	0.22	0.87	-1.53	0.15	0.43	-2.27*	0.22	0.71	-1.84	0.18
Time	0.86	-3.63***	0.36	1.01	0.57	0.06	0.84	-2.07*	0.20	1.02	0.83	0.08
Implicit ID	0.62	-1.07	0.11	1.15	1.17	0.12	0.29	-1.73	0.17	1.58	1.63	0.16
Explicit ID	0.87	-0.22	0.02	1.44	2.86 **	0.28	0.91	-0.14	0.01	2.58	4.11 ***	0.41

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Risk/Liq/Soc	0.92	-0.26	0.03	1.41	3.14**	0.31	0.54	-1.38	0.14	1.21	0.87	0.09
Impair/Self-perc	2.68	3.07**	0.30	0.91	-0.78	0.08	4.21	2.71*	0.27	1.18	0.85	0.08
Sexuality	0.70	-1.17	0.12	1.03	0.37	0.04	0.93	-0.19	0.02	1.51	2.43*	0.24
Tension Reduce	0.69	-1.77	0.17	0.90	-1.35	0.13	0.57	-1.62	0.16	0.63	-3.19**	0.31
Implicit ID x Time	1.17	1.78	0.18	1.01	0.54	0.05	1.43	1.83	0.18	1.08	1.44	0.14
Explicit ID x Time	0.98	-0.23	0.02	0.98	-0.64	0.06	0.92	-0.45	0.04	0.87	-3.04**	0.30
Risk/Liq/Soc x Time	0.97	-0.53	0.05	0.97	-1.42	0.14	1.04	0.40	0.04	0.98	-0.51	0.05
Impair/Self-perc x Time	0.93	-1.11	0.11	0.99	-0.38	0.04	0.71	-2.48*	0.24	0.99	-0.32	0.03
Sexuality x Time	1.08	1.23	0.12	1.00	-0.25	0.02	1.10	0.68	0.07	0.99	-0.21	0.02
Tension Reduce x Time	0.99	-0.13	0.01	1.00	0.04	0.00	0.95	-0.44	0.04	1.05	1.56	0.15

Note: Bolded values indicate statistically significant identity variables. Sex was coded 0 = men, women = 1. e^b = the exponentiated coefficient. Cohen's $d = (2t / df)$.

p < .001.

**
p < .01.

*
p < .05.

Table 5
Evaluating T1 Drinking Identity as Predictors of Consumption and Problems Over Time After Controlling for Drinking Motives

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Sex	0.83	-0.83	0.08	0.88	-1.52	0.15	1.05	0.09	0.01	0.90	-0.64	0.06
Time	0.93	-1.93	0.20	0.99	-0.47	0.05	0.89	-1.15	0.12	1.04	0.98	0.10
Implicit ID	0.67	-1.12	0.11	1.48	3.09 **	0.31	0.57	-1.04	0.11	1.21	1.04	0.11
Explicit ID	0.62	-1.01	0.10	2.07	5.94 ***	0.60	0.38	-1.25	0.13	2.27	4.45 ***	0.45
Coping	1.02	0.27	0.03	1.01	0.75	0.08	0.99	-0.08	0.01	1.09	3.93 ***	0.40
Conformity	1.02	0.39	0.04	0.97	-1.96	0.20	0.75	-1.35	0.14	0.99	-0.54	0.05
Social	0.87	-3.06**	0.31	1.03	1.94	0.20	0.89	-1.76	0.18	1.05	2.09*	0.21
Enhancement	0.83	-2.68**	0.27	1.01	0.36	0.04	0.88	-2.30*	0.23	1.00	0.15	0.02
Implicit ID x Time	1.18	2.00 *	0.20	0.96	-1.41	0.14	1.21	1.03	0.10	1.08	1.63	0.17
Explicit ID x Time	0.99	-0.12	0.01	0.94	-2.31 *	0.23	1.05	0.29	0.03	0.88	-3.27 **	0.33
Coping x Time	1.00	-0.13	0.01	0.99	-2.28*	0.23	0.99	-0.38	0.04	0.99	-2.66**	0.27
Conformity x Time	1.01	0.52	0.05	1.00	0.57	0.06	1.02	0.86	0.09	1.00	1.00	0.10
Social x Time	1.00	0.31	0.03	1.00	-1.16	0.12	1.00	-0.09	0.01	0.98	-2.66**	0.27
Enhancement x Time	1.02	1.51	0.15	1.01	3.25**	0.33	1.02	1.08	0.11	1.02	3.31**	0.34

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Baseline DV	0.56	-4.31***	0.46	1.03	5.32***	0.57	0.77	-1.96	0.21	1.02	2.33*	0.25
Sex	0.81	-0.78	0.08	0.90	-1.25	0.13	0.83	-0.32	0.03	0.87	-0.68	0.07
Time	0.86	-2.33*	0.25	1.01	0.56	0.06	0.78	-1.16	0.12	1.02	0.49	0.05
Implicit ID	0.74	-0.58	0.06	1.12	0.99	0.11	0.41	-0.91	0.10	1.10	0.31	0.03
Explicit ID	2.23	1.11	0.12	1.41	2.70 **	0.29	1.91	0.64	0.07	2.15	3.23 **	0.34
Coping	0.88	-0.51	0.05	0.97	-1.39	0.15	0.81	-0.44	0.05	1.06	1.78	0.19

	DV = Alcohol consumption						DV = Alcohol problems					
	Logistic Portion			Count Portion			Logistic Portion			Count Portion		
	e ^b	t	d	e ^b	t	d	e ^b	t	d	e ^b	t	d
Conformity	1.05	0.72	0.08	1.00	0.30	0.03	0.94	-0.26	0.03	1.01	0.17	0.02
Social	1.00	-0.07	0.01	1.03	1.90	0.20	0.98	-0.09	0.01	1.04	1.11	0.12
Enhancement	0.85	-2.31*	0.25	1.02	1.10	0.12	0.90	-0.93	0.10	1.00	0.00	0.00
Implicit ID x Time	1.15	1.29	0.14	0.99	-0.28	0.03	1.38	1.02	0.11	1.08	1.32	0.14
Explicit ID x Time	0.83	-1.34	0.14	0.98	-0.97	0.10	0.80	-0.79	0.08	0.87	-3.39**	0.36
Coping x Time	1.01	0.23	0.02	1.00	-0.49	0.05	1.01	0.32	0.03	0.99	-1.47	0.16
Conformity x Time	1.00	0.20	0.02	1.00	-0.48	0.05	0.98	-0.49	0.05	1.00	0.49	0.05
Social x Time	0.99	-0.58	0.06	0.99	-1.74	0.19	1.01	0.11	0.01	0.99	-1.18	0.13
Enhancement x Time	1.02	1.27	0.14	1.01	2.10*	0.22	1.01	0.20	0.02	1.01	1.46	0.16

Note: Lifetime non-drinkers at baseline were excluded from these analyses. Bolded values indicate statistically significant identity variables. Sex was coded 0 = men, women = 1. e^b = the exponentiated coefficient. Cohen's *d* = (2*t* / *df*).

*** *p* < .001.

** *p* < .01.

* *p* < .05.