Normative Perceptions and Past-year Consequences as Predictors of Subjective Evaluations and Weekly Drinking Behavior

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Abstract

Problem drinking during the college years continues to be an important area of study. Subjective evaluations of consequences have recently been demonstrated to predict future drinking behavior; however, what predicts those evaluations is yet unknown. Social Learning Theory (SLT) provides a guiding framework in this study with primary aims to investigate whether individual differences in past experience with and normative perceptions of alcohol consequences predict subjective evaluations (i.e., the extent to which consequences are perceived as negative, aversive, or severe) and weekly drinking behavior. We also test whether evaluations mediate the influence of past consequences and norms on weekly drinking behavior. Following a baseline assessment, participants (N=96 regularly drinking college students, 52% female) completed ten weekly web-based surveys on previous week alcohol use, consequences, and subjective evaluations of those consequences. A series of hierarchical linear models were used to test hypotheses. Most mediational pathways were not supported – weekly level evaluations do not appear to fully explain the effect of norms or past experience on weekly level drinking behavior. However, results demonstrated that normative perceptions of and past experience with consequences were associated with both weekly drinking behavior and subjective evaluations, and evaluations remained significant predictors of alcohol use behavior after accounting for these important between-person influences. Findings support the importance placed by SLT on cognition in drinking behavior, and suggest that norms for consequences and subjective evaluations may be appropriate targets of intervention in college students.

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1. Introduction

College students have been identified as a group at risk for heavy alcohol use and associated problems (e.g., Hingson, Zha, & Weitzman, 2009; SAMHSA, 2012). While for some students, heavy drinking persists and even escalates beyond the college years, for others, heavy drinking resolves naturalistically over time (Littlefield, Sher, & Wood, 2010; O'Malley 2004/2005). Elucidation of predictors of the maintenance of versus naturalistic change in alcohol misuse can provide keys to improving interventions, by isolating appropriate targets.

The experience of negative consequences from drinking is one important catalyst for motivation to change (e.g., Barnett et al., 2003; Barnett, Goldstein, Murphy, Colby & Monti, 2006; Morgan, White & Mun, 2008; Read, Merrill, Kahler & Strong, 2007). Yet, it may not be the consequences themselves but rather the subjective evaluation of those consequences (i.e., the extent to which they are perceived as negative, aversive, and/or severe) that leads to behavioral change. In recent years, subjective evaluations have been found to be associated with drinking behavior (Gaher & Simons, 2007; Mallett, Bachrach & Turrisi., 2008; Merrill, Read, & Barnett, 2013; Patrick & Maggs, 2011). However, little is known about what predicts those subjective evaluations, or whether they mediate the impact of individual difference variables on drinking behavior.

Social Learning Theory (SLT, Bandura, 1969; 1986; Maisto, Carey & Bradizza, 1999) provides a unifying framework that guides the present study. SLT suggests that alcohol use is a behavior learned both through personal experience and vicariously (through interactions with the social environment), while also highlighting the mechanistic role of cognitions, or interpretations of these learning experiences, in the determination of behavioral outcomes. The goal of the present study was to test SLT-based direct effects of individual-level difference variables related to personal learning (past experience with consequences) and vicarious learning (normative perceptions of consequences) on alcohol use behavior, as well as indirect effects of these two variables (by way of influence on one's more proximal cognitive subjective evaluations of consequences) on alcohol use behavior.

1.1. Learning-Based Predictors of Drinking Behavior

1.1.1. Normative perceptions of consequences—SLT suggests that normative perceptions of drinking behavior represent one socio-environmental factor that results in the vicarious learning of one's own drinking behavior (Maisto et al., 1999). Likewise, the theory of normative conduct (Cialdini, Reno, & Kallgren, 1990) posits that an individual's behavior is influenced by perceptions about the behavior of others. Descriptive norms refer to how typical or common a person believes drinking behavior is in his or her peer group (Larimer, Turner, Mallett, Geisner, 2004). Though much of the extant literature focuses on descriptive norms for alcohol *use*, norms for alcohol *consequences* also may guide behavior. Perceptions of alcohol consequences as normative may influence drinking and interfere with naturalistic change by providing a justification for one's own drinking patterns, or by serving as a model of normative alcohol use behavior to which students attempt to conform (Caldwell, 2002). Few studies have examined whether higher normative perceptions of consequences are associated with higher levels of one's own alcohol use and consequences

(e.g., Lee, Geisner, Patrick & Neigbors, 2010a; Lewis et al., 2005), and no studies to our knowledge have examined the potential *mechanisms* of this association.

1.1.2. Prior experience with alcohol consequences—SLT (Maisto et al., 1999), as well as learning theory more broadly (e.g., Vogel-Sprott & Fillmore, 1999) posit a role for personal learning of alcohol information in the prediction of alcohol use behavior. Current drinking behavior may be a result of either reinforcement or punishment that has occurred through previous experience with alcohol consequences. While some research suggests that previous negative consequences should prompt an individual to change (Apodaca & Schermer, 2001; Vik, Culbertson & Sellers, 2000), other research suggests that those with more drinking experience may be *less* likely to change or to express interest in changing (Barnett et al., 2002; Barnett et al., 2003; Blume, Schmaling & Marlatt, 2006; Lewis, 2005; McCarthy, Pederson & Leuty, 2005; Read et al., 2007; Read, Wardell, & Bachrach, 2012; Thombs & Briddick, 2000). Yet again, mechanisms underlying this effect are left untested.

1.2. Proximal Predictors of Drinking Behavior: Subjective Evaluations of Alcohol Consequences

Cognitive appraisal of alcohol-related consequences, rather than the consequences themselves, may be an active mechanism of change. Subjective evaluation of consequences vary both between- and within-individuals (Mallett et al., 2008; Merrill et al., 2013; Patrick & Maggs, 2011), and have been shown to be associated with readiness to change (Barnett et al., 2002, 2003, 2006; Park, 2004; Ramsey et al., 2000) and retrospective reports of drinking (Gaher & Simons, 2007; Mallett et al., 2008). More recent studies have examined *prospective* associations between subjective evaluations and drinking behavior, demonstrating that personal evaluation of consequences predict alcohol use (Lee et al., 2010a) and consequences (Patrick & Maggs, 2011) over time. Recently, Merrill et al. (2013) demonstrated that experiencing a consequence that was subjectively worse than other consequences experienced previously by that same individual was associated with decreases in drinking the next week. While evidence is building that evaluations of consequences predict short-term changes in drinking behavior, questions regarding the individual difference factors that may predict more negative evaluations, and whether evaluations may mediate effects of such individual differences on drinking behavior, are left unanswered.

1.3. Influences of Learning Based Predictors on Evaluations

1.3.1. Normative perceptions of consequences—Individual differences in normative perceptions may be one factor that influences subjective evaluations. An individual who perceives that alcohol consequences are uncommon among friends may be more likely to evaluate a recently experienced consequence of his or her own as severe, and may in turn be more likely to change his/her drinking behavior. Zamboanga, Schwartz, Ham, Jarvis & Olthuis (2009) demonstrated in a sample of adolescents that higher norms for alcohol *use* were associated with less negative evaluations of alcohol's effects. In addition, Lee et al (2010a) reported a bivariate correlation indicating that higher perceived frequency of consequences in the typical student was associated with less negative evaluations of consequences. Norms may interfere with change in drinking behavior indirectly, such that believing consequences are less normative may be associated with viewing personal consequences more negatively, which in turn may result in decreased alcohol use behavior. This has yet to be tested.

1.3.2. Past experience with consequences—Like norms, prior experience with alcohol also may influence drinking behavior indirectly, through subjective evaluations. While the literature is mixed, with one recent study demonstrating that more experience with consequences was associated with rating consequences of alcohol as more bothersome

(White & Ray, 2013), some research suggests that more past experience with drinking behavior is associated with viewing consequences as *less* bothersome or important (Barnett et al., 2006; Patrick & Maggs, 2008). A student who has little experience with consequences, when encountering consequences, may perceive them more negatively, be more affected by them, and be highly motivated to avoid further consequences (Barnett et al., 2006). We might expect to see reductions in such a student's subsequent drinking behavior.

1.4. The Present Study

According to SLT, both vicarious and personal learning are important, and cognitive factors are the putative *mechanism* involved in associations between more distal factors and behavioral outcomes. While normative perceptions of and prior experience with consequences may affect students' future drinking behavior across time, both theory and research support that these individual difference variables may also influence subjective evaluations of consequences. Thus, their effects on drinking behavior may be mediated by such evaluations. The present study extends previous prospective research on subjective evaluations (Merrill et al., 2013; Patrick & Maggs, 2011) in several ways. First, we examine two potential learning-based, between-person predictors (i.e., consequence norms, past experience) of both drinking behavior (alcohol use, consequences) and subjective evaluations. We also test multilevel mediational pathways from these between-person predictors, to weekly within-person associations between subjective evaluations and alcohol use behavior. In addition, whereas Merrill et al. (2013) examined deviations from one's own typical evaluation score (i.e., the extent to which, on a given week, a student rates consequences more negatively than he/she typically does) as a predictor of change, whether deviations from the sample mean on evaluation scores (i.e., the extent to which a student rates consequences more negatively as compared to others) predicts week-to-week drinking behavior is yet unknown. This is important as it can help to identify more clearly whether students with relatively less negative evaluations *than their peers* are more at risk for continued problematic alcohol use. Our design and hypotheses have several important strengths, including a test of a theoretically-driven model of substance abuse and a prospective repeated measures design. Moreover, while much prior work has focused on the role of normative perceptions for alcohol *use* in college student drinking behavior, little research has been conducted to understand the role of normative perceptions of *consequences.* These strengths can allow us to more accurately ascertain mechanisms by which changes in drinking behavior occur.

1.4.1. Hypotheses—Based on theory and prior literature, we tested several hypotheses. First, we expected that (1) higher past year experience with consequences and higher normative perceptions of consequences would be associated with higher average weekly alcohol use and consequences. Second, we hypothesized that (2) lower past year experience with consequences and lower normative perceptions of consequences would be associated with more negative evaluations of recent consequences. Third, it was hypothesized that (3) more negative evaluations, as compared to the sample mean, would be associated with lower levels of next week alcohol use and consequences, above and beyond the effects of norms or past experience. Finally, we expected that (4) evaluations would partially mediate the effects of either or both normative perceptions of consequences and past experience with consequences (Figure 1) on drinking behavior. In particular, we hypothesized that (a) Higher normative perceptions of consequences → Lower negative evaluations → Higher weekly alcohol use/consequences; and (b) Higher past year consequences → Lower negative evaluations → Higher weekly alcohol use/consequences.

2. Materials and Method

2.1. Participants and Recruitment Procedures

All procedures were approved by the university's Institutional Review Board. Participants were 96 college students (Table 1), sampled from a larger ongoing longitudinal study examining traumatic stress and substance use among college students (Read, Colder, Merrill, Ouimette, White & Swartout, 2012). For this larger study, incoming students (N=773) at a university in the Northeastern U.S. were recruited in the summer prior to matriculation. The response rate of this larger study was 81%. At the time of data collection for the present study, these students were in their third and fourth years post-matriculation. Out of the 773 participants in the larger study, 169 met eligibility criteria for regular drinking (at least once/week) and had experienced at least one negative alcohol consequence over the past month. We sought to ensure sufficient variability in number and severity of alcohol consequences over the 10 weeks of assessment with good representation of high consequence drinkers, but to ensure a range of drinkers across consequence levels, low consequence drinkers were needed as well. Thus, we recruited high consequence drinkers (i.e., those reporting past-month alcohol consequences at least equal to the mean in the overall sample [2.84, SD = 3.76]) and low consequence drinkers (below the mean) from the eligible subsample of 169 at a 2:1 ratio.

Personalized e-mails describing the study and inviting participation were sent to eligible participants. Through an iterative process that continued until we achieved our desired sample of 100 participants (based on power analysis), 150 of the 169 eligible participants received invitations to be in the study. Sixty-seven percent of the 150 who were invited agreed to participate (N=100), and 96 of the 100 participants provided enough data to be included in data analytic models. Participants in the final sample did not differ from those who were eligible but who were not invited because we achieved our desired sample size early on (N=19) or those who or did not agree to participate (N=50) on past-year consequences, normative perceptions, typical weekly alcohol use, gender or age (all ps>.05).

2.1.1. Web-based assessment—With approval from the Institutional Review Board, a passive consent procedure was used; participants viewed an "Information Sheet" describing risks and benefits of the study. Using commercially available web-based assessment software, data were collected once per week (between Sunday and Monday) for ten consecutive weeks in the Spring semester. For each weekly survey (10–15 minutes), participants earned $2.50 (i.e., $25 over 10 weeks) in gift cards, and a bonus of up to $40 depending on the number completed.

2.2. Baseline Measures

2.2.1. Demographics—Participants reported gender, age, ethnicity, GPA, and educational status.

2.2.2. Past year experience with alcohol-related consequences—Participants reported past year consequences using the 24-item Brief Young Adult Alcohol Consequences Questionnaire (B-YAACQ, Kahler, Strong & Read, 2005). The B-YAACQ contains minimal redundancy, includes only those items from the original 48-item YAACQ (Read, Kahler, Strong & Colder, 2006) that most closely follow a unidimensional model, and demonstrates strong psychometric properties (Kahler et al., 2005). Example items include "I have felt very sick to my stomach or thrown up after drinking" and "I have woken up in an unexpected place after heavy drinking". As consequences are scored dichotomously, the total score is a count of different types of consequences experienced in the past year. In the present sample, alpha was .94.

2.2.3. Normative perceptions of consequences—Perceived norms for alcohol consequences were assessed by asking participants to report whether, in the past year their "typical" same-gender close friend experienced each of the 24 consequences from the B-YAACQ (Kahler et al., 2005). This particular referent group was chosen as norms of close friends (LaBrie, Hummer, Neighbors & Larimer, 2010; Lewis, 2005) and those of the same gender (LaBrie et al., 2011; Rimal & Real, 2003) are most closely linked to one's own drinking behavior. Previous work documents the validity of similar items as predictors of college student drinking (Lee et al., 2010a; Read, Wood, Davidoff, McLacken, & Campbell., 2002; Wood, Read, Palfai, & Stevenson, 2001). In the present sample, alpha was .97.

2.3. Weekly Measures

2.3.1. Past-week alcohol use—Participants reported the number of standard drinks consumed on each day in the past week, using a format modeled after the Daily Drinking Questionnaire (Collins, Parks & Marlatt, 1985). The web survey page included a Standard Drink Conversion chart indicating what constitutes a standard alcoholic drink. Average alcohol quantity (drinks per drinking day) was calculated for each week.

2.3.2. Past-week alcohol consequences—Participants reported whether, over the past week, they had experienced any of the same 24 B-YAACQ consequences assessed at baseline. A weekly consequence outcome variable represented the total number of different consequences experienced over the past week. Across ten weeks, alphas for this measure ranged from .90 to .95.

2.3.3. Subjective evaluations—Subjective evaluation items were designed to tap a unified construct of how negative, severe, and/or aversive a student perceived an experienced consequence to be (Merrill et al., 2013). The web survey was programmed so that upon endorsement of a consequence, follow-up questions about that consequence were presented. This included two items from previous work (Barnett et al., 2006; Longabaugh et al., 1995) to reflect the aversiveness of the incident ("To what extent did the experience upset you?", "How badly do you feel about the experience?"), and three additional items ("How negative was the experience for you?", "Given the range of problems that may result from alcohol use, how severe do you think this type of experience is?", "How bad do you think it is that you had this experience?"). Responses ranged from 1 (not at all) to 7 (extremely). For each consequence reported, scores across the five items were summed. The average alpha across consequences for each of the 10 weeks was .83 to .91.

Students often experienced more than one single consequence in a given week. The highest subjective evaluation sum score across consequences on each week was used in analyses. This variable essentially represented one's "worst" consequence over the past week – the most negatively evaluated consequence among those experienced (Merrill et al., 2013; Park, 2004).

3. Data Analytic Plan

Hierarchical linear modeling (HLM) was used to test all hypotheses. HLM is an ideal approach for the analysis of longitudinal data characterized by weekly measurements nested within persons, as it requires fewer assumptions than other approaches that can be used with such data. HLM allows examination of within-person associations (i.e., whether subjective evaluations of consequences determine subsequent level of drinking on one week as compared to another), while providing natural controls for between-individual differences (Raudenbush & Bryk, 2002). In addition, unlike other approaches (e.g., repeated measures

GLM), HLM can handle data where spacing between observations (in this case, weekly observations) and number of observations differs from one participant to the next. Analyses were conducted using HLM 6.0 (Raudenbush, Bryk, Cheong, Congdon & Toit, 2004), with full maximum likelihood estimation.

3.1. Data Screening and Preparation

Analysis began with a screen for missing data and tests for violations of the assumptions of HLM. Across the final sample (N= 96), data were missing due to failure to complete surveys on 66 out of 960 potential weekly assessments (7%), and less than .01% of items were skipped.

Before importing data into the HLM program, outcome variables (use and consequences) were lagged in the SPSS program (e.g., Week 2 Use was copied into a new variable named "Week 1 NEXT Use, Week 5 Use was copied into a new variable named "Week 4 NEXT Use"). When data were restructured into the person-period data set format necessary for the HLM program, the outcome variable of "Week 1 NEXT Use" and the independent variables of "Week 1 Use" and "Week 1 Evaluation" all corresponded to Week 1 assessments (even though Week 1 Next Use was actually collected at Week 2). As such, the prior week's use could be controlled (as a time-varying covariate that differed each week) when predicting the following week's use. The multilevel person-period dataset comprised 10 weekly observations nested within the final sample size of 96 persons (960 survey points). Alcohol use was normally distributed, and a square-root transformation of alcohol consequences resolved both non-normality in this outcome variable and a violation of the homogeneity of Level 1 variances assumption in consequence models. In models with alcohol use as the outcome, there was a violation of normality of Level 2 (between-person level) errors and heterogeneity of Level 1 variances. We also observed non-normality of Level 1 residuals in models predicting evaluation scores. Thus, robust standard errors were used (Zeger, Liang, & Albert, 1988) when predicting alcohol use and evaluations.

3.2. Substantive Analyses

Fully unconditional models were used to determine intraclass correlations (ICCs) for alcohol use, consequences and subjective evaluations. This allowed a test of whether multilevel models were appropriate (i.e., whether there was between- and within-person variation in outcomes; Raudenbush & Bryk, 2002). Subsequently, Level 1 (within-person) and Level 2 (between-person) variables were added to models consistent with hypotheses. Finally, effect sizes were calculated (Rosenthal & Rosnow, 1991). Effects of $r = 0.1 – 0.23$ are considered small, $r = 0.24 – 0.36$ are medium, and r 0.37 are large (Cohen, 1988).

4. Results

4.1. Retention and Response Rates

The average number of ten weekly surveys completed was 9.36 (SD=1.67). Seventy-seven participants (79%) completed all ten; 12 (12%) completed between seven and nine weekly surveys. Across 960 points of data collection (96 participants x 10 weeks), 894 (93%) were completed.

4.2. Descriptives

Sample demographics and descriptive statistics for variables assessed weekly are presented in Table 1. Consistent with previous work (Baer & Carney, 1993; Lee et al., 2010a; Lewis, 2005), norms for consequences were over-estimated, as evidenced by higher mean number of perceived than personal consequences (Table 1). ICCs indicated that 55% and 28% of the

variance in alcohol use (average quantity) and consequences, respectively, was at Level 2 (between individuals; differences between participants).

Endorsement rates and subjective evaluation scores by consequence type are reported in full elsewhere (Merrill et al., 2013) and described briefly here. The mean evaluation score observed across all consequences indicates that on average participants rated the consequences as "somewhat negative/severe/upsetting" across the 5 evaluation items. Participants experienced the full range of consequences, with all but two consequences reported at least once by 20% or more of our sample. The three most negatively rated consequences on average were "Had quality of your work or schoolwork suffer", "Had problems with boyfriend, girlfriend, spouse, or parents" and "Drove a car when knew had too much to drink". These consequences were experienced at least once by 35%, 20%, and 40% of our sample, respectively. Across weeks, there were 563 occasions on which consequences occurred. The consequence that was rated as worst each week varied greatly, covering the full range of 24 consequences assessed. The most frequently rated "worst" consequences were "had less energy or felt tired because of your drinking. (n=133 occasions)" and "Ended up drinking on nights when you had planned not to drink" (n=56). Evaluation scores within these consequence experiences ranged both across and within participants. Forty-two percent of the variance in evaluation scores was between individuals. Thus, examining between-person predictors (normative perceptions, past experience) of evaluations was warranted.

4.3. Substantive Analyses

In the HLM models, all intercept effects were specified as random, to allow individual differences in mean levels of use and consequences; slope effects were fixed. Gender was included as a Level 2 predictor of the intercept in all models predicting alcohol use, given that male students typically consume more than females (Johnston, O'Malley, & Bachman, 2003; O'Malley & Johnston, 2002). However, gender was found to be a non-significant predictor of alcohol consequences and for reasons of parsimony was not included in consequence models reported here. Though males report higher alcohol use, in part due to differences in alcohol metabolism, women and men seem to reach equivalent blood alcohol levels (e.g., Carey, Neal, & Collins, 2004; Hustad & Carey, 2005). Accordingly, some research also shows that males and females also experience consequences at similar levels (e.g., Nolen-Hoeksema, 2004; Perkins, 2002; White, Jamieson-Drake & Swartzhelder, 2002). Level 2 predictors of interest were sample-mean centered (by subtracting the mean of norms or experience at Level 2 across all participants at baseline).

One advantage of testing mediation in multilevel analyses is the ability to model a mediational chain (Figure 1) in which a between-subjects variable influences a within-subjects variable, by way of its effect on a second, mediating, within-subjects variable, while still accounting for the clustered structure of the data (Krull & MacKinnon, 2001; MacKinnon, 2008). Still, the procedure follows similar conceptual steps as in single-level, regression-based mediation models (Baron & Kenny, 1986) in that it involves an examination of the influence of (1) the independent variable (IV) on the dependent variable, (2) the IV on the mediator, (3) the mediator on the dependent variable (DV), above and beyond the influence of the IV, and (4) a test of the significance of the mediated effect. Each of these steps corresponded to hypotheses forwarded for direct and indirect effects.

4.3.1. Step 1: Effects of IVs on DVs—The first step of multilevel mediation provided a test of our first hypothesis – that (1) higher normative perceptions of and more past experience with alcohol consequences would predict higher levels of alcohol use and consequences across weeks. Four separate models were run; each one included one of two

IVs (either norms or past year consequences) as a predictor of one of two DVs (use, consequences). Higher normative perceptions of consequences at baseline were associated with higher weekly reports of both alcohol use (B=.15, SE=.04, p <.01) after controlling for gender, and with alcohol consequences (B=.03, SE=.01, p<.01). Effect sizes on both use (r = .37) and consequences (r =.39) were large. Similarly, higher past experience with consequences at baseline was associated with higher weekly reports of both alcohol use (B=.22, SE=.05, p<.01) after controlling for gender, and alcohol consequences (B=.06, SE=.01, p<.01). Again, effect sizes on both use (r =.38) and consequences (r = .61) were large. Our first hypothesis was supported.

4.3.2. Step 2: Effects of IVs on Mediators—The next step of multilevel mediation provided a test of our second hypothesis – that (2) higher normative perceptions of and more past experience with alcohol consequences would predict less negative subjective evaluations. Two separate models were run; each one included a single IV (either norms or past year consequences) as a predictor of the mediator of the proposed mediational model (subjective evaluations). Both IVs were associated with evaluations, but not in the expected direction. Reporting higher than the sample average on norms (B=.19, SE=.09, p<.05) and on one's own past year consequences (B=.31, SE=.13, p<.05) was associated with higher negative evaluation scores. The effect sizes were small (r = .20) and medium (r = .24), respectively. Though the direction of the effects of the between-person predictors on evaluations was unanticipated, given their significance, we continued on in the test of mediation.

4.3.3. Step 3: Effects of IVs and Mediator on Outcomes—The third step of mediation allowed a test of our third hypothesis – that (3) more negative subjective evaluations would significantly predict weekly drinking behavior above and beyond the influence of norms and past experience. Evaluations were sample-mean centered (by subtracting the mean on evaluations at Level 1 across all participants and all 10 time points). Results are presented in Table 2. As hypothesized, higher negative evaluations in a given week were associated with decreases in alcohol use the following week, controlling for prior week's alcohol use at Level 1 and above and beyond the between-person influences of both gender and either norms or past year consequences (ps<.05). Similarly, consistent with our hypothesis, whether including norms or past year consequences at Level 2, more negative evaluations were associated with fewer alcohol consequences the following week, controlling for prior week consequences (ps<.05)[1]. Across models predicting either use or consequences, and controlling either Level 2 norms or past year consequences, effect sizes for evaluations were small (range r = .10 to .11).

4.3.4. Step 4: Testing Significance of Mediated Effects—As norms and past experience remained significant when controlling for the mediators, full mediation was not observed. To test partial mediation, the magnitude of mediated effects were calculated using the a*b method (multiplying the effect of the IV on the mediator by the effect of the mediator on the DV), and Sobel's (1982) formula was used to calculate the standard errors of those effects. Finally, asymmetric confidence intervals (CIs) were calculated using RMediation (Tofighi & MacKinnon, 2011) to determine whether mediated effects were significant. The indirect effects from norms to evaluations to both use and consequences,

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[1]Models also were run with the additional control for a person's average evaluation scores across the 10 weeks (at Level 2) in order to isolate the effect of a person's evaluations on any given week affecting the next week's drinking behavior. These models allowed us to remove any confound between average ratings a person tends to give and variations in weekly experience, thus testing whether weekly evaluations were significant even after controlling for a person's general tendency to rate evaluations as more or less negative. Average evaluations at Level 2 were not significant predictors of weekly drinking behavior in any model, while weekly variation in evaluations remained significant. Therefore, we chose to present the more parsimonious models without these additional controls.

and the indirect effect from past year consequences to evaluations to weekly consequences were non-significant (all CIs included 0). However, we observed a significant indirect effect whereby higher past year consequences predicted more negative evaluation scores, which in turn predicted decreases in alcohol use at the weekly level (B= −.017, 95% CI [−.04 – −.001]); Figure 2.

5. Discussion

In this study, we examined theorized associations among normative perceptions of and past experience with consequences, subjective evaluations, and weekly reports of alcohol use and consequences in regularly drinking college students. Prior work has demonstrated that subjective evaluations of recent consequences that are more negative relative to one's own typical evaluations predict future drinking behavior (Merrill et al., 2013) and that norms for consequences (Lee et al., 2010a) and past experience with consequences (Read et al., 2012) predict one's own drinking behavior. The present study builds on this prior work by demonstrating that (a) norms and past experience with consequences are associated with subjective evaluations, and (b) more negative subjective evaluations predict lower levels of future alcohol use and consequences even after controlling for the influence of norms or past experience. This study also adds to the literature evidence that consequence norms, a variable largely understudied, predict drinking behavior across 10 weeks in college students. However, we did not find evidence that subjective evaluations explain the positive association between norms or past year consequences on weekly drinking behavior.

One of the most important findings to emerge from our analysis was that a given week's evaluation scores predicted subsequent week alcohol use and consequences above and beyond the large effects of both norms and past experience with alcohol consequences. That is, regardless of one's perception of the level of consequences one's friends have experienced or the level of consequences one has experienced him/herself over the past year, when a student perceives a *recent* consequence as particularly negative, he or she is likely to drink less and with fewer consequences the following week. In a recent study by our group (Merrill et al., 2013), subjective evaluations were person-centered (representing deviations from *one's own* average evaluation). Here, we have built on this by examining mean-centered subjective evaluations. Our findings from this analysis suggest that students who evaluate consequences more negatively *than other students* are more likely to modify their drinking. Taken together, findings are consistent with Bandura's SLT (1969) view that behavior is a function of both external stimulus events (e.g., social environment; norms) and internal processing systems and self-regulation (subjective evaluations).

Of note, the role of norms and past experience was consistent across models with only these between-person variables as predictors, as well as in models also including within-person factors (i.e., past week behavior, subjective evaluations). Specifically, individuals with higher normative perceptions regarding the consequences experienced by one's typical close friend, and those with more past year experience with alcohol consequences, also reported higher average levels of drinking and consequences across 10 weeks. Few studies have examined the role of normative perceptions of alcohol consequences (rather than of alcohol use) in college drinking, and as such, this finding offers an important contribution to the literature.

The present study also revealed that perceived consequence norms and past experience significantly predicted subjective evaluations, though not in the direction that we hypothesized. The unexpected finding that higher levels of past experience were associated with more negative evaluations is in contrast with our hypotheses, and with some prior literature. Of note, one recent study also demonstrates that individuals with more past

experience with consequences may rate consequences as more bothersome (White & Ray, 2013). One potential explanation for the association between higher past experience with consequences and more negative evaluations is that the *accumulation* of adverse alcohol events over time in these more involved drinkers may have resulted in what Baumeister, Heatherton & Tice (1994) termed a "crystallization of discontent." Alternatively, students who have experienced more past consequences also may have experienced consequences that are different in some way, and perhaps more likely to evoke change in subsequent drinking. For example, it may be that consequences of a particular type (e.g., interpersonal, requiring medical attention, particularly embarrassing, etc) are more likely to affect later drinking. It also is possible that the evaluations of consequence as more negative may in part be a function of the types of consequences more heavily involved drinkers report. Indeed, some research suggests that the type of consequence may be important for whether increased versus decreased drinking occurs over time (Blume et al., 2006; Read et al., 2007; 2012). Future research could examine the link between past experience and evaluations at a more consequence-specific level.

The differences between the direction of the past experience effect on evaluations in our study and some prior research might be explained by methodological differences across studies. Whereas we analyzed past year consequences at baseline as a measure of past experience, Barnett et al. (2006) examined past month alcohol *use*, and Patrick and Maggs (2008) measured consequences across the prospective 10 weeks of their study. Further, Patrick and Maggs examined the *importance of* negative consequences as compared to the *severity/negativity* as assessed here. Future research incorporating multiple timeframes (both past month and year), behavioral outcomes (both drinking and consequences), and evaluation measures into a single study might shed light on current discrepancies in the literature.

The finding that higher norms for friends' consequences predicted more negative evaluations also diverges from prior work (Zamboanga et al., 2009). Here again, differences in measurement approach may have played a critical role. In our study we assessed perceptions of peer *consequences* (descriptive norms) whereas Zamboanga et al. assessed perceptions of peer *use* and peer approval of use (injunctive norms), which may have a very different set of antecedents and outcomes (Larimer et al., 2004). Further, Zamboanga et al's sample consisted of adolescents, the majority of whom were non-drinkers, a contrast to our sample of regularly drinking college students. The observed association between higher norms for consequences and more negative evaluations may reflect the ambivalence regarding drinking behavior that is common in college students; while students may recognize that their consequences are severe, they also perceive their peers to be engaging in similarly problematic behavior.

Based on SLT, our fourth hypothesis was that subjective evaluations – a cognitive process – would mediate the path from between-person factors and next week drinking behavior. We observed a significant indirect effect for one of the four hypothesized paths (from past year consequences to evaluations to alcohol use); however, the effect was one of "inconsistent mediation" (MacKinnon, Fairchild, & Fritz, 2007) whereby the negative direction of the indirect effect is inconsistent with the positive direction of the direct effect of past year consequences on weekly drinking. As such, while evaluations do not fully *explain* the influence of past year consequences on weekly drinking behavior, they do demonstrate a pathway by which learning occurs, beyond the direct path from past experience to current behavior only. Specifically, individuals who have had more negative consequences in their recent past may start to become sensitized to such consequences; the accumulation of such events may lead to a general discontent with their drinking, which in turn may result in more negative evaluations of consequences, on average, when they do occur. However, on weeks

when students rate their consequences particularly negatively (i.e., a higher deviation on evaluations from all students and all consequence experiences), they adjust their drinking downward the following week. As the direction of the effect is inconsistent with our *a priori* hypothesis, and as a similar effect was not observed across the three other mediational tests, our interpretation is tentative and replication in future studies will bolster confidence in this finding. Though evaluations emerged as important in this study, they do not *fully explain* the influence of either norms or past experience with consequences on weekly drinking or consequence levels. Other mediators of the link between past experience or normative perceptions of consequences and weekly drinking behavior should be tested in future work. Other potential cognitive mediators may include alcohol expectancies (Goldman, Del Boca & Darkes, 1999) or drinking motives (Cooper, Frone, Russell & Mudar, 1995).

5.1. Limitations and Future Directions

The limitations of this study point to several future directions for research. First, that the sample was comprised solely of regularly drinking junior and senior college students may limit the generalizability of findings. Learning processes that occur through the experience of consequences may differ in younger students or more novice drinkers. It is possible that the hypothesis that higher norms and past experience with consequences would predict less (not more) negative evaluations would be observed in younger students. Second, normative perceptions were conceptualized as a stable between-person variable in the present study; however, norms could change with time and their influence on evaluations could be measured at the within-person level in future studies. Of note, in the larger study from which our participants were drawn, norms did correlate highly across time points that were up to three months apart (r=.70 to .80). This speaks to the stability in this variable, which may be particularly likely to be more stable in these older college students.

Third, weekly assessment of drinking, consequences, and evaluations provides more detailed analysis of the associations of interest than has been done before; however, future work might benefit from use of daily data and/or ecological momentary assessment to examine links between evaluations and changes in drinking behavior, as they occur in the shorter-term or even in the moment. Additionally, it would be interesting to examine the associations tested here in a more consequence-specific manner (e.g., do norms for blackouts predict evaluations of blackouts, which in turn predict the future experience of blackouts specifically?). Finally, we assessed consequences typically viewed as negative, and did not assess consequences of alcohol use that are more likely to be uniformly positive (e.g., social enhancement, tension reduction). Nor did we assess positive evaluations of the consequences experienced by our participants. Positive consequences can influence one's overall perception of a drinking occasion (Lee et al., 2010b), and therefore may offset the effect of negative consequences on self-change in drinking. As such, the small effect sizes of negative evaluations on future drinking may be due to the unmeasured role of positive consequences or positive evaluations in this study.

5.2. Clinical Implications

Personalized feedback and motivational interviewing techniques (e.g., Baer, Kivlahan, Blume, McKnight & Marlatt, 2001; Borsari & Carey, 2001; Murphy et al., 2001), which typically involve providing feedback on alcohol use and related consequences, are among the most popular and effective interventions to target drinking among college students. The present findings suggest that such treatments may be enhanced by emphasizing not only the consequences experienced, but personal cognitive appraisals of one's consequences – a component more fully targeting how students evaluate the impact of their drinking-related problems. Within these interventions, treatment providers should use as motivational material only those consequences students view negatively. Subsequently, perhaps whether

individuals evaluate consequences more negatively over the course of treatment may be a useful marker of treatment progress. Whether subjective evaluations are malleable and can be targeted in intervention has yet to be tested.

Findings also suggest that both normative perceptions and past experience with consequences represent risk factors for higher levels of alcohol use behavior. Thus, individuals with these factors may need to be prioritized for intervention. As mentioned, whereas many studies have examined the role of normative perceptions of alcohol use, we sought to examine the impact of normative perceptions of *consequences.* Higher norms for consequences were associated with higher average levels of alcohol use and consequences across the 10 weeks of this study, suggesting a potential value for inclusion of normative perceptions of consequences, and not just alcohol use norms in social norms campaigns or personalized feedback interventions.

In this study, we found that the perception that consequences are common in one's friends was not associated with lower negative evaluations of one's own recent consequences. Therefore, though public health social marketing campaigns, which target misperceptions of normative drinking behavior show efficacy (e.g., Graham, Tatterson, Roberts, & Johnston, 2004; Neighbors, Larimer, & Lewis, 2004), subjective evaluations of consequences are unlikely to be a mechanism of their effect. If such universal prevention approaches are used, proponents should refrain from highlighting the possibility of alcohol consequences that are rated least negatively by students, as these will be less likely to motivate change.

5.3. Conclusion

The knowledge gained from this study addresses gaps in the extant literature, and may inform both theory and practice. Consistent with SLT, cognitions (subjective evaluations) are proximal predictors, with both direct learning (experience with consequences) and indirect learning (modeling/norms) from the environment that has occurred over the past year also playing a role in the determination of weekly drinking behavior. Findings may help guide the refinement of effective and focused preventive substance use interventions for college students. Such interventions may benefit from inclusion of a component seeking to foster in students more negative subjective evaluations of consequences. Future research should (a) examine the role of evaluations and their predictors in younger college students, (b) measure norms and other psychosocial factors as the vary over time in the prediction of evaluations, and (c) use even more fine-grained methodologies (e.g., ecological momentary assessment) to understand how consequences are evaluated in real-time, are influenced by contextual factors, and may predict shorter-term drinking decisions.

Abbreviations

SLT	social learning theory
HLM	hierarchical linear modeling
ICC	intraclass correlation
IV	independent variable
DV	dependent variable

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Highlights

- Examined learning-based predictors of drinking behavior and consequence evaluations

- Consequence norms were positively associated with drinking behavior and evaluations

- Past consequences were positively associated with drinking behavior and evaluations

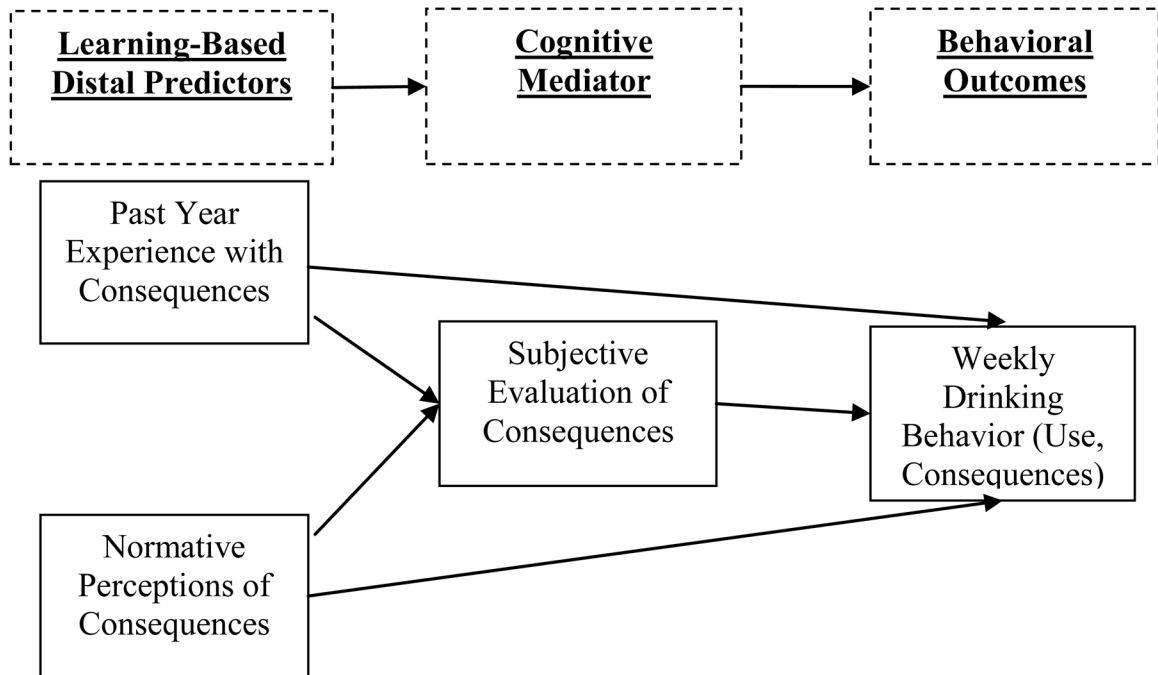- Evaluations predicted drinking behavior after controlling learning-based predictors

Figure 1.
Social Learning Based Conceptual Model: Predictors of Variation in Drinking Behavior
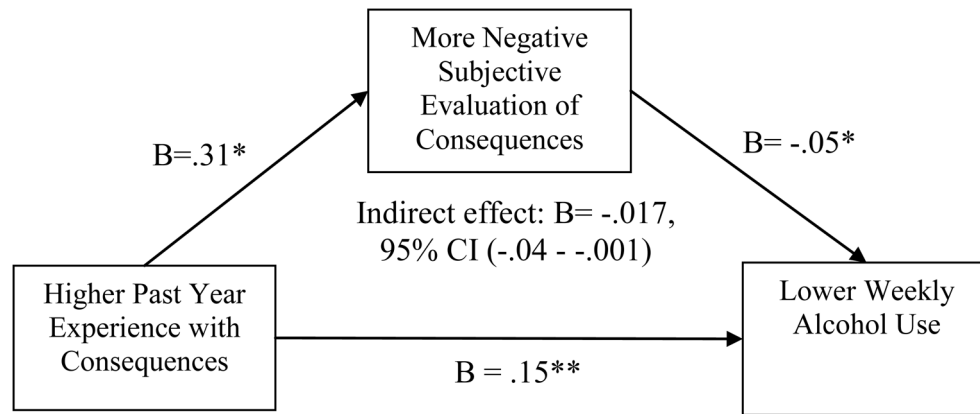
Figure 2.
Significant Partial Mediation of Effect of Past Year Consequences on Weekly Drinking by Subjective Evaluations. Note: *p<.05, **p<.01

Table 1

Descriptive Information for Final Sample at Baseline (N=96)

Demographics	
	N (%)
Gender	
Female	50 (52.1)
Male	46 (47.4)
Race/Ethnicity	
White	79 (82.3)
Hispanic/Latino	5 (5.2)
Black	2 (2.1)
Asian	7 (7.3)
Multiracial	3 (3.1)
Year in School	
Junior	38 (39.6)
Senior	58 (60.4)
	Mean (SD)
Age	20.92(0.52)
Grade point average	3.29 (0.46)
Experience: Past year consequences	10.33(5.36)
Norms: Past-year consequences	16.17 (6.29)
Weekly Variable Averages	
	Mean (SD)
Subjective Evaluation Score (highest)	17.13 (7.85)
Alcohol Consequences	2.15 (2.63)
Alcohol Use Quantity (drinks per drinking day)	5.42 (4.04)
Alcohol Use Frequency (days per week)	2.24 (1.48)

Table 2

Within-person Influences of Negative Evaluation Scores and Between-person Influences (Norms, Experience) on Next Week Alcohol Use and Consequences

	Alcohol Use as Outcome				Alcohol Consequences as Outcome			
	Norms at L2		Past year cons at L2		Norms at L2		Past year cons at L2	
FIXED EFFECTS	**B (SE)**	ES	**B (SE)**	ES	**B (SE)**	ES	**B (SE)**	ES
Intercept of Next Wk Behavior	3.34(.58) ***	.51	3.26(.58) ***	.50	.71(.08) ***	.68	.75(.08) ***	.70
Within-person (Level 1) influences								
Last Wk Behavior	.21(.11) †	.09	.23(.11) *	.09	.11(.02) ***	.27	.10(.02) ***	.24
Subjective Eval	**−.05(.02)** *	.11	**−.05(.02)** *	.11	**−.01(.01)** *	.11	**−.01(.01)** *	.10
Between-person (Level 2) influences								
Norms	.12(.03) ***	.33			.03(.01) **	.32		
Past year cons			.15(.05) **	.30			.04(.01) ***	.40
Gender	1.90(.52) ***	.35	1.87(.52) ***	.35				
MODEL FIT								
Deviance	2609.77(7)		2607.75(7)		1308.03(6)		1300.69(6)	
AIC	2623.77		2621.75		1320.03		1312.69	
BIC	2641.72		2639.70		1335.42		1328.08	

Note: B = unstandardized beta, SE = standard error, ES = effect size; Next Wk Behavior = Next week drinking behavior (use or consequences); Last Wk Behavior = Past week drinking behavior (use or consequences); Subjective Eval = Subjective negative evaluations; Norms = Normative perceptions of number of consequences among friends, Past year cons = Total number of past year consequences reported;

†
p .10,

*
p .05,

**
p .01,

***
p .001;

bold = effects of primary interest