Published in final edited form as:

Addict Behav. 2018 May ; 80: 39–46. doi:10.1016/j.addbeh.2017.12.022.

The relative strength of attitudes versus perceived drinking norms as predictors of alcohol use[★]

Angelo M. DiBello^{a,*}, Mary Beth Miller^a, Clayton Neighbors^b, Allecia Reid^c, and Kate B. Carey^a

^aCenter for Alcohol and Addiction Studies, Department of Behavioral and Social Sciences, Brown University School of Public Health, Box G-S121-5, Providence, RI 02912, United States

^bDepartment of Psychology, University of Houston, Houston, TX 77204-5022, United States

^cDepartment of Psychology, Colby College, Waterville, ME 04901, United States

Abstract

Social cognitive factors such as perceived norms and personal attitudes toward alcohol consumption are reliable predictors of alcohol use and related problems. The current study aimed to evaluate the relative importance of one's attitude toward alcohol use as a unique and important predictor of drinking related outcomes when directly compared to perceived descriptive and injunctive norms. Participants were mandated students ($n = 568$; 28% female) who violated a campus alcohol policy and received a Brief Motivational Intervention. Analyses included the use of linear regression for prospective predictions to evaluate the relative importance of predictors which included perceived descriptive norms and injunctive norms, and attitudes toward moderate and heavy alcohol use. Overall, the results indicate that one's attitude toward heavy alcohol use is a stronger predictor of drinks per week, binge frequency, as well as alcohol related problems when directly compared to norms. Thus, the findings of the current study provide a compelling rationale for incorporating attitudes in the development and refinement of intervention strategies.

Keywords

Alcohol; Drinking; College students; Attitudes; Social norms

[★]This research was supported by grants from the National Institute on Alcohol Abuse and Alcoholism (R01-AA012518, PI: Kate B. Carey, T32-AA007459, PI: Peter Monti, and R01 AA014576-07A2, PI: Neighbors). NIH had no role in the study design, collection, analysis, or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication. The authors have no conflicts of interest to report.

*Corresponding author. angelo_dibello@brown.edu (A.M. DiBello).

Contributors

Authors 1 and 2 conducted the literature search and summary of previous research studies. Authors 1 and 2, developed statistical analysis, authors 1, 2, 3, 4, and 5 developed all drafts of the discussion including the final draft.

Conflict of interest

All five authors have declared no conflict of interest.

1. Introduction

Social cognitive factors such as perceived norms, expectancies, and motives are established predictors of alcohol use and related problems (Kuntsche, Knibbe, Gmel, & Engels, 2005; Neighbors, Lee, Lewis, Fossos, & Larimer, 2007). Among young adults, when descriptive norms, injunctive norms, expectancies, and motives are evaluated simultaneously, descriptive and injunctive norms are among the most robust predictors of alcohol use (Neighbors et al., 2007). Thus, it is not surprising that interventions effective at reducing college student drinking include normative comparisons paired with personalized feedback on consumption, risk factors, and/or consequences (Carey, Scott-Sheldon, Carey, & DeMartini, 2007; Carey, Scott-Sheldon, Elliott, Garey, & Carey, 2012). However, a robust body of research suggests that an individual's personal attitudes toward alcohol consumption are also important social cognitive determinants of alcohol use; they predict not only intention to use but also concurrent and prospective drinking behavior (Burden & Maisto, 2000; Collins & Carey, 2007; Collins, Witkiewitz, & Larimer, 2011; Wiers, Van Woerden, Smulders, & De Jong, 2002). This study aimed to determine the relative importance of personal attitudes versus descriptive and injunctive norms as predictors of alcohol use and related problems to inform intervention development.

The association between attitudes and drinking behaviors may be particularly important among mandated college students, as mandated students are a high-risk population for heavy alcohol use. LaBrie, Tawalbeh, and Earleywine (2006) found that mandated students report more drinking days per month, drinks per drinking occasion, maximum drinks at one time, total drinks per month, and episodes of binge drinking when compared to a convenience sample of non-mandated students. Moreover, when compared to the general student sample, mandated students report twice the number of drinks per week, and the effect size of this difference was medium to large (Cohen's $d = 0.73$; Merrill, Carey, Lust, Kalichman, & Carey, 2014). Thus, the pattern of drinking reported by mandated students, as a group, appears to be more hazardous and warrants further examination with respect to potential prevention and intervention targets.

1.1. Norms

Social Norms Theory (Perkins & Berkowitz, 1986) contends that human social behavior is influenced by individuals' perceptions of the 'norm.' Social norms include perceptions of other's attitudes as well as their behaviors, a distinction that is important because they capitalize on different sources of motivation. Injunctive norms refer to one's perception of what should be done: what is approved or disapproved of by others. They are similar to the subjective norms construct utilized in the Theory of Reasoned Action (TRA) and its extension, the Theory of Planned Behavior (TPB) (Ajzen, 1985; Fishbein & Ajzen, 1975). Descriptive norms, on the other hand, specify typical or 'normal' behavior: what most people actually do (Perkins & Berkowitz, 1986). Research indicates that individuals frequently misperceive the actual attitudes and behaviors of others (Prentice & Miller, 1993). In terms of alcohol use, theory suggests that individuals will overestimate (a) how approving others are of alcohol use (perceptions of attitudes, or injunctive norms) and (b) how much and/or how often others drink (perceptions of behaviors, or descriptive norms).

Research has been consistent with theory in documenting the influential effects of perceived injunctive and descriptive norms on alcohol use. In terms of injunctive norms, individuals tend to believe that others are more approving of drinking and related behaviors than they are themselves, and these perceptions predict personal drinking and related problems (LaBrie, Hummer, Neighbors, & Larimer, 2010; Lewis, Litt, & Neighbors, 2015; Prentice & Miller, 1993; Schroeder & Prentice, 1998). Similarly, in regard to descriptive norms, individuals tend to overestimate the amount of alcohol that others consume, and these perceptions correspond with heavier drinking behaviors (Litt, Lewis, Rhew, Hodge, & Kaysen, 2015; Martens et al., 2006; Neighbors, Larimer, & Lewis, 2004; Perkins, Haines, & Rice, 2005). Among young adults, injunctive and descriptive norms are distinct predictors of alcohol consumption (e.g., Lee, Geisner, Lewis, Neighbors, & Larimer, 2007). In addition, they explain more unique variance than other reliable cognitive antecedents of drinking such as expectancies or motives (Neighbors et al., 2007). However, studies published to date have not compared the strength of descriptive or injunctive drinking norms relative to alcohol-related attitudes in predicting alcohol consumption or consequences.

1.2. Attitudes

Broadly defined, attitudes are relatively stable evaluative judgments of various aspects of a person's experience (e.g., an idea, a person, a behavior, etc.) that range from negative to positive and are influenced by situational factors, including observations of one's own behavior. Attitudes represent a key explanatory variable in many theories of health behavior, as research has shown attitudes predict both intentions and one's behavior (Bem, 1967; Glasman & Albarracín, 2006; Higgins, 1987; Montano & Kasprzyk, 2008). For example, in the Theory of Reasoned Action and the Theory of Planned Behavior (Ajzen, 1985; Fishbein & Ajzen, 1975), attitudes are integral in the prediction of behavior due to their strong influence on behavioral intentions as well as behavior (Glasman & Albarracín, 2006). Consistent with this theory, a recent meta-analysis found that alcohol-related attitudes have stronger associations with intentions to consume alcohol than subjective (injunctive) norms, self-efficacy, or perceived control; and intentions, in turn, predicted drinking behavior (Cooke, Dahdah, Norman, & French, 2016). However, this model did not include descriptive norms, which have been identified as a dominant predictor of alcohol consumption among college students in previous research (Neighbors et al., 2007) and are utilized almost universally in efficacious interventions for college student drinking (Cronce & Larimer, 2011; Miller et al., 2013).

While the above research supports the predictive validity of global attitudes toward alcohol use, global attitudes are often weakly or un-correlated with specific behaviors (Wicker, 1969), with the strength of associations increasing as a function of the specificity of the construct being assessed (e.g., Ajzen & Fishbein, 2005; Davidson & Jaccard, 1979; Fishbein & Ajzen, 1974). With respect to drinking, Carey and Johnson (1994) provided evidence of attitude-behavior specificity; that is, relative to more global attitudes, attitudes aligned with drinking outcomes (e.g., attitudes toward drinking beer) were more robust predictors of specific drinking behaviors (i.e., beer consumption). Similarly, studies have demonstrated strong relationships between attitudes towards binge drinking (Norman, Armitage, & Quigley, 2007) and attitudes towards getting drunk (Collins & Carey, 2007) with the

corresponding drinking intentions. Although as yet untested, it follows that specific attitudes about different levels of drinking (i.e., moderate vs. heavy drinking) may have differential utility in predicting drinking behavior.

1.3. Current study

The current paper aimed to extend previous work on the relative importance of theory-based predictors of alcohol consumption by comparing the predictive utility of attitudes toward moderate and heavy alcohol use to that of known predictors of alcohol use behavior – descriptive and injunctive drinking norms. Consistent with previous research (Cooke et al., 2016), we hypothesized that attitude toward heavy alcohol use would be positively associated with drinks per week, binge drinking frequency, and alcohol-related problems and that the effect would be stronger than what is found for norms. We also assessed attitude toward moderate alcohol consumption, defined as consumption under the gender-specific binge drinking threshold in order to explore how attitude toward moderate drinking would be associated with drinks per week, binge drinking, and alcohol-related problems. Finally, as all the participants in the current study were exposed to an intervention designed to change their normative perceptions, we conducted analyses aimed at examining the predictive effects of both attitude toward moderate and attitude toward heavy consumption after accounting for changes in norms. Thus, we extended this literature by examining the unique predictive value of these attitudes over both injunctive and descriptive norms and changes in norms.

2. Methods

2.1. Participants and procedure

Undergraduate students from a large public university in the Northeast U.S. were recruited on a rolling basis to participate in a larger research project evaluating outcomes of intervention for students mandated for campus alcohol violations from 2011 to 2013 (Carey, Scott-Sheldon, Garey, Elliott, & Carey, 2016). The final sample consisted of 568 students (72% male, 84% White) with a mean age of 19.18 years ($SD = 1.16$). To complete the standard sanction requirements, participants attended three appointments: a baseline survey, a brief motivational interview, and a 1-month follow-up survey session. Those who elected to be a part of the research project (94% of those sanctioned from 2011 to 2013) provided additional follow up data at four additional time points. All students who consented to participate in the larger study were included in current analyses. Data for this study were collected at baseline and one-month assessments; all participants received an identical single brief alcohol intervention between baseline and the one-month assessment. The baseline and one-month assessments consisted of online surveys completed in a private suite and facilitated by a research assistant. All study procedures were approved by the university's Institutional Review Board.

2.2. Measures

2.2.1. Alcohol consumption—The Daily Drinking Questionnaire (DDQ) (Collins, Parks, & Marlatt, 1985) was used to assess alcohol use over the past month. The DDQ 7-day grid was summed to calculate typical drinks per week (DPW). Binge frequency was assessed

using the following single item, “During the last month, how many times have you consumed 4/5 or more drinks on one drinking occasion?” for women and men respectively. A standard drink was defined as 12 oz. of beer, 5 oz. of 12% table wine, 12 oz. of wine cooler, or 1.25 oz. of 80-proof liquor.

2.2.2. Alcohol-related consequences—The Brief Young Adult Alcohol Consequences Questionnaire (BYAACQ) (Kahler, Strong, & Read, 2005) is a 24-item self-administered checklist of problems related to drinking; responses are dichotomous (*yes/no*) and refer to the past month. The BYAACQ demonstrates strong psychometric properties and is free of gender bias (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.” Internal consistency reliability ranged from 0.84–0.90 across the two timepoints.

2.2.3. Attitudes toward alcohol use—Attitude toward moderate drinking and attitude toward heavy drinking were assessed using an adapted version of the attitudes measure developed by Hagger et al. (2012). For moderate drinking, the stem read, “Keeping my alcohol drinking within what is considered moderate drinking for adults (i.e. at 4 or fewer drinks for men or at 3 or fewer drinks for women) on each individual occasion over the next month would be...” For heavy drinking, the stem read, “Having five or more drinks (for males)/four or more drinks (for females) in a sitting over the next month would be...” For both stems, five semantic differential scales ranged from 1 to 5: unenjoyable-enjoyable, bad-good, harmful-beneficial, foolish-wise, and unpleasant-pleasant. Each set of five items was averaged to create scales representing attitude toward moderate drinking ($\alpha = 0.86$) and attitude toward heavy drinking ($\alpha = 0.90$).

2.2.4. Drinking norms—Items from the Drinking Norms Rating Form (Turrissi, Mastroleo, Mallett, Larimer, & Kilmer, 2007) were used to assess perceived descriptive norms related to alcohol use. Questions included (a) “How many of your close friends drink alcohol?” (b) “How many of your friends get drunk on a regular basis (at least once a month)?” and (c) “How many of your close friends drink primarily to get drunk?” Items were scored on a 5-point scale ranging from 0 (none) to 4 (nearly all) and were averaged to create a composite score. Reliability for the current sample ranged from 0.91.

We operationalized injunctive norms as perceptions regarding friends’ approval of drinking and of getting drunk. Participants indicated “How do most of your friends feel about drinking?” and “How do most of your friends feel about getting drunk?” (Kahler, Read, Wood, & Palfai, 2003). Responses were rated on 5-point continuous-response scales ranging from 0 (strongly disapprove) to 4 (strongly approve) and were averaged to create a composite score. Reliability for the current sample was 0.90.

3. Results

3.1. Data analytic plan

The primary purpose of this study was to evaluate the unique contribution of attitudes in predicting concurrent and prospective alcohol outcomes (drinks per week, binge drinking

frequency, and alcohol-related problems) while controlling for perceived drinking norms. Predictors were entered into a theoretically-informed hierarchical regression model, with covariates entered in the first step of the model, normative perceptions (descriptive and injunctive) entered in the second step, attitudes toward moderate drinking entered in the third step, and attitudes toward heavy drinking entered in the fourth and final step. This analysis allows for simultaneous estimation of the associations of several predictors to an outcome variable. We entered attitudes toward moderate versus heavy drinking in separate steps of the model in order to determine the incremental validity of attitudes toward moderate/heavy drinking in predicting alcohol-related outcomes. In cross-sectional models (predicting baseline alcohol use outcomes), we included gender as a covariate. In prospective models (predicting 1-month alcohol use outcomes), we also included intervention condition and baseline levels of the outcome as covariates to account for intervention-related changes in alcohol use outcomes.

Because hierarchical regression may underestimate the unique variance accounted for by predictors entered in the final step of the model, a stepwise regression approach was used to determine which predictor explained the most variance in drinks per week, binge frequency, and alcohol-related problems, both cross-sectionally and at 1-month follow up. Stepwise regression is designed to find the most parsimonious set of predictors for a given outcome variable. The “first step” is to identify the “best” one-variable model; thus, all predictors are entered in the model simultaneously and the one that accounts for the most variance in the outcome (according to R^2) is retained. Each subsequent step identifies the “best” two-variable, three-variable, etc. model, with variables added to the regression equation one at a time, using the statistical criterion of maximizing the R^2 of the included variables. Analyses were conducted in SAS, which uses a default minimum F-to-enter significance level of 0.15. All variables that fall below this significance threshold are excluded from the model.

3.2. Descriptive statistics

Table 1 depicts the zero-order correlations, means, and standard deviations for predictor and outcome variables. As expected, all drinking variables were significantly and positively correlated with each other, both within and across time points. Drinking variables also correlated positively with perceived descriptive norms and injunctive norms, and attitude toward heavy drinking. Conversely, attitude toward moderate drinking reflects a protective factor and was negatively correlated with attitude toward heavy drinking, both norms, and all drinking variables. Notably, attitudes toward moderate drinking were uncorrelated with baseline problems. We conducted tests of sex difference for our three outcomes and found that, overall, women drank fewer drinks per week ($t = -6.94, p < 0.001$) and reported fewer binge drinking episodes ($t = -4.95, p < 0.001$); thus gender was included as a covariate in all models.

3.3. Examining attitudes as unique predictors

3.3.1. Outcome 1: drinks per week—In the final step of the cross-sectional model predicting drinks per week (see left column of Table 2), male gender and stronger descriptive norms were associated with more drinks per week. Both attitude toward moderate drinking and attitude toward heavy drinking accounted for unique variance in

baseline drinks per week while controlling for other predictors. Having a more favorable attitude toward moderate drinking was associated with fewer drinks per week. Conversely, having a more favorable attitude toward heavy consumption was associated with more drinks per week. In the prospective model (see right column of Table 2), male gender, greater baseline drinks per week, and stronger descriptive norms were associated with greater drinks per week at 1-month follow-up.¹ Again, both attitude toward moderate drinking and attitude toward heavy drinking accounted for unique variance in 1-month drinks per week. Consistent with the cross-sectional model, a more favorable attitude toward heavy alcohol use was associated with more drinks per week, whereas a more favorable attitude toward moderate drinking was associated with fewer drinks per week.

3.3.2. Outcome 2: binge drinking frequency—In the final step of the cross-sectional model predicting binge drinking frequency (see Table 3), stronger descriptive norms were associated with more frequent binge drinking. Both attitude toward moderate drinking and attitude toward heavy drinking accounted for unique variance in binge frequency, with attitude toward moderate drinking inversely associated and attitude toward heavy drinking positively associated with frequency of binge drinking. This pattern of results was consistent in the prospective model predicting binge frequency at 1-month follow-up (see Table 3).

3.3.3. Outcome 3: alcohol-related problems—Contrary to our hypothesis, stronger descriptive norms were the only significant predictor of alcohol problems in the final step of the cross-sectional model (see Table 4). However, in the prospective model, attitude toward heavy drinking was the only significant social cognitive predictor of alcohol problems at 1-month follow-up after controlling for other predictors.

3.3.4. Stepwise regression results—The results of the stepwise regressions are presented in Table 5. Results were largely consistent with those presented in the hierarchical regression models, with attitude toward heavy drinking accounting for a larger portion of variance in drinks per week, binge frequency, and alcohol problems than descriptive or injunctive norms in five of the six models. Contrary to expectations, descriptive norms accounted for the largest portion of variance in baseline alcohol problems.

4. Discussion

In the present study, we examined the predictive utility of social cognitive constructs that have emerged as strong correlates of college alcohol consumption and problems. Specifically, we assessed the relative strength of attitudes toward both moderate and heavy alcohol consumption, perceived injunctive norms, and perceived descriptive norms in predicting both cross-sectional and prospective drinking outcomes. Overall, we found support for attitudes towards both moderate and heavy drinking as independent prospective predictors of alcohol consumption among at-risk mandated college drinkers. Furthermore, when compared with perceived drinking norms, attitude toward heavy drinking emerged as

¹This pattern of results remained the same when we conducted additional analyses examining descriptive and injunctive norms separately rather than in one combined model.

the strongest predictor of drinks per week, binge frequency, and alcohol-related problems in five of six models.

Both drinking attitudes and perceived descriptive norms consistently emerged as independent predictors of alcohol-related outcomes in our analyses. On average, attitudes toward heavy drinking tended to be stronger predictors of drinking quantity, binge drinking frequency, and alcohol-related problems than were normative perceptions. Notably, attitudes toward both moderate and heavy drinking had independent roles in predicting alcohol consumption. Specifically, attitude toward heavy drinking was a risk factor and attitude toward moderate drinking was a protective factor with regard to heavy alcohol consumption in this sample. The moderate correlation between the two attitudes indicates that drinkers formulate separate evaluations of drinking above and below the binge drinking threshold, which raises the possibility that either or both may be targets for intervention.

Previous research has not directly compared the relative contributions of attitudes, injunctive norms, and descriptive norms in predicting actual drinking. However, a meta-analysis of studies evaluating the TRA/TBP revealed that attitudes had stronger indirect effects on drinking behavior than subjective norms (Cooke et al., 2016). The use of friends as the reference group for injunctive norms in the present study makes our measure of injunctive norms similar to measures of subjective norms, which often use friends as referents. The Cooke et al. (2016) meta-analysis found average correlations of attitudes and norms to intentions (0.62 and 0.47, respectively). In turn, the average correlation between intentions and drinking was 0.54 (Cooke et al., 2016). The majority of studies assessed attitudes with indices that correspond to heavy drinking, broadly defined. Thus, our findings of the predictive importance of attitudes over subjective norms are consistent with the TPB meta-analytic results.

The absence of injunctive norms as a unique predictor of drinking is somewhat surprising, given previous research indicating that injunctive norms are associated with drinking when using proximal reference groups (e.g., friends, parents). Injunctive norms with friends as the reference have been uniquely associated with drinking even in models that also include other strong predictors (i.e., gender, fraternity/sorority, descriptive norms, injunctive norms regarding parents, drinking motives, and drinking expectancies); LaBrie et al., 2010; Lewis et al., 2015; Neighbors et al., 2007; Prentice & Miller, 1993; Schroeder & Prentice, 1998). Importantly, however, this work did not include attitudes among the predictors. Thus, it seems reasonable to conclude that injunctive norms may not be uniquely associated with behavior when controlling for attitudes; indeed, some have suggested that the link between injunctive norms and behavior may be mediated by attitudes (Reid & Aiken, 2013).

We acknowledge the limitations of the present study. First, attitudes and injunctive norms were not assessed using measures which asked about the same drinking behaviors, as has been done in previous examinations. Thus, future studies might utilize measures of attitudes and norms that are better aligned with the same drinking behaviors, to minimize the role of measurement variability. Second, our sample consisted of mandated college students, with an overrepresentation of males. Replication with more diverse samples would enhance confidence in the generalizability of the observed relationships. Additionally, future work

among mandated students should assess and control for the type of alcohol violation that a student received, something the current research team did not have access to. Finally, the parent study did not include a measure of intentions, precluding any conclusions being drawn about the predictive importance of intentions as mediators of the associations between attitudes, perceived norms, and drinking behavior.

The current findings have implications for both clinical work and future research. At least some of the success of Motivational Interviewing (MI; Miller & Rollnick, 2013) may be due to its incorporation of several classic principles of attitude change. Based on cognitive dissonance theory (Festinger, 1957), Miller (1983) noted "... if a person perceives his or her behavior to be seriously discrepant with his or her beliefs, attitudes, or feelings, a motivational condition is created to bring about change in one or another of these elements so that consistency is restored" (p. 157). Despite the use of some attitude change techniques in MI, few studies have provided strong tests of attitude change as a mechanism of behavior change (Reid & Carey, 2015). Furthermore, the results of this study suggest that a brief motivational intervention that was designed to change norms was effective and those changes in norms are associated with changes in drinking. However, changing perceived norms did not mitigate the predictive strength of baseline measures of attitude toward heavy drinking. Therefore, given the previous research documenting the efficacy of targeting norms as an intervention strategy we would not advocate for removal of norms in interventions but rather that future interventions should be designed to target attitudes as an alternative way to reduce drinking. Furthermore, interventions designed to target both attitudes and norms may serve to increase the efficacy and duration of existing interventions.

Intervention development in the field of alcohol prevention might consider borrowing more extensively from the science of attitude change (Petty & Brinol, 2010). The present research documents attitudes as strong prospective predictors of alcohol consumption, providing empirical support for the potential efficacy of changing attitudes as a means of changing behavior in a mandated student population. The existence of large literatures related to attitude change outside of the alcohol field further suggests ample resources for developing novel strategies based on empirically supported procedures. Yet attitudes toward drinking are underutilized as a target of college student drinking interventions (Cronce & Larimer, 2011). Several social psychological paradigms could be used as novel attitude change paradigms in the domain of alcohol use. For example, Counter Attitudinal Advocacy (CAA) is a cognitive dissonance based attitude change paradigm that has been successfully used to target other health behaviors (e.g., smoking cessation) that could be adapted for use in the alcohol use domain (Simmons, Heckman, Fink, Small, & Brandon, 2013). Briefly, CAA asks participants to engage in an activity in a way that is contrary to an existing attitude or behavior and is hypothesized to create dissonance (e.g., an individual who experiences alcohol-related consequences describes how he/she can avoid those consequences and why avoiding those consequences is a positive approach to alcohol use). This dissonance may be reduced by changing future behavior or attitudes (e.g., reducing drinking to avoid problems).

Overall, these findings support the independence of attitudes toward moderate and heavy alcohol consumption as unique predictors of drinking outcomes. Moreover, this work provides evidence for the predictive utility of attitude toward heavy alcohol use when

compared to well-known predictors of alcohol outcomes such as perceived descriptive norms. Outside of the TRA/TPB perspectives and Motivational Interviewing, attitudes have received relatively little attention in the larger alcohol prevention and treatment literatures as a potential mechanism of behavior change. The present results provide a compelling empirical basis for considering attitudes more purposefully and systematically in the development and refinement of intervention strategies.

Acknowledgments

Role of funding sources

Funding for this study was provided by four grants from NIAAA (R01-AA012518; R01 AA014576-07A2; T32 AA007459). NIAAA had no role in the study design, collection, analysis or interpretation of the data, writing the manuscript, or the decision to submit the paper for publication.

References

- Ajzen, I. From intentions to actions: A theory of planned behavior. In: Kuhl, J., Beckman, J., editors *Action-control: From cognition to behavior* Heidelberg: Springer; 1985 11-39
- Ajzen, I., Fishbein, M. The influence of attitudes on behavior. In: Albarracín, D., Johnson, B.T., Zanna, M.P., Albarracín, D., Johnson, B.T., Zanna, M.P., editors *The handbook of attitudes* Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers; 2005 173-221
- Bem DJ. Self-perception: An alternative interpretation of cognitive dissonance phenomena. *Psychological Review*. 1967; 74(3):183–200. [PubMed: 5342882]
- Burden JL, Maisto SA. Expectancies, evaluations and attitudes: Prediction of college student drinking behavior. *Journal of Studies on Alcohol*. 2000; 61(2):323–331. [PubMed: 10757144]
- Carey KB, Johnson BT. The structure of attitudes toward alcohol: Specific beverages differ from generic alcohol. *Psychology of Addictive Behaviors*. 1994; 8:70.
- Carey KB, Scott-Sheldon LA, Carey MP, DeMartini KS. Individual-level interventions to reduce college student drinking: A meta-analytic review. *Addictive Behaviors*. 2007; 32(11):2469–2494. DOI: 10.1016/j.addbeh.2007.05.004 [PubMed: 17590277]
- Carey KB, Scott-Sheldon LA, Elliott JC, Garey L, Carey MP. Face-to-face versus computer-delivered alcohol interventions for college drinkers: A meta-analytic review, 1998 to 2010. *Clinical Psychology Review*. 2012; 32(8):690–703. DOI: 10.1016/j.cpr.2012.08.001 [PubMed: 23022767]
- Carey KB, Scott-Sheldon LJ, Garey L, Elliott JC, Carey MP. Alcohol interventions for mandated college students: A meta-analytic review. *Journal of Consulting and Clinical Psychology*. 2016; 84(7):619–632. DOI: 10.1037/a0040275 [PubMed: 27100126]
- Collins RL, Parks GA, Marlatt GA. Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *Journal of Consulting and Clinical Psychology*. 1985; 53:189–200. [PubMed: 3998247]
- Collins SE, Carey KB. The theory of planned behavior as a model of heavy episodic drinking among college students. *Psychology of Addictive Behaviors*. 2007; 21(4):498–507. DOI: 10.1037/0893-164x.21.4.498 [PubMed: 18072832]
- Collins SE, Witkiewitz K, Larimer ME. The theory of planned behavior as a predictor of growth in risky college drinking. *Journal of Studies on Alcohol and Drugs*. 2011; 72(2):322–332. [PubMed: 21388605]
- Cooke R, Dahdah M, Norman P, French DP. How well does the theory of planned behaviour predict alcohol consumption? A systematic review and meta-analysis. *Health Psychology Review*. 2016; 10(2):148–167. [PubMed: 25089611]
- Cronce JM, Larimer ME. Individual-focused approaches to the prevention of college student drinking. *Alcohol Research and Health*. 2011; 34:210–221. [PubMed: 22330220]
- Davidson AR, Jaccard JJ. Variables that moderate the attitude–behavior relation: Results of a longitudinal survey. *Journal of Personality and Social Psychology*. 1979; 37(8):1364–1376.

- Festinger, L. A theory of cognitive dissonance. California: Stanford University Press; 1957
- Fishbein M, Ajzen I. Attitudes towards objects as predictors of single and multiple behavioral criteria. *Psychological Review*. 1974; 81(1):59–74.
- Fishbein, M., Ajzen, I. Belief, attitude, intention, and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley; 1975
- Glasman LR, Albarracín D. Forming attitudes that predict future behavior: A meta-analysis of the attitude-behavior relation. *Psychological Bulletin*. 2006; 132(5):778–822. DOI: 10.1037/0033-2909.132.5.778 [PubMed: 16910754]
- Hagger MS, Lonsdale A, Koka A, Hein V, Pasi H, Lintunen T, Chatzisarantis NLD. An intervention to reduce alcohol consumption in undergraduate students using implementation intentions and mental simulations: A cross-national study. *International Journal of Behavioral Medicine*. 2012; 19:82–96. [PubMed: 21562782]
- Higgins ET. Self-discrepancy: A theory relating self and affect. *Psychological Review*. 1987; 94(3): 319–340. [PubMed: 3615707]
- Kahler CW, Read JP, Wood MD, Palfai TP. Social environmental selection as a mediator of gender, ethnic, and personality effects on college student drinking. *Psychology of Addictive Behaviors*. 2003; 17(3):226–234. [PubMed: 14498817]
- Kahler CW, Strong DR, Read JP. Toward efficient and comprehensive measurement of the alcohol problems continuum in college students: The Brief Young Adult Alcohol Consequences Questionnaire. *Alcoholism: Clinical and Experimental Research*. 2005; 29:1180–1189.
- Kuntsche E, Knibbe R, Gmel G, Engels R. Why do young people drink? A review of drinking motives. *Clinical Psychology Review*. 2005; 25:841–861. [PubMed: 16095785]
- LaBrie JW, Hummer JF, Neighbors C, Larimer ME. Whose opinion matters? The relationship between injunctive norms and alcohol consequences in college students. *Addictive Behaviors*. 2010; 35:343–349. DOI: 10.1016/j.addbeh.2009.12.003 [PubMed: 20045262]
- LaBrie JW, Tawalbeh S, Earleywine M. Differentiating adjudicated from nonadjudicated freshmen men: The role of alcohol expectancies, tension, and concern about health. *Journal of College Student Development*. 2006; 47(5):521–533.
- Lee CM, Geisner IM, Lewis MA, Neighbors C, Larimer ME. Social motives and the interaction between descriptive and injunctive norms in college student drinking. *Journal of Studies on Alcohol and Drugs*. 2007; 68(5):714–721. DOI: 10.15288/jsad.2007.68.714 [PubMed: 17690805]
- Lewis MA, Litt DM, Neighbors C. The chicken or the egg: Examining temporal precedence among attitudes, injunctive norms, and college student drinking. *Journal of Studies on Alcohol and Drugs*. 2015; 76:594–601. [PubMed: 26098035]
- Litt DM, Lewis MA, Rhew IC, Hodge KA, Kaysen DL. Reciprocal relationships over time between descriptive norms and alcohol use in young adult sexual minority women. *Psychology of Addictive Behaviors*. 2015; 29:885–893. DOI: 10.1037/adb0000122 [PubMed: 26478944]
- Martens MP, Page JC, Mowry ES, Damann KM, Taylor KK, Cimini MD. Differences between actual and perceived student norms: An examination of alcohol use, drug use, and sexual behavior. *Journal of American College Health*. 2006; 54:295–300. DOI: 10.3200/JACH.54.5.295-300 [PubMed: 16539222]
- Merrill JE, Carey KB, Lust SA, Kalichman SC, Carey MP. Do students mandated to intervention for campus alcohol-related violations drink more than nonmandated students? *Psychology of Addictive Behaviors*. 2014; 28(4):1265. [PubMed: 25180559]
- Miller WR. Motivational interviewing with problem drinkers. *Behavioural Psychotherapy*. 1983; 11:147–172.
- Miller, WR., Rollnick, S. Motivational interviewing: Helping people change. 3. New York, NY, US: Guilford Press; 2013
- Miller MB, Leffingwell T, Claborn K, Meier E, Walters S, Neighbors C. Personalized feedback interventions for college alcohol misuse: An update of Walters & Neighbors (2005). *Psychology of Addictive Behaviors*. 2013; 27(4):909–920. [PubMed: 23276309]
- Montano, DE., Kasprzyk, D. Theory of reasoned action, theory of planned behavior, and the integrated behavioral model. In: Glanz, K., Rimer, BK., Viswanath, K., editors *Health behavior and health education*. 4. San Francisco: Jossey-Bass; 2008:67–96

- Neighbors C, Larimer ME, Lewis MA. Targeting misperceptions of descriptive drinking norms: Efficacy of a computer-delivered personalized normative feedback intervention. *Journal of Consulting and Clinical Psychology*. 2004; 72(3):434–447. DOI: 10.1037/0022-006X.72.3.434 [PubMed: 15279527]
- Neighbors C, Lee CM, Lewis MA, Fossos N, Larimer ME. Are social norms the best predictor of outcomes among heavy drinking college students? *Journal of Studies on Alcohol and Drugs*. 2007; 68:556–565. [PubMed: 17568961]
- Norman P, Armitage CJ, Quigley C. The theory of planned behavior and binge drinking: Assessing the impact of binge drinker prototypes. *Addictive Behaviors*. 2007; 32(9):1753–1768. DOI: 10.1016/j.addbeh.2006.12.009 [PubMed: 17270356]
- Perkins HW, Berkowitz AD. Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. *International Journal of the Addictions*. 1986; 21:961–976. [PubMed: 3793315]
- Perkins HW, Haines MP, Rice R. Misperceiving the college drinking norm and related problems: A nationwide study of exposure to prevention information, perceived norms, and student alcohol misuse. *Journal of Studies on Alcohol*. 2005; 66:470–478. [PubMed: 16240554]
- Petty RE, Brinol P. Attitude change. *Advanced social psychology: The state of the science*. 2010:217–259.
- Prentice DA, Miller DT. Pluralistic ignorance and alcohol use on campus: Some consequences of misperceiving the social norm. *Journal of Personality and Social Psychology*. 1993; 64:243–256. DOI: 10.1037/0022-3514.64.2.243 [PubMed: 8433272]
- Reid AE, Aiken LS. Correcting injunctive norm misperceptions motivates behavior change: A randomized controlled sun protection intervention. *Health Psychology*. 2013; 32(5):551. [PubMed: 23646838]
- Reid AE, Carey KB. Interventions to reduce college student drinking: State of the evidence for mechanisms of behavior change. *Clinical Psychology Review*. 2015; 40:213–224. [PubMed: 26164065]
- Schroeder CM, Prentice DA. Exposing pluralistic ignorance to reduce alcohol use among college students. *Journal of Applied Social Psychology*. 1998; 28(23):2150–2180.
- Simmons VN, Heckman BW, Fink AC, Small BJ, Brandon TH. Efficacy of an experiential, dissonance-based smoking intervention for college students delivered via the internet. *Journal of Consulting and Clinical Psychology*. 2013; 81(5):810–820. DOI: 10.1037/a0032952 [PubMed: 23668667]
- Turrisi R, Mastroleo NR, Mallett KA, Larimer ME, Kilmer JR. Examination of the mediational influences of peer norms, environmental influences, and parent communications on heavy drinking in athletes and nonathletes. *Psychology of Addictive Behaviors*. 2007; 21(4):453–461. DOI: 10.1037/0893-164X.21.4.453 [PubMed: 18072827]
- Wicker AW. Attitudes versus actions: The relationship of verbal and overt behavioral responses to attitude objects. *Journal of Social Issues*. 1969; 25(4):41–78.
- Wiers RW, Van Woerden N, Smulders FT, De Jong PJ. Implicit and explicit alcohol-related cognitions in heavy and light drinkers. *Journal of Abnormal Psychology*. 2002; 111(4):648. [PubMed: 12428778]

HIGHLIGHTS

- Attitude toward heavy consumption is positively associated with problems over time.
- Attitude toward moderate consumption is negatively associated with drinking over time.
- Attitude toward heavy consumption is a stronger predictor than norms.

Table 1

Descriptive statistics and zero-order correlations for study variables.

	1.	2.	3.	4.	5.	6.	7.	9.	11.	12.
1. BL drinks per week	–									
2. Imo drinks per week	0.61	–								
3. BL binge drinking	0.79	0.58	–							
4. Imo binge drinking	0.56	0.82	0.59	–						
5. BL alcohol-related consequences	0.42	0.22	0.43	0.19	–					
6. Imo alcohol-related consequences	0.34	0.49	0.35	0.50	0.42	–				
7. BL descriptive norms	0.40	0.34	0.44	0.36	0.30	0.28	–			
9. BL injunctive norms	0.35	0.24	0.36	0.27	0.25	0.25	0.57	–		
11. BL Attitude toward moderate consumption	–0.38	–0.39	–0.41	–0.39	–0.06	–0.20	–0.16	–0.27	–	
12. BL Attitude toward heavy consumption	0.49	0.49	0.52	0.50	0.20	0.30	0.33	0.30	–0.44	–
Mean	12.58	9.54	4.16	2.88	5.44	2.83	3.20	3.12	3.78	2.74
SD	9.74	7.89	3.77	2.89	4.25	3.50	0.77	0.64	0.83	0.87

Note. BL = baseline. Imo = 1 month. Bold font indicates $p < 0.001$.

Table 2

Hierarchical regression models predicting drinks per week at baseline (cross-sectional model) and 1-month follow-up (prospective model).

Variable	Cross-sectional Model DV: BL drinks per week				Prospective Model DV: Imo drinks per week			
	β	<i>p</i>	Adj. R^2		β	<i>p</i>	Adj. R^2	
Step 1 Gender	-0.27	< 0.001	0.07		-0.14	< 0.001	0.39	
Intervention group	-	-	-		< 0.001	0.99	-	
Drinks per week	-	-	-		0.58	< 0.001	-	
Step 2 Gender	-0.24	< 0.001	0.23		-0.15	< 0.001	0.44	
Intervention group	-	-	-		0.001	0.96	-	
Drinks per week	-	-	-		0.53	< 0.001	-	
Descriptive norms	0.28	< 0.001	-		0.14	0.001	-	
Injunctive norms	0.17	< 0.001	-		-0.02	0.56	-	
Step 3 Gender	-0.21	< 0.001	0.28		-0.16	< 0.001	0.44	
Intervention group	-	-	-		0.02	0.67	-	
Drinks per week	-	-	-		0.48	< 0.001	-	
Descriptive norms	0.27	< 0.001	-		0.14	0.002	-	
Injunctive norms	0.06	0.21	-		-0.05	0.25	-	
Attitude moderate	-0.30	< 0.001	-		-0.18	< 0.001	-	
Step 4 Gender	-0.18	< 0.001	0.35		-0.15	< 0.001	0.46	
Intervention group	-	-	-		0.01	0.81	-	
Drinks per week	-	-	-		0.42	< 0.001	-	
Descriptive norms	0.20	< 0.001	-		0.12	0.01	-	
Injunctive norms	0.04	0.38	-		-0.07	0.13	-	
Attitude moderate	-0.19	< 0.001	-		-0.13	0.001	-	
Attitude heavy	0.29	< 0.001	-		0.18	< 0.001	-	

Note. Imo = 1 month. Attitude heavy = attitude toward heavy drinking. Attitude moderate = attitude toward moderate drinking. BL = baseline. Gender was coded men = 0 and women = 1.

Table 3

Hierarchical regression models predicting binge drinking frequency at baseline (cross-sectional model) and 1-month follow-up (prospective model).

Variable	Cross-sectional Model DV: BL binge frequency			Prospective Model DV: 1mo binge frequency		
	β	p	Adj. R^2	β	p	Adj. R^2
Step 1						
Gender	-0.15	0.001	0.02	-0.13	< 0.001	0.37
Intervention group	-	-	-	-0.05	0.17	-
Binge frequency	-	-	-	0.57	< 0.001	-
Step 2						
Gender	-0.11	0.01	0.22	-0.12	< 0.001	0.38
Intervention group	-	-	-	-0.04	0.19	-
Binge frequency	-	-	-	0.52	< 0.001	-
Descriptive norms	0.34	< 0.001	-	0.12	0.01	-
Injunctive norms	0.15	0.001	-	0.01	0.74	-
Step 3						
Gender	-0.11	0.001	0.30	-0.12	0.001	0.38
Intervention group	-	-	-	-0.02	0.63	-
Binge frequency	-	-	-	0.43	< 0.001	-
Descriptive norms	0.33	< 0.001	-	0.13	0.01	-
Injunctive norms	0.05	0.28	-	0.02	0.70	-
Attitude moderate	-0.33	< 0.001	-	-0.18	< 0.001	-
Step 4						
Gender	-0.07	0.07	0.38	-0.11	0.01	0.41
Intervention group	-	-	-	-0.02	0.56	-
Binge frequency	-	-	-	0.36	< 0.001	-
Descriptive norms	0.26	< 0.001	-	0.11	0.02	-
Injunctive norms	0.03	0.48	-	-0.002	0.97	-
Attitude moderate	-0.21	< 0.001	-	-0.13	0.003	-
Attitude heavy	0.32	< 0.001	-	0.20	< 0.001	-

Note. Imo = 1 month. Attitude heavy = attitude toward heavy drinking. Attitude moderate = attitude toward moderate drinking. BL = baseline. Gender was coded men = 0 and women = 1.

Table 4

Hierarchical regression models predicting alcohol problems at baseline (cross-sectional model) and 1-month follow-up (prospective model).

Variable	Cross-sectional Model DV: BL alcohol problems			Prospective Model DV: Imo alcohol problems		
	β	<i>p</i>	Adj. R^2	β	<i>p</i>	Adj. R^2
Step 1						
Gender	0.04	0.34	< 0.001	0.004	0.92	0.20
Intervention group	–	–	–	0.01	0.73	–
Drinks per week	–	–	–	0.20	< 0.001	–
Alcohol problems	–	–	–	0.34	< 0.001	–
Step 2						
Gender	0.06	0.11	0.10	< 0.001	0.99	0.22
Intervention group	–	–	–	0.02	0.65	–
Drinks per week	–	–	–	0.14	0.002	–
Alcohol problems	–	–	–	0.31	< 0.001	–
Descriptive norms	0.24	< 0.001	–	0.10	< 0.05	–
Injunctive norms	0.11	0.02	–	0.07	0.15	–
Step 3						
Gender	0.06	0.20	0.11	–0.001	0.98	0.21
Intervention group	–	–	–	0.05	0.28	–
Drinks per week	–	–	–	0.05	0.33	–
Alcohol problems	–	–	–	0.32	< 0.001	–
Descriptive norms	0.27	< 0.001	–	0.09	0.10	–
Injunctive norms	0.11	0.05	–	0.09	0.10	–
Attitude moderate	–0.03	0.52	–	–0.11	0.02	–
Step 4						
Gender	0.07	0.12	0.12	0.01	0.81	0.22
Intervention group	–	–	–	0.04	0.33	–
Drinks per week	–	–	–	–0.002	0.97	–
Alcohol problems	–	–	–	0.32	< 0.001	–
Descriptive norms	0.25	< 0.001	–	0.07	0.21	–
Injunctive norms	0.10	0.07	–	0.07	0.19	–
Attitude moderate	0.004	0.93	–	–0.07	0.18	–
Attitude heavy	0.10	0.07	–	0.17	0.001	–

Note. Imo = 1 month. Attitude heavy = attitude toward heavy drinking. Attitude moderate = attitude toward moderate drinking. BL = baseline. Gender was coded men = 0 and women = 1.

Table 5

Stepwise regression models predicting alcohol use outcomes at baseline (cross-sectional models) and 1-month follow-up (prospective models).

Cross-sectional models			Prospective models		
Step	Predictor	Partial R^2	Step	Predictor	Partial R^2 Model R^2
DV: drinks per week					
1	Attitude heavy	0.23	1	BL drinks per week	0.39
2	Descriptive norms	0.05	2	Attitude heavy	0.05 0.44
3	Attitude moderate	0.03	3	Gender	0.02 0.46
4	Gender	0.03	4	Attitude moderate	0.01 0.47
			5	Descriptive norms	0.00 0.47
DV: Binge frequency					
1	Attitude heavy	0.27	1	BL binge frequency	0.34
2	Descriptive norms	0.07	2	Attitude heavy	0.05 0.39
3	Attitude moderate	0.04	3	Attitude moderate	0.01 0.40
			4	Gender	0.01 0.41
			5	Descriptive norms	0.00 0.41
DV: Alcohol problems					
1	Descriptive norms	0.10	1	BL alcohol problems	0.17
2	Injunctive norms	0.01	2	Attitude heavy	0.05 0.22
3	Attitude heavy	0.01	3	Injunctive norms	0.01 0.23
4	Gender	0.01			

Note. BL = baseline. Attitude heavy = attitude toward heavy drinking. Attitude moderate = attitude toward moderate drinking. Gender was coded men = 0 and women = 1.