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Predicting Driving after Drinking Over Time Among College Students: The Emerging Role of
Injunctive Normative Perceptions

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Abstract

Objective. Despite prevention efforts, driving after drinking (DAD) is a prevalent high-risk behavior among college students and is a leading cause of death and injury. Examination of factors predicting future DAD behavior is necessary in order to develop efficacious targeted interventions to reduce DAD among college students. The current study evaluated demographic, social cognitive and behavioral predictors of DAD using longitudinal data.

Method. Participants were 655 non-abstaining college students (67.2% female, 60.3% Caucasian, of mean age 19.3 years) who completed online surveys at two time points 12 months apart. **Results.** Results revealed that participants consistently overestimated their peer's approval (injunctive norms) of DAD. In a three-step hierarchical logistic regression model, injunctive norms, age, and past DAD behavior uniquely contributed to the prediction of DAD behavior 12 months subsequently. Neither gender nor membership in a sorority or fraternity emerged as significant predictors. **Conclusions.** The findings provide important new insights into the longitudinal predictors of DAD among college students, and highlight the need for DAD interventions particularly among older students.

Keywords: Driving after drinking, College students, Alcohol, Longitudinal study

Approximately 16% to 30% of U.S. college students report driving after drinking alcohol (DAD) (Beck et al., 2010; Fromme et al., 2008; Hingson et al., 2009; Quinn and Fromme, 2011) exposing themselves and others to serious potential consequences. For example, an estimated 49% of traffic fatalities among students are alcohol-related (Hingson et al., 2009). Previous cross-sectional research has identified a number of risk factors for DAD among college students, including male sex, Greek affiliation, being over 21 years of age (Kenney et al., in press; Wechsler et al., 2003), as well as owning a fake ID (Nguyen et al., 2011), family history of alcohol problems (LaBrie et al., 2011), and sensation-seeking personality characteristics (Zakletskaia et al., 2009). Further, heavy drinkers are more likely to DAD, (Kenney et al., in press; LaBrie et al., 2011; Quinn and Fromme, 2011), perhaps because of a decreased perception of subjective intoxication and perceived driving impairment (Marczinski et al., 2008).

The social norms approach suggests that perceptions of both how others behave (descriptive norms), and how accepting or approving they are of certain behaviors (injunctive norms) can exert considerable influence on individuals' behavior (Berkowitz, 2004; Borsari and Carey, 2001; Cialdini, 1991). Congruent with this approach, a significant body of evidence has demonstrated that injunctive norms for drinking are strongly predictive of college students' alcohol use (Borsari and Carey, 2001; LaBrie et al., 2010a; Neighbors et al., 2007; Neighbors et al., 2008). A limited number of studies specifically investigating injunctive norms for DAD have indicated that those who perceive their friends to be more approving of DAD are more likely to engage in DAD (Gastil, 2000; McCarthy et al., 2007). Further, recent research has demonstrated that students tend to overestimate how approving a typical student is towards DAD, and that

personal attitudes towards DAD mediate the relationship between misperception of typical student approval and DAD behavior (Kenney et al., in press). These findings diverge from the theory of planned behavior (Ajzen, 1991), which posits that attitudes and perceived norms independently predict motivation to engage in DAD (Armitage et al., 2002). Instead, Kenney and colleagues' (in press) findings align with models of social norms (Perkins, 1985) that suggest perceived peer norms can shape personal attitudes towards DAD, in addition to directly influencing DAD behavior.

A major limitation of previous collegiate DAD findings is the scarcity of longitudinal assessment of DAD risk factors. Past longitudinal studies have identified demographic risk factors for DAD including male gender and turning 21 years of age (Beck et al., 2010). Longitudinal data from high school students indicates that frequency of alcohol use and prior DAD are associated with increased likelihood and frequency of subsequent DAD (McCarthy and Pedersen, 2009). Further, prevalence of DAD has been shown to decrease as students transition from high school to college (Fromme et al., 2008). The current study aims to extend previous collegiate research by utilizing longitudinal data to examine the role of social cognitive variables, such as attitudes towards DAD and injunctive norms, in predicting future DAD behaviors. It is hypothesized that less disapproving attitudes towards DAD, perceptions of typical students as less disapproving of DAD, greater alcohol use, and having engaged in DAD in the past will be associated with future DAD behavior over and above established demographic factors.

Method

Procedures and Participants

Participants were students from a medium-sized private university who took part in two larger studies in two consecutive fall semesters. During both years students were randomly selected from the student population, and mailed and emailed invitations to complete online surveys (more detailed descriptions of Time 1 and Time 2 data collection may be found in LaBrie et al. (2010a) and LaBrie et al. (2010b) respectively). A total of 2219 participants were invited to participate at both time points. Of these students, 27.2% completed one survey and 34.2% completed both surveys. The sample for the current study consisted of 655 non-abstainers who participated at both time points. The participants were 67.2% female and had a mean age of 19.3 years ($SD = .86$; range 18 to 22 years). Students were 60.3% Caucasian, 12.6% Multiracial, 7.1% Asian, 3.8% African American / Black, and 14.1% Other.

Measures

Participants reported age, sex, race, ethnicity, and whether they were affiliated with a fraternity or sorority at Time 1. In addition, the following were assessed:

Driving after Drinking. At both time points, participants completed an item assessing whether they had driven shortly after drinking 3 or more drinks within the past three months. Participants responded using a scale from 0 (*never*) to 4 (*more than 10 times*). This item, modeled after the 23-item Rutgers Alcohol Problem Index (RAPI; White and Labouvie, 1989), has previously been used as a measure of DAD (LaBrie et al., 2010a).

Driving after drinking attitude and injunctive norms. The Injunctive Norms Questionnaire (Baer, 1994) was completed at both time points and measured DAD attitudes and injunctive norms for the typical student at their school. Participants indicated the extent to

which they and the typical student approved of "driving a car after drinking" on a 7-point scale (1 = *strongly disapprove* to 7 = *strongly approve*).

Weekly alcohol use. At Time 1, the Daily Drinking Questionnaire (DDQ; Collins et al., 1985; Dimeff et al., 1999) assessed the number of standard drinks consumed in a typical week during the past month. Participants were provided guidelines of what constitutes a standard drink (e.g., 12 oz. of beer, 4 oz. of wine, 1 cocktail with 1 1/4 oz. of 80 proof liquor, etc.).

Family history. Participants' family history of alcohol problems was assessed at Time 1 by asking if any biological relatives "had a significant drinking problem—one that should or did lead to treatment?" (Miller and Marlatt, 1984). Participants responded yes or no to this question.

Analysis plan

Due to the limited number of participants who had engaged in DAD more than twice in the past three months (Time 1: 2.6%; Time 2: 4.5%), the DAD variables were coded into binary variables that indicated whether or not participants had driven after drinking three or more drinks (1 = Yes, 0 = No). A three-step hierarchical logistic regression was performed with baseline alcohol consumption, baseline self-report of DAD, and demographic variables entered as the first hierarchical block. Given that attitudes mediate the relationship between injunctive norms and behavior (Kenney et al., in press), injunctive norms were entered in the second block and students' attitudes to DAD were entered in the third block.

Results

Overall, 27.9% of students reported engaging in DAD at either time point, with the proportion of students reporting DAD increasing significantly from Time 1 (15.7%) to Time 2 (21.1%), $Z = 2.29$, $p = .011$. At Time 1, the vast majority of students (86.1%) reported strongly disapproving of DAD; whereas just over half (50.2%) believed that the typical student strongly disapproved of DAD. There were no significant differences in participants' attitudes towards DAD at Time 1 ($M = 1.2$, $SD = .69$) and Time 2 ($M = 1.3$, $SD = .71$), $t(651) = 1.64$, $p = .10$, or differences in their perceptions of the typical students approval of DAD across time (Time 1: $M = 1.8$, $SD = 1.06$; Time 2: $M = 1.8$, $SD = 1.05$), $t(651) = 0.55$, $p = .59$. At both time points, the participants perceptions of the typical student was more approving than the actual student approval level (i.e., students overestimated the actual level of approval/injunctive norm; Time 1: $t(654) = 14.96$, $p < .001$; Time 2: $t(652) = 13.65$, $p < .001$).

Logistic Regression Analyses

Prior to the logistic regression, multi-way cross-tabulations of all categorical independent variables were examined (Field, 2009). The inclusion of family history of alcohol problems and race/ethnicity resulted in empty cells and low expected frequencies, and therefore these variables were not included in the regression model. In bivariate chi-square analyses, neither of these variables were associated with self-reports of DAD at Time 2. Correlations between Time 2 DAD and continuous independent variables are presented in Table 1.

Results from the hierarchical logistic regression are presented in Table 2. The final model were statistically significant, $\chi^2(7) = 127.04$, $p < .001$, Nagelkerke $R^2 = .28$, Cox & Snell $R^2 =$

.18. Collinearity diagnostics were performed, and variance inflation factor for each variable did not exceed 1.38, suggesting multicollinearity was not encountered. At Step 1 age ($OR = 1.59$, 95% C.I. = 1.23, 2.04), baseline alcohol consumption ($OR = 1.07$, 95% C.I. = 1.04, 1.10), and baseline DAD ($OR = 4.76$, 95% C.I. = 2.89, 7.82) emerged as significant predictors of DAD at Time 2, with older students, those who drank more alcohol at baseline, and those who reported engaging in DAD at baseline more likely to report DAD at Time 2. Although males (64/215; 29.7%) were more likely than females (74/440; 16.8%) to report DAD, $\chi^2(1) = 14.56$, $p < .001$, in the multivariate model participant sex did not significantly contribute to the prediction of DAD. Membership in a sorority or fraternity was not associated with self-reports of DAD at Time 2.

In Step 2, the odds ratio for injunctive norms for DAD was 1.36 (95% C.I. = 1.12, 1.65), indicating that those who perceived the typical student to be more approving of DAD were more likely to engage in DAD at Time 2. In Step 3, attitudes towards DAD did not significantly contribute to prediction of DAD ($OR = 1.23$, 95% C.I. = 0.90, 1.68). In the final model, age, baseline drinking, baseline DAD and injunctive norms for DAD significantly contributed to the prediction of DAD at Time 2. We examined the sensitivity of the decision to collapse the DAD variable into two categories by re-running the analysis using a Poisson regression. The results were largely similar to the logistic regression. After controlling for demographic variables, baseline DAD, baseline alcohol use, and injunctive norms for the typical student predicted DAD at Time 2.

Discussion

The current study examined factors associated with DAD longitudinally in a sample of college students. Over one-quarter of the participants reported DAD at one or both time points, indicating that despite public health efforts DAD continues to be a significant problem. Older students, and students who at Time 1 reported DAD, drank more alcohol and had less disapproving injunctive norms for a typical student were more likely to report DAD at Time 2. The findings add further support to cross-sectional data demonstrating that normative beliefs are associated with DAD intentions and behavior (Armitage et al., 2002; LaBrie et al., 2011).

Consistent with past research (Armitage et al., 2002; Fairlie et al., 2010; Zakletskaia et al., 2009), older students were more likely than younger students to report DAD. This may reflect that older students are more likely to drink at venues that require transportation (Fromme et al., 2010) increasing their likelihood to engage in DAD. Harm-reduction efforts among college students often target freshmen who tend to have the highest rates of alcohol consumption (Turrisi et al., 2000) and display alcohol-dependence symptoms at higher rates than the general adult population (Grekin and Sher, 2006). In contrast, because older students are seen to often “mature” out of risky alcohol use and report gradual decreases in their alcohol consumption (Larimer et al., 1998), fewer interventions target problematic drinking among this population. However, our results combined with past research showing the tremendous harm associated with DAD (Hingson, 2010; Hingson et al., 2009) suggest that older students are in fact a high-risk group that would benefit from specific interventions targeting DAD behavior.

DAD at Time 1 was the strongest predictor of DAD at Time 2: the odds of reporting DAD at Time 2 were over four times higher than for participants who did not report DAD at Time 1. These results are consistent with previous research suggesting that past behavior is often the best predictor of future behavior (Conner and Armitage, 1998). While the current study did not test for mediation effects, the Theory of Planned Behavior (Ajzen, 1991) posits that past behavior influences future behavior through shaping people's beliefs and attitudes. Past behaviors unique contribution to predicting Time 2 DAD may indicate that social cognitive variables other than norms and attitudes may be important mediators of the relationship between past and future DAD (Norman and Conner, 2006). For example, past DAD may shape individuals' perceptions of their ability to drive under the influence of alcohol or the perceived likelihood of risks associated with DAD, which in turn influences future DAD. Further research is needed to explore the possible mechanisms by which past DAD behavior influences future behavior.

The emergence of perceived injunctive norms for the typical student as a significant predictor when controlling for the other variables, reveals that what students think about the attitudes of other students on their campus plays an important role in determining DAD. Extending the cross-sectional findings of Kenney et al. (in press), participants significantly overestimated the level of approval of the typical student across both time points. Although students perceived the typical student to be generally disapproving of DAD, the consistent overestimation of peers' approval, along with the fact that greater perceived approval was associated with increased risk for DAD, provides further support for the potential benefits of

normative interventions targeting college students DAD behaviors and using injunctive norms for DAD.

While injunctive norms for DAD emerged as a significant predictor in the final model, students' own attitudes towards DAD did not. This finding is consistent with models of social norms that suggest students sometimes conform their behavior to social norms, even when doing so contradicts their personal attitude (Perkins, 1985). For example, for students who drive with friends to attend a social event, both peer pressure to take the group home, and perceptions of others' acceptance of DAD may have a greater impact in a student's decision to DAD than the drivers' own attitudes towards DAD. The results, however, differ from earlier cross-sectional research that suggests attitudes are associated with DAD intentions and behavior (Armitage et al., 2002; Kenney et al., in press). There are several reasons why the current study may have found that attitudes did not significantly predict DAD in the logistic model. For example, attitudes were correlated with both Time 1 DAD ($r(653) = .31, p < .001$) and baseline drinking ($r(653) = .23, p < .001$), and inclusion of these as covariates in the model may have made the unique contribution of attitudes become non-significant. Also, students' self-report of their attitudes may be more susceptible to social desirability bias than reports of injunctive norms for DAD. For instance, students may be more willing to report that students in general approve of DAD than to acknowledge that they personally approve of DAD. Indeed, 86.1% of students reported that they strongly disapproved of DAD, which may indicate that findings are a result of a floor effect.

Contrary to previous work (LaBrie et al., 2011), membership in a fraternity or sorority was not associated with DAD. Data for the present study came from a college at which DAD is discouraged among Greek students by providing group transport to off-campus Greek-sponsored social events, the location of which is kept undisclosed. It is possible that campus differences in characteristics of fraternities/sororities may impact whether Greek affiliation emerges as a risk factor for DAD.

Changing DAD behavior is likely to be challenging given the persistent nature of this behavior. Since both injunctive norms for DAD and past behavior uniquely contribute to predicting DAD, it may be beneficial to develop multipronged interventions that focus on correcting normative misperceptions as well as targeting various environmental factors, such as safe ride programs or placement of inhibiting cues in drinking environments.

This study has several limitations including the use of a single-item measure of DAD which did not capture other variables associated with level of intoxication, such as time spent drinking prior to DAD. Further, the reliance on self-report of data may be subject to self-presentation biases and inaccurate recall. The online survey emphasized the confidentiality of participant responses, but because of the potentially illegal nature and perceived disapproval of this behavior, students may have under-reported DAD. The current study relied on data from a single college campus, and further studies should use longitudinal data to examine factors associated with DAD across diverse campuses. Nonetheless, the longitudinal nature of the data in this study and its findings yield important insight into the phenomenon of college student

DAD and point to significant sources of new preventative interventions, especially those targeting injunctive norms for DAD.

Table 1.

Summary of Intercorrelations for Time 2 DAD and Continuous Predictors.

Variable	Time 2 DAD	Age	Baseline drinking	Injunctive norms
Age	.17**			
Baseline drinking	.32**	.05		
Injunctive norms for DAD	.12*	.07	-.02	
Attitude to DAD	.24**	.03	.23**	.40**
* $p < .01$. ** $p < .001$				

Table 2.

Hierarchical logistic predicting driving after drink 3 or more drinks at 12 months.

Predictor	<i>B</i>	S.E.	Wald	Odds Ratio [95% CI]	Δ Nagelkerke R^2
Step 1					.25**
Gender ^a	0.17	.25	0.43	1.18 [0.72, 1.95]	
Age	0.44	.13	11.59	1.56 [1.21, 2.01]	
Greek Affiliation ^b	-0.37	.26	2.06	0.69 [0.42, 1.14]	
Baseline drinking	0.06	.01	20.75	1.07 [1.04, 1.09]	
Baseline DAD ^c	1.47	.27	30.86	4.35 [2.59, 7.31]	
Step 2					.02*
Injunctive norms	0.25	.11	5.13	1.28 [1.03, 1.58]	
Step 3					.00
Attitude	0.21	.16	1.71	1.23 [0.90, 1.68]	

Note. Odds ratios are reported for the final step of the logistic regression. CI = 95% confidence interval.

^aFor gender the reference level was female. ^bFor Greek affiliation the reference group was non-membership in a fraternity / sorority. ^cFor baseline DAD the reference group was no DAD.

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

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