The Theory of Planned Behavior as a Predictor of Growth in Risky College Drinking*

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ABSTRACT. Objective: This study tested the Theory of Planned Behavior (TPB) as a predictor of growth in risky college drinking over a 3-month period. As predicted by the TPB model, it was hypothesized that attitudes, subjective norms, and perceived behavioral control would predict intention to engage in risky drinking, which would in turn predict growth in future risky drinking. **Method:** Participants were 837 college drinkers (64.2% female) who were randomly selected from two U.S. West Coast universities to participate in a larger study on college drinking norms. This study used latent growth analyses to test the ability of the TPB to predict baseline levels of as well as linear and quadratic growth in risky college drinking (i.e., heavy episodic drinking and peak drinking quantity). **Results:** Chi-square tests and fit indices indicated close fit for the final structural models. Self-efficacy, attitudes, and subjective norms significantly predicted baseline intention, which in turn predicted future heavy episodic drinking. Self-efficacy and attitudes were also related to intention in the model of peak drinking; however, subjective norms were not a significant predictor of intention in the peak drinking model. Mediation analyses showed that intention to engage in risky drinking mediated the effects of self-efficacy and attitudes on growth in risky drinking. **Conclusions:** Findings supported the TPB in predicting risky college drinking. Although the current findings should be replicated before definitive conclusions are drawn, results suggest that feedback on self-efficacy, attitudes, and intentions to engage in risky drinking may be a helpful addition to personalized feedback interventions for this population. (*J. Stud Alcohol Drugs, 72,* 322–332, 2011)

DESPITE MANY ADVANCES IN KNOWLEDGE about and interventions for risky college drinking in the past decade (Larimer and Cronce, 2007), research has shown that it has not decreased in proportion to these efforts. According to the results of a nationwide population-based study, the prevalence of heavy episodic drinking (HED; i.e., consuming five or more drinks for men and four or more for women in a single sitting) has increased slightly since the early 1990s (Nelson et al., 2009).

Modeling college drinking trajectories

Researchers have suggested that longitudinal modeling of substance use and associated factors may be necessary to better describe underlying mechanisms and thereby highlight new points for intervention and intervention enhancement (Piasecki et al., 2002; Sobell et al., 2000). In fact, innovative analysis techniques involving person-centered, longitudinal modeling have become increasingly accessible to researchers. For example, latent growth analyses allow for more precise examination of individuals' drinking trajectories (Muthén and Khoo, 1998). Such analyses also allow for more sensitive longitudinal change parameters that can accommodate not only linear but also quadratic growth, which may better fit the more irregular alcohol use trajectories encountered with younger drinkers (Crawford et al., 2003; Sayer and Willett, 1998). Last, some statistical programs can accommodate both continuous and count-observed variables in the same latent model framework (Muthén, 2002; Muthén and Muthén, 2007). This feature is particularly important for risky college drinking outcomes, which are typically skewed count variables (e.g., number of drinks consumed during peak drinking occasion, HED frequency) that follow Poisson or negative binomial distributions versus the traditional Gaussian or normal distribution (Neal and Simons, 2007).

Addressing a gap in the college drinking literature: A need for theory-based modeling

The use of various types of growth models to examine college drinking trajectories has increased dramatically over the past decade. In fact, a recent search in PsycINFO found 77 studies of college drinking trajectories, all of which were conducted since 2001. On the other hand, nearly all of these studies have either examined growth curves in and of themselves or the influence of various covariates on growth but not the prediction of growth by theoretically based models

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(Schulte et al., 2009). Addressing this gap in the literature by testing clinically relevant, theoretical frameworks may help account for underlying mechanisms of college drinking and may elucidate points for more comprehensive intervention development and enhancement.

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is one such framework with a well-established theoretical and empirical basis (Ajzen, 1988b, 1991; Armitage and Conner, 2001; Godin and Kok, 1996). According to the TPB, a certain set of motivational factors, including attitudes toward a behavior, subjective norms (i.e., a person's perception of injunctive and descriptive norms in a given population), and perceived behavioral control lead to intention to perform a behavior (Ajzen, 1991). Given the right opportunity, people will translate this intention into actual behavior.

Several studies focusing on college drinkers have established the prediction of drinking behavior by intention (Armitage et al., 2002; Conner et al., 1999; O'Callaghan et al., 1997). Attitudes, which are people's evaluation of the target behavior, have been shown to correlate with drinking quantity and frequency (Leigh, 1989). Further, longitudinal evidence has shown that positive attitudes toward alcohol use are positively correlated with future alcohol use among college drinkers (Stacy et al., 1994). The subjective norm was originally operationalized similarly to injunctive norms in the norms and college drinking literature (i.e., a person's perception of others' evaluations of the person performing the target behavior; Ajzen, 1991). More recently, however, Ajzen (2002a) has expanded the measurement of subjective norms to include descriptive norms, which are a person's perceptions of how others drink. Perceived behavioral control—the perceived ease or difficulty of performing a behavior—is also theorized to influence intention (Ajzen, 1988a, 1991). Both self-efficacy, which has been defined as one's perceived control over a certain behavior in a specific situation (Bandura, 1977; Marlatt and Gordon, 1985), and controllability beliefs, or beliefs that the performance of a behavior depends on the individual alone, make up the construct of perceived behavioral control (Ajzen, 2002b).

Several studies have established the prediction of risky drinking among college students using the TPB (Collins and Carey, 2007; Glassman et al., 2010; Huchting et al., 2008; Johnston and White, 2003; Norman et al., 1998; Wall et al., 1998). This framework has, however, mainly been tested in the context of smaller-scale, cross-sectional, and/or pre–post studies—not yet in a study with multiple time points to describe longitudinal growth in risky college drinking. Further, no studies to date have explicitly tested the implied role of intention as a mediator of TPB effects on drinking trajectories. Thus, further research is needed to characterize and clarify the roles of the TPB variables in predicting college drinking in a more dynamic and longitudinal way.

Aims and hypotheses of current study

Because the TPB has been shown to explain variance in both cross-sectional (Glassman et al., 2010; Nagoshi et al., 1994; Norman et al., 1998; Wall et al., 1998) and pre–post models of risky college drinking (Collins and Carey, 2007; Huchting et al., 2008; Johnston and White, 2003), it is well positioned to explain variance in college drinking trajectories as well. The present study, therefore, tested the relative strengths of attitudes, perceived behavioral control, and subjective norms in predicting intention to engage in risky drinking. Using latent growth analyses, we also tested whether intention to engage in risky drinking predicts drinking trajectories over time.

It was hypothesized that subjective norms, perceived behavioral control, and attitudes regarding risky drinking would predict risky-drinking intention at the first assessment (Time 1). Based on previous findings (Collins and Carey, 2007; Johnston and White, 2003), it was estimated that Time 1 intention would be positively associated with Time 1 drinking (i.e., the intercept in the latent growth model) and would be positively associated with increases in drinking over a 3-month follow-up. Consistent with research in a related area (Martin et al., 2010), it was hypothesized that drinking intention would explain (or mediate) the associations between the TPB (i.e., subjective norms, perceived behavioral control, and attitudes) and changes in drinking behavior.

Method

Participants

Participants consisted of 837 (64.2% female) college students at two U.S. West Coast 4-year universities. Participants were recruited from a random sample of 1,200 students who had participated in a larger parent study assessing campus drinking norms. To be considered for recruitment for the current study, participants from the parent study had to have given their consent to be contacted for subsequent studies.

Participants reported a mean age of 20.15 (SD = 1.39) years, and 97.1% reported being enrolled as full-time students (17.2% freshmen, 27% sophomores, 27.5% juniors, 28.3% seniors). In this sample, 67.3% self-identified as White, 12% as Asian, 10% as multiracial, 2.9% as African American/Black, 2% as Hawaiian/Pacific Islander, 0.8% as Native American/American Indian, and 5% endorsed the "other" racial/ethnicity group. Regarding ethnicity, 12.5% of participants identified as Hispanic/Latino/a. Of the overall sample, 25.4% reported being members of the fraternity/sorority system.

Measures

The Personal Information Questionnaire assessed participants' age, gender, year in college, race/ethnicity, and membership in an on-campus fraternity/sorority organization.

Theory of Planned Behavior model indicators by latent variable. The intention factor was represented by two indicators of risky-drinking intention from the Behavioral Intentions Questionnaire (Neal and Carey, 2004): (a) intention to engage in HED in the next 30 days and (b) intention to "drink until you get drunk." The internal consistency of these indicators was acceptable in this sample ($\alpha = .94$).

The attitude indicators in the current study were selected from the Global Attitude Scale (Simons and Carey, 1998) and suggestions by Ajzen (2002a). The Global Attitude Scale has previously evinced good reliability ($\alpha \geq .91$) and discriminant validity (Simons and Carey, 1998). Participants rated their general "overall opinions" about "drinking until you get drunk" along an unnumbered, 9-point scale framed by two opposing word pairs on either end. The global scale of the Global Attitude Scale measure was supplemented with additional items suggested by Ajzen (2002a) and included "dislike–like," "undesirable–desirable," "harmful–beneficial," and "worthless–valuable." These items evinced good internal consistency ($\alpha = .92$).

The subjective norms factor was made up of indicators from the Subjective Norms Questionnaire, a measure based on suggestions by Ajzen (2002a) and modified from a previous study (Collins and Carey, 2007). Participants reported how much different groups of people would approve or disapprove of their "drinking until you get drunk" on a bipolar scale ranging from 1 to 5, in which 1 = *highly disapprove* and 5 = *highly approve.* Target groups used in the current analysis included an average American college student and average college student at "your" university.

As suggested by Ajzen (2002a), this question stem was also rephrased to assess descriptive norms (i.e., "Will an average American college student/college student at your university drink until they get drunk in the next 30 days?"). Participants could agree or disagree with these statements on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Measured items for both descriptive ($\alpha = .96$) and injunctive ($\alpha = .96$) norms showed good internal consistency.

Because a review has suggested that perceived behavioral control may be broken down into two subordinate factors, self-efficacy and controllability (Ajzen, 2002b), both constructs were measured in this study. Controllability was measured using items suggested by Ajzen (2002a) and included "being able to control . . .," "being able to resist . . .," and "having control" over "drinking to get drunk" (in which 1 = *possible* to 5 = *impossible*). Internal consistency was adequate ($\alpha = .94$). Measured indicators of self-efficacy to resist "drinking until you get drunk" included the factor scores for the emotional relief and opportunistic scales of the Drinking Refusal Self-Efficacy Questionnaire (adapted from Young et al., 1991). Good internal consistency ($\alpha = .87–.94$) and concurrent and discriminant validity have been established for this measure (Baldwin et al., 1993; Young et al., 1991), and the current study replicated these findings ($\alpha = .93–.96$).

Risky-drinking factors. The Timeline Followback questionnaire (TLFB; Sobell and Sobell, 1992) was used to create the aggregate risky-drinking indicators: peak drinking quantity and HED frequency. The TLFB is a set of monthly calendars that allows for a retrospective evaluation of drinking for each day of the previous month. Although a recent study indicated problems with longer term recall for the alcohol TLFB (i.e., 90–365 days; Searles et al., 2000), the shorter 30-day and 60-day TLFB procedures used in this study were deemed adequately reliable to create the aggregate outcome scores. Concordance tests have indicated that the TLFB and prospective daily self-monitoring correlated up to $r = .89$ for 30-day drinking (Carney et al., 1998). In this study, 30-day TLFB measures were administered at baseline and 1-month follow-up and yielded the aggregate risky-drinking variables for these time points. A 60-day TLFB measure was administered at the 3-month follow-up and yielded the 2- and 3-month follow-up aggregate variables.

Materials

All data were collected via a web-based data collection software program, DatStat Illume, which allows for the creation and modification of surveys for use with Internet assessment. Web-based assessment is a secure and feasible method of data collection, particularly in such highly web-accessible environments as the universities included in this study. To protect privacy and confidentiality, participants were required to log into a secure server and to enter a unique study identifier developed for this research. All information transferred between participants and servers was secured using a 128-bit encrypted secure sockets layer. Data maintained in the online repository were encrypted, and the password to access these data was known only to research staff on this project. Previous studies have indicated no significant differences between paper-and-pencil and web administration of alcohol assessment measures similar to those proposed in this application (McMorris et al., 2009; Miller et al., 2002). Although no studies to date have provided psychometric information about web-administered TLFB specifically, computer-administered TLFB assessment has been shown to be reliable (Sobell et al., 1996).

Procedure

The parent study initially recruited participants from a random sample of 7,000 undergraduates using participants' names, addresses, email addresses, and phone numbers provided by the registrars' offices at the home universities. A total of 3,592 students (51.3%) were successfully recruited

for the parent study, and 3,156 (87.9% of those participating) consented to be contacted for future studies. A random sample of 1,200 participants from the parent study who consented to be contacted about future trials comprised the pool of potential participants for the current study. The procedures used in both the parent and current study, including obtaining consent for participants to be contacted for future studies, were approved by the respective universities' institutional review boards.

Potential participants for the current study were mailed or emailed invitations. Invitations included the study URL and a randomly generated personal identification number to allow them to log into the secure website and complete the informed consent form. Participants who provided informed consent completed a contact information form to facilitate contact for future follow-ups. Next, participants completed the baseline sociodemographic, TPB, and TLFB questionnaires, which took approximately 45 minutes. Participants were mailed $20 for completing the questionnaires and received a reminder that they would be contacted for the next assessment in a month.

One and 3 months after the baseline questionnaires were completed, participants were contacted via email and prompted to revisit the website to complete the next set of online study questionnaires (i.e., the TLFB calendars). Participants were reminded via email and, if necessary, were prompted up to three times by the investigators via telephone. Following completion of the online questionnaires, participants were mailed $10 and $20 for their efforts at the 1- and 3-month follow-ups, respectively. Participants who provided complete data for all three assessments were entered into a drawing to receive one of four American Express gift certificates (valued at $250 each).

Data analysis plan

We used two latent growth models, which examine individuals' development over time on outcome variables, to test the TPB as a predictor of risky-drinking outcomes among college students (i.e., quantity during the heaviest drinking occasion in the past month [peak drinks] and HED frequency). The latent growth models were conducted in a multivariate framework, which reconceptualizes random effects as multivariate outcome vectors. Mplus 5.1, the statistical modeling program used for these analyses, incorporates a generalized latent variable framework and allows for a wide array of variable types, estimation methods, and longitudinal modeling options (Muthén and Muthén, 2007). Anticipating skewed count-outcome data, we planned to specify drinking outcomes as count indicators of continuous latent drinking growth factors. We also planned to use maximum likelihood estimation with robust standard errors and Monte Carlo integration. The Satorra–Bentler corrected chi-square test (*TRd*) was used for tests of hypothesized model fit (Satorra and Bentler, 2001).

A few steps were taken to ensure model identification, generate basic fit statistics, and establish the measurement models for the overall analyses. First, baseline analyses were conducted to confirm that the measured TPB indicators loaded onto their respective latent TPB factors (i.e., intention, perceived behavioral control, attitudes, subjective norm), and to assess initial model fit.

Next, the simple growth models—without TPB covariates—were tested, using the risky-drinking variables. Given the distributional assumptions for count-based analyses, however, the mean, variance, and covariance structures are not sufficient to produce traditional tests of model fit that are familiar to readers and facilitate model interpretation. Therefore, to provide at least approximate estimates of model fit, we respecified count variables as continuous for the initial models. For interpretation of parameters, however, we reverted to the more appropriate count models. Last, drinking growth models were tested in conjunction with the TPB model to determine whether the TPB predicted growth in risky-drinking outcomes over the 3-month follow-up and to determine whether drinking intention mediated the association between the other TPB latent variables and risky-drinking outcomes.

Mediation effects were tested using the product of coefficients approach (MacKinnon et al., 2002), which involves the multiplication of regression coefficients for the regression of drinking intentions on the TPB variables (a-paths) and for the regression of the growth parameters on drinking intentions (b-paths), where a × b is considered the mediated effect. Asymptomatic 95% confidence intervals of the mediated effect were estimated using PRODCLIN (MacKinnon et al., 2007).

Results

Preliminary data analyses

Exploratory data analyses were conducted with continuous and count variables to determine the shape of the distributions and detect outliers, as necessary. Because risky-drinking outcome variables were positively skewed count data (see Table 1 for descriptive statistics) Poisson distributions were specified (Neal and Simons, 2007). Participant retention rates were 86% and 78% at the 1- and 3-month follow-ups, respectively. A set of logistic regressions was conducted to test whether missingness at any given time point was associated with baseline demographic or drinking variables. Analyses indicated that neither baseline drinking nor demographic variables significantly predicted missingness on outcome variables (peak drinking and HED) at any follow-up points (all $ps > .12$). Although missingness occurring completely at random cannot be directly tested because

TABLE 1. Descriptive statistics for model variables

Variable	*M* (*SD*)	*Mdn*	Skewness
Intention			
Intention: HED	3.13 (1.85)	3.00	0.15
Intention: "Drink until you get drunk"	3.12 (1.89)	3.00	0.19
Attitudes			
Dislike/like	4.55 (2.62)	5.00	-0.03
Undesirable/desirable	4.30 (2.48)	5.00	0.01
Harmful/beneficial	3.54 (1.91)	4.00	0.12
Worthless/valuable	3.86 (2.07)	5.00	-0.07
Subjective norms			
Descriptive: Average U.S. college student	4.32 (1.10)	5.00	-1.73
Descriptive: Average student at your university	4.30 (1.12)	5.00	-1.68
Injunctive: Average U.S. college student	3.97 (0.98)	4.00	-0.65
Injunctive: Average student at your university	3.98 (0.96)	4.00	-0.66
Controllability			
Can control drinking to get drunk	4.39 (1.11)	5.00	-1.87
Able to resist drinking to get drunk	4.40 (1.12)	5.00	-1.95
Control over drinking to get drunk is possible/impossible	4.34 (1.13)	5.00	-1.69
Self-efficacy			
DRSEQ: emotional	5.29 (0.99)	5.86	-1.61
DRSEQ: opportunistic drinking	5.64 (0.67)	6.00	-2.80
Alcohol variables			
HED Time 1	2.76 (4.24)	1.00	2.11
HED Time 2	2.64 (4.12)	1.00	2.03
HED Time 3	2.06 (3.79)	0.00	2.90
HED Time 4	2.45 (4.04)	1.00	2.67
Peak drinks Time 1	4.84 (4.67)	4.00	1.38
Peak drinks Time 2	4.43 (4.48)	4.00	1.64
Peak drinks Time 3	3.77 (4.38)	3.00	1.97
Peak drinks Time 4	4.12 (4.16)	4.00	1.32

Notes: HED = heavy episodic drinking; DRSEQ = Drinking Refusal Self-Efficacy Questionnaire.

the probability of missingness on the outcome variable is assessed as a function of the values of both predictors and outcome variables, these analyses suggested that the missingness mechanism may be considered "ignorable" for the following analyses (Allison, 2001). The use of maximum likelihood estimation in the analyses also served to minimize bias that may otherwise be introduced if using methods resulting in listwise data deletion (Allison, 2001).

Preliminary factor analyses indicated that descriptive and injunctive norms loaded onto two separate latent factors,

TABLE 2. Parameter estimates from the baseline Theory of Planned Behavior model

Variable	*B*	β	*SE*	*p*
Intention				
Intention: HED	1.00	0.94	0.01	<.001
Intention: "Drink until you get drunk"	1.03	0.94	0.01	<.001
Attitudes				
Dislike/like	1.00	0.90	0.02	<.001
Undesirable/desirable	0.99	0.94	0.01	<.001
Harmful/beneficial	0.66	0.82	0.02	<.001
Worthless/valuable	0.73	0.83	0.02	<.001
Subjective norms				
Descriptive norms	1.00	0.69	0.03	<.001
Average U.S. college student	1.00	0.96	0.01	<.001
Average student at your university	1.02	0.96	0.01	<.001
Injunctive norms	0.78	0.60	0.04	<.001
Average U.S. college student	1.00	0.97	0.004	<.001
Average student at your university	0.98	0.96	0.01	<.001
Controllability				
Can control drinking to get drunk	1.00	0.90	0.02	<.001
Able to resist drinking to get drunk	1.08	0.97	0.01	<.001
Control over drinking to get drunk is possible/impossible	1.00	0.89	0.02	<.001
Self-efficacy				
DRSEQ: emotional	1.00	0.92	0.01	<.001
DRSEQ: opportunistic drinking	0.60	0.82	0.02	<.001

Notes: HED = heavy episodic drinking; DRSEQ = Drinking Refusal Self-Efficacy Questionnaire.

TABLE 3. Parameter estimates from the simple growth models

Variable	*B*	β	*SE*	*p*
Heavy episodic drinking				
Intercept				
HED 1	1.00	1.00	–	–
HED 2	1.00	0.85	0.03	<.001
HED 3	1.00	0.84	0.03	<.001
HED 4	1.00	0.98	0.04	<.001
Linear slope				
HED 1	0.00	0.00	–	–
HED 2	1.00	0.36	0.04	<.001
HED 3	2.00	0.71	0.08	<.001
HED 4	3.00	1.24	0.17	<.001
Quadratic slope				
HED 1	0.00	0.00	–	–
HED 2	1.00	0.11	0.01	<.001
HED 3	4.00	0.42	0.05	<.001
HED 4	9.00	1.09	0.17	<.001
Linear slope with intercept	0.76	0.52	0.12	<.001
Quadratic slope with intercept	-0.27	-0.63	0.11	<.001
Quadratic slope with linear slope	-0.17	-0.96	0.01	<.001
Peak drinks				
Intercept				
Peak drinks 1	1.00	1.00	–	–
Peak drinks 2	1.00	0.88	0.03	<.001
Peak drinks 3	1.00	0.88	0.04	<.001
Peak drinks 4	1.00	0.96	0.04	<.001
Linear slope				
Peak drinks 1	0.00	0.00	–	–
Peak drinks 2	1.00	0.27	0.05	<.001
Peak drinks 3	2.00	0.54	0.10	<.001
Peak drinks 4	3.00	0.88	0.18	<.001
Quadratic slope				
Peak drinks 1	0.00	0.00	–	–
Peak drinks 2	1.00	0.08	0.02	<.001
Peak drinks 3	4.00	0.33	0.07	<.001
Peak drinks 4	9.00	0.82	0.18	<.001
Linear slope with intercept	0.28	0.57	0.14	<.001
Quadratic slope with intercept	-0.10	-0.63	0.14	<.001
Quadratic slope with linear slope	-0.04	-0.93	0.03	<.001

Note: HED = heavy episodic drinking.

but that they could be best conceptualized using an additional overarching norms factor. Factor analyses indicated inadequate fit for perceived behavioral control as a unitary, second-order factor. Therefore, we separated self-efficacy and controllability to serve as two, separate latent factors predicting intention in the primary analyses.

Primary analyses

Evaluation of preliminary models. The first evaluation step tested the baseline model (see Table 2 for parameter estimates in the measurement model). This model showed close fit, comparative fit index (CFI) = .97, root mean square error of approximation (RMSEA) = .06, although not exact fit, $T(83, N = 837) = 320.56$, $p < .001$.

The next model evaluation step confirmed the fit of the drinking growth models without the TPB predictors. The growth models included intercepts, linear growth factors, and quadratic growth factors. The first set of models treated the count variables as continuous to provide approximate estimates of model fit. Adequate overall fit was shown for both peak drinking, $T(1, N = 837) = 4.44$, $p = .03$, CFI = .99, RMSEA = .06, and HED, $T(1, N = 837) = 2.29$, $p = .13$, CFI = .99, RMSEA = .04. Parameter estimates resulting from the final count-based models (see Table 3 for parameter estimates from count models) showed that for peak drinking and HED, the intercepts were positively associated with the linear slopes. Thus, higher levels of peak drinking and HED at the initial assessment were associated with increases in risky alcohol use over the course of the 3-month follow-up. On the other hand, linear slopes were inversely correlated with the quadratic slopes, which indicated that increases in drinking over the 3-month follow-up were associated with a downturn or plateauing slope in risky drinking toward the end of the 3-month follow-up.

Evaluation of the complete TPB and growth models. The final evaluation step combined the TPB and growth models and thereby tested the effects of attitudes, self-efficacy, norms, and controllability on intention, as well as the effects of intention on the intercept, linear growth factors,

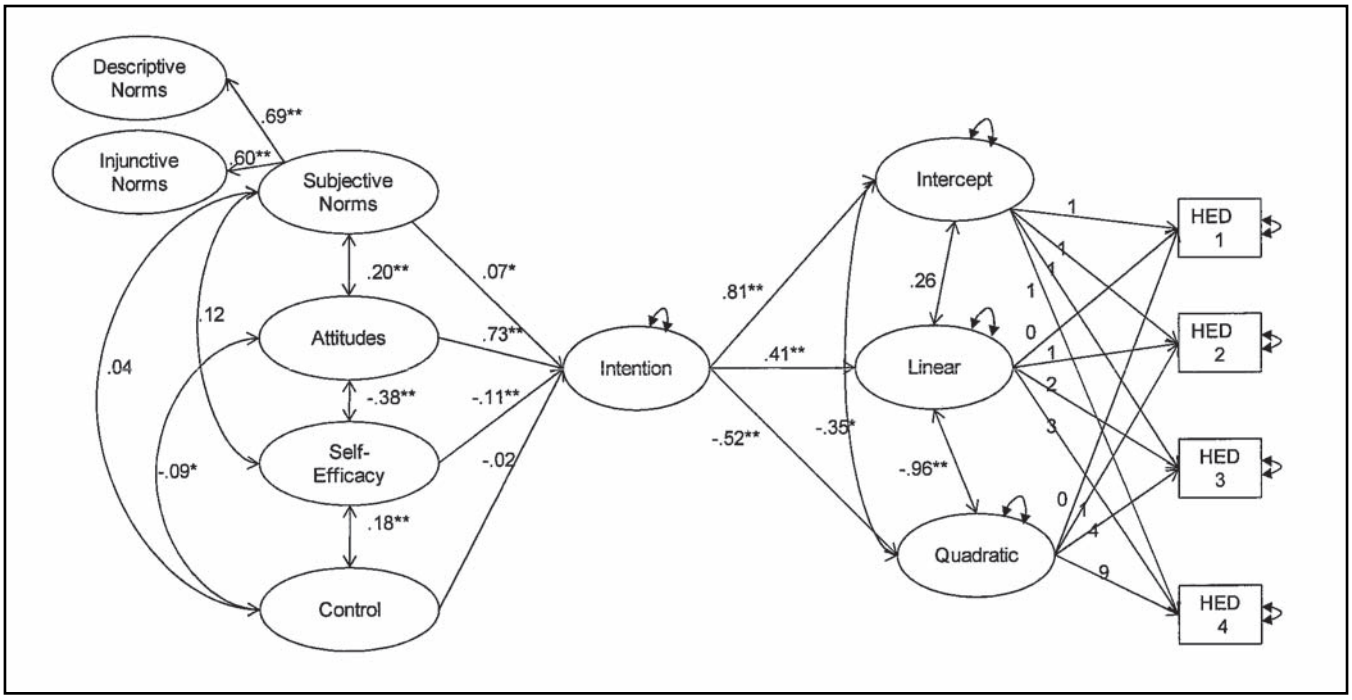

FIGURE 1. Structural model for the full Theory of Planned Behavior model predicting heavy episodic drinking (HED). For ease of interpretation, measured indicators in the Theory of Planned Behavior portion of the model are not shown.
*$p \leq .05$; **$p \leq .001$.

and quadratic growth factors. Further, a formal mediation test was applied to determine whether drinking intentions significantly mediated effects of the other TPB variables on growth in risky drinking.

As shown in Figures 1 and 2, the final count models for HED and peak drinking were similar in their effects. Both models indicated that attitudes and self-efficacy predicted intention to engage in risky drinking (HED and peak drinking). Norms predicted intention to engage in HED but not peak drinking. Controllability did not significantly contribute to intention in either model. The TPB variables accounted for 64% and 65% of the variance in intention in the HED and peak drinking models, respectively. For both HED and peak drinking models, higher intention was associated with elevated levels of risky drinking at baseline and increases in risky drinking over the 3-month follow-up. After taking into account the higher baseline and increasing linear slope, higher intention was also associated with a plateauing of the upward risky-drinking slope toward the end of the follow-up. For HED, the hypothesized model accounted for 66%, 16%, and 27% of the variance in intercept, linear slope, and quadratic slope terms, respectively. For peak drinking, the hypothesized model accounted for 64%, 14%, and 19% of the variance in intercept, linear slope, and quadratic slope terms, respectively.

Second, the indirect effects of the TPB on drinking outcomes were examined. As shown in Table 4, attitudes and self-efficacy were significantly associated with the intercepts (i.e., Time 1) of both peak drinking and HED (all *p*s < .03). For the peak drinking outcome, mediation analyses indicated that intentions significantly mediated the associations between both attitudes and self-efficacy and the intercepts and quadratic slopes of peak drinking. This indicated that intention significantly mediated the associations between the TPB variables and the initial level and acceleration or deceleration of peak drinking over time. Intention significantly mediated the association between both attitudes and self-efficacy in the prediction of all HED growth factors, thus intention to drink partially explained the association between TPB variables and initial level of and changes in HED over time.

Discussion

This study tested the ability of the TPB factors—including attitudes, subjective norms, and perceived behavioral control (i.e., self-efficacy and controllability)—to predict intention to engage in risky drinking ("drinking until you get drunk") and growth in actual risky drinking among college students. Previous findings in the college drinking literature have shown that Time 1 TPB factors can predict Time 2 risky drinking (Collins and Carey, 2007; Huchting et al., 2008; Johnston and White, 2003). This study built on these findings in a few important ways. First, this study replicated these findings in a larger sample (N = 837) than had been

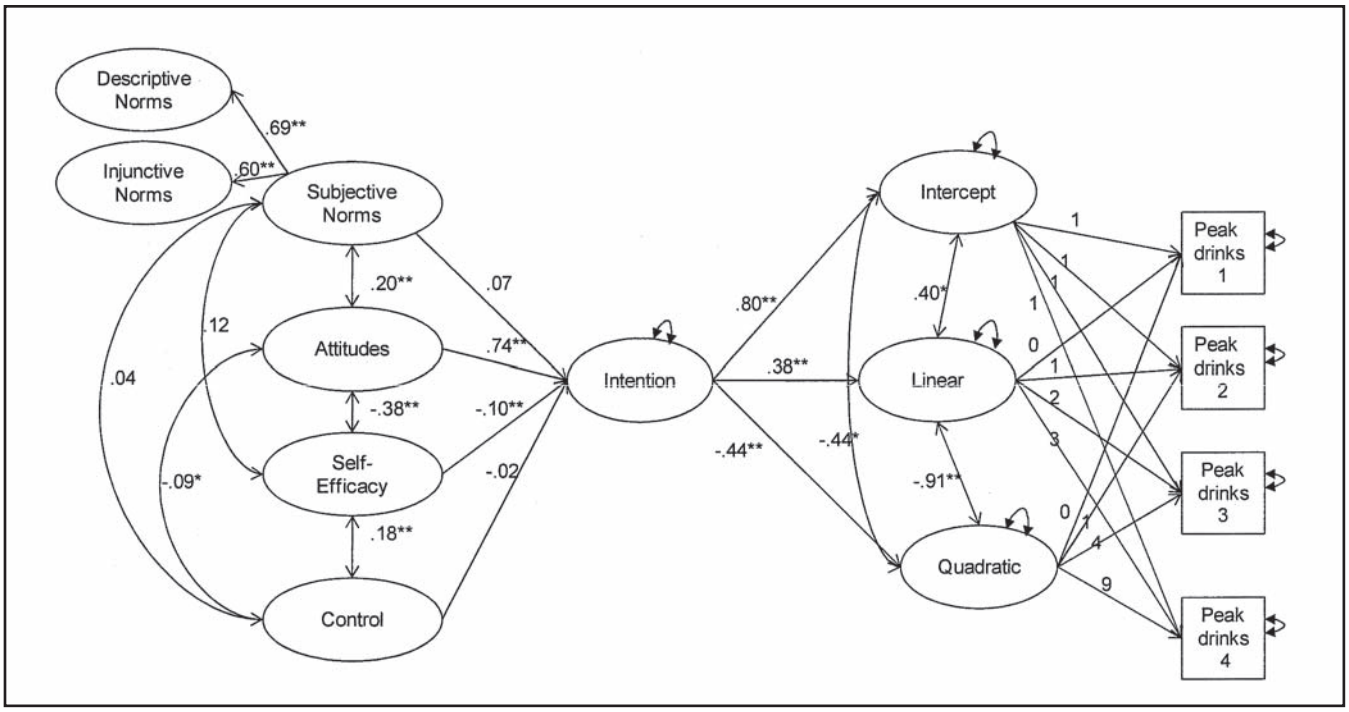

FIGURE 2. Structural model for the full Theory of Planned Behavior model predicting drinks consumed during peak drinking occasion in the last month (peak drinks). For ease of interpretation, measured indicators in the Theory of Planned Behavior portion of the model are not shown.
*$p \leq .05$; **$p \leq .001$.

previously reported in the literature. Next, this study extended the literature by increasing the follow-up period and testing whether TPB factors predicted growth in risky drinking over a 3-month period. Finally, this study is the first to test indirect effects of the TPB factors on growth in drinking, thereby testing intention as a mediator of longitudinal TPB effects. In accomplishing these aims, this study was able to provide a more thorough test of the TPB model in predicting risky college drinking.

As hypothesized, attitudes, subjective norms, and self-efficacy predicted intention to engage in risky drinking. Specifically, more positive attitudes about risky drinking, stronger beliefs that other college students both engage in and condone risky drinking, and lower levels of confidence for avoiding risky drinking all predicted higher intention to engage in this behavior. These findings corresponded, at least in part, to those of previous pre–post, longitudinal studies involving the TPB and college students (Collins and Carey, 2007; Huchting et al., 2008; Johnston and White, 2003). Differences in findings are likely attributable to the fact that each of these studies used slightly different samples and different measured indicators for the TPB

TABLE 4. Confidence intervals from mediation analyses

Outcome	Mediated effect	*B* [95% CI]
Peak drinks		
Intercept	on attitude via intention	0.19 [0.15, 0.23]**
Linear slope		0.03 [-0.003, 0.07]
Quadratic slope		-0.01 [-0.02, -0.001]*
Intercept	on self-efficacy via intention	-0.06 [-0.11, -0.02]**
Linear		-0.01 [-0.03, 0.001]
Quadratic slope		0.004 [0.0003, 0.01]*
Heavy episodic drinking		
Intercept	on attitude via intention	0.36 [0.29, 0.43]**
Linear slope		0.10 [0.04, 0.16]**
Quadratic slope		-0.04 [-0.05, -0.02]**
Intercept	on self-efficacy via intention	-0.12 [-0.20, -0.04]**
Linear slope		-0.03 [-0.06, -0.01]*
Quadratic slope		0.01 [0.003, 0.02]*

Note: B = unstandardized regression coefficient for the mediated effect.
*$p < .05$; **$p < .01$.

variables. For example, Huchting et al. (2008) found that norms played a more important role than self-efficacy and attitudes in predicting intention; however, the sample exclusively comprised sorority members. Further, Collins and Carey (2007) did not show a significant effect for subjective norms; however, the latent factor comprised injunctive but not descriptive norms. This variability in sampling, design, and methods complicates generalizability of the findings across studies. Overall, however, this study provided stronger support for the promising initial findings documented in previous studies and improved on their methods by including a larger sample size, more complete assessment of the TPB variables, and more dynamic measurement of the drinking outcome variables.

Despite the overall support for the TPB model, the perceived behavioral control factor did not conform to expectations advanced by the TPB. Ajzen (2002b) asserted that including both self-efficacy and controllability items could boost the internal consistency of the perceived behavioral control construct. However, the current findings indicated that self-efficacy and controllability were only modestly correlated (r = .20). Further, despite its significant correlation with intention in the initial models, the controllability factor did not significantly predict intention in the final, structural models and was thus the only aspect of the TPB that was not confirmed in this study. On the other hand, self-efficacy, which has been proposed as a key component of perceived behavioral control, was a significant predictor of intention to engage in risky drinking (Ajzen, 2002b). It may be that controllability, which is conceptualized as having actual control over one's *external* environment, is more predictive of intention when external barriers may fully obstruct a person's ability to perform a behavior (e.g., not having access to affordable health care to get a mammogram screening). Controllability may, however, be less relevant in predicting college drinking, where external factors (i.e., obtaining alcohol without being of legal age) may be present but more easily overcome than internal factors (i.e., self-efficacy to avoid drinking with friends).

In accordance with the second part of the TPB model (Ajzen, 1991), intention was positively associated with Time 1 drinking (growth model intercept) and positively predicted curvilinear growth in drinking over the 3-month follow-up. In other words, higher intention to engage in risky drinking was associated with higher levels of risky drinking at baseline. Higher intention was also associated with greater positive growth in risky drinking, accompanied by a deceleration in risky drinking from the 2- to 3-month follow-ups. This study, therefore, provided support for the TPB in predicting both intention and drinking growth among college drinkers.

Mediation analyses indicated that two constructs of the TPB—self-efficacy and attitudes—were indirectly associated with changes in drinking via their association with intentions. These results are somewhat consistent with a recent study that found intentions mediated the association between attitudes and drinking behavior among sorority members (Huchting et al., 2008). On the other hand, the previous study also found that the direct effects of social norms on drinking behavior were mediated by intentions. This finding was not fully supported in the current study: subjective norms were not directly associated with peak drinking quantity and were not indirectly associated with either risky-drinking variable via intentions. There were, however, two major differences worth noting between the Huchting et al. (2008) study and the current study. First, as previously noted, the current study included a broader and larger sample of college students (N = 837) than the study described in Huchting et al. (2008), which focused on 247 female students who were members of a sorority. Because normative influences are stronger in social groups that emphasize a collective culture (Trafimow and Finlay, 1996), studies focusing on fraternity/sorority samples are likely to show a stronger relationship between norms and intentions. Second, the current study assessed changes in risky-drinking behavior over the course of 3 months, whereas the Huchting et al. study only included a 1-month follow-up.

Some limitations of this study deserve mention. The first set of TPB variables (i.e., attitudes, subjective norms, self-efficacy, and controllability) was measured concurrently with intentions (the proposed mediator). Although temporal precedence was established between intentions and drinking changes over time, lack of temporal precedence from the variables of the TPB to drinking intentions precludes our ability to conclude that the variables of the TPB precipitated drinking intentions. Alternative interpretations include the possibility that variables of the TPB are influenced by intentions or that both the variables of the TPB and intentions mutually influence each other. It could also be the case that the TPB and intentions are completely unrelated and that some other unmeasured third variable is influencing both the variables of the TPB and drinking intentions. A more stringent test of the mediation effect would have assessed the variables of the TPB before intentions. Likewise, it would be ideal to control for risky-drinking episodes throughout the chain of measurement (for example, after the measurement of the TPB variables but before the measurement of intentions) to best differentiate among the contributions of these variables to the prediction of risky drinking (MacKinnon, 2008). Such analyses would provide stronger evidence for the hypothesis that drinking intentions mediate the associations between the TPB and risky drinking.

Further, it is important to note that the outcomes being modeled represent global, not event-level, outcomes. For example, someone may have intentions to engage in risky drinking that are not realized on a specific evening. Similarly, someone who has no intention to engage in risky drinking may end up doing so. Future studies could supplement the global analyses conducted in this study with event-level

analyses that provide information on associations between intentions and specific drinking events.

Last, the proportion of women in the sample (64%) was slightly higher than the female population at the two universities sampled (51% and 58%). It is possible that women were more likely to consent to participate in this study, which may have introduced bias and/or limited generalizability of the current findings to other populations and samples.

Despite its limitations, this study indicated overall support for the TPB in predicting risky college drinking. It also provided the first test of the TPB in predicting growth in risky drinking among college students, as well as the ability of intention to mediate the relationships between TPB variables and drinking trajectories. In showing the relevance of the TPB model in predicting longitudinal drinking trajectories in a college population, this study has highlighted some important future research directions. First, replication of these findings is necessary to provide further support for TPB variables in predicting risky college drinking. Second, although some brief motivational interventions have included elements aiming to correct distorted attitudes about drinking and support drinking refusal self-efficacy, most recent brief motivational interventions for college students have centered on personalized normative feedback to correct beliefs about drinking norms (Larimer and Cronce, 2007). The current findings, however, suggest that self-efficacy, attitudes, and intentions might all serve as important targets for college students. Future studies might test the efficacy of personalized feedback–type interventions that include feedback on students' own attitudes about, self-efficacy to avoid, and intentions to engage in risky drinking, in addition to normative and alcohol use information. If this information is key to predicting risky drinking, it might boost the efficacy and impact of personalized feedback by providing a more complete and salient picture of college students' understanding of their alcohol use and the potentially increasing discrepancy between their current use and their desired outcomes.

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