

Predicting Binge Drinking in College Students: Rational Beliefs, Stress, or Loneliness?

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Yixin Chen¹ and Thomas Hugh Feeley²

Abstract

We proposed a conceptual model to predict binge-drinking behavior among college students, based on the theory of planned behavior and the stress-coping hypothesis. A two-wave online survey was conducted with predictors and drinking behavior measured separately over 2 weeks' time. In the Wave 1 survey, 279 students at a public university in the United States answered questions assessing key predictors and individual characteristics. In the Wave 2 survey, 179 participants returned and reported their drinking behavior over 2 weeks' time. After conducting a negative binomial regression, we found that more favorable attitude toward drinking and less perceived control of drinking at Wave 1 were associated with more binge drinking at Wave 2; subjective norm at Wave 1 was not a significant predictor of binge drinking at Wave 2; students with higher stress at Wave 1 engaged in more binge drinking at Wave 2, but those with higher loneliness did not. Implications of findings are discussed.

Keywords

binge drinking, college students, theory of planned behavior, stress, loneliness

Binge drinking in college students has been recognized as one of the most serious public health concerns for over a decade, in that it often has severe health and

¹Department of Communication Studies, Sam Houston State University, Huntsville, TX, USA

²Department of Communication, University at Buffalo, The State University of New York, Buffalo, NY, USA

Corresponding Author:

Yixin Chen, Department of Communication Studies, Sam Houston State University, Huntsville, TX 77341–2299, USA.

Email: cindychen@shsu.edu

behavioral consequences for drinkers themselves, as well as others in the campus community (Hingson, Heeren, Winter, & Wechsler, 2005; Wechsler et al., 2002). Binge drinking refers to having five or more drinks for males and having four or more drinks for females in about 2 hours, according to the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2004). There is an alarming rate of binge drinking among college students, with 37% of students being surveyed reporting binge drinking in 2010, almost the same as the rate in 1993 (Johnston, O'Malley, Bachman, & Schulenberg, 2011). It appears that public education efforts over the past quarter century have not been effective in reducing binge drinking in college students. Thus, additional binge-drinking research focusing on this population is needed to inform alcohol-prevention strategies on and off campus.

A number of studies have been conducted to explain why college students binge drink (Collins & Carey, 2007; Elliott & Ainsworth, 2012; Norman, Armitage, & Quigley, 2007; Quinlan, Jaccard, & Blanton, 2006; Todd & Mullan, 2011). The lion's share of existing research was based on rational theoretical models, assuming that students' binge-drinking behavior was an outcome of weighing various alcohol-related beliefs. There is also evidence that many students engage in heavy drinking due to a pressing need to cope with emotional distress (e.g., stress and loneliness; Aldridge-Gerry et al., 2011; Knox, Vail-Smith, & Zusman, 2007). However, no researcher to date has examined the combined influence of emotional distress together with rational beliefs on students' binge-drinking behavior; in the current study, we endeavor to test these factors in combination.

Specifically, our primary aim is to examine the effects of alcohol-related beliefs and emotional distress on binge-drinking behavior in college students. A related aim is to reveal the most important protective factor that *deters* binge drinking and the most important risk factor that *encourages* binge drinking. A conceptual model is proposed based on two theoretical models: the theory of planned behavior (TPB), which predicts health/risky behaviors from a cognitive perspective (Ajzen, 1991) and the stress-coping hypothesis, which emphasizes the role of emotional distress in maladaptive behaviors (Cohen, 1984).

The TPB and Rational Beliefs

The TPB argues that individuals' decisions to perform or not perform a behavior under consideration is guided by the beliefs they hold toward the behavior (Ajzen, 1991). Individuals' beliefs about a behavior shape their attitude, subjective norm, and perceived behavioral control related to the behavior in question, and these three factors, in turn, influence intentions to engage in the behavior (Yzer, 2013). The central tenets of this line of research include (a) intention is a variable that is proximal to behavior performance; (b) attitude, subjective norm, and perceived behavioral control are considered proximal factors that directly

affect intention, and these three proximal factors are specified as internal to the model (Ajzen, 1991). Next, we reviewed empirical evidence regarding the influence of these three rational beliefs on drinking behavior in the college student population.

Attitude and Drinking Behavior

Attitude is a mental evaluation of performing a future behavior regarding “favor or disfavor, good or bad, like or dislike” (Fishbein & Ajzen, 2010, p. 78). Based on the value-expectancy approach, attitude represents a positive or negative mental evaluation of a behavior (Fishbein & Ajzen, 1975). Among studies on college binge drinking, some researchers focused on the attitude–intention link and failed to examine the attitude–behavior link (Norman et al., 2007; Todd & Mullan, 2011). For instance, Norman et al. (2007) found that participants with more positive attitude toward binge drinking had stronger intention to binge drink and that attitude is the strongest predictor of intention among all TPB variables.

Other researchers have looked at the association between attitude and actual drinking behavior (Elliott & Ainsworth, 2012; Johnston & White, 2003; Quinlan et al., 2006). For example, Quinlan et al. (2006) suggested that attitude is a prominent and positive predictor of binge-drinking behavior. Unfortunately, Quinlan et al. used cross-sectional data, so the behavior they examined was actually past behavior, violating an assumption of the TPB in terms of predicting future behavior. As the *attitude–behavior* link has been less studied than the *attitude–intention* link, we propose to further study the relationship between *attitude toward drinking* and *binge-drinking behavior*.

Subjective Norm and Drinking Behavior

Subjective norm refers to the extent to which individuals believe that other people think that they should or should not perform a particular behavior (Ajzen, 1991). This construct represents individuals’ perceived social pressure to perform or not to perform a behavior. In contrast to attitude, which is a more intrapersonally-generated component, subjective norm is considered more interpersonally related (Collins & Carey, 2007).

Although the theory of reasoned action (TRA, the predecessor of the TPB) and the TPB both identify subjective norm as a key predictor of intention, according to two meta-analyses, subjective norm makes little contribution to the explanation of intention (Cooke & French, 2008; Hagger, Chatzisarantis, & Biddle, 2002). In the context of binge-drinking behavior, some researchers found that subjective norm fails to predict intention (Collins & Carey, 2007; Cooke, Sniehotta, & Schüz, 2007; Elliott & Ainsworth, 2012; Norman et al., 2007), suggesting that subjective norm is not predictive of binge-drinking

behavior. To the contrary, researchers from two other studies suggested that subjective norm is significantly associated with binge-drinking intention: in one study, subjective norm and attitude were both significant predictors of intention, and subjective norm was a weaker predictor than attitude (Johnston & White, 2003); in another study, subjective norm accounted for the largest proportion of variance in intention (Todd & Mullan, 2011). One possible reason for these inconsistent findings may be the sampling difference. For example, Todd and Mullan's (2011) sample exclusively comprised first-year female college students. This completely female sample probably explains why subjective norm was the strongest predictor of intention in their study, as women appear to be more susceptible to social influences than men, based on a meta-analysis of social influence studies (Eagly & Carli, 1981). The inconsistency of these findings suggests additional research is needed to examine the association between *subjective norm of drinking* and *binge-drinking behavior*.

Perceived Behavioral Control and Drinking Behavior

Perceived behavioral control was initially conceptualized as "people's perception of the ease or difficulty of performing the behavior of interest," and "compatible with . . . perceived self-efficacy" (Ajzen, 1991, pp. 183–184). This definition was considered problematic (Yzer, Hennessy, & Fishbein, 2004) so, in the integrative model, the *perceived behavioral control* construct was changed to *self-efficacy* (Fishbein, 2000), which refers to individuals' beliefs in their ability to complete tasks and reach goals (Bandura, 1986). Later on, in the reasoned action theory, this construct was renamed as *perceived behavioral control*, but the conceptual and operational definitions remained the same as those for *self-efficacy* (Yzer, 2013).

As to the predictive ability of perceived control, findings are mixed from studies on college students' binge drinking (Elliott & Ainsworth, 2012; Norman et al., 2007). Norman et al. (2007) suggested that perceived behavioral control, measured by items of perceived controllability of binge drinking, is negatively related to binge drinking at 1-week follow-up. Elliott and Ainsworth (2012), however, failed to establish a significant relationship between perceived controllability of binge drinking and subsequent binge-drinking behavior 2 weeks later. In Norman et al.'s study, the outcome variable was measured by the number of days and times over the previous week that participants had engaged in a binge-drinking session, while in Elliott and Ainsworth's study, the outcome variable was assessed by frequency (e.g., never and very often) of binge drinking over the last 2 weeks. Perhaps a more precise measure of the outcome variable, like the one in Norman et al.'s study, is more likely to capture the influence of perceived control. In light of these mixed findings, we propose to further assess the effect of perceived control on binge-drinking behavior with a precise behavioral measure reflecting the binge-drinking definition of NIAAA (2004).

Although the TPB model has been widely supported in the literature, two limitations in this line of research are salient. First, researchers using the TPB model often examined intentions as a proxy of behavioral outcomes but failed to inspect *actual* behaviors (Ajzen, Brown, & Carvajal, 2004; Ajzen, Czasch, & Flood, 2009). Individuals may have high intentions to perform protective behaviors or stop risky behaviors, but in reality, they may fail to do so for a variety of reasons. To address this deficiency, we focus on actual binge-drinking *behavior* rather than *intention* in the present study.

Second, although the TPB and the TRA have undergone almost 40 years' development (Fishbein & Ajzen, 1975), the models have been criticized for relying too much on rational decision making and failing to account for the influences of emotional factors (Ingham, 1994). Indeed, people, especially young adults, can initiate/repeat risky behaviors, even though they know very well the dangers and possible negative consequences of their choices (Reyna & Farley, 2006). There is empirical evidence which suggests that college students' risky behaviors, like excessive drinking, can result from emotional distress (Aldridge-Gerry et al., 2011). Next, the stress-coping hypothesis is explicated to address the absence of emotional factors in the TPB.

The Stress-Coping Hypothesis, Stress, and Loneliness

The TPB model has been shown to account for between 22% and 65% of the variance in binge-drinking behavior (Cooke et al., 2007; Johnston & White, 2003; Norman et al., 2007). It appears that there is a considerable amount of variance in behavior that has been left unexplained. One way to enhance the TPB model's ability to predict binge drinking in college students is to examine the potential role of stress. Stress is defined as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources" (Lazarus & Folkman, 1984, p. 19). Life as a college student can be stressful: from leaving home for the first time to academic difficulty, from financial strain to balancing work and study, from relationship problems to worries about job prospects after graduation. According to a national survey involving more than 200,000 students who entered U.S. colleges in 2010, incoming students had a record level of stress: 58% of them occasionally and 29% frequently felt overwhelmed by what they had to do during the past year (Higher Education Research Institute, 2012).

The stress and coping hypothesis states that, under stressful life events, individuals are motivated to mitigate or cope with their stress with adaptive or maladaptive behaviors (Cohen, 1984). Alcohol use is a possible way to deal with stress, especially when individuals are trying to temporarily escape from a life problem. For many college students, studying at college can be both exciting and stressful. On one hand, they may enjoy greater freedom than they ever had before; on the other hand, they need to adjust themselves to the

demands of the college environment, often in the absence of their preexisting support networks (e.g., parents and high school friends). In the face of this freedom and these challenges, many college students are prone to risky behaviors, such as binge drinking (Read et al., 2012).

Stress and Drinking Behavior

Stress-motivated drinking occurs among college students (Broman, 2007). There is evidence that college students with high levels of stress tend to drink heavily (Kenney, Lac, LaBrie, Hummer, & Pham, 2013; Park, Armeli, & Tennen, 2004) or experience alcohol-related problems (Backer-Fulghum, Patock-Peckham, King, Roufa, & Hagen, 2011; Bodenlos, Noonan, & Wells, 2013). For example, Park et al. (2004) examined students who completed daily surveys for 28 consecutive days, and they found that participants drank more alcohol on days that they had more stressful experiences. Backer-Fulghum et al. (2011) reported that, among a sample of college students, increased stress is linked to more alcohol-related problems (e.g., indicative of alcohol use or dependence in emerging adulthood). Taken together, the high level of stress among college students may drive a significant group of students to drink or binge drink in order to cope with their stress (Mohr, Brannan, Mohr, Armeli, & Tennen, 2008).

However, some researchers showed that there is no significant relationship between stress and alcohol use among college students (Dermody, Cheong, & Manuck, 2013; Pauley & Hesse, 2009; Von Ah, Ebert, Ngamvitroj, Park, & Duck-Hee, 2004). For example, in a study on predictors of health behaviors in college students, Von Ah et al. (2004) reported that perceived stress was not a significant predictor of alcohol use. Similarly, in a study on the *stress-negative affect* model for alcohol use, Dermody et al. (2013) failed to detect stress-related drinking in a sample of college students. It remains unknown whether stress can account for additional variance in binge drinking beyond what is explained by other identified predictors (e.g., attitude). Thus, we propose to further study the effect of stress on college binge drinking.

Loneliness and Drinking Behavior

Aside from stress, loneliness may be another emotional factor that explains alcohol consumption in college students. In other words, some students may drink excessively to cope with loneliness rather than stress. Loneliness refers to emotional distress resulting from perceived deficits in the quantity and/or quality of one's social relationships (Peplau & Perlman, 1982). Loneliness has been described as the *most painful* of all human experiences (Sullivan, 1953). Loneliness has also been identified as a unique risk factor for physical and psychological health (Cacioppo, Hawkley, & Thisted, 2010; Chen & Feeley, 2014a).

College students often experience many changes in their levels of social contact, and such changes may trigger feelings of loneliness. In a study on freshman and sophomore students, over a quarter of the men and about 17% of the women agreed that they felt a deep sense of loneliness (Knox et al., 2007). There is evidence from epidemiological studies that lonely people are more likely to consume more alcohol (Miller, 2011). Although feeling lonely is not an unusual experience for college students, few researchers have explored the link between loneliness and alcohol use in this population. In one study, Knox et al. (2007) found that lonely college men were more likely to consume more alcohol and to perceive themselves as losers. In another study, Sherry et al. (2012) found that students with more perfectionistic attitudes also reported feeling isolated, lonely, and alienated, and such feelings drove them to hazardous drinking. It is unclear whether feeling lonely is a unique risk factor for binge drinking among the general college student population. Thus, we propose to examine the unique impact of loneliness on college binge drinking, independent of stress.

Although the above studies are informative regarding the *stress/loneliness–alcohol consumption* link, those investigators have not considered the roles of cognitive beliefs (e.g., attitude, subjective norm, and perceived control), which are identified as key predictors of health/risky behaviors in the TPB. The inconsistent findings as to the role that stress plays in college students' alcohol consumption may be due to overlooking the impact of cognitive factors. Also, those investigators all used a cross-sectional design, which potentially generates biased findings, as they actually examined whether then-current stress/loneliness levels predict past drinking behavior. To better understand how levels of stress/loneliness influence college students' drinking behavior, we propose to examine the impact of stress/loneliness on *future* binge drinking, after controlling for the effects of cognitive factors.

Unresolved Issues, Research Hypotheses, and Proposed Model

Several unresolved issues in the existing research are evident. First, researchers using the TPB model to examine binge drinking assumed that individuals' behaviors are driven by cognitive reasoning but overlooked the effects of affective factors (e.g., stress and loneliness). Second, researchers trying to establish the link between stress/loneliness and binge drinking did not incorporate cognitive factors as control variables. Third, in many studies, investigators relied on cross-sectional designs, which prohibit inferences of causality from cognitive/affective factors to binge-drinking behavior. Fourth, findings are mixed regarding the influences of subjective norm, perceived behavioral control, and stress on binge drinking. These mixed findings are likely attributable to the fact that each of these studies used different samples and/or different measures for the TPB variables or failed to consider cognitive and affective predictors of binge-drinking behavior simultaneously. In fact, no studies to date have systematically tested the joint effects of cognitive

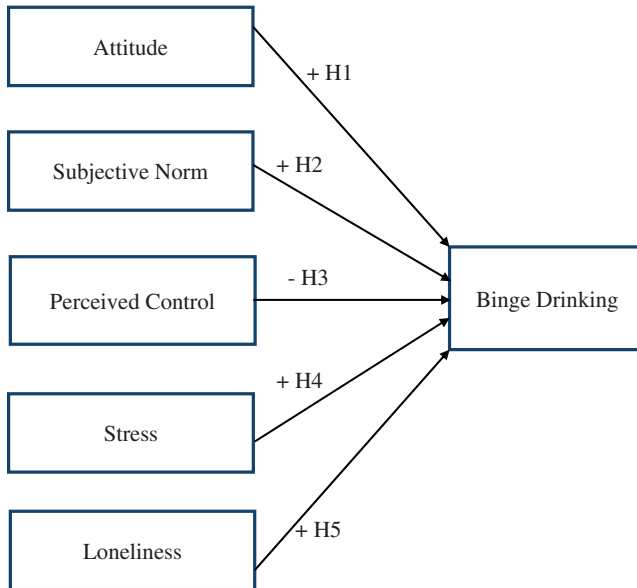


Figure 1. Proposed conceptual model.

beliefs, stress, and loneliness on binge drinking among college students. As such, the following hypotheses are posed:

Hypothesis 1 (H1): Attitude toward drinking is positively related to future binge drinking.

Hypothesis 2 (H2): Subjective norm related to drinking is positively related to future binge drinking.

Hypothesis 3 (H3): Perceived control of drinking is negatively related to future binge drinking.

Hypothesis 4 (H4): Stress is positively related to future binge drinking.

Hypothesis 5 (H5): Loneliness is positively related to future binge drinking.

Figure 1 shows the proposed conceptual model, which depicts the relationships among key study variables.

Method

We conducted a two-wave online survey with the two waves separated by 2 weeks. In the Wave 1 survey, we measured all predictors, including individual

characteristics. In the Wave 2 survey, we assessed participants' drinking behavior in the last 2 weeks. The decision to use a 2-week time frame was based on two reasons. First, to test the hypotheses that cognitive/affective factors predict future behavior, behavior should be assessed some time after the behavioral predictors were measured (Yzer, 2013). Second, affective factors (i.e., stress and loneliness) tend to fluctuate in the college student population, depending on different time points in a semester (e.g., the beginning of a semester, the finals' week); using a shorter time frame (e.g., 2-week) is more likely to capture the imminent consequences of affective factors than a longer time frame (e.g., half a year).

At the beginning of the Wave 1 survey, participants were informed the study's purpose, procedure, risks, benefits, confidentiality, and the timeline for the Wave 2 survey. At the beginning of both of the surveys, participants were provided the following definition: "Throughout these questions, by a 'drink' we mean a can or bottle of beer, a glass of wine or a wine cooler, a shot of liquor, or a mixed drink with liquor in it. We are not asking about times when you only had a sip or two from a drink. By 'on the same occasion,' we mean within a 2-hour period." This definition was taken from the National Survey on Drug Use and Health (NSDUH) series (visit <https://www.icpsr.umich.edu/icpsrweb/ICPSR/series/64>).

Procedures

Participants were undergraduate students taking an introductory communication class at a public university in the United States. The research procedure had been approved by the institutional review board of the university. An announcement was made in class to solicit participation, and the link to the Wave 1 survey was subsequently posted on the class website. After 2 weeks, the link to the Wave 2 survey was posted, and students were informed that only individuals who participated in the Wave 1 survey were eligible. Students were given 48 hours to complete each of the two surveys.

In both the Wave 1 and Wave 2 surveys, participants were asked their date of birth and the first three letters of their mothers' first name to create a unique identifier for each participant. After data cleaning, it was determined that 279 participants completed the Wave 1 survey, and 179 finished both the Wave 1 and Wave 2 surveys. The attrition rate at Wave 2 was 35.8%. The Wave 1 and Wave 2 data sets were merged together to create a new data set. This new data set was double checked on the unique identifier, and it showed that each participant at Wave 1 corresponded to the same person at Wave 2. The following section describes measures for variables. Sample characteristics and descriptive statistics are reported in the Results section.

Measures

Individual characteristics. Individual characteristics including sex, age, ethnicity, number of months in college, and health status were measured and treated as

control variables. Health status was measured by a single question: How would you describe your health status? The response scales ranged from 1 = *poor* to 5 = *excellent*.

Number of binge-drinking days. Number of binge-drinking days in the past 2 weeks measured at Wave 2 is the outcome variable. Males and females have different binge-drinking criteria (NIAAA, 2004). If a participant was female, then the number of binge-drinking days was counted as the number of days that she had *four or more* drinks on the same occasion; if a participant was male, then the number of binge-drinking days was counted as the number of days that he had *five or more* drinks on the same occasion.

Attitude. Attitude toward drinking was measured by one stem statement "For me, drinking alcohol/having four or more drinks on the same occasion/having five or more drinks on the same occasion/over the next 2 weeks would be . . ." followed by four semantic words: enjoyable, good, pleasant, and satisfying (Johnston & White, 2003). The response scales ranged from 1 = *strongly disagree* to 7 = *strongly agree*. The reliability of this measure was $\alpha = .980$, 95% CI [0.975, 0.984]. These items were averaged to create a measure of attitude toward drinking. Higher values indicate more positive attitudes toward drinking.

Subjective norm. Subjective norm related to drinking was measured by two groups of statements (Johnston & White, 2003). The first group started with "If I drink alcohol/have four or more drinks on the same occasion/have five or more drinks on the same occasion/in the next 2 weeks, most people who are important to me," followed by "would . . ." with the response scales ranging from 1 = *strongly disapprove* to 7 = *strongly approve*; the second group started with the same stem statement, but followed by "would find it . . ." with the response scales ranging from 1 = *very undesirable* to 7 = *very desirable*. The reliability of this measure was $\alpha = .944$, 95% CI [0.930, 0.956]. These items were averaged to create a measure of subjective norm toward drinking. Higher values indicate more favorable subjective norms related to drinking.

Perceived control. Perceived control of drinking was measured by two groups of statements (Norman et al., 2007). The first group started with "Whether or not I drink alcohol/have four or more drinks on the same occasion/have five or more drinks on the same occasion/in the next 2 weeks is," followed by "under my control." The second group started with the same stem statement, but followed by "up to me." The response scales for all statements ranged from 1 = *strongly disagree* to 7 = *strongly agree*. The reliability of this measure was $\alpha = .918$, 95% CI [0.889, 0.939]. These items were averaged to create a measure of perceived control. Higher values indicate higher perceived control.

Stress. Stress was measured by five items from the Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). These items followed a stem question “In the last 2 weeks, how often have you felt ... ” Sample items include “nervous and stressed?” and “difficulties were piling up so high that you could not overcome them?” The response scales ranged from 1 = *never* to 7 = *very Often*. The reliability of this measure was $\alpha = .779$, 95% CI [0.702, 0.836]. These items were averaged to create a measure of stress. Higher values indicate higher levels of stress.

Loneliness. Loneliness was measured by a stem question “In the last 2 weeks, how much of the time did you feel ... ” followed by four items from the UCLA Loneliness Scale (Russell, 1996): (a) You lack companionship? (b) You were left out? (c) You were isolated from others? (d) You were alone? The response scales ranged from 1 = *never* to 7 = *very often*. The reliability of this measure was $\alpha = .915$, 95% CI [0.893, 0.934]. These items were averaged to create a measure of loneliness. Higher values indicate higher levels of loneliness.

Analysis Plan

As the outcome variable (number of binge-drinking days) is a count variable, the residuals are not normally distributed (Cohen, Cohen, West, & Aiken, 2003). Thus, ordinary least square regressions are not appropriate for data analysis purposes. Count regression approaches, such as Poisson or negative binomial regression, are much more appropriate for count data (Coxe, West, & Aiken, 2009). We chose negative binomial regression over Poisson regression, as the former accounts for overdispersion in count data (Cohen et al., 2003).

Although, in some studies, researchers also included past drinking behavior as a predictor for binge-drinking behavior in 1, 2, or 3 weeks (e.g., Cooke et al., 2007; Todd & Mullan, 2011), Collins and Carey (2007) demonstrated, through a confirmatory test of the TPB model in predicting binge drinking among college students, that a TPB model without past drinking behavior supplies a better fit than a model which included it. They also concluded that a TPB model including past behavior was “neither statistically nor theoretically superior to a model comprising solely cognitive TPB predictors” (p. 505). Additionally, neither the TPB, nor the stress-coping hypothesis includes past behavior as a predictor of future behavior. Thus, for the purpose of parsimony, and with the theory-driven approach in mind, we did not include past drinking behavior as a predictor in the proposed model.

Results

Sample Characteristics, Descriptive Statistics, and Correlations

Among the final sample of 179 participants, 84 (46.9%) were males. Their ages ranged from 18 to 29 years ($M = 19.76$, $SD = 1.75$). Among the participants, 101

Table 1. Descriptive Statistics and Reliabilities of Major Variables.

Variables	Mean	SD	Minimum	Maximum	α
Attitude	3.43	1.92	1.00	7.00	.98
Subjective norm	3.51	1.67	1.00	7.00	.94
Perceived control	6.08	1.66	1.00	7.00	.92
Stress	3.67	1.61	1.00	7.00	.78
Loneliness	2.91	1.59	1.00	7.00	.92
No. of binge-drinking days	0.81	1.75	0	13	

Table 2. Zero-Order Correlation Matrix.

Variable	1	2	3	4	5	6
1. Attitude	—	.699**	.158*	-.099	-.040	.384**
2. Subjective norm		—	.263**	-.061	.114	.251**
3. Perceived control			—	-.252**	-.028	-.010
4. Stress				—	.212**	.115
5. Loneliness					—	-.071
6. No. of binge-drinking days						—

Note. * $p < .05$. ** $p < .01$.

(56.4%) were White, 43 (24.0%) were Asian or Pacific Islander, 15 (8.4%) were Black, 5 (2.8%) were Hispanic, 1 (0.6%) were American Indian or Alaska Native, and 14 (7.8%) were “Other Ethnicities.” The number of months that participants have been in college ranged from 2 to 60 ($M = 15.91$, $SD = 12.27$). Their health status ranged from 2 to 5 ($M = 3.69$, $SD = .79$), indicating that their average health status was close to “very good.” Number of binge-drinking days ranged from 0 to 13 ($M = .81$, $SD = 1.75$). Table 1 presents descriptive statistics, and Table 2 presents the zero-order correlation matrix of major study variables.

The Roles of Individual Characteristics, TPB variables, Stress, and Loneliness

A negative binomial regression (Table 3) was conducted to examine the effects on the outcome variable of individual characteristics, TPB variables, stress, and loneliness. The model was significant, the likelihood ratio $Chi-square = 85.35$, $df = 10$, $p < .001$. Table 3 shows the coefficients and their 95% confidence intervals, the exponentiated values of the coefficients and their 95% confidence intervals, along with the significance values.

As shown on Table 3, ethnicity was a significant predictor of number of binge-drinking days, $Exp(B) = 2.595$, 95% CI [1.401, 4.807], $p = .002$. White

Table 3. Effects of All Predictors on Number of Binge-Drinking Days.

Predictors	B	SE	95% Wald confidence interval for B	Exp(B)	95% Wald confidence interval for Exp(B)	p Value
Gender (0 = male; 1 = female)	-.342	.285	[-0.900, 0.216]	.710	[0.407, 1.241]	.229
Ethnicity (0 = none-White; 1 = White)	.954	.315	[0.337, 1.570]	2.595	[1.401, 4.807]	.002
Age	.070	.115	[-0.156, 0.295]	1.072	[0.856, 1.343]	.545
Months	-.007	.014	[-0.034, 0.020]	.993	[0.966, 1.020]	.613
Health status	-.026	.171	[-0.360, 0.309]	.975	[0.697, 1.362]	.881
Attitude	.480	.102	[0.281, 0.679]	1.616	[1.324, 1.972]	<.001
Subjective norm	.058	.120	[-0.176, 0.292]	1.059	[0.838, 1.339]	.629
Perceived control	-.226	.096	[-0.414, -0.039]	.798	[0.661, 0.962]	.018
Stress	.320	.093	[0.138, 0.503]	1.378	[1.147, 1.654]	.001
Loneliness	-.159	.096	[-0.347, 0.030]	.853	[0.707, 1.030]	.099

Note. SE = standard error.

students' number of binge-drinking days at Wave 2 was 2.595 times that of non-White students. Attitude was a significant predictor of number of binge-drinking days, $Exp(B) = 1.616$, 95% CI [1.324, 1.972], $p < .001$. For each one-unit increase in attitude at Wave 1, participants had 1.616 times more days binge drinking at Wave 2. Perceived control was a significant predictor of number of binge-drinking days, $Exp(B) = .798$, 95% CI [0.661, 0.962], $p = .018$. For each one-unit increase in perceived control at Wave 1, participants had .798 times fewer days binge drinking at Wave 2. Stress was a significant predictor of number of binge-drinking days, $Exp(B) = 1.378$, 95% CI [1.147, 1.654], $p = .001$. For each one-unit increase in stress at Wave 1, participants had 1.378 times more days binge drinking at Wave 2. Neither subjective norm nor loneliness was a significant predictor of number of binge-drinking days. The above analyses suggest that Hypotheses 1, 3, and 4 were supported, while Hypotheses 2 and 5 were not.

Discussion

We proposed a conceptual model predicting binge drinking among college students, based on the TPB and the stress-coping hypothesis. A two-wave online survey was conducted within a 2-week time frame. The following key findings

were revealed: First, attitude toward drinking was highly correlated with subjective norm of drinking. Second, more favorable attitude toward drinking and less perceived control of drinking were associated with more binge drinking in 2 weeks. Third, subjective norm was not a significant predictor of binge drinking in 2 weeks. Finally, students with higher stress engaged in more binge drinking in 2 weeks, but those with higher loneliness did not. Implications of these findings are discussed later.

Interpretation of Findings

An interesting finding is that attitude is highly correlated with subjective norm ($r = .699$). The TPB/TRA assumes that attitude and subjective norm are distinct constructs that influence intention *independently*. There is evidence against and evidence for the *attitude–subjective norm* distinction in research from the 1980s and 1990s but, overall, the evidence favors the distinction (Trafimow, 2007). There are two explanations for the highly correlated relationship between attitude and subjective norm found in this study. One possibility is that participants' attitudes toward drinking are significantly influenced by opinions of drinking held by important others (e.g., siblings and friends). Participants in this study are young adults, and this age group's attitudes toward drinking may be subject to their perceptions of whether important others would approve of drinking. Another possibility is that attitude toward drinking can be contagious, and thus participants' attitudes toward drinking may also affect the same domain of attitudes of important others, which then shape participants' perceptions of norms regarding drinking.

Based on our findings, positive attitude toward drinking is the most salient risk factor of binge drinking; attitude is also the strongest predictor of binge drinking (except ethnicity). This finding is consistent with previous studies suggesting that, among all TPB variables, attitude was most strongly associated with binge-drinking intention (e.g., Norman et al., 2007). The attitude construct assessed in this study represents *affective attitude*, which refers to anticipated feelings associated with performing a specific behavior (Elliott & Ainsworth, 2012). That attitude is the strongest predictor of binge drinking may indicate that positive affect expectancies (i.e., pleasant feelings) associated with alcohol consumption outperform other considerations when college students decide to engage in binge drinking.

Contrary to expectations, subjective norm is not a significant predictor of binge drinking. However, this finding is consistent with some previous studies in which researchers did not detect a significant relationship between subjective norm and binge-drinking intention (Elliott & Ainsworth, 2012; Norman et al., 2007). The nonsignificant *subjective norm–binge drinking* association observed in the present study and those previous studies may be explained by the high correlation between attitude and subjective norm (e.g., $r = .699$ in the present study;

$r = .57$ in Elliott & Ainsworth, 2012), as such high correlation can suppress the effect of subjective norm on binge drinking. Another possible explanation is that subjective norm is a more interpersonally dependent and distal predictor, while attitude is a more intrapersonally generated and proximal predictor of behavior; thus subjective norm exerts a less salient influence on binge-drinking behavior than does attitude.

Findings of this study also suggest that perceived control of drinking is negatively related to binge drinking, and it appears to be the only protective factor of binge drinking among all examined factors. Thus, those students who reported a higher control over drinking behavior were less likely to engage in binge drinking over the following 2 weeks. Perceived control has been documented as a kind of psychological resource, which helps to promote or maintain health and well-being (Chen & Feeley, 2012). High perceived control is likely to motivate individuals to engage in protective behaviors (e.g., exercise and cancer screening) and terminate risky behaviors (e.g., binge drinking and smoking). Binge drinking often happens at a party or social event when students are faced with external pressures to drink—pressures over which they possess little control (Norman & Conner, 2006). Perceived control, as an important psychological resource, may help students to resist external pressures to binge drink and refrain from such risky behavior, which may put them in jeopardy.

It seems that students use binge drinking as a way to cope with stress, but not loneliness. It is probably because, when students are stressed out, they drink alcohol as a way to forget their problems, as a momentary relief from the daily stress they experience. This finding is consistent with results from a longitudinal study in which researchers found a causal link between stress and alcohol consumption (Russell, Cooper, Frone, & Peirce, 1999). This finding also indicates that, even after the impacts of cognitive predictors are considered, stress still serves as a catalyst driving students to binge drink. As to why loneliness is not a significant predictor of binge drinking, it is possible that lonely students have fewer social connections, and they are isolated and stay by themselves; thus, they are less frequently involved in social gatherings or events, where alcohol is often used as a social lubricant and excessive drinking may be complimented.

Theoretical and Practical Implications

This study has two implications for theoretical development. First, in previous binge-drinking studies, researchers generally used a single, cognitive perspective, and they overlooked the roles of affect. The present research is unique in that we propose a comprehensive model integrating two theoretical frameworks. We recommend that theories (e.g., the TRA and TPB) that try to explain risky behaviors incorporate the impact of emotional distress to improve their predictive capacity. Second, considering that attitude and subjective norm are highly correlated, and that attitude, but not subjective norm, exhibits a significant effect

on binge drinking, it seems that attitude is a proximal, while subjective norm is a distal predictor of binge drinking. Thus, it appears appropriate for the TRA/TPB to outline a mediating path from subjective norm to behavioral outcomes through attitude in the context of risky behaviors, where individuals' attitudes are likely to be influenced by perceptions of norms or sanctions toward risky behaviors.

This study's findings have important implications for the design of binge-drinking intervention programs. As attitude, perceived control, and stress are all significant predictors of binge drinking, intervention programs should incorporate elements that could potentially change attitude, improve perceived control, and alleviate stress. First, interventions among college students should target the attitude construct with an aim to alter a favorable attitude toward drinking to a more negative one. Second, intervention messages should emphasize that controlling one's drinking behavior is an achievable goal and try to improve students' confidence in their abilities to resist the temptation to binge drink. Third, intervention programs should debunk the myth that drinking can cope with stress and highlight that stress-induced drinking can make the problem even worse. College administrators should also provide students workshops on stress-management skills and offer individual counseling to those at risk. One possible strategy is mindfulness-based stress reduction, which has been successful in decreasing alcohol-related problems by diminishing stress (Bodenlos et al., 2013). In sum, the take-away message is that an intervention program should target all of the significant predictors identified in the current study simultaneously, in order to achieve the maximum effect in reducing binge drinking on college campuses.

The current findings also have important policy implications for college campuses. School administrators can enforce strict alcohol policies, such as ban of alcohol sales on campus, a zero tolerance for alcohol use by minors on campus, and regulations for alcohol use by students aged 21 or older in university housing and for student activities. Universities can also have a policy to implement campus-wide social marketing campaigns aimed at all students, especially those high-risk populations (e.g., White students), at the beginning of each semester when students return to campus. Those campaigns would need to explain policies and legal consequences of campus drinking and emphasize potential risks associated with binge drinking. Additionally, campus media such as student newspapers or radio stations can be utilized to raise the campus community's awareness of alcohol problems and support for strict alcohol policies. Some alcohol intervention programs, such as the Alcohol Skills Training Program and Brief Alcohol Screening and Interventions for College Students, have been used on college campuses (e.g., University of Nebraska, Lincoln; Newman, Shell, Major, & Workman, 2006). University administrators can require first-year students and students who have had alcohol-related offenses to have mandatory enrollment in such intervention programs, as part of the alcohol education efforts on campus. Special intervention efforts should be directed to students with high stress. For example, university administrators can

request the wellness center and counseling center to have an interactive and personalized stress-screening and alcohol-problem questionnaire on their websites, so that students can go online to self check their stress- and drinking-related issues, and decide if they need to seek professional assistance. The enforcement of those policies promises to cut the binge-drinking rate on campus.

Methodological Strengths

Two methodological strengths of this study are worth mentioning. The first is the use of a two-wave online survey with a prospective measure of the behavioral outcome. In some studies on college students' alcohol consumption, investigators used a cross-sectional design (e.g., Boyle & Boekeloo, 2009; Von Ah et al., 2004), which violates the basic assumption of TPB in terms of predicting future behavior from current rational beliefs. In contrast, we measured the follow-up binge-drinking behavior after 2 weeks. Although this is a relatively short time period, follow-ups with similar lengths were commonly used in previous studies on binge-drinking behavior among college students (e.g., Cooke et al., 2007; Elliott & Ainsworth, 2012; Norman & Conner, 2006; Norman et al., 2007). With over half of published TPB studies employing cross-sectional designs (Elliott & Ainsworth, 2012), we consider using a prospective measure of binge-drinking behavior in 2 weeks, a strength of the present study. Although some alternative explanations (e.g., risk perception) cannot be ruled out (Chen & Yang, 2015), using a two-wave online survey makes the causal claims in this study stronger, as all predictors preceded the outcome variable.

A second methodological strength is measuring two types of drinking behavior (i.e., number of days having *four or more drinks/five or more drinks* on the same occasion), and then calculating the number of binge-drinking days of female and male participants based on the *four drinks* and *five drinks* standard separately. Some researchers assessed participants' drinking behavior by asking *how often/whether* they had engaged in a binge-drinking session (Elliott & Ainsworth, 2012; Woolfson & Maguire, 2010). Using such a measure in the survey might incur an issue of social desirability, as the term *binge drinking* has a negative connotation, and might create some confusion, as different people may have different opinions about what is considered binge drinking. In another study, the same five drinks standard was used to categorize all binge drinkers regardless of gender (Johnston & White, 2003). This practice may be problematic as, based on the NIAAA's (2004) definition, males and females should have different binge-drinking criteria.

Limitations

Several limitations of this study should be noted. First, our findings are based on self-report, and participants might underreport their drinking behavior due to

poor recall or social desirability. Second, although we established a 2-week time lag between measures of predictors and the measure of drinking behavior, using a cross-lagged panel design may produce a more powerful analysis and make our causal claims stronger. Third, although key predictors based on two theoretical frameworks were identified, we did not examine descriptive norm (Perkins & Berkowitz, 1986) and risk perception (Chen & Yang, 2015), which are potential predictors of binge drinking. Finally, our findings are based on a convenience sample, which may not be representative of U.S. college students and thus may limit the generalizability of our findings.

Future Research Directions

Researchers can achieve fruitful results in a variety of directions in the future. One direction is to test the possible mediating effect of subjective norm on binge drinking through attitude. A second direction is to incorporate descriptive norm and risk perception in the analyses and then compare the predicting roles of attitude, descriptive norm, perceived control, stress, and risk perception in binge drinking. A third direction is to explore potential factors (e.g., information seeking and social support) that may boost self-efficacy or perceived control in the context of resisting binge drinking (Chen & Feeley, 2012, 2014b). A fourth direction is to explore whether stress moderates the relationships between TPB variables and binge-drinking behavior. For example, under stressful situations, some students may have a pressing need to have a drink to cope with their stress, even though they have a negative attitude toward drinking. In this case, stress may weaken the relationship between TPB variables and binge-drinking behavior.

Conclusion

Binge drinking in college students is a nationwide problem. It is a problem both at an individual level and a societal level (Sharma & Kanekar, 2008). No single theory can explain it, and no sole effort from one discipline can solve it. A multitheoretical perspective, together with interdisciplinary collaborations from health communication, public health, and substance use treatment, may be more effective in reducing this problem. We contribute to the substance use literature by identifying that attitude toward and subjective norm of drinking are highly correlated, justifying that attitude is the strongest predictor of binge drinking, and clarifying the protective role of perceived control in resisting binge drinking. Our findings are important, as we showed that students with high stress are at risk of binge drinking. Finally, our findings may be valuable to college administrators and public health professionals regarding the implementation of alcohol-intervention programs and alcohol-use policies on college campus.

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Author Biographies

Yixin Chen (PhD in Communication, 2014) is an Assistant Professor in the Department of Communication Studies at Sam Houston State University. Her research interests include the impact of cognition, emotion, and communication processes on health decision-making and personal well-being. Currently, her research centers on how social support is associated with well-being, and how health literacy and health beliefs are related to health/risky behaviors.

Thomas Hugh Feeley (PhD in Communication, 1996) is Professor of Communication at the University at Buffalo where he conducts research on social influence processes in relation to health decision-making. His research program on promoting organ donation has been funded for the past 13 years by the Health Resources and Services Administration. He recently authored a book entitled, *Research from the inside out: Lessons from exemplary studies in communication* (Routledge, 2015).

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