Addictive Behaviors 38 (2013) 2080–2083

Contents lists available at SciVerse ScienceDirect

Addictive Behaviors

Short Communication

A field investigation of perceived behavioral control and blood alcohol content: A pattern-oriented approach

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HIGHLIGHTS

- The average BAC of drinkers in a downtown, college bar setting was .096 mL/L.
- Three latent classes of drinking perceived behavioral control were observed.
- Classes differed as a function of Greek-life status and gender.
- BAC was a significant predictor of drinking perceived behavioral control class.

ARTICLE INFO

Keywords:
Perceived behavioral control
Theory of planned behavior
Alcohol
College
Blood alcohol content

ABSTRACT

As the first field study of perceived behavioral control (PBC) to assess alcohol consumption with a physiological measure (i.e., blood alcohol content; BAC), the research examined the impact of intoxication on alcohol-specific PBC (APBC). In total, 665 passersby were recruited into the study at several late-night drinking locations near a large university campus. After answering questions regarding personal demographics and APBC, participants were administered a breath alcohol test (Lifeloc FC-20; ±.005 mL/L). The average BAC of drinking participants was .096 mL/L. A latent class analysis (LCA) was performed to classify participants based on APBC responses. Three classes emerged: *high PBC*, *high controllability*, and *low controllability*. Class membership varied as a function of gender and Greek-life membership. Blood alcohol content was a significant predictor of class membership. Results show a link between alcohol consumption and APBC that varies based on gender and Greek-life status. These findings are discussed with regard to their implications for a variety of prevention interventions.

1. Introduction

College alcohol use and abuse continue as a significant public health concern. Each year, college alcohol consumption results in an estimated 1825 student deaths, 600,000 injuries, 700,000 assaults, and 90,000 sexual assaults (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson, Zha, & Weitzman, 2009). One promising area for prevention interventions is perceived behavioral control (PBC).

Perceived behavioral control branches across multiple theories including the theory of planned behavior (TPB; Ajzen, 1988, 1991), perceived self-efficacy (Bandura, 1977, 1982, 1993), and perceived locus of control (Rotter, 1966). This construct has also been linked to various alcohol-related outcomes (e.g., Hutching, Lac, & LaBrie, 2008; Marcil, Bergeron, & Audet, 2001; Marcoux & Shope, 1997; McEachan, Conner, Taylor, & Lawton, 2011; Todd & Mullan, 2011). Yet, many questions remain regarding the association between PBC and alcohol consumption.

The purpose of this study is to further investigate the relationship between PBC and alcohol consumption by using a pattern-oriented approach. This approach assumes that the interaction or pattern of variables is more meaningful and descriptive of human functioning than an examination of single variables (Foti, Bray, Thompson, & Allgood, 2012). In contrast to a variable-oriented approach (e.g., Hutching et al., 2008; Todd & Mullan, 2011), the pattern approach to PBC isolates different subgroups (i.e., classes) of drinkers based on the PBC subconstructs of controllability and self-efficacy. The value of the pattern approach has been demonstrated in the alcohol domain outside of PBC (Buettner, Bartle-Haring, Andrews, & Khurana, 2010; Sacco, Bucholz, & Spitznagel, 2009; Ward, Cleveland, & Messman-Moore, 2013).

This study also aims to extend beyond traditional self-report measures of alcohol consumption by assessing alcohol consumption with a physiological measure, blood alcohol content (BAC). This allows for a more precise measure of student intoxication than allowed by self-report. As the first PBC field study to use such a measure, this research complements previous investigations, but should also provide a more accurate examination of the relationship between PBC and alcohol consumption.

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http://dx.doi.org/10.1016/j.addbeh.2013.01.003

2. Material and methods

2.1. Participants

Participants were 665 passersby near drinking locations at a large, public southeastern university. Males constituted 69.6% ($n = 463$) of participants. Members of a Greek-life organization (i.e., fraternity or sorority) made up 18.5% ($n = 123$) of participants.

2.2. Measure of PBC

A five-item questionnaire based on a public health handbook to guide construction of TPB surveys was used to assess alcohol-related PBC (APBC; Francis et al., 2004). This scale was chosen due to participation time constraints in this field setting which made larger scales impractical. Previous research with this scale demonstrated a Cronbach's Alpha of .72 (Smith, Geller, Plummer, & Deal, 2011). This scale specifically measures APBC in relation to perceptions of controllability and self-efficacy. A seven-point likert scale was used with "1" indicating "Strongly Disagree" and "7" indicating "Strongly Agree." Items are provided in Table 1. Self-efficacy is measured with items 1 & 2, and controllability is measured with items 3–5.

A pilot study of 472 participants was conducted to examine the psychometric properties of this scale in a field setting. A confirmatory factor analysis (CFA) was run with the two factors of controllability and self-efficacy. All items loaded significantly onto their respective factors. The chi-square value for the overall model fit was significant, χ^2 (4) = 12.16, $p < .05$, suggesting a lack of fit between the hypothesized model and the data. Due to the sensitivity of chi-square in large samples, however, other fit indices were assessed (Kline, 1998). Examination of these indices indicated good model fit, IFI = .95; TLI = .95; CFI = .95; and RMSEA = .06.

2.3. Apparatus

Participants' BACs were assessed using handheld Lifeloc FC-20 breathalyzers (Lifeloc Technologies, Inc., Wheat Ridge, CO). Lifeloc FC-20 breathalyzers are accurate to ±.005 mL/L. All breathalyzers were calibrated prior to data collection to ensure optimum performance and accuracy.

Table 1
Item response probabilities and gamma parameter estimates reflecting gender and Greek-life differences in probability of PBC class membership.

Demographic group	PBC latent class		
	High PBC	High controllability	Low controllability
Female non-Greek	(69.04%)	(7.52%)	(23.44%)
Male non-Greek	(61.81%)	(23.72%)	(14.47%)
Female Greek	(62.71%)	(17.26%)	(20.03%)
Male Greek	(52.95%)	(27.00%)	(20.05%)
PBC item	**Probability of "yes" response**		
I have difficulty drinking to my desired level of intoxication (R)	1.00	0.61	0.56
I am confident that I can drink to my desired level of intoxication	0.99	0.63	0.55
I know the alcohol concentration of the drinks I consume tonight	0.85	0.76	0.26
How much alcohol I drink tonight is completely up to me	0.99	1.00	0.26
Factors beyond my control impact my level of intoxication (R)	0.87	0.77	0.48

Note. Gamma estimates shown are those for the invariant measurement model tested with multiple groups across gender and Greek-life status.

2.4. Procedure

On each night of the study, three teams of trained researchers set up tables at two downtown locations near college bar establishments and one on-campus location near a late-night dining facility. All data were collected between the hours of 10:00pm and 2:00am. The three research teams consisted of two recruiters/surveyors and one breathalyzer administrator.

Passersby at each of the research locations were randomly recruited into the study by surveyors. After providing consent, surveyors collected participants' demographic information and verbally administered the APBC measure. Upon completing the survey, participants were administered a breath alcohol test.

2.5. Analysis plan

All analyses were conducted with categorical data analysis methods because variables were not normally distributed. All PBC items were dichotomized. Responses at or below the midpoint of the original scale were classified as a "disagree" response in order to properly evaluate individuals based on an "agree" response (Fishbein & Stasson, 1990). Blood alcohol content was trichotomized into the categories of completely sober (BAC = 0.00), mildly intoxicated ($0 < BAC \leq .08$), and highly intoxicated (BAC > .08).

A CFA using asymptotically distribution-free estimation was first performed to examine the psychometric properties of the APBC measure followed by several pattern analyses. Latent class analysis (LCA) is a pattern-oriented approach that identifies a set of mutually exclusive, unobserved classes of individuals characterized by similar, multidimensional patterns of items while accounting for measurement error in participant responses (Buettner et al., 2010; Sacco et al., 2009). Therefore, these classes can be considered subgroups of individuals with similar standing on a particular latent construct. Latent class analysis with grouping variables was performed to examine the impact of gender and Greek-life status on latent class membership. Finally, LCA with BAC as a covariate was run to examine if level of intoxication was a predictor of latent class membership.

3. Results

3.1. Overall level of intoxication

In total, 15.5% ($n = 103$) of participants were completely sober. The average BAC of drinkers was .096 mL/L ($SD = .044$), ranging from .010 to .261 mL/L. No significant differences in BAC were observed as a function of demographic group. Male drinkers (M = .099) had a statistically similar BAC to female drinkers (M = .091), $t(559) = -1.963$, $p = .050$. Additionally, Greek-life drinkers (M = .101) had a statistically similar BAC to non-Greek-life drinkers (M = .095), $t(559) = -1.07$, $p = .284$.

3.2. Confirmatory factor analysis

A CFA was used to examine the factor structure of the APBC measure. The two factors (controllability and self-efficacy) were allowed to covary ($r = -.30$, $p < .05$). All items loaded significantly onto their respective factors (factor loadings ranged from .36 to .72). The chi-square value for the model was significant [χ^2 (4) = 11.09, $p < .05$] suggesting a lack of fit. However, other fit indices were assessed due to the sensitivity of chi-square in large samples (Kline, 1998). Examination of these indices indicated adequate model fit, IFI = .93; CFI = .93; and RMSEA = .05. This model was compared to a one-factor model; which not only showed poor fit [χ^2 (4) = 34.23, $p < .05$; IFI = .71; CFI = .70; RMSEA = .09], but also fit significantly worse using a chi-square difference test. Thus, the two-factor model was statistically superior to the one-factor model.

Table 2
Beta parameters, odds ratio and inverse odds ratio estimates for multiple groups using BAC as a covariate.

Class	Blood alcohol content											
	Non-Greek females			Non-Greek males			Greek females			Greek males		
	β	OR	IOR	β	OR	IOR	β	OR	IOR	β	OR	IOR
High PBC	−0.41	0.7	1.5	−0.79	0.5	2.2	−2.0	0.1	7.7	−0.21	0.8	1.2
High controllability	−0.54	0.6	1.7	−0.45	0.6	1.6	−2.28	0.1	10	1.14	3.8	0.3
Low controllability	–	1	1	–	1	1	–	1	1	–	1	1

Note. OR indicates odds of membership in a particular latent class compared to the low controllability reference group for a one-unit increase in BAC, given gender and Greek-life status. IOR indicates the inverse odds ratio.

3.3. Latent class analysis

Latent class analysis of the five items assessing the self-efficacy and controllability subscales of APBC was used to identify and describe latent classes of APBC. Models with one through six classes were fit and compared using G^2 value, Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample size adjusted BIC (a-BIC), and the theoretical interpretation of the classes (Buettner et al., 2010; Sacco et al., 2009). The three-class model was associated with the lowest AIC and a-BIC, as well as the most parsimonious non-significant G^2 value. Based on these fit statistics, as well as interpretability, the three-class model was superior to all other models. Furthermore, analyses of model stability using 500 sets of random starting values show 100.00% of randomly generated seeds were associated with the best-fitting model.

The item-response probabilities and distribution of the classes of individuals with regard to APBC are summarized in Table 1. The three-class solution was characterized by individuals with *high PBC* (35.23%), *high controllability* (55.04%), and *low controllability* (9.73%). Latent class analysis with multiple groups was performed to examine differences in probability of class membership as a function of gender and Greek-life status. Measurement invariance was tested across these four groups (Eid & Rolf, 2003; Lubke & Neale, 2008). The difference in G^2 between the invariant and free measurement models was non-significant (54.94, $p > .05$). Thus, the invariant measurement model does not fit significantly worse than the free measurement model, and the parameter restrictions should be kept. The gamma parameter estimates reflecting differences in probability of class membership as a function of gender and Greek-life status are reflected in Table 1.

Following the analysis of multiple groups, BAC was tested as a predictor of latent class membership. The *low controllability* latent class was selected as the reference group for comparability and interpretability reasons. The exclusion likelihood was −1596.92 ($df = 8$) with a change in the −2 log-likelihood of 20.67 ($p < 0.01$). Thus, BAC was a significant predictor of latent class membership.

Table 2 provides the Beta parameters, odds ratios, and inverse odds ratios for the LCA with multiple groups using BAC as a covariate. Odds ratios are interpreted as the increase in odds of membership in a target latent class relative to membership in the *low controllability* latent class for a one-unit increase in BAC. Inverse odds ratios allow for examination of odds of membership in the *low controllability* class, relative to other classes.

4. Discussion

Overall, the results showed high levels of intoxication in this college setting. Over half of the drinkers in this study were over the legal limit to drive of .08 mL/L. Nearly 10% of drinkers were more than twice the legal limit. As the first field study to examine PBC in relation to a physiological measure of intoxication, the results shed a unique light on the relationship between student alcohol consumption and APBC.

The LCA demonstrated that most college students feel at least a moderate level of APBC, especially self-efficacy as compared to controllability. This suggests that many college students are confident they have the ability to control their level of intoxication, but acknowledge that outside factors often influence their drinking on a given night. While individuals at higher BACs were generally more likely to report lower APBC, the opposite trend was observed for Greek-life males.

These results hold implications for prevention interventions and suggest APBC education may be a useful component of these efforts. Particularly, education efforts could provide students with a more realistic perception of their actual ability to estimate their level of intoxication and teach strategies to increase drinking controllability (e.g., knowing alcohol concentration of drinks, having a sober friend, ways to resist peer pressure). Special consideration should be given to Greek-life males who may be at heightened risk because of increased perceptions of control at higher BACs.

Role of funding source
No funding was received for support of this research.

Contributors
All authors contributed to and have approved the final manuscript. The study was designed by Smith. Data analyses were conducted by Smith, Coyle, Baldner, and Bray. Smith, Coyle, and Geller prepared the original drafts of the manuscript.

Conflict of interest
No authors have any conflict of interest.

Acknowledgments
The authors would like to thank research assistants with the Center for Applied Behavior Systems for the numerous nights of data collection and hard work.

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