

Relationships between Drinking Onset, Alcohol Use Intensity, and Nighttime Risk Behaviors in a College Bar District

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Objective: To identify antecedents of risk behavior events in college bar patrons. **Methods:** In this nighttime field study, self-report data and alcohol intoxication readings were collected from patrons immediately upon exiting bars ($n = 618$). **Results:** Multilevel structural equation modeling revealed positive associations between age of drinking onset and both alcohol use intensity in the past year and recent bar-going frequency. In turn, alcohol use intensity in the past year was positively associated with bar-going frequency and intoxication at bar exit. An association between drinking onset and bar-going frequency was mediated by alcohol use intensity in the past year. **Conclusions:** Discernable paths from age of drinking onset to monthly bar-going frequency and intoxication level after leaving a bar can be identified. The results highlight the critical role of drinking onset in development of college student alcohol abuse. Research is needed to determine whether college bars are environmental pathogens mediating between genetic risk factors and patron risk behavior.

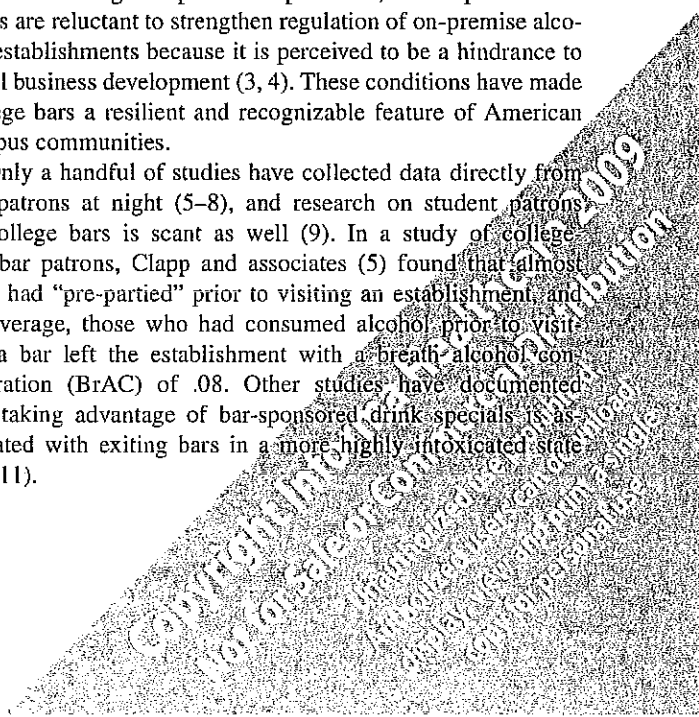
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INTRODUCTION

Most cities with large populations of residential college students have specific bars and often entire bar districts that cater to students (1). Colleges and universities typically exert little or no influence on the regulation of these establishments (2), but their academic reputations can be marred by problems associated with noise, underage drinking, illegal drug use, and impaired driving. Despite these problems, municipalities and states are reluctant to strengthen regulation of on-premise alcohol establishments because it is perceived to be a hindrance to small business development (3, 4). These conditions have made college bars a resilient and recognizable feature of American campus communities.

Only a handful of studies have collected data directly from bar patrons at night (5-8), and research on student patrons of college bars is scant as well (9). In a study of college-age bar patrons, Clapp and associates (5) found that almost 75% had "pre-partied" prior to visiting an establishment, and on average, those who had consumed alcohol prior to visiting a bar left the establishment with a breath alcohol concentration (BrAC) of .08. Other studies have documented that taking advantage of bar-sponsored drink specials is associated with exiting bars in a more highly intoxicated state (10, 11).



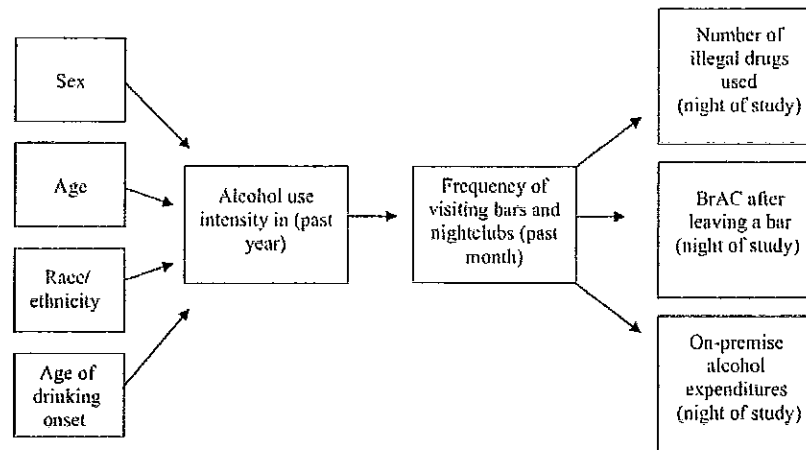


FIG. 1. Hypothesized relationships in a model of college bar patron risk behavior.

The aim of the present study is to extend previous research on college bar patrons by describing the extent to which three nighttime risk behaviors of college bar patrons are the endpoints of a long-established pattern of alcohol involvement. Event-level analyses of this type, conducted to examine variability between nighttime incidents (i.e., alcohol intoxication, illegal drug use, and alcohol expenditures) and drinking history among people frequenting bars, have not been previously reported in the literature. Much of the existing knowledge based on patron drinking comes from studies relying on: (1) retrospective self-reports of alcohol use occurring during some past time period and (2) analyses comparing drinking practices across settings, venues, situations, and demographic groups (12–16). These studies do not provide information about sources of variability in specific risk behavior outcomes among people exposed to bar conditions. This type of assessment is a critical first step in determining whether on-premise establishments represent true environmental pathogens for young adults who may have a genetic susceptibility for alcohol use disorder (17). Gene–environment interaction may play an important role in the etiology of young adults' drinking behavior in bars.

Figure 1 depicts a conceptual model used to describe the relations among antecedents of three patron risk behaviors. Age of drinking onset was included in the model because it increases lifetime risk for alcohol use disorder (18, 19). Demographic variables were added to the model because of their associations with excessive binge drinking and other drug use in high school and college students (20). Alcohol use intensity as measured by the AUDIT-C was included to characterize alcohol involvement during the past year. Frequency of patronizing bars and nightclubs in the past month was included as a mediating variable potentially linking chronic alcohol use to three specific nighttime risk behaviors (or incidents). BrAC identified intoxication levels that could pose safety risks to patrons and possibly expose drinking establishments to legal risks. Self-reported illegal drug use is a relatively prevalent risk behavior among college

bar patrons (21), and it might be expected to be associated with bar-going based on theoretical considerations regarding co-occurrence of problem behaviors (22). Bar/nightclub alcohol expenditures were included in the model because they represent the financial burden experienced by college students, most of whom have limited disposable income. The hypotheses tested by the model are that (a) alcohol intoxication, illegal drug use, and on-premise alcohol expenditures, on a specific night, are associated with an existing habit of nighttime bar-going; (b) in turn, this bar-going frequency (in past month) is associated with alcohol use intensity (in past year), and (c) alcohol use intensity is associated with age of drinking onset, after accounting for age, sex, and race/ethnicity.

METHODS

Site

This institutional review board-approved study was conducted in a bar district located in a campus community in the southeastern United States. In this cross-sectional study, data were collected from exiting bar patrons on four consecutive nights in April, 2008 (Wednesday through Saturday). Consisting of seven on-premise drinking establishments, the bar district is adjacent to the campus of a public research university enrolling over 51,000 students and within five miles of a public college with about 16,000 students.

Nighttime Data Collection Procedures and Measures

Recruitment

Data were collected from 10:00 p.m. until 3:00 a.m. on each night by a research team consisting of 35 trained graduate and undergraduate students, supervised by principal investigators. For the duration of each 5-hour data collection period, team members solicited the participation of every third patron exiting the main entrance of all seven drinking establishments in the

bar district. Irrespective of whether they subsequently participated in the study, information was recorded for each of these patrons to determine participation rate and sample representativeness (i.e., bar exited, sex, and self-reported racial/ethnic identification). Verbal informed consent was obtained to place uniquely-numbered red bracelets on the patrons' wrists. After recording the bar location, time, sex, and race/ethnicity, participants were directed to a research station in the center of the bar district for data collection. Exiting patrons interested in participation, but who were not randomly selected, were directed to the research station without a red bracelet.

Research Station

Within 50 meters from the main entrances of all seven bars, a research station was constructed for data collection purposes. In addition to recruiting patrons as they exited bars, pedestrians passing by the research station also were solicited for study participation if they had been in one of the district bars that night. With consent, these self-selected participants had green bracelets placed on their wrists. Randomly selected participants (with red bracelets) were given priority for being interviewed.

The first step in data collection was a 3- to 5-minute structured interview assessing demographic characteristics and on-premise drink information. Second, participants responded to a self-administered questionnaire assessing sensitive items including: birth date, age of drinking onset based on recalling the year in school in which their first experience with consuming alcohol occurred [ranging from "grade 5 or earlier" (scored as 1) to "I have never consumed alcohol" (scored as 9)]; use of 8 other drugs in the past 12 hours [summed to form a composite scale representing number of illegal drugs used that night (possible range = 0–8)]; frequency of drinking in bars and nightclubs during the past month [ranging from "never" (scored as 0) to "7 times a week" (scored as 8)]; and a version of the Alcohol Use Disorders Identification Test (AUDIT-C), which assessed past-year drinking pattern (23). Third, participants were given water to rinse their mouth of any residual alcohol (21), and breath tested using the Alco-Sensor IV (Intoximeters, Inc.). Participants were offered free food, non-alcoholic drinks, and a card with information about the study and sources of help for alcohol problems. Randomly-selected participants were also offered a free t-shirt.

RESULTS

Sample Representation

Data were collected from 1,255 patrons (randomly recruited non-participants: $N = 453$; randomly recruited participants: $N = 227$; self-selected participants: $N = 575$; see Table 1). The random selection procedure yielded a participation rate of 33.4% ($227/453 + 227$). Among the 802 participants ($227 + 575$), 71.7% were self-selected. With the exception of last bar exited, there were no significant differences ($p > .05$) between the three groups, including none between the randomly selected

and self-selected participant groups on five variables shown in Table 1, suggesting the sample was representative of patrons in the district on study nights. Due to lack of differences between samples, they were pooled for data analyses.

Descriptive Statistics

Analyses excluded participants who: (a) failed to provide a substantial amount of data ($n = 85$), (b) reported no alcohol use that night ($n = 44$), (c) declined to provide a BrAC reading ($n = 31$), (d) admitted providing inaccurate self-report data ($n = 23$), and (e) had not been in a bar in the district that night ($n = 1$). Among the remaining 618 participants, the mean age was 22.6 years ($sd = 2.4$), with 16.2% less than 21. Most were current students (92.4%) or recent graduates (5.2%). Mean breath test time of night was 1:07 a.m. ($sd = 61$ minutes), and mean length of time in a bar was 2.1 hours ($sd = .5$). Mean BrAC was .08 ($sd = .5$), with a range of .00 to .21.

Among the 618 patrons, 8.1% reported their first use of alcohol use (drinking onset) occurred prior to seventh grade in school, with 56.4% indicating it had taken place by 10th grade, and 81.5% by 12th grade. Mean AUDIT-C score was 6.6 ($sd = 2.7$), with a range of 1 to 12. Based on established scoring criteria (23), 64.0% of patrons were at high-risk for alcohol dependence, i.e., scores ≥ 6 points. In the past month, 34.0% reported going to bars and nightclubs less than once a week, 16.4% did so once a week, and 49.6% reported two or more times a week. Past 12-hour use of other drugs was: marijuana – $n = 98$ (15.9%), non-medical use of prescription drugs – $n = 25$ (4.0%), cocaine – $n = 20$ (3.3%), MDMA – $n = 5$ (.8%), LSD – $n = 4$ (.7%), methamphetamine – $n = 4$ (.7%), inhalants – $n = 2$ (.3%), and heroin – $n = 1$ (.2%). Bivariate associations among the variables are shown in Table 2.

Strategy for Identifying Structural Relations

Mplus-version 5.2 (24) was used to assess the direct and indirect relations between patron demographic characteristics, age of drinking onset, alcohol use intensity in the past year, frequency of visiting bars/nightclubs in the past month, and three nighttime risk behaviors. The model was built in four stages. Paths that were not statistically significant and/or whose inclusion did not improve model fit were excluded in each stage. Last bar exited was specified as a nested random effect to account for the dependency of observations among participants within each bar. A Poisson distribution was specified for past 12-hour illegal drug use, i.e., a count of substances other than alcohol and tobacco.

Fit of the models was assessed with three goodness-of-fit indices: comparative fit index (CFI), Tucker-Lewis fit index (TLI), and root mean square error of approximation (RMSEA). The CFI and TLI describe the improvement in fit of the tested model compared with that of a null model assuming zero covariance among the variables (25). A value greater than .90 indicates reasonably good model fit (26). The RMSEA is a

TABLE 1
Results of a dual sampling procedure in a college bar district.

	Randomly Recruited Non-Participants <i>N</i> = 453	Randomly Recruited Participants <i>N</i> = 227	Self-Selected Participants <i>N</i> = 575
Drinking Establishment %			
Bar #1	13.2	13.6	11.7
Bar #2	9.3	6.1	6.6
Bar #3	9.9	6.6	6.8
Bar #4	23.0	22.7	20.5
Bar #5	2.6	11.6	20.7
Bar #6	9.9	16.7	17.4
Bar #7	32.0	22.7	16.2
Total %	99.9	100.0	99.9
Sex %			
Men	57.5	59.3	62.5
Women	42.5	40.7	37.5
Total %	100.0	100.0	100.0
Race/Ethnicity %			
White	82.4	80.2	81.4
Hispanic	8.0	8.4	8.9
African-American	1.9	3.1	2.3
Asian	2.1	3.1	3.0
Other	5.6	5.3	4.5
Total %	100.0	100.1	100.1
Alcohol Intoxication %			
BrAC < .08	–	54.5	50.9
BrAC ≥ .08	–	45.5	49.1
Total %	–	100.0	100.0
Alcohol Dependence Risk %			
Lower risk (AUDIT-C score < 6)	–	34.7	35.2
Higher risk (AUDIT-C score ≥ 6)	–	65.3	64.8
Total %	–	100.0	100.0

Note: Drinking establishment composition of randomly recruited non-participants was significantly different from randomly recruited participants ($\chi^2 = 26.94$, $df = 6$, $p < .0001$) and self-selected participants ($\chi^2 = 1.05$, $df = 6$, $p < .0001$). All other pair-wise comparisons, involving the 3 groups, were non-significant ($p > .05$).

parsimony-adjusted index, where a value $\leq .05$ indicates close approximate fit, values between .05 and .08 suggest reasonable fit, and values $\geq .10$ suggest poor model fit (25). Indirect effects were calculated as the product of the regression coefficients describing the effect of the independent variable on the hypothesized mediator and the hypothesized mediator on the outcome. Sobel's (27) method was used for calculation of the standard errors of the indirect effects (28). Minimum variance weighted least squares (WLSMV) was used for parameter estimation.

The final multilevel structural model with standardized estimates is shown in Fig. 2. Paths that were tested but not statistically significant or whose inclusion did not improve model fit are indicated with a dashed line. The goodness-of-fit indices suggest good representation of the data (CFI = .985, TLI = .985, RMSEA = .029). Age of drinking onset had a

significant negative relationships with past year alcohol dependence ($\beta = -.194$, $p \leq .001$) and frequency of visiting bars/nightclubs in the past month ($\beta = -.096$, $p \leq .001$). The associations between sex, age, and race/ethnicity and past year alcohol dependence were not statistically significant or did not improve the fit of the model; therefore, they were excluded from the final model. Alcohol use intensity in the past year was positively associated with frequency of bar-going in the past month ($\beta = .690$, $p \leq .001$) and alcohol intoxication ($\beta = .229$, $p \leq .05$), but not with illegal drug use or on-premise alcohol expenditures. Frequency of visiting bars/nightclubs in the past month was not associated with illegal drug use, alcohol intoxication, or alcohol expenditures. Alcohol use intensity in the past year was a significant mediator of the association between age of drinking onset and frequency of visiting bars and

TABLE 2
Bivariate associations in a sample of college bar patrons

	AUDIT-C (alcohol use intensity in past year)	AUDIT-C (alcohol use intensity in past year)	On-premise alcohol expenditures (night of study participation)	Frequency of visiting bars /nightclubs (past month)	Age of drinking onset
AUDIT-C (alcohol use intensity in past year)	.244*	—			
On-premise alcohol expenditures (night of study participation)	.249*	.125*	—		
Frequency of visiting bars/nightclubs (past month)	.126*	.667*	.085*	—	
Age of drinking onset	-.063	-.188*	-.102*	-.221*	—
Number of illegal drugs used (night of study participation)	.085*	.202*	-.004	.196*	-.096*

* p < .05.

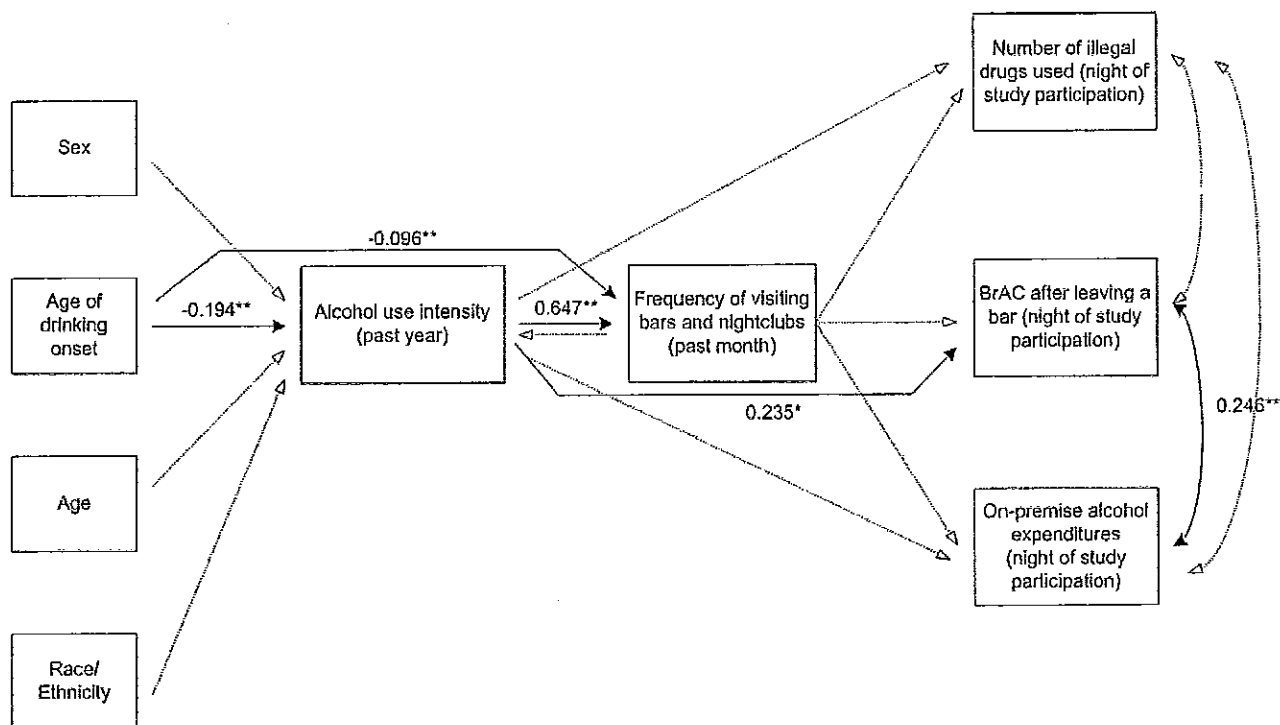


FIG. 2. Multilevel model of the nighttime alcohol and drug use of college bar patrons. (Model fit: CFI = .985, TLI = .985, RMSEA = .029, * $p \leq .05$, ** $p \leq .001$.)

nightclubs in the past month ($\beta = -.126$, $p \leq .001$). There was a significant positive correlation between alcohol intoxication and on-premise alcohol expenditures ($r = .246$, $p \leq .001$).

DISCUSSION

This study identified pathways of relationships linking history of alcohol involvement to incidents of alcohol intoxication in a college bar district. Multilevel structural equation modeling showed that among college bar patrons, there are statistically significant relationships involving age of drinking onset, risk for alcohol dependence, bar-going habit, and alcohol intoxication after leaving an establishment in college students. These findings suggest drinking onset is an important variable in a chain of associations leading to increased levels of alcohol involvement in young adulthood. These results are consistent with previous research noting that age at first alcohol use is a robust predictor of lifetime alcohol abuse and dependence (18, 19). The present study did not find associations between alcohol use history and illegal drug use.

Further research is needed to determine whether drinking onset age is modifiable, thereby pointing to an effective prevention strategy, or is simply a marker of an inevitable disorder yet to fully develop (18, 19). Regardless, an early experience with drinking likely introduces the child or adolescent to social contexts and networks of older peers which instigate adoption of a variety of risk behaviors (29). In addition, early introduction

to alcohol use by peers or older siblings is probably associated with a pattern of inadequate parental monitoring and supervision (30, 31), which further contributes to the development and maintenance of a syndrome of problematic behavior (22).

In the behavior-genetic research arena, large pools of environmental risk factors are thought to exist for the instigation of alcohol and other drug abuse in adolescents and young adults (32–34). Genotype essentially modulates an individual's responsiveness to these environmental pathogens or risks (17, 35). In this study, the observed variability between alcohol antecedents and intoxication after leaving a bar, as well as the highly elevated rate of alcohol use, suggest that individual differences in genetic susceptibility might be at work. On-premise alcohol establishments may hold a differential attraction to young adults depending upon their genetic predispositions. Prospective studies are needed to determine whether college bars are environmental pathogens mediating between genetic risk factors and the nighttime risk behavior of patrons.

Strengths and Limitations of Methods

The major strength of this study was analysis of event-specific relationships in a naturalistic, high-risk setting, along with objective measurement of patron intoxication. Thus, the study may be considered to have strong ecological validity. However, there may be some uncertainty about the extent to which the sample represented the population of patrons in the

bar district. These questions often arise in field studies because logistics and cost issues often make it difficult to randomly select participants (36). In addition, it should be recognized that the bar-focused sampling strategy used in this investigation does not provide information about relations among the measured variables in the general population of college students. Another possible concern is that, although participation was anonymous, highly intoxicated patrons might have been more likely to avoid participation due to embarrassment, thereby producing a biased sample. The large number of highly intoxicated participants and their relatively high AUDIT-C scores belie this concern. Comprehensive patron assessments could not be obtained due to field conditions. Finally, the deleterious effects of alcohol intoxication could have impaired some patron's ability to accurately recall information about their drinking.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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