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Party Characteristics, Drinking Settings, and College Students' Risk of Intoxication: A Multi-Campus Study

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Abstract

We examined party characteristics across different college drinking settings, associations between party characteristics and likelihood of drinking to intoxication, and the mediating role of perceived prevalence of intoxicated partygoers. Students ($N = 6903$) attending 14 public universities in California during the 2010 and 2011 fall semesters completed surveys on individual and party characteristics in six unique settings (e.g., residence hall). We used descriptive statistics to examine party characteristics by setting. We estimated multilevel logistic regression models to identify party characteristics associated with drinking to intoxication, and we used RMediation to determine significance of mediating effects. Individual and party characteristics varied by drinking context. Greater time at a party was associated with drinking to intoxication at five of six settings, while larger party size was significant only for outdoor settings. Enforcing the legal drinking age and refusing to serve intoxicated patrons were associated with lower likelihood of intoxication at Greek and off-campus parties. The presence of a keg was associated with drinking to intoxication at Greek, off-campus and outdoor parties; at bars, cover charges and drink promotions were positively associated with drinking to intoxication. In four of six settings, we found evidence of significant mediating effects through perceived prevalence of intoxicated partygoers. Findings highlight risk and protective characteristics of parties by drinking setting, and have prevention implications.

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Keywords

College students; Drinking environment; Party characteristics; Prevention

Introduction

Heavy drinking among college students continues to be a major public health challenge associated with academic problems, sexual and physical assaults, unplanned sexual activity, injury and death (Hingson, Zha, & Weitman, 2009). Numerous studies have identified individual factors that influence heavy drinking (e.g., Baer, 2002; LaBrie, Atkins, Neighbors, Mirza, & Larimer, 2012; Prince & Carey, 2010; Thombs, Ray-Tomasek, Osborn, & Olds, 2005); however, less is known about drinking settings, even though college parties are known to be high-risk social environments because of their association with heavy drinking and related problems (Clapp, Min, Shillington, Reed, & Croff, 2008; Paschall & Saltz, 2007). The available research suggests the risk of heavy drinking may vary depending on the presence/absence, or degree, of various party characteristics (e.g., party size; Clapp et al., 2008; DuRant et al., 2007; Paschall & Saltz, 2007; Wechsler & Nelson, 2008). Further examination of drinking setting characteristics and students' risk of intoxication is, therefore, warranted.

Drinking Settings

Previous studies have examined the role specific drinking settings (e.g., bars, off-campus parties) play in heavy college drinking behavior (Buettner, Khurana, & Slesnick, 2011; Clapp, Holmes, Reed, Freisthler, & Lange, 2007; Harford, Wechsler, & Muthen, 2003). For example, in a large sample of California college students, Paschall and Saltz (2007) found variation in the number of drinks consumed the last time students went to a party in a residence hall, Greek house, off-campus residence, campus event, outdoor setting, and bar/restaurant. We build upon this prior work by examining not only drinking to intoxication at each setting, but also the influence of party characteristics on student drinking by setting.

Party Characteristics

Recent literature has highlighted associations between college party characteristics and high-risk drinking behaviors (Clapp et al., 2008; DuRant et al., 2007; Paschall & Saltz, 2007; Wechsler & Nelson, 2008). One potentially important characteristic is party size. Clapp et al. (2008) found that breath blood alcohol concentration was inversely associated with party size. Alcohol availability (e.g., keg at party) is another party characteristic that may influence students' drinking (Harford, Wechsler, & Seibring, 2002; Toomey, Lenk, & Wagenaar, 2007; Toomey & Wagenaar, 2002). For example, Kuo, Wechsler, Greenberg, and Lee (2003) found that the availability of large volumes of alcohol (i.e., kegs) was associated with heavier alcohol consumption among students.

An additional factor associated with high-risk drinking is length of time at a party (Clapp et al., 2006; Paschall & Saltz, 2007). On the one hand, limiting the hours of a party might lead to partygoers being less intoxicated at the end of the night. Contrarily, shorter party times

could encourage pre-partying behavior, party hopping, or after parties (Paschall & Saltz, 2007; Pederson & LaBrie, 2007).

Examining the impact of alcohol risk management strategies employed at parties is also warranted. Saltz, Paschall, McGaffigan, and Nygaard (2010) demonstrated that alcohol risk management strategies (e.g., legal drinking age enforcement and refusing service to intoxicated partygoers) were effective at reducing heavy alcohol use among college students. Although additional studies have supported these findings (DeJong & Langford, 2002; Wolfson et al., 2012), no previous studies have examined whether such strategies are uniquely related to high-risk drinking at parties and whether their relationship with high-risk drinking may vary across different drinking settings.

Because numerous studies have demonstrated the effects of price on alcohol consumption (e.g., Wagenaar, Salois, & Komro, 2009), and cost may be particularly relevant for younger drinkers, party cover charge and alcohol promotions are also relevant factors to consider. Although a party cover charge could deter some students from joining a party, it is also possible that students who are willing to pay a cover charge are more likely to drink excessively to “get their money's worth.” Conversely, a cover charge may limit the amount of funds available to purchase alcohol. Alcohol promotions (e.g., happy hours) may increase excessive drinking by lowering the price of alcoholic drinks.

Finally, a student's perception of the percentage of intoxicated partygoers may act as a mediator of the relationship between party characteristics and high-risk drinking. Examining perceived drunkenness of partygoers as a potential mediator is consistent with the theories of reasoned action and planned behavior (Ajzen, 1989; Fishbein, Hennessy, Yzer, & Douglas, 2003), as well as prior research on effects of normative beliefs on heavy alcohol use among college students (Baer, 2002; Borsari & Carey, 2001; Paschall, Grube, Thomas, Cannon, & Treffers, 2012; Perkins & Berkowitz, 1986). For example, in a review of the literature, Borsari and Carey (2001) found high-risk drinking is influenced by peer pressure, which they defined as being a function of perceived social norms. In addition, Clapp et al. (2008) found that higher breath blood alcohol concentration levels were observed when a student perceived many intoxicated partygoers.

For illustrative purposes, we provide the following potential mediating mechanism: presence of a keg may lead to greater perceptions of others drinking to intoxication, as presence of a keg may establish a drinking norm; in turn, this greater perception of intoxicated partygoers may lead to heavier drinking. Perceived intoxication could also be influenced directly by party size and length of time at parties via greater exposure to other students drinking. Perceived intoxication could be inversely related to refusal of alcoholic beverage service and legal drinking age enforcement, as these may establish a norm of responsible alcohol consumption.

Summary of Study Purpose

We sought to extend previous research by examining context-specific drinking. Specifically, we explored the extent to which the aforementioned party characteristics, and their association with student intoxication, may vary across settings. Given theories relating

behavior and normative beliefs, we also examined the mediating effect of perceived prevalence of intoxicated partygoers. In summary, we aimed to: (1) describe party characteristics across different college drinking settings; (2) examine, by drinking setting, possible associations between party characteristics and likelihood of drinking to intoxication; and (3) test the mediating role of perceived prevalence of intoxicated partygoers with respect to certain party characteristics (e.g., party size, presence of a keg).

Method

Data Source and Study Population

The Safer California Universities Randomized Trial was characterized by an experimental design and was conducted to determine the impact of environmental prevention strategies (e.g., DUI checkpoints and social host ordinances) on college students' alcohol use (Saltz et al., 2010). The Safer Trial included 14 public universities in California. Baseline assessment began in 2003, with the intervention years occurring in 2005 and 2006. As of 2007, all schools became "treatment" schools. Therefore, we did not control for condition status in these analyses. The dataset we used included responses from 11,287 students at 14 California colleges and universities who participated in the 2010 and 2011 fall surveys. Because our focus was on students who consume alcohol, we reduced the analytical sample to focus on the 6913 students who reported drinking alcohol at least once in the past 28 days. Students indicating they had consumed alcohol in the past 28 days reported the average number of drinks they had each time they drank in the past 28 days; to reduce the influence of extreme values, we excluded students who reported drinking more than three standard deviations above the mean (19 or more drinks; Tabachnick & Fidell, 2001) each time they drank in the past 28 days. Our final analytical sample size was 6903 students. Responses to questions pertaining to party size and time spent at a party greater than three standard deviations above the mean were coded as missing. In addition, we focused on drinking at social gatherings attended by at least two people (as opposed to drinking alone).

Measures

Drinking Settings—We asked students whether they attended six specific settings in the past academic term. Settings included: a fraternity or sorority party at a Greek house; a party somewhere in a university residence hall; an on-campus sporting event, concert, or dance; a party at someone's house or apartment off-campus; a pub, bar or restaurant on or within a few blocks of campus; and an outdoor setting where students might go to drink. We directed students who attended each setting in the current semester to a set of follow-up questions about their most recent experience at that setting, including party characteristics.

College Party Characteristics—We conducted confirmatory factor analysis on nine items related to party characteristics. Our analysis revealed four items [people under the legal drinking age were not admitted, people under the legal drinking age were identified at the door, anyone asking for a drink was asked for proof of age, and there was no way of knowing who was of legal age (reverse coded)] loaded strongly onto one factor (e.g., CFI = 0.997, RMSEA = 0.027 in the Greek party setting). We created a binary measure called *legal drinking age enforcement*, and we gave a score of 1 (vs. 0) if at least one of the four

items was present at the party. Five additional binary (0 = not present; 1 = present) party-characteristic items included whether: people were drinking from a *keg* (social availability), there was a *drink promotion* or *cover charge* (cost), drinks were *refused* to intoxicated patrons (risk management), and there was a *system* in place to look after intoxicated patrons (risk management). We also included continuous measures of *party size* (number of people at the party) and *time* at the party as party-level characteristics.

Drinking Outcome—Students were asked whether they drank to intoxication the last time they attended each of the six drinking settings (0 = no; 1 = yes). Although this measure is subjective in nature, Quinn and Fromme (2011) found college students' perceived self-intoxication was associated with a negative outcome index, illicit drug use, unplanned sexual activity, and unsafe sexual behavior. Additionally, our supplemental analyses indicated a significant relationship between number of drinks consumed and intoxication at each setting [range of unadjusted *ORs*: 1.68, $p < 0.05$ (on-campus event) to 2.30 (bars), $p < 0.01$]; providing evidence for the construct validity of the drinking outcome measure.

Demographic and Typical Drinking Variables—We included binary measures of *gender* (1 = male), *ethnicity* (1 = non-Hispanic White), and *age* (1 = 21 years and older) as background characteristics. Students were also asked to indicate the *average number of drinks* consumed per drinking occasion in the past 28 days.

Mediator—We asked students to estimate the total number of people at the party, and of those, the number they perceived as being intoxicated. Our proposed mediator (*perceived percentage of intoxicated partygoers*) was calculated by dividing the estimated number of intoxicated partygoers by party size and multiplying by 100.

Analytic Strategy

We conducted statistical analyses using Stata v.12.1. First, we obtained descriptive statistics on student intoxication levels and characteristics of each drinking setting. We then conducted multi-level regression analyses for each of the six settings; the dependent variable for each of these analyses was whether the student drank to intoxication the last time they attended that setting. Because the dependent variable for each of the six analyses was binary in nature and the study included 14 schools, we estimated multilevel logistic regression models (students nested within schools) to obtain the median odds ratio (*MOR*; a more appropriate index of clustering for binary outcomes than the intraclass correlation; Larsen & Merlo, 2005) and the adjusted odds ratios (*ORs*) of intoxication in each setting for the abovementioned covariates (fixed effects) at the school level (random effect). Specifically, in estimating the adjusted *ORs* for our six multilevel models:

$$Pr[\text{intoxication}] = \pi_{ij} \quad \pi \sim \text{Binomial} \quad (u) \quad (1)$$

$$\begin{aligned} \text{Logit}\pi_{ij} &= \text{Log}\{\pi_{ij}/(1 - \pi_{ij})\} \\ &= M + \beta_1\text{gender}_i + \beta_2\text{age}_i + \beta_3\text{ethnicity}_i + \beta_4\text{average_drink}_i + \beta_5\text{size}_i + \beta_6\text{time}_i + \beta_7\text{age_enf}_i + \beta_8\text{keg}_i + \beta_9\text{cover}_i + \zeta \end{aligned}$$

where M = the overall mean probability (prevalence) of intoxication expressed in the logistic scale, β_1 – β_4 are parameter estimates for the individual covariates, β_5 – β_{12} are parameter estimates for the party characteristics, and E_j is the school-level residual. The school-level residuals are on the logistic scale and are normally distributed with a mean of 0 and variance V_j . The *MOR* for each setting's null model supported our use of multilevel modeling (i.e., the *MOR* for the six settings ranged from 1.16 to 1.52).

For each context, we estimated (a) the null model containing only the dependent variable and the random effect of school, (b) the model with individual parameters and the random effect of school, and (c) the full model with individual and party-specific variables and the random effect of school. We then tested the mediating role of perceived percentage of intoxicated party attendees; we first added this proposed mediator to each full regression model. When there was preliminary evidence for mediation in a particular setting (i.e., when there was a decrease in the magnitude and/or significance of relationships and there was a significant relationship between the proposed mediator and the outcome in that setting (Paschall et al., 2012), we tested the significance of mediated effects using asymmetric confidence intervals (Tofighi & MacKinnon, 2011); we used this technique due to the limitations of the Sobel method (MacKinnon, Warsi, & Dwyer, 1995). Specifically, we estimated an unstandardized model where the dependent variable was “perceived percentage of intoxicated partygoers” and the independent variables remained background and party characteristics; doing so provided us with the “a” path parameter estimates and standard errors. We then estimated unstandardized models with “intoxication” as the dependent variable, and background and party characteristics (including “perceived percentage of intoxicated partygoers”) as the independent variables; we then looked at the path from our proposed mediator to the outcome of intoxication, and used the parameter estimate and standard error as our “b” path. We then used RMediation (Tofighi & MacKinnon, 2011) to estimate each mediated effect and its asymmetric 95 % confidence interval to determine whether mediated effects were significant.

Results

Table 1 shows descriptive characteristics of the sample by party setting. Overall, the majority of respondents were female (56.2 %), at least 21 years old (57.8 %), and nearly half (49.4 %) identified as non-Hispanic White. The overall average number of drinks consumed by students per drinking occasion in the past 28 days was 2.71. In all settings, the prevalence of drinking to intoxication ranged from 39.6 % (at outdoor settings) to 62.8 % (at Greek settings). The mean perceived percentage of intoxicated partygoers ranged from 43.3 % (at outdoor settings) to 68.8 % (at Greek settings).

Table 1 also illustrates the variation in party characteristics by context. We found that party size varied by setting, with the average party size being smallest in residence halls (mean = 14.92 students) and largest at on-campus events (mean = 438.48 students). The average time at each setting ranged from 2.61 h (bar) to 3.82 h (off-campus party). Nearly all students attending bars (99.0 %) reported the minimum drinking age was enforced. On the other hand, fewer than half (43.6 %) of students attending Greek parties indicated that minimum drinking age laws were enforced. While 40.5 % of students reported the presence of a keg at

Greek parties, <15 % of students in all other party settings reported kegs were present. Approximately 18 % of students reported a cover charge at the last bar they attended; this percentage was <10 % in all other settings. Similarly, the only setting in which a drink promotion was reported by a large percentage of students (21.0 %) was bars. Intoxicated partygoers were refused drinks most often at bars (33.3 %); drink refusal was reported by <17 % of respondents at all other settings. Across all settings, <30 % of students reported that a system was in place to look after intoxicated patrons; such a system was reported most frequently at Greek parties (28.9 %).

Table 2 presents the fully estimated logistic regression models and adjusted *ORs* for each party setting, excluding the hypothesized mediator. With respect to party characteristics, in all settings except on-campus events, the longer a student remained at a party, the more likely he or she was to drink to intoxication. Larger party size, on the other hand, was significantly associated with drinking to intoxication only in outdoor settings. Enforcement of the minimum drinking age was associated with lower odds of drinking to intoxication at Greek and off-campus parties. At parties held in Greek, off-campus, and outdoor settings, the presence of a keg was significantly associated with higher odds of drinking to intoxication. At bars, a cover charge or drink promotion was associated with higher odds of drinking to intoxication. At Greek and off-campus parties, refusing to serve drinks to intoxicated patrons was associated with lower odds of drinking to intoxication. Moreover, across all party settings, gender and age were not associated with drinking to intoxication. Students identifying as non-Hispanic White (as compared to all other students) were significantly more likely to drink to intoxication in all settings except on-campus events and outdoor parties. Students with greater average number of drinks per occasion in the past 28 days were more likely to report drinking to intoxication the last time they attended parties in each setting except on-campus events.

Table 3 presents the full model including the mediator (perceived percentage of intoxicated partygoers). In all settings except outdoor and on-campus parties, the proposed mediator was significantly associated with drinking to intoxication. Moreover, the associations between virtually all types of party characteristics and drinking to intoxication in Table 2 were attenuated and in many instances no longer statistically significant in Table 3, providing evidence of at least partial mediation.

Table 4 presents *a* paths, *b* paths, indirect effect estimates and corresponding 95 % confidence intervals for significant mediated effects; results are shown for the four settings that showed preliminary evidence of mediation (i.e., results for on-campus and outdoor settings are not shown as they did not show preliminary evidence of mediation). Significant *a* × *b* mediated effects were observed among four of the eight party characteristics in the Greek setting, three of the eight party characteristics at the residence hall setting, five of the eight at the off-campus setting, and four of the eight at the bar setting.

Discussion

Our examination of college parties across six drinking settings at 14 college campuses expands our understanding of college alcohol environments. Our first goal was to describe

party settings and students' risk of intoxication by setting. Over 50 % of students reported drinking to intoxication the last time they attended a party at a Greek house, residence hall, on-campus event, or off-campus residence. We also observed that party characteristics differ by drinking settings. For example, legal drinking age enforcement was nearly universal within bars/pubs/restaurants, but occurred to a lesser degree at all other settings. Also, kegs were present at many Greek parties, but essentially nonexistent at all other drinking settings.

Our second goal was to examine the influence of specific party characteristics on student intoxication. Time at a party was the only characteristic consistently associated with drinking to intoxication across settings. This suggests that greater time at parties could be associated with greater access to, and subsequent use of, alcohol.

The majority of our results suggest the influence of party characteristics on intoxication vary by setting. For example, risk management strategies (e.g., legal drinking age enforcement and drink refusal) were inversely and significantly associated with drinking to intoxication only at Greek and off-campus parties. It could be that students under the age of 21 are less likely to frequent a drinking setting where drinking age laws are knowingly enforced (e.g., bars, campus sponsored event), and this is why we did not observe a significant relationship at such settings. Additionally, settings that can receive sanctions and fines for serving intoxicated patrons (e.g., bars) may refuse to even allow access to intoxicated patrons. We also found the relationship between party size and intoxication was significant only at outdoor settings; reasons for this finding should be further examined.

Lastly, and contrary to expectations, having a system in place to look after intoxicated patrons was not associated with drinking to intoxication at any setting. This finding may indicate that safety measures are not a determining factor with respect to students' drinking per se, though they may be associated with alcohol-related harm.

Our third goal was to test one hypothesized mechanism by which party characteristics may influence high-risk drinking. When we controlled for the perceived percentage of intoxicated people at each party, we found this measure to be associated with our outcome of interest in all settings but two, and associations between our dependent variable and the majority of other party characteristics were attenuated, suggesting a mediating effect. Our follow-up analyses provided further evidence of significant mediated effects through perceived percentage of intoxicated partygoers. The results from our mediation analysis support existing evidence that suggest how an individual perceives drinking among peers is important in influencing his or her drinking behavior (Clapp et al., 2008; Grant, LaBrie, Hummer, & Lac, 2012). Given the cross-sectional nature of our analyses, future studies are needed to determine if perceived intoxication of partygoers is causally related to heavy drinking and/or if heavy drinking influences perceived intoxication.

Study Limitations

Although the present study extends our knowledge of college drinking settings, limitations were present. First, the cross-sectional nature of the data limits our ability to make causal inferences about relationships between party characteristics and drinking to intoxication. Future studies should be longitudinal in nature to accurately test causal flow. An additional

issue raised by our study was the lack of variation for some measures (e.g., legal drinking age enforcement in bars was nearly 100 % and presence of kegs at residence halls was nearly 0 %), which could have limited our ability to detect an association with intoxication when one may be present. We asked participants retrospectively about party characteristics and whether they drank enough to be intoxicated, which may have generated a social desirability or recall bias; nonetheless, previous studies support this method for behavioral assessment (Burleson, Kaminer, & Dennis, 2006; Sobell & Sobell, 1997). Moreover, the lack of missing data on these items suggests response bias was minimal. Another limitation may be related to asking students about the characteristics of their last drinking occasion at a particular setting. While our question could result in more accurate recall, a student's most recent experience may have differed from a typical experience at that setting. Nonetheless, by asking about a student's most recent experience, we were still able to examine how variations in party characteristics influence drinking to intoxication by setting. Lastly, we cannot draw conclusions about what factors influence drinking to intoxication when alcohol is consumed in non-social settings (e.g., drinking alone).

Future research should consider additional mechanisms by which party characteristics may influence heavy drinking. Paschall et al. (2012) found that perceived ease of obtaining alcohol, enforcement, and acceptability of alcohol use helped to explain the significant relationships between funding for underage drinking enforcement activities, alcohol availability (outlet density), adult alcohol use, and heavy drinking among adolescents. Such perceptions may also act as mediators of relationships between party characteristics and heavy drinking among college students. In addition, future research should use qualitative methodologies to better understand findings related to observed correlates of drinking to intoxication by setting. Lastly, given that a student's most recent drinking occasion could have occurred in multiple settings during the same night, future research should determine which settings most contribute to a student's intoxication. Also, examining interactive effects of “pre-partying” and “after-partying” could provide more insight into an overall drinking experience.

Prevention Implications

Our findings have relevant prevention implications. For example, refusing to serve drinks to intoxicated partygoers was found to be inversely associated with intoxication at Greek and off-campus parties; as such, curricula promoting the development of refusal skills related to serving intoxicated partygoers should be incorporated into pre-existing harm reduction programs. We found that drinking to intoxication was prevalent in all settings, particularly campus-affiliated settings (e.g., Greek parties, residence hall, on-campus events). Therefore, one recommendation for administrators not already doing so is to implement stricter university-wide alcohol policies, such as restricting alcohol use at on-campus events. Further, given the associations we observed between legal drinking age enforcement and drinking at Greek and off-campus parties, universities not already doing so should collaborate with local law enforcement to promote awareness and enforcement of social host laws.

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References

- Ajzen, I. Attitude structure and behavior.. In: Pratkanis, AR.; Breckler, SJ.; Greenwald, AG., editors. Attitude structure and function. Lawrence Erlbaum; Hillsdale, NJ: 1989. p. 241-274.
- Baer JS. Student factors: Understanding individual variation in college drinking. *Journal of Studies on Alcohol*. 2002; 14:40–53.
- Borsari B, Carey KB. Peer influences on college drinking: A review of the research. *Journal of Substance Abuse*. 2001; 13:391–424. [PubMed: 11775073]
- Buettner CK, Khurana A, Slesnick N. Drinking at college parties: Examining the influence of student host-status and party-location. *Addictive Behaviors*. 2011; 36:1365–1368. [PubMed: 21862229]
- Burleson JA, Kaminer Y, Dennis ML. Absence of iatrogenic or contagion effects in adolescent group therapy: Findings from the Cannabis Youth Treatment (CYT) Study. *The American Journal on Addictions*. 2006; 15:4–15. [PubMed: 17182415]
- Clapp JD, Holmes MR, Reed MB, Freisthler B, Lange JE. Measuring college students' alcohol consumption in natural drinking environments. *Evaluation Review*. 2007; 31:469–489. [PubMed: 17761807]
- Clapp JD, Min JW, Shillington AM, Reed MB, Croff JK. Person and environment predictors of blood alcohol concentrations: A multi-level study of college parties. *Alcoholism, Clinical and Experimental Research*. 2008; 32:100–107.
- Clapp JD, Min JW, Shillington AM, Reed MB, Lange JE, Holmes MR. Environmental and individual predictors of error in field estimates of blood alcohol concentration: A multilevel analysis. *Journal of Studies on Alcohol and Drugs*. 2006; 67:620–627.
- DeJong W, Langford LM. A typology for campus-based alcohol prevention: Moving toward environmental management strategies. *Journal of Studies on Alcohol and Drugs*. 2002; 14:140–147.
- DuRant RH, McCoy TP, Champion H, Parries MT, Mitra A, Martin BA, et al. Party behaviors and characteristics and serial drunkenness among college students. *Journal of Studies on Alcohol and Drugs*. 2007; 69:91–99. [PubMed: 18080069]
- Fishbein M, Hennessy M, Yzer M, Douglas J. Can we explain why some people do and some do not act on their intentions? *Psychology, Health, and Medicine*. 2003; 8:3–18.
- Grant S, LaBrie JW, Hummer JF, Lac A. How drunk am I? Misperceiving one's level of intoxication in the college drinking environment. *Psychology of Addictive Behaviors*. 2012; 26:51–58. [PubMed: 21604830]
- Harford TC, Wechsler H, Muthen BO. Alcohol-related aggression and drinking at off-campus parties and bars: A national study of current drinkers in college. *Journal of Studies on Alcohol*. 2003; 64:704–711. [PubMed: 14572193]
- Harford TC, Wechsler H, Seibring M. Attendance and alcohol use at parties and bars in college: A national survey of current drinkers. *Journal of Studies on Alcohol and Drugs*. 2002; 63:726–733.
- Hingson RW, Zha W, Weitzman ER. Magnitude of trends in alcohol-related mortality and morbidity among US college students ages 18–24, 1998–2005. *Journal of Studies on Alcohol and Drugs*. 2009; 16:12–20. [PubMed: 19538908]
- Kuo M, Wechsler H, Greenberg P, Lee H. The marketing of alcohol to college students: The role of low prices and special promotions. *American Journal of Preventive Medicine*. 2003; 25:204–211. [PubMed: 14507526]
- LaBrie JW, Atkins DC, Neighbors C, Mirza T, Larimer ME. Ethnicity specific norms and alcohol consumption among Hispanic/Latino/a and Caucasian students. *Addictive Behaviors*. 2012; 37:573–576. [PubMed: 22293207]
- Larsen K, Merlo J. Appropriate assessment of neighborhood effects on individual health: Integrating random and fixed effects in multilevel logistic regression. *American Journal of Epidemiology*. 2005; 161:81–88. [PubMed: 15615918]

- MacKinnon DP, Warsi G, Dwyer JH. A simulation study of mediated effect measures. *Multivariate Behavioral Research*. 1995; 30:41–62. [PubMed: 20157641]
- Paschall MJ, Grube JW, Thomas S, Cannon C, Treffers R. Relationships between local enforcement, alcohol availability, drinking norms, and adolescent alcohol use in 50 California cities. *Journal of Studies on Alcohol and Drugs*. 2012; 73:657–665. [PubMed: 22630804]
- Paschall MJ, Saltz RF. Relationships between college settings and student alcohol use before, during and after events: A multi-level study. *Drugs and Alcohol Review*. 2007; 26:635–644.
- Pedersen ER, LaBrie J. Partying before the party: Examining prepartying behavior among college students. *Journal of American College Health*. 2007; 56:237–245. [PubMed: 18089504]
- Perkins HW, Berkowitz AD. Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. *Substance Use and Misuse*. 1986; 21:961–976.
- Prince MA, Carey KB. The malleability of injunctive norms among college students. *Addictive Behaviors*. 2010; 35:940–947. [PubMed: 20598806]
- Quinn PD, Fromme K. Subjective response to alcohol challenge: A quantitative review. *Alcoholism, Clinical and Experimental Research*. 2011; 35:1759–1770.
- Saltz RF, Paschall MJ, McGaffigan RP, Nygaard PMO. Alcohol risk management in college settings: The Safer California universities randomized trial. *American Journal of Preventive Medicine*. 2010; 39:491–499. [PubMed: 21084068]
- Sobell, LC.; Sobell, MB. Alcohol consumption measures.. In: Allen, JP.; Columbus, M., editors. *Assessing alcohol problems: A guide for clinicians and researchers*. NIAAA; Bethesda, MD: 1997.
- Tabachnick, BG.; Fidell, LS. *Computer-assisted research design and analysis*. Vol. 748. Allyn and Bacon; Boston: 2001.
- Thombs DL, Ray-Tomasek J, Osborn CJ, Olds RS. The role of sex-specific normative beliefs in undergraduate alcohol use. *American Journal of Health Behavior*. 2005; 29:342–351. [PubMed: 16006231]
- Tofighi D, MacKinnon DP. RMediation: An R package for mediation analysis confidence intervals. *Behavior Research Methods*. 2011; 43:692–700. [PubMed: 21487904]
- Toomey TL, Lenk KM, Wagenaar AC. Environmental policies to reduce college drinking: An update of research findings. *Journal of Studies on Alcohol and Drugs*. 2007; 68:208–219. [PubMed: 17286339]
- Toomey TL, Wagenaar AC. Environmental policies to reduce college drinking: Options and research findings. *Journal of Studies on Alcohol and Drugs*. 2002; 14:193–205.
- Wagenaar AC, Salois MJ, Komro KA. Effects of beverage alcohol price and tax levels on drinking: A meta-analysis of 1003 estimates from 112 studies. *Addiction*. 2009; 104:179–190. [PubMed: 19149811]
- Wechsler H, Nelson TF. What we have learned from the Harvard School of Public Health College Alcohol Study: Focusing attention on college alcohol consumption and the environmental conditions that promote it. *Journal of Studies on Alcohol and Drugs*. 2008; 69:481–490. [PubMed: 18612562]
- Wolfson M, Champion H, McCoy TP, Rhodes SD, Ip EH, Blocker JN, et al. Impact of a randomized campus/community trial to prevent high-risk drinking among college students. *Alcoholism, Clinical and Experimental Research*. 2012; 36:1767–1778.

Table 1

Descriptive statistics by drinking setting ($N = 6903$ students in 14 schools)

Drinking setting	Greek party	Residence hall	On-campus event	Off-campus party	Pub/bar/restaurant	Outdoors
Variables	N (%) or mean (SD); range					
Background						
Female	1097 (57.7 %)	572 (48.4 %)	534 (49.9 %)	3164 (55.8 %)	1815 (55.1 %)	869 (49.7 %)
Under 21 years of age	1248 (65.6 %)	833 (70.5 %)	588 (54.9 %)	2594 (45.8 %)	454 (13.8 %)	785 (44.9 %)
Non-Hispanic White	993 (52.2 %)	585 (49.5 %)	597 (55.7 %)	2855 (50.4 %)	1749 (53.1 %)	933 (53.3 %)
Average number of drinks per occasion	3.40 (2.41); 0-18	3.29 (2.50); 0-17	3.44 (2.46); 0-15	2.88 (2.21); 0-18	2.71 (2.11); 0-17	3.28 (2.48); 0-18
Party characteristics						
Size of party	66.46 (52.48); 2-300	14.92 (14.05); 2-100	438.48 (393.76); 2-999	24.47 (21.34); 2-150	50.12 (52.88); 2-300	27.49 (64.68); 2-500
Time at party (in h)	2.91 (1.68); 1-15	2.87 (1.92); 1-15	2.75 (1.42); 1-8	3.82 (2.14); 1-20	2.61 (1.26); 1-10	2.87 (2.01); 1-17
Legal drinking age enforcement ^a	791 (43.6 %)	755 (68.7 %)	800 (81.0 %)	3573 (66.4 %)	3049 (99.0 %)	551 (85.2 %)
Keg at party ^a	735 (40.5 %)	54 (4.9 %)	53 (5.4 %)	847 (15.7 %)	84 (2.7 %)	36 (2.3 %)
Cover charge ^a	155 (8.5 %)	15 (1.4 %)	91 (9.2 %)	230 (4.3 %)	567 (18.4 %)	7 (1.1 %)
Drink promotion ^a	27 (1.5 %)	7 (0.6 %)	24 (2.4 %)	59 (1.1 %)	647 (21.0 %)	5 (0.8 %)
Drinks refused to intoxicated ^a	303 (16.7 %)	124 (11.3 %)	114 (11.5 %)	644 (12.0 %)	1025 (33.3 %)	32 (5.0 %)
Care system in place ^a	524 (28.9 %)	262 (23.8 %)	104 (10.5 %)	1509 (28.0 %)	444 (14.4 %)	80 (12.4 %)
Proposed mediator						
Percentage of attendees intoxicated	68.8 % (24.82); 0-100 %	60.7 % (31.24); 0-100 %	39.6 % (30.39); 0-100 %	61.9 % (30.28); 0-100 %	50.0 % (33.6); 0-100 %	43.3 % (36.62); 0-100 %
Outcome						
Drank to intoxication last time attended ^a	1059 (62.8 %)	498 (52.7 %)	424 (56.0 %)	2949 (57.7 %)	1296 (46.5 %)	496 (39.6 %)

^a Percentages provided reflect "percent saying yes"

Table 2

Multilevel logistic regression models estimating odds of drinking to intoxication by each setting in a multi-school ($N = 14$) sample of college students ($N = 6903$); models exclude hypothesized mediator

Variables	Greek party ($n = 1621$)	Residence hall ($n = 904$)	On-campus event ($n = 730$)	Off-campus party ($n = 4934$)	Pub/bar/restaurant ($n = 2712$)	Outdoors ($n = 463$)
Adjusted odds ratios (95 % confidence intervals)						
Background covariates						
Gender						
Female	1.00	1.00	1.00	1.00	1.00	1.00
Male	1.15 (0.91, 1.45)	1.11 (0.83, 1.47)	1.19 (0.73, 1.95)	1.00 (0.88, 1.13)	1.03 (0.86, 1.22)	1.19 (0.80, 1.79)
Age						
Under 21	1.00	1.00	1.00	1.00	1.00	1.00
21 and over	0.98 (0.77, 1.24)	0.76 (0.55, 1.05)	1.30 (0.76, 2.23)	1.03 (0.90, 1.17)	1.17 (0.88, 1.55)	0.86 (0.57, 1.30)
Ethnicity						
Other	1.00	1.00	1.00	1.00	1.00	1.00
Non-Hispanic White	2.14 (1.70, 2.69)**	1.70 (1.27, 2.27)**	1.98 (0.87, 4.52)	1.70 (1.50, 1.93)**	1.51 (1.27, 1.81)**	1.18 (0.78, 1.76)
Average no. drinks/occasion	1.26 (1.19, 1.34)**	1.20 (1.13, 1.28)**	1.34 (0.99, 1.82)	1.37 (1.32, 1.43)**	1.22 (1.17, 1.29)*	1.15 (1.06, 1.24)**
Context-specific covariates						
Size of party	1.00 (1.00, 1.00)	0.99 (0.98, 1.01)	1.00 (1.00, 1.00)	1.01 (1.00, 1.01)	1.00 (1.00, 1.01)	1.01 (1.00, 1.01)*
Time at party (in h)	1.31 (1.21, 1.42)**	1.26 (1.16, 1.36)**	1.28 (0.95, 1.73)	1.19 (1.15, 1.23)**	1.71 (1.58, 1.85)**	1.13 (1.04, 1.24)**
Legal drinking age enforcement	0.77 (0.61, 0.98)*	0.76 (0.56, 1.03)	0.36 (0.11, 1.17)	0.85 (0.74, 0.98)*	0.98 (0.40, 2.42)	0.91 (0.51, 1.61)
Keg at party	1.74 (1.37, 2.21)**	0.98 (0.49, 1.95)	4.57 (0.75, 27.82)	1.34 (1.10, 1.62)**	1.08 (0.64, 1.83)	4.52 (1.11, 18.45)*
Cover charge	0.85 (0.55, 1.32)	2.58 (0.70, 9.54)	0.99 (0.46, 2.16)	0.78 (0.56, 1.09)	1.34 (1.07, 1.70)*	0.69 (0.10, 4.70)
Promotion	0.77 (0.29, 2.03)	2.42 (0.17, 34.95)	3.16 (0.48, 20.91)	1.08 (0.59, 1.97)	1.30 (1.05, 1.60)*	0.08 (0.00, 1.99)
Drinks refused to intoxicated	0.72 (0.52, 1.00)*	0.95 (0.59, 1.53)	0.71 (0.30, 1.64)	0.77 (0.63, 0.94)**	1.05 (0.87, 1.27)	1.41 (0.57, 3.47)
System to care for intoxicated	0.89 (0.68, 1.18)	0.95 (0.66, 1.36)	1.96 (0.72, 5.33)	1.14 (0.98, 1.32)	1.22 (0.95, 1.56)	1.05 (0.58, 1.89)

* $p < 0.05$

** $p < 0.01$

Table 3

Multilevel logistic regression models estimating odds of drinking to intoxication by each setting in a multi-school ($N = 14$) sample of college students ($N = 6903$); models include hypothesized mediator

Variables	Greek party ($n = 1620$)	Residence hall ($n = 903$)	On-campus event ($n = 730$)	Off-campus party ($n = 4934$)	Pub/bar/restaurant ($n = 2712$)	Outdoors ($n = 463$)
Adjusted odds ratios (95 % confidence intervals)						
Background covariates						
Gender						
Female	1.00	1.00	1.00	1.00	1.00	1.00
Male	1.34 (1.05, 1.72)*	1.17 (0.84, 1.61)	1.14 (0.69, 1.89)	1.04 (0.90, 1.21)	1.10 (0.85, 1.43)	1.27 (0.66, 2.43)
Age						
Under 21	1.00	1.00	1.00	1.00	1.00	1.00
21 and Over	1.12 (0.87, 1.45)	0.83 (0.58, 1.18)	1.48 (0.69, 3.18)	1.32 (1.14, 1.53)**	1.55 (0.88, 2.72)	1.40 (0.59, 3.30)
Ethnicity						
Other	1.00	1.00	1.00	1.00	1.00	1.00
Non-Hispanic White	1.90 (1.50, 2.42)**	1.41 (1.02, 1.96)*	1.99 (0.61, 6.52)	1.39 (1.12, 1.61)**	1.66 (0.99, 2.79)	0.93 (0.52, 1.66)
Average no. drinks per occasion	1.24 (1.16, 1.32)**	1.17 (1.09, 1.25)**	1.34 (0.84, 2.16)	1.28 (1.23, 1.34)**	1.22 (1.02, 1.46)*	1.11 (0.89, 1.38)
Context-specific covariates						
Size of party	1.00 (1.00, 1.00)	0.99 (0.98, 1.00)	1.00 (1.00, 1.00)	1.00 (1.00, 1.01)	1.00 (1.00, 1.00)	1.01 (0.99, 1.03)
Time at party (in h)	1.33 (1.22, 1.45)**	1.28 (1.16, 1.40)**	1.22 (0.84, 1.76)	1.18 (1.14, 1.23)**	1.75 (1.10, 2.77)*	1.20 (0.85, 1.70)
Legal drinking age enforcement	0.87 (0.68, 1.11)	0.84 (0.60, 1.19)	0.43 (0.10, 1.89)	1.06 (0.91, 1.24)	1.35 (0.37, 4.97)	1.32 (0.60, 2.92)
Keg at party	1.45 (1.23, 1.86)**	0.71 (0.34, 1.47)	1.91 (0.43, 8.50)	1.12 (0.91, 1.39)	1.32 (0.58, 2.98)	2.66 (0.27, 26.01)
Cover charge	0.97 (0.61, 1.54)	3.08 (0.79, 12.00)	1.00 (0.45, 2.25)	0.82 (0.57, 1.19)	1.15 (0.81, 1.63)	0.29 (0.00, 29.20)
Promotion	0.63 (0.22, 1.74)	0.86 (0.07, 10.91)	2.63 (0.38, 25.02)	0.96 (0.47, 1.95)	1.26 (0.88, 1.81)	0.01 (0.00, 1.74)
Drinks refused to intoxicated	1.07 (0.75, 1.53)	1.29 (0.75, 2.22)	0.94 (0.42, 2.10)	0.98 (0.78, 1.24)	1.13 (0.84, 1.51)	1.67 (0.38, 7.47)
Care system in place	0.88 (0.66, 1.18)	0.98 (0.65, 1.48)	1.73 (0.52, 5.70)	1.15 (0.97, 1.36)	1.32 (0.84, 2.09)	1.01 (0.46, 2.21)
Proposed mediator						
Percentage of attendees intoxicated	1.04 (1.03, 1.04)**	1.04 (1.04, 1.05)**	1.04 (0.98, 1.10)	1.05 (1.04, 1.05)**	1.05 (1.01, 1.10)*	1.05 (0.95, 1.17)

* $p < 0.05$

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Table 4

Significant $a \times b$ mediated effects by each setting^a in a multi-school ($N = 14$) sample of college students ($N = 6903$)

	(a) Paths (party characteristics → perceived percentage intoxicated)	(b) Path (perceived percentage intoxicated → intoxicated)	Indirect effect (95 % confidence interval) ^b
	Estimate (standard error)		
Greek party			
Size of party	0.055 (0.011) **	0.037 (0.003) **	0.002 (0.001, 0.003)
Age enforcement	-4.279 (1.163) **		-0.158 (-0.249, -0.073)
Keg at party	6.816 (1.182) **		0.252 (0.161, 0.351)
Drinks refused to intoxicated	-10.770 (1.659) **		-0.398 (-0.541, -0.268)
Residence hall			
Time at party (in h)	1.498 (0.488) **	0.042 (0.003) **	0.063 (0.022, 0.105)
Age enforcement	-5.726 (2.016) **		-0.240 (-0.414, -0.074)
Keg at party	11.406 (4.599) *		0.479 (0.100, 0.872)
Off-campus party			
Size of party	0.157 (0.019) **	0.046 (0.002) **	0.007 (0.005, 0.009)
Time at party (in h)	1.066 (0.184) **		0.049 (0.032, 0.066)
Age enforcement	-6.297 (0.858) **		-0.29 (-0.372, -0.21)
Keg at party	4.914 (1.174) **		0.226 (0.119, 0.335)
Drinks refused to intoxicated	-5.900 (1.263) **		-0.271 (-0.389, -0.156)
Pub/bar/restaurant			
Size of party	0.099 (0.011) **	0.049 (0.022) *	0.005 (0.001, 0.009)
Time at party (in h)	5.702 (0.460) **		0.279 (0.033, 0.536)
Cover charge	8.047 (1.567) **		0.394 (0.045, 0.814)
Drink promotion	3.658 (1.393) **		0.179 (0.009, 0.432)

*
 $p < 0.05$

**
 $p < 0.01$

^aResults for on-campus and outdoor settings are excluded as each (b) path was not significant and there were no significant mediated effects

^bIndirect effect and asymmetric 95 % confidence intervals calculated using RMediation