Person and Environment Predictors of Blood Alcohol Concentrations: A Multi-Level Study of College Parties

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Aims: This study builds upon previous research by assessing the relationship of breath blood alcohol concentrations (BrAC) to environmental and individual characteristics.

Design: We conducted a multi-level study of college parties. Our design included observational measures of party environments, a brief self-administered questionnaire, and the collection of breath samples from partygoers.

Setting: Data were collected in private residences of students living in a neighborhood adjacent to a large public university located in the Southwestern United States.

Participants: A total of 1,304 individuals attending 66 parties participated in the study.

Measures: Observational measures of party characteristics were made by 2 trained research assistants at each party. Four to 5 trained interviewers administered a brief field survey to partygoers at each party. In addition, the trained interviewers collected breath samples using handheld breathalyzer devices.

Findings: Hierarchical linear modeling analyses revealed significant variation at the party and individual levels. At the individual level, motivations to socialize were significantly associated with lower BrAC, while drinking games and providing the sample after 11:00 PM were associated with higher BrACs. At the party level, large parties were significantly associated with lower BrACs while reports of many intoxicated partygoers were associated with higher BrACs. Finally, we identified a significant gender by theme party interaction, indicating women had higher BrACs at theme parties relative to nontheme parties; however, BrACs for men were similar regardless of the type of party attended.

Conclusions: Alcohol consumption among young adults in natural settings is a function of both person and environmental factors.

Key Words: Environments, Parties, BrAC, Young Adults.

IN RECENT YEARS, a good deal of research has examined alcohol consumption and its attendant problems among college students and young adults. Such research has been epidemiological (e.g., Wechsler et al., 2002), and intervention-based (e.g., DeJong et al., 2006), most frequently with a focus on individual level predictors of drinking (i.e. psychological attributes such as expectancies, normative misperceptions, or attitudes toward drinking) (DeJong et al., 2006; Wechsler et al., 2002). There has been, however, a smaller body of research examining environmental characteristics related to heavy drinking among this population (e.g., Clapp et al., 2003, 2006b; Demers et al., 2002; Greenfield and Room, 1997; Harford et al., 2002).

Conceptually, environmental factors are important to etiological explanations of drinking behavior (Clapp et al., 2002a; Harford, 1979; Jessor, 1982) and applied preventive strategies (Clapp et al., 2005; Holder et al., 1997). That is, environmental factors conceptually facilitate heavy drinking (e.g., readily available alcohol) or protect against heavy drinking (e.g., responsible beverage service). From a prevention standpoint, environmental factors represent potential "leverage points" in the causal chain, which may be amenable to manipulation that results in decreased risk or increased protection related to a health problem (Stokols, 2000). Stokols further notes that most situations are made up of a mixture of positive as well as negative environmental factors (Stokols, 2000). Thus, researchers are challenged to untangle the relative importance of person-level and environmental factors as they operate within complex and dynamic natural settings. As such, both person level and environmental characteristics are important to consider when examining drinking contexts.

The physical setting of alcohol consumption is one key environmental factor related to drinking behavior. Alcohol is typically consumed by college students in party and bar settings (Harford et al., 2002). According to Harford et al. (2002), as student's progress through university, bar attendance increases and party attendance decreases. Overall, however, party attendance has been noted as more common than bar attendance as a part of the college lifestyle (Clark, 1985). This is likely due to the age distribution in college coupled with minimum drinking age laws of 21 years age. In general

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Received for publication April 19, 2007; accepted September 27, 2007.

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DOI: 10.1111/j.1530-0277.2007.00547.x

parties tend to be "wet" settings (Clapp et al., 2006b) and off-campus parties drew larger proportions of students than fraternity parties and often resulted in heavy drinking (Harford et al., 2002). Given the social acceptability of drinking is greatest in bar environments (Greenfield and Room, 1997), and party settings have less formal controls (Clapp et al., 2002a), parties conceptually have more potential to be wild and uncontrolled environments that attract heavy drinkers (Lange and Voas, 2000).

Yet, there is evidence that certain environmental factors vary across parties which relate to alcohol consumption. Examination of college students' last drinking event (past 28 days), for instance, indicated the presence of food at parties was protective against heavy episodic drinking while playing drinking games and the availability of illicit drugs were risk factors for such behavior (Clapp et al., 2002b). Consistent with the notion of an uncontrolled setting, when respondents reported that many people were intoxicated at their most recent drinking event, they were12.8 times more likely to report heavy episodic drinking at the event themselves relative to events with fewer intoxicated partygoers (Clapp and Shillington, 2001b). A later study replicated earlier findings and demonstrated heavy drinkers seek out party environments with these features (Clapp et al., 2003).

Person level factors such as motivations for selecting a drinking setting, one's history of drinking, and gender all potentially interact with environmental factors to influence drinking outcomes (Clapp et al., 2003). Demers et al. examined information from multiple drinking situations in a large sample of students at 18 Canadian universities and found that drinking setting is as important as individual characteristics such as alcohol consumption history, perceptions of campus drinking norms, viewing recreational activities as being important, and living arrangement in predicting alcohol consumption (Demers et al., 2002).

The bulk of the studies focusing on the relationship among environmental factors, personal characteristics and alcohol consumption have utilized cross-sectional designs based on retrospective self-report survey data. Although common and feasible, both economically and methodologically, the traditional survey approach to such research is limited in several ways.

First, retrospective analyses of drinking environments are contingent on the respondents' ability to recall social and physical environment features. Although survey items have been developed to query respondents on a variety of environmental characteristics (e.g., drinking games were being played, kegs were present), such lists may fail to prompt recall or respondents may confuse the presence of some environmental characteristics if they have been drinking in several different drinking environments. This methodological limitation may also be compounded by the level of respondents' intoxication while at the event.

Closely related to the recall of environmental factors is the respondents' ability to accurately recall their drinking behavior. Recent field research by Hustad and Carey (Hustad and Carey, 2005) and Clapp and colleagues (Clapp et al., 2006a) illustrate the problems with estimating blood alcohol concentrations using retrospective survey data. Indeed, the Clapp et al. study showed that such estimates were unreliable even when the reporting of drinking behavior was collected in natural drinking settings at the same time breath (BrAC) samples of blood alcohol concentration were collected (Clapp et al., 2006a). Inaccuracies were compounded by environmental characteristics such as party size which produced errors in estimated BAC.

The present research employed methodological features which address the issues identified above. For this study, we made observations of environmental party characteristics and collected individual level data in the field. This approach allowed us to link observational contextual data to person level data. Finally, we collected BrAC samples to estimate blood alcohol concentrations. Together, these methodologies provide a comprehensive approach to analyzing the relationships among environmental and individual level factors as they related to alcohol consumption.

METHODS

Data for the present study were collected as part of a multi-year study with the aims of identifying environmental factors associated with heavy drinking and attendant alcohol problems. The field methodologies used in the larger study, including the study presented here, have been described in great detail in a methodological paper (Clapp et al., 2007a). In addition, the instruments used in this study are available from the corresponding author. The study was approved by the San Diego State University Institutional Review Board.

Identifying Parties

Two hundred and twenty-six (n = 226) randomly selected, naturally occurring, college parties were studied through observation, field surveys and corresponding BrAC samples of 1,725 student partygoers. Parties were defined as a gathering of 5 or more students; however, given the hierarchical analytic approach necessary to address the objectives of the present study (see below), analyses were restricted to parties of 16 people or more to enhance statistical power, resulting in a total of 1304 individuals from 66 parties (Bickel, 2007).

Parties were located by driving a 6.2 mile route around a public university located in an urban area in southern California. The driving route included single family homes (including student rentals), 3 large apartment complexes, and fraternity/sorority housing. Surveys were conducted Thursday through Saturday and on select holidays over the course of 3 semesters.

A team of 6 research assistants drove the route to identify potential parties during 2 time periods (9 PM and 11 PM) each survey night. At the end of each driving sweep, parties were randomized into the order they would be observed. Not all of the identified parties were observed; typically, 3 parties were surveyed after the first driving sweep, and 4 after the second.

Gaining Access

Two research assistants approached the residence and asked to speak to the party host. The host was given an explanation of the study along with other informed consent information. We offered hosts a $20 gift card as incentive for access to the party. Very few (8.4%) hosts refused admission to the party. If a host refused entry

or if the party had disbanded following the sweep, the next party on the list was approached by the research assistants.

Surveying Partygoers and Collecting BrAC samples

The dynamic environment inside parties precluded any attempts to randomly sample partygoers. Thus, research assistants attempted to interview as many partygoers as possible within 30 minutes. In the parties included in the present analysis, on average, 34.4% of partygoers were surveyed (based on head counts or crowd estimates as the denominator). Of the partygoers approached, only 11.6% refused to participate. To ensure partygoers were only surveyed once, each respondent's hand was marked with a colored marking pen that could not easily be washed off.

The questionnaire was completed by respondents. Research assistants watched respondents complete the questionnaire to ensure that respondents did not influence other respondent's answers.

MEASURES

Items on the partygoer survey included in this study were: participant gender, age, weight (pounds), student status (i.e., student vs. nonstudent) motivation to attend party (i.e., to get drunk, to socialize, to meet a partner), drinking game participation, used illegal drugs tonight, brought own alcohol (BYOB), drank hard liquor, time spent drinking tonight, amount of money spent on alcohol for the evening, number of drinks consumed, and number of heavy episodic drinking occasions (5 or more drinks) in the past 2 weeks. These items have been used in previous empirical work and several have shown to be predictive of heavy drinking (Clapp and Shillington, 2001a; Clapp et al., 2000, 2003).

Breath samples were collected from partygoers using handheld Breath Alcohol Concentration test units (CMI Intoxilyzer SD-400; CMI, Inc., Owensboro, KY). All units were calibrated monthly and were manufactured between 2000 and 2003. BrAC values were concealed from partygoers and interviewers on the night of the party; however, study participants could call the following day to obtain their BrAC values. Thus, neither the researchers nor the respondents had access to BrAC values during the party. Potential respondents displaying symptoms of impairment (slurring, stumbling, etc.) were not interviewed. Research assistants were authorized to offer arrange for and pay for a cab for such respondents; however, no cabs were arranged. Post hoc analyses of our data indicated that partygoers who drove to the event had significantly lower BrACs than partygoers using all other forms of transportation ($F = 7.4$, df = 7,1596, $p < 0.001$).

The manufacturer of the breathalyzer test units recommend that 15 to 20 minutes pass between the consumption of alcohol and the administration of the breath test to eliminate mouth alcohol which can result in falsely inflated BrAC estimates. This recommendation is a legal evidentiary standard. In some cases, the field setting precludes this long duration between a respondent's last drink and providing a breath sample. At least 10 minutes had passed between last alcohol consumption and the breath test in 84% of our sample.

Two research assistants were assigned to observe and collect data on party characteristics. These observers drew a map of the physical layout of the party. They were also responsible for assessing the following variables: party size, type of party (i.e., theme vs. nontheme), rowdy behavior, loud music, availability of food, presence of drug paraphernalia, use of illegal drugs by partygoers, types of alcohol present, whether people were intoxicated (the respondent's perception of 'intoxicated'), and the location of the party (i.e., inside vs. outside). Themed parties observed included several sexualized events e.g., lingerie, anything but clothes, and "just had sex". The inter-rater reliability coefficient across all observed variables averaged 0.77. For a much more detailed discussion of our methods, see Clapp et al. (2007a).

DATA ANALYSIS PROCEDURE

The primary data analysis strategy used in this study was to conduct a multilevel analysis using Hierarchical Linear Modeling (HLM) to estimate variance in BrACs of individuals clustered within parties based on person level and party level characteristics. Prior to HLM, descriptive and bivariate analyses were run. HLM is appropriate to estimate the influences of both individual- and party-characteristics (Hox, 2002; Raudenbush and Bryk, 2002) and allows for disentangling effects of individual- and party-characteristics on BrAC. The multilevel models presented here included an individual level equation (Level 1) and a party-level equation (Level 2). Three different models of multilevel estimates were generated. The first model, Model 1, provided a grand mean for BrAC, and with a maximum likelihood estimate of variance components; it yielded an intraclass correlation corresponding to the proportion of variance in BrAC that is attributed to differences between parties. The next model, Model 2 (A Random Coefficient model), added individual-level (Level 1) characteristics to the preceding model and estimated their effects on BrAC. Finally, party-level characteristics (Level 2) were included in the final model, Model 3 (An Intercept- and Slopes-as-Outcomes Model), in an attempt to build an explanatory model to examine whether Level 2 characteristics accounted for the variability in intercept and slopes of BrAC estimates. Several cross-level interaction terms were also tested in this final model.

Before model building and testing, we assessed whether missing data were distributed randomly in our dataset (Little, 1992; Schafer, 1997) using the SPSS Missing Value Analysis (MVA) procedure (SPSS Version 13.0. http://www.spss.com). The results of this analysis indicated a nonrandom pattern of missing data (Little's MCAR test: chi-square = 239.297, df = 64, $p < 0.001$), suggesting list-wise deletion of missing data might introduce potential bias. MVA expectation-maximization (EM) procedure was used to impute values for missing values on the dependent variable (BrAC) and on a series of independent variables to address this potential problem. Subsequent data analysis was performed on the imputed data set. All variables in the final models were imputed. Missing

values for variables ranged from 25.3% (total time drinking) to 0% (gender). The BrAC variable had 4.1% of the cases with missing values.

Predictor variables for inclusion in the HLM models were identified via a series of bivariate analyses with BrAC as the dependent measure. The variables reported in Tables 1 and 2 were included in the preliminary analyses. Variables statistically related to BrAC in the bivariate analyses were retained in the final models. Several substantively important cross-level interaction terms were also explored to determine if they contributed significantly to the model. Specifically we tested the following cross-level interactions (one significant interaction is reported in Table 3): (i) Played drinking games by Perceptions of many partygoers being intoxicated, (ii) Motivation to socialize by party size, (iii) BYOB by party size, and (iv) themed party by gender. In addition, the within-level (Level 2) interaction of party size by exit time from party was tested. Only statistically significant interactions were retained in the final 3 level model. The hierarchical linear model data was analyzed using the HLM (ver. 6.02) statistical analysis program.

RESULTS

Characteristics of Individuals and Parties

Table 1 presents the Level 1 (individual characteristics) included in our analyses. Approximately 58% of the participants were male and two-thirds (68.0%) were 20 years old or younger. There was no statistical difference between older (21 and up) and younger partygoers on BrAC ($t = -0.088$, df = 13.02, p = 0.93). The vast majority of the participants were college students (88.9%). Sixty-one percent of surveyed partygoers cited socializing as their main motivation for party attendance. About 37% of partygoers reported party attendance in order to get drunk. One-fifth of the participants came to the party to meet a potential sexual partner. At the party, 32% reported playing drinking games and 70% reported that they had access to illicit drugs. About two-thirds of them brought alcohol to the party. Approximately 15% had shots and mixed drinks at the party. Participants reported consuming an average of 1.4 drinks at a party, with 74.8% reporting 1 or 2 drinks.

Table 3 presents the results of the multilevel analyses. The Model 1 shows an overall (grand) mean of BrAC among study participants to be 0.072, with significant variations among them. The intraclass correlation is 0.105, indicating that 10.5% of the variance in BrAC is between parties.

In the Model 2 which assesses the effects of individual characteristics (Level 1) on BrAC. The variables gender and BYOB did not have any significant effects on BrAC. However, other individual level variables such as coming to the party to socialize, playing drinking games, and history of heavy episodic drinking (HED) did significantly contribute to the model. Those partygoers who reported attending the party to socialize had a BrAC an average of 0.012 lower than those who did not, whereas those who played drinking games and had a higher number of past HED episodes significantly contributed to elevated levels of BrAC as indicated by positive

Table 1. Individual Characteristics

Individual characteristics (Level-1) (n = 1304)	
Characteristics	%
Gender	
Female	42.4
Male	57.6
Age group	
20 years old or younger	68.0
21 or older	32.0
Being a college student	88.9
Motivations – to socialize	61.0
Motivations – to meet a partner	21.1
Motivations – to get drunk	37.3
Played drinking game	32.0
Access to illicit drugs	70.1
Brought own drinks (BYOB)	66.1
Drank both shots and mixed drinks at the party	15.4
Reasons for coming to party (percent yes)	
Socialize	61.3
Meet sexual partner	21.4
Have fun	45.0
Get drunk	38.8
Get in fight	5.3
On a date	3.0
Self-reported number of drinks (Mean = 1.40, SD = 0.92)	
0	12.3
1	50.6
2	24.2
3	10.1
4	2.7
Mode of transportation to party	
Drove self	23.3
Rode in car other driver	21.6
Walked	37.1
Live at survey location	17.5
Other	3.5
Planned mode of transportation to next location	
Drive self	11.2
Ride in car other driver	16.2
Walk	48.5
Staying here all night	12.4
Other	11.7
People partying with (percent yes)	
Roommate(s)	37.6
Spouse	2.7
Partner	10.6
Friend(s)	67.0
Plans for next location (percent yes)	
Leave to my place	53.2
Leave to a friend's house	21.8
Leave to family's house	2.3
Leave to bar/restaurant	9.1
Leave to other place	13.6
Plan to continue drinking tonight (percentage yes)	86.9
Weight (pounds)	Mean = 157.59, SD = 38.52
Time spent drinking (minutes)	Mean = 124.04, SD = 123.77
Amount of money spent on alcohol (USD)	Mean = 13.05, SD = 24.85
The number of heavy episodic drinking occasions in past 2 weeks	Mean = 4.48, SD = 4.24
BrAC	Mean = 0.0769, SD = 0.0629

Table 2. Party-Level Characteristics

Party-level characteristics (Level-2) (n = 66)	
Characteristics	% Yes
Themed party	15.2
Rowdy behavior observed	12.1
Loud music	33.3
Food available	12.1
Illicit drugs available	12.1
People were intoxicated	87.9
Beer present	86.4
Kegs present	47.0
Hard alcohol present	63.6
Drug paraphernalia or hookah present	15.2
Party location	
Inside	66.7
Outside	33.3
Time of survey	
9:00–11:00 PM	24.2
11:00 PM–2:00 AM	75.8
Type of location	
House party	93.9
Frat party	6.1

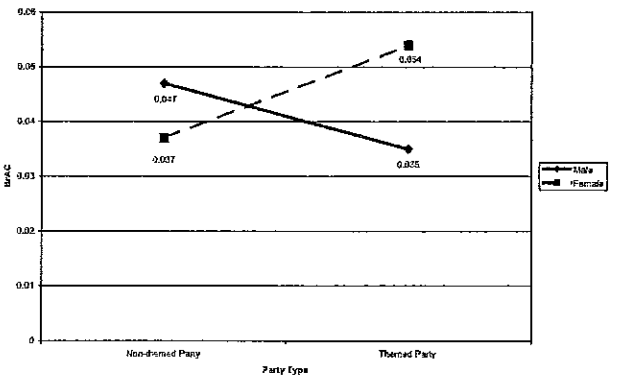

Fig. 1. Interaction effects of gender and themed party on BrAC.

estimates; 0.013 and 0.001, respectively. The addition of individual characteristics explains 9% of the variances at the individual level (Level 1) and 29% of the variances at the party level (Level 2).

Model 3 adds party-level characteristics and 2 interaction terms to Model 2 and evaluates the effects of party-level characteristics on BrAC. Two of 7 party-characteristics had significant contributions to the model; party size and raters' perception of many people being intoxicated at the event. Those in a large party reported an average BrAC level of $M = 0.011$ lower than those in a small party setting. On the other hand, when research assistants perceived many intoxicated partygoers, the average level of BrAC increased by 0.023. Other party-level variables such as themed party, rowdy behavior, loud music, illicit drug, hard alcohol, and exit time of period did not have significant effects on the BrAC.

Of all the interactions tested (see above) only themed party by participant gender was statistically significant. As shown in Fig. 1, the average level of BrAC for male and female participants depended on whether party attended was themed. Specifically, there is virtually no difference in BrAC for male

Table 3. Multilevel Estimates for BrAC Based on Individual and Party-Level Characteristics

	Model 1		Model 2		Model 3	
	Estimate	T-ratio	Estimate	T-ratio	Estimate	T-ratio
Fixed effect						
Intercept	0.072***	27.20	0.069***	12.95	0.035**	3.64
Level 1 (individual)						
Gender (1 = male)			−0.002	−0.43	0.004	0.91
Motivation – to socialize (1 = yes)			−0.012***	−3.84	−0.014**	−3.62
Played drinking game (1 = yes)			0.013***	3.65	0.015***	4.08
Past binge drinking			0.001**	3.39	0.001**	3.31
BYOB (1 = yes)			0.008	1.89	0.008	1.84
Level 2 (party)						
Party size (1 = large)					−0.011*	−2.07
No of parties going on the night					0.001	0.87
Themed party (1 = yes)					0.017*	2.06
Rowdy behavior (1 = yes)					−0.001	−0.28
Loud music (1 = yes)					0.003	0.73
Illicit drug (1 = yes)					−0.008	−1.19
Many people intoxicated (1 = yes)					0.023**	3.03
Hard alcohol (1 = yes)					0.008	1.45
Period of exit time (1 = 11 PM–2 AM)					0.005	1.36
Cross-level interaction						
Gender × themed party					−0.023**	−2.84
						1.31
Random effect (variance components)						
Between party	0.00031***		0.00024***		0.00020***	
Within party	0.00264		0.00234		0.00232	
Deviance	−3870.65		−3288.68		−3220.06	

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

participants as a function of the type of party the attended (theme, $M = 0.036$; nontheme, $M = 0.037$); however, females had higher BrAC values at theme parties ($M = 0.49$) compared to nontheme parties ($M = 0.033$).

Party-level characteristics explained 13.6% of the variance at the individual level (Level 1) and 45.2% of the variance at the party level (Level 2) for this third model. Contrasted with Model 2, the third model explained more variance at both the individual and party levels.

DISCUSSION

The present study was one of the first to examine both the contribution of individual and environment factors to alcohol consumption using several different types of data collection methodologies in naturally occurring drinking settings. The use of observational, biological and self-report survey data afforded us the opportunity to examine more accurately (relative to retrospective self-report approaches) assess the relationship between person and environmental factors on drinking behaviors in a "typical" college student drinking environment.

The results of the second model demonstrated significant associations between individual factors and alcohol consumption. Specifically, participants whose motivation for attending the party was to socialize had higher BrAC values than those with different motivations highlighting the role that alcohol may serve as a social lubricant in this population of young adult drinkers (Monahan and Lannutti, 2000; Sayette, 1993, 1994). Additionally, participants who reported playing drinking games and those who reported more past episodes of heavy drinking had significantly higher alcohol consumption, replicating findings obtained from other studies using self-report data (Clapp et al., 2003, 2006a).

In several previous studies we have demonstrated significant associations between factors related to drinking environments and alcohol consumption using retrospective self-report data obtained from phone interviews (Clapp and Shillington, 2001a; Clapp et al., 2000, 2003, 2006a). Specifically, these studies have shown that in drinking events where drinking games are being played, illicit drugs are present, hard alcohol is served, and respondents perceiving many people were intoxicated at an event, heavier drinking is more prevalent. The presence of food and nonalcoholic beverages serve as protective factors. In terms of environmental predictors of alcohol consumption, the results of the present study indicated a significant association between party size and BrAC as well as a significant association between the perception that many partygoers were intoxicated and BrAC. Factors such as the presence of hard alcohol and illicit drugs, the availability of food, rowdy behavior, and loud music were not significantly associated with BrAC, contrasting the results obtained in earlier studies.

At first glance, the finding that larger parties were predictive of lower BrAC values relative to small parties appears counterintuitive and some evidence suggests that students attending larger parties (i.e., fraternity parties) are more intoxicated than students attending smaller house or apartment parties (Glindemann and Geller, 2003). It is, however, also possible that there is less alcohol available to partygoers who do not bring their own alcohol beverages to large parties. For example, at a party with a keg, partygoers will have more beer available to them if the party is attended by 25 people versus 50 people. The size of a party may also limit the amount one drinks. For instance, a partygoer may have to wait in line for some time to get another drink at a large party; thus, the amount of time spent consuming alcohol may be longer and as a result, a partygoer may ultimately consume less alcohol.

In general, men consume more alcohol drinks and are more likely to engage in heavy episodic drinking when drinking relative to women (Clapp et al., 2006b; Glindemann and Geller, 2003; Johnston et al., 2006; Wechsler et al., 2000; Wilsnack et al., 2000). This difference has been observed for studies utilizing both self-report data (Clapp et al., 2006b; Johnston et al., 2006) and BAC estimates from breath samples (Glindemann and Geller, 2003; Lange and Voas, 2001; Lange et al., 2002a). Interestingly, we were not able to replicate this effect in the present study. It is possible that differences in study settings and/or samples could account for the differences observed between our findings and the results obtained by these other researchers. For example, Lange and colleagues (Lange et al., 2002b) utilized BrAC data collected from bars popular with college students while the sample of college study parties utilized by Glindemann and Geller included nearly 60% fraternity parties (Glindemann and Geller, 2003). In contrast, our sample included a very small number fraternity parties ($n = 8$; 3.5%).

Although we did not find that women had lower BrACs than men in our sample, it does appear there are strong differences in level of BrAC between men and women as a function of the type of party attended. The significant themed party by gender interaction in our study showed that women had higher BrACs than men at themed parties and no difference in level of intoxication between men and women at nonthemed parties. This finding is very surprising considering the large number of studies demonstrating greater alcohol consumption among men compared to women (Clapp et al., 2006a; Glindemann and Geller, 2003; Johnston et al., 2006; Wechsler et al., 2000). Given the setting of some theme parties can be highly sexualized future investigation of the mechanisms that may explain this effect is warranted (Clapp et al., 2007b).

Clapp, Segars, and Voas suggest that drinking events are dynamic across the night (Clapp et al., 2002a). In this study, the average BrAC estimate across all study participants was 0.0769. The mean number of drinks reported was 1.40 during a median time at the party of 75 minutes. The incongruence between the BrAC value and the reported number of drinks at the party may be related to several factors. First, it might be indicative of drinking in multiple settings. Second, it is possible that the vessel used to consume the alcohol (i.e., plastic

cups of various sizes) might have influenced drink counts (Kerr et al., 2005). Similarly, it may be a result of errors in counting due to the party environment itself. To this end, Clapp et al. (2006b) found the BrAC and survey-based estimates of BAC varied significantly and that variation could be predicted by drinking environments. Future research is needed to examine (i) drinking across multiple contexts during the course of a day or night, and (ii) how individuals count drinks in different settings.

STUDY STRENGTHS AND WEAKNESSES

The study has several strengths including strong measurement validity of breath alcohol concentrations, triangulation of drinking data (BrAC, self-report and observational), and strong ecological validity (Brunswick, 1956). Unlike data collected in laboratory settings, the data reported here are very likely reflective of party settings in other regions.

The study, however, is not without limitations. First, by entering parties, our research team is temporarily disrupting the natural environment. Our observers, for instance, were able to document drinking games in progress which typically were suspended during the survey. In bar or tavern settings it is possible to embed observers to collect environmental data (Graham et al., 2006) and use a portal methodology (i.e., patron surveys entering and exiting an establishment) to survey individuals (Lange et al., 1999; Voas et al., 2006); however, this approach is problematic in private parties, as we would need to use deception to gain access in most cases.

Given our inability to randomly select partygoers, it is uncertain that our BAC estimates represent the parameter for the mean BrAC at parties. It is possible, for instance, that heavy drinkers or lighter drinkers are over represented in the sample. As noted above less than 12% of the partygoers approached refused to participate in the study, thus the likelihood of a systematic reporting bias may not be substantial. However, in larger parties it is possible that the heaviest drinkers were in inaccessible areas.

Second, our BrAC data provide a snap-shot of intoxication among partygoers in a single environment at a single point in time. Drinking occasions are dynamic and alcohol consumption varies across settings. Similarly, blood alcohol concentrations vary across the course of an evening. Our findings suggest that environmental factors influence BrAC. Thus, drinking in multiple settings on any given night very likely results in different blood alcohol trajectories and levels of risk for intoxication. Future research might attempt to follow individuals across time and settings using ecological momentary assessment of some similar methodology.

Indeed, there is much to be learned about the relationships among alcohol consumption and environmental conditions in general, and among college students specifically. In addition to the areas for research noted above, a better understanding of how party environments relate to overall drinking patterns and alcohol-related problems (both acute and chronic) would be useful for researchers and prevention professionals alike. Follow-up studies on the day after a party as well as longitudinal work would be informative in this regard. Finally, prevention trials attempting to reduce heavy drinking (or problems identified) in party settings are needed. Much environmental prevention has focused on policy and enforcement. Linking these types of interventions with host or partygoer level interventions might be a next logical step.

ACKNOWLEDGMENTS

This study was funded by a grant from the National Institute on Alcohol Abuse and Alcoholism (RO1 AA013968, Dr. Clapp, PI).

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