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Journal

Substance Use & Misuse, 51(8)

ISSN

1082-6084

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Publication Date

2016-07-02

DOI

10.3109/10826084.2016.1152496

Peer reviewed



SUBSTANCE USE & MISUSE
An International Interdisciplinary Forum

Substance Use & Misuse

ISSN: 1082-6084 (Print) 1532-2491 (Online) Journal homepage: <http://www.tandfonline.com/loi/isum20>

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To cite this article: Mary Beth Miller, Brian Borsari, Anne C. Fernandez, Ali M. Yurasek & John T. P. Hustad (2016): Drinking Location and Pregaming as Predictors of Alcohol Intoxication Among Mandated College Students, Substance Use & Misuse, DOI: [10.3109/10826084.2016.1152496](https://doi.org/10.3109/10826084.2016.1152496)

To link to this article: <http://dx.doi.org/10.3109/10826084.2016.1152496>



Published online: 12 Apr 2016.



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ORIGINAL ARTICLE

Drinking Location and Pregaming as Predictors of Alcohol Intoxication Among Mandated College Students

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ABSTRACT

Background: Both drinking location and pregaming have been associated with heavy alcohol use among college students, yet the manner by which they uniquely contribute to alcohol intoxication remains unclear. *Objective:* The current study examined the unique utility of drinking location and pregaming in predicting alcohol intoxication among college students who violated campus alcohol policy. *Method:* Between 2011 and 2012, mandated college students who reported drinking prior to their referral events ($N = 212$, 41% female, 80% White, $M_{\text{age}} = 19.4$ y) completed a computerized assessment of drinking location and related behaviors as part of larger research trial. Chi-squared statistics, t-tests, one-way analyses of covariance, and regression were used to examine study aims. *Results:* Participants were most likely (44%) to report drinking in off-campus housing prior to the referral event, and approximately half (47%) reported pregaming. Alcohol intoxication on the night of the referral event differed significantly as a function of both drinking location and pregaming, but pregaming did not moderate the association between drinking location and alcohol intoxication among mandated students. Female birth sex, pregaming, and drinking at either fraternities or off-campus housing predicted greater levels of alcohol intoxication on the night of the referral incident, while drinking in a residence hall/dorm predicted lower intoxication. *Conclusions/Importance:* Drinking location and pregaming are distinct predictors of alcohol intoxication among mandated college students. Future interventions may benefit from targeting both where and how college students consume alcohol.

KEYWORDS

Alcohol; college students; drinking; location; pregaming

Heavy alcohol use is a problem on college campuses, where two out of five students engage in heavy episodic drinking at least once per month (Hingson, 2010). This pattern of drinking, defined as consumption of four/five or more drinks in one setting for women/men, places college students and their peers at risk for a number of consequences, ranging from decreased academic performance and neurocognitive impairment to physical/sexual assault (Courtney & Polich, 2009; Hingson, 2010). Heavy alcohol use also places a significant burden on colleges and universities as organizations, via property damage, decreased enrollment, and increased demands on security and disciplinary personnel (Perkins, 2002). This combination of consequences has led to a number of campus and public policy standards against heavy drinking (Mitchell, Toomey, & Erickson, 2005). Since 2001, however, there has been a 14% increase in liquor law violations on college campuses (National Center for Education Statistics, 2014), suggesting that intervention and prevention strategies can be improved. Two risk factors for alcohol-related problems that may serve as targets for

such efforts include the location where drinking occurs and drinking in anticipation of a subsequent social event (also known as “pregaming”; Borsari et al., 2007).

Drinking location has been linked to heavy alcohol use among college students (Clapp, Reed, Holmes, Lange, & Voas, 2006; Demers et al., 2002; Harford, Wechsler, & Seibring, 2002; Kypri, Paschall, Langley, Baxter, & Bourdeau, 2010; Labhart, Graham, Wells, & Kuntsche, 2013; Usdan, Moore, Schumacher, & Talbott, 2005), to the point that many states have banned drink specials and “happy hours” at licensed drinking establishments (Nelson, Naimi, Brewer, & Wechsler, 2005). In the United States, where alcohol is not legally permitted until age 21 years, heavy drinking seems to be most common at off-campus and fraternity parties, while drinking in general occurs frequently at both off-campus parties and bars/restaurants (Clapp et al., 2006; Harford et al., 2002). Overall, heavy drinking seems to be more common at parties where there are large numbers of people, provision of alcohol is unmonitored, people are playing drinking games, and illicit drugs are available (Clapp et al.,

2006). It seems intuitive that such parties would be hosted off campus, where students may perceive weaker enforcement of alcohol policies and, therefore, less likelihood of getting caught (Buettner, Khurana, & Slesnick, 2011). However, the specific link between drinking locations and alcohol intoxication among college students remains unclear.

Research with college students in Switzerland suggests that situational factors such as drinking location (defined as on- or off-campus) may play a smaller role in heavy drinking than behaviors such as pre-gaming, which extend the amount of time spent drinking (Labhart et al., 2013). Pre-gaming, also known as pre-drinking or pre-partying, is a particularly problematic drinking behavior that is common in collegiate contexts (Borsari et al., 2007; Pedersen & LaBrie, 2007; Read, Merrill, & Bytschkow, 2010). College students report pre-gaming for a variety of reasons, including saving money, loosening up, getting a buzz, and hanging out with friends before going out for the night (Bachrach, Merrill, Bytschkow, & Read, 2012; LaBrie, Hummer, Pedersen, Lac, & Chithambo, 2012). It is fairly ubiquitous on college campuses, with anywhere from 64% to 85% of students reporting pre-gaming in the past month (DeJong, DeRicco, & Schneider 2007; LaBrie & Pedersen, 2008; Pedersen & LaBrie, 2007). While fun for students (Bachrach et al., 2012), the increased quantity of alcohol consumed on pre-gaming nights places them at increased risk of blacking out, passing out, and engaging in impulsive behaviors such as drunk driving (Labhart et al., 2013; Merrill, Vermont, Bachrach, & Read, 2013; Pedersen & LaBrie, 2007; Read et al., 2010). Pre-gaming has also been implicated in approximately a third of campus policy violations (Borsari et al., 2007), indicating that pre-gaming is not only highly prevalent but also highly problematic for students on college campuses. In regards to drinking location, there is some evidence that college students are more likely to pregame for a bar than a fraternity party (Zamboanga et al., 2013). It is possible, then, that certain drinking locations are more strongly associated with pre-gaming, which leads to greater use of alcohol at those locations.

The current study sought to disentangle the influences of drinking location and pre-gaming in predicting alcohol intoxication among US college students. To do so, we first explored differences in drinking location and pre-gaming by birth sex, ethnicity, age, and residence in order to identify influential covariates for subsequent analyses. We then examined whether college students' levels of intoxication prior to their referral events (event BAC) varied as a function of drinking location and pre-gaming. Consistent with previous research (Harford et al., 2002;

Merrill et al., 2013), it was expected that participants who reported drinking at fraternities and off-campus locations prior to the referral event would demonstrate higher event BACs than those drinking in a residence hall/dorm (Hypothesis 1) and that those who reported pre-gaming would report higher event BACs than those who did not (Hypothesis 2). Because pre-gaming has been associated with drinking location in previous studies (Labhart et al., 2013; Zamboanga et al., 2013), it was also expected that pre-gaming would moderate the association between drinking location and event BAC, such that those drinking at fraternities and off-campus locations would reach higher event BACs if they reported pre-gaming prior to the referral event (Hypothesis 3). Finally, we explored the unique utility of each drinking location in predicting event BAC after accounting for pre-gaming behavior. Given findings that pre-gaming plays a larger role than drinking location in alcohol consumption among university studies in other countries (Labhart et al., 2013), it was expected that drinking locations would no longer predict event BAC after accounting for pre-gaming behavior (Hypothesis 4).

Method

Participants and procedure

Undergraduate students at a large, public, mid-Atlantic university who had been mandated to treatment following violation of a drinking-related campus policy, alcohol-related medical attention at the local emergency department, or alcohol-related arrest were recruited to participate in a larger research trial (see Pearson & Hustad, 2014). Recruitment occurred between November 2011 and August 2012. Eligible participants for the current study were over age 18 years, scored <16 on the Alcohol Use Disorders Identification Test (AUDIT; Bradley, McDonell, Kivlahan, Diehr, & Fihn, 1998), denied suicidal ideation, and reported drinking prior to the referral event. Those scoring higher than 16 on the AUDIT as well as those endorsing suicidal ideation were excluded from the study in favor of a referral for more intense treatment. All mandated students were required by the University to pay a \$200 program fee, complete a baseline assessment, receive a brief motivational intervention, and complete a 1-month follow-up. Those who chose to participate in the research trial completed a computerized baseline assessment and participated in a one-hour brief motivational intervention (Dimeff, Baer, Kivlahan, & Marlatt, 1999). Assessment of drinking location was

included in baseline measures in the final year of the trial; therefore, only data from the final year of the larger study are included in current analyses. Of the 514 eligible participants, 42.2% ($N = 217$) consented to participate. All procedures were approved by the Institutional Review Board.

The final sample consisted of 212 undergraduate students (59% male) with a mean age of 19.35 years ($SD = 1.39$). Represented ethnicities were White (80%), Bi/Multiracial (8%), Asian (5%), Hispanic/Latino (5%), and African American (2%). The majority of participants reported living in on-campus residence halls ($n = 135$, 64%), followed by off-campus housing ($n = 66$, 31%), at home with guardians ($n = 7$, 3%), or on a sorority floor ($n = 4$, 2%). The majority reported drinking in off-campus housing (44%) prior to the referral incident, with fewer students drinking at a residence hall/dorm (33%), a fraternity (16%), or a bar/restaurant (7%). Although some students received multiple charges, citations were related primarily to underage drinking (68%), excessive consumption (17%), having alcohol in a prohibited area or building (7%), driving under the influence (5%), and providing to minors (2%). Less frequent citations included criminal mischief, disorderly conduct, use of fake identification, resisting arrest, and possession of marijuana. Overall, participants reported consuming an average of 9.60 ($SD = 6.65$) drinks in a typical week and reaching peak estimated BACs of .13 ($SD = .09$) in the past month, suggesting that they may represent a lower-risk sample than mandated samples described in previous studies (Borsari et al., 2015; Mastroleo, Oakley, Eaton, & Borsari, 2014; Terlecki, Buckner, Larimer, & Copeland, 2015).

Measures

Demographic information

Participants provided information regarding their birth sex, age, weight, year in school, race/ethnicity, and current residence.

Alcohol use

Drinking prior to the referral incident was assessed using the Event Description Form (Borsari et al., 2007). Participants indicated the number of standard drinks they consumed and the number of hours they spent drinking prior to their referral event. Along with birth sex and body weight, this information was used to calculate students' event blood alcohol concentrations (event BAC)

using Matthews and Miller's (1979) equation. These estimates are expected to be valid, given findings that self-reported alcohol consumption has been strongly correlated with biomarkers of alcohol use among college students (Leffingwell et al., 2013).

Drinking location

Using the Event Description Form (Borsari et al., 2007), participants indicated all locations at which they drank prior to the event (a fraternity house, residence hall/dorm, my own off-campus housing, someone else's off-campus housing, a bar/restaurant, or a tailgate) and the number of standard drinks (12oz beer, 5oz wine, 1.5oz 80-proof alcohol) consumed at each location. For participants who reported more than one drinking location ($n = 21$), the location at which they reported consuming the greatest number of drinks was identified as their "drinking location." Drinking locations were categorized in final analyses as fraternity, residence hall/dorm, off-campus housing (my own or someone else's), or bar/restaurant.

Pregaming

Participants reported (yes/no) if they had 'pre-gamed' or 'pre-partied' prior to the event. As in previous studies (Borsari et al., 2007), pregaming was defined as follows: "This is when you drink before you go out for the night (e.g., in your home/room or a friend's home/room). This includes drinking while waiting for people to gather for the evening or drinking in order to get buzzed before going to a party/function at which alcohol will be expensive (e.g., at a bar or a club) or difficult to obtain (e.g., at a school function). Please do not include tailgating." Participants were not asked to specify pregaming locations versus drinking locations; therefore, all locations throughout the manuscript refer to drinking, rather than pregaming, locations.

Data analysis plan

SPSS 22.0 was used for all data analysis. Chi-squared, t -test, and analysis of covariance techniques were used to examine demographic differences between both drinking location and pregaming groups (see Table 1 for complete demographic information across groups). As a result of these analyses, birth sex, age, and residence were included as covariates in analysis of covariance models. One-way analysis of covariance was used to determine if mandated students' event BACs differed as a function of drinking location and pregaming. Drinking location (fraternity, residence hall/dorm, off-campus housing, bar/restaurant) and pregaming (yes/no) were included in the model as fixed factors, while birth sex, age, and residence were

Table 1. Group differences in demographic variables.

DRINKING LOCATION GROUPS					
Gender	N	Female (%)	Male (%)	F / χ^2 (df)	p
Fraternity	34	20 (23.3)	14 (11.1)	10.89 (3)	.01
Residence hall/dorm	70	20 (23.3)	50 (39.7)		
Off-campus housing	93	42 (48.8)	51 (40.5)		
Bar/restaurant	15	4 (4.7)	11 (8.7)		
<i>Ethnicity</i>		White (%)	Non-White (%)	7.84 (3)	.05
Fraternity	34	33 (18.2)	1 (3.2)		
Residence hall/dorm	70	62 (34.3)	8 (25.8)		
Off-campus housing	93	73 (40.3)	20 (64.5)		
Bar/restaurant	15	13 (7.2)	2 (6.5)		
<i>Age</i>		M	SD	44.67 (3, 208)	< .001
Fraternity	34	18.94	.92		
Residence hall/dorm	70	18.60	.60		
Off-campus housing	93	19.65	1.32		
Bar/restaurant	15	22.00	1.56		
<i>Residence</i>		On-campus (%)	Off-campus (%)	62.22 (3)	< .001
Fraternity	32	26 (18.7)	6 (9.1)		
Residence hall/dorm	70	67 (48.2)	3 (4.5)		
Off-campus housing	90	45 (32.4)	45 (68.2)		
Bar/restaurant	13	1 (0.7)	12 (18.2)		
PREGAMING GROUPS					
Gender	N	Female (%)	Male (%)	t / χ^2 (df)	p
Pregaming	100	48 (55.8)	52 (41.3)	4.33 (1)	.04
No pregaming	112	38 (44.2)	74 (58.7)		
<i>Ethnicity</i>		White (%)	Non-White (%)	0.40 (1)	.53
Pregaming	100	87 (48.1)	13 (41.9)		
No pregaming	112	94 (51.9)	18 (58.1)		
<i>Age</i>		M	SD	3.01 (210)	.08
Pregaming	100	19.51	1.55		
No pregaming	112	19.18	1.15		
<i>Residence</i>		On-campus (%)	Off-campus (%)	0.22 (1)	.64
Pregaming	98	68 (48.9)	30 (45.5)		
No pregaming	107	71 (51.1)	36 (54.5)		

Note. Percentages indicate proportion of individuals within each demographic (e.g., females) who fell within each group (e.g., fraternity drinking location).

included as covariates. Models tested main effect differences (Hypotheses 1–2) and the interaction between (Hypothesis 3) drinking location and pregaming groups, using Bonferroni correction ($\alpha = .05/10 = .005$) to control for inflation in Type I error in pairwise comparisons. Drinking locations were then dummy coded (e.g., 1 =

fraternity, 0 = other locations), and four separate hierarchical linear regressions were used to determine the unique variance in event BAC accounted for by each separate drinking location (fraternity, residence hall/dorm, off-campus housing, bar/restaurant) after accounting for pregaming behavior (Hypothesis 4).

Results

Preliminary analyses

Data were screened for missing values, outliers, and normality prior to analysis. Given the limited number of missing values, no imputation procedures were used for missing data; therefore, *Ns* vary across analyses. Data were recoded in three ways. First, BACs greater than 0.40 g/dL ($n = 4$), which would typically result in coma or death, were recoded as .40. This resulted in a distribution of event BAC estimates ($M = .15$, $SD = .10$; skewness = 0.60, $SE = .17$; kurtosis = $-.42$, $SE = .33$) within the normal range. Second, drinking locations were recoded for parsimony of categorization. Given the low prevalence of drinking at one's own off-campus apartment ($n = 13$), this drinking location was combined with 'drinking at someone else's off-campus apartment' to form an "off-campus housing" category for drinking location. Conversely, because so few participants reported drinking at a tailgate ($n = 5$), these individuals were excluded from analyses. Finally, ethnicity was dummy coded (1 = White, 0 = non-White) for analysis of covariance and regression models.

Demographic differences in drinking location and pregaming

As can be seen in Table 1, drinking location groups differed significantly in terms of birth sex [$\chi^2(3) = 10.89$, $p = .01$, Cramer's $V = .23$], age [$F(3, 208) = 44.68$, $p < .001$, $\eta_p^2 = .39$], and residence [$\chi^2(3) = 59.862.228$, $p < .001$, Cramer's $V = .55$]. Females were also more likely than males to report pregaming prior to the referral event [56% vs. 41%; $\chi^2(1) = 4.34$, $p = .04$, Cramer's $V = .14$].

Group differences in event BAC (Hypotheses 1–3)

A one-way analysis of covariance was performed, including drinking location (fraternity, residence hall/dorm, off-campus housing, bar/restaurant) and pregaming (yes/no) as fixed factors and birth sex, age, and residence as covariates. Event BAC varied significantly as a function of birth

sex [$F(1, 194) = 8.86, p = .003, \eta_p^2 = .04$], drinking location [$F(3, 194) = 7.03, p < .001, \eta_p^2 = .10$], and pregaming [$F(1, 194) = 11.77, p = .001, \eta_p^2 = .06$]. Females ($n = 86; M = .18, SD = .10$) reported reaching higher event BACs prior to their referral events than males ($n = 126; M = .12, SD = .09$). In terms of drinking location, participants who reported drinking at a residence hall/dorm ($M = .11, SD = .08$) reported significantly lower BACs prior to the referral event than those who drank at a fraternity ($M = .18, SD = .11; p < .001$) or off-campus apartment ($M = .17, SD = .10; p < .001$); there were no statistically significant differences in event BAC between those drinking in a bar/restaurant ($M = .14, SD = .11$) and other location groups. Those who reported pregaming ($n = 100; M = .17, SD = .10$) also reached significantly higher event BACs than those who did not ($n = 112; M = .12, SD = .10$). No other demographic covariate [age, $F(1, 194) = 0.27, p = .60, \eta_p^2 = .001$; residence, $F(1, 194) = 0.03, p = .86, \eta_p^2 < .001$] was significant. Similarly, the drinking location by pregaming interaction [$F(3, 194) = 0.83, p = .48, \eta_p^2 = .01$] was not a significant predictor of event BAC within the model, precluding the presence of a moderation effect.

Drinking locations and pregaming as unique predictors of event BAC (Hypothesis 4)

To characterize the unique utility of each drinking location and pregaming in predicting event BAC, we conducted four hierarchical linear regressions, one for each dummy-coded drinking location (see Table 2.). Significant demographic covariates (birth sex) were entered in Step 1, pregaming was added in Step 2, and each drinking location was included in Step 3.

Across all models, female birth sex was associated with higher estimated event BAC in Step 1 [$t(206) = 4.08; p < .001; 95\% CI = .03, .08; Adj. R^2 = .07$] and pregaming accounted for an additional 5.6% of unique variance in event BAC in Step 2 [$t(205) = 3.63; p < .001; 95\% CI = .02, .07; Adj. R^2 = .12$]. In the first model, in which drinking at a fraternity prior to the referral event was evaluated as a predictor of event BAC, drinking at a fraternity accounted for an additional 1.9% of unique variance in event BAC [$t(204) = 2.11; p = .04; 95\% CI = .002, .07; Adj. R^2 = .14$]. In the second model, in which drinking at a residence hall/dorm prior to the referral event was evaluated as a predictor of event BAC, drinking at a residence hall/dorm accounted for 7.8% of unique variance in event BAC [$t(204) = -4.47; p < .001; 95\% CI = -.09, -.03; Adj. R^2 = .20$]. In the third model, drinking in off-campus housing accounted for 2.2% of unique variance in event BAC [$t(204) = 2.28; p = .02; 95\% CI = .004, .05; Adj.$

Table 2. Summary of hierarchical regression analyses predicting event BAC.

Variable	B	SE of B	β	p	F(df)	R ²	Adj. R ²
Fraternity vs. Other Locations							
Step 1					16.65 (1, 206)*	.08	.07
Sex	.06	.01	.27	< .001			
Step 2					15.41 (2, 205)*	.13 ^Δ	.12 ^Δ
Sex	.05	.01	.24	< .001			
Pregaming	.05	.01	.24	< .001			
Step 3					11.93 (3, 204)*	.15 ^Δ	.14 ^Δ
Sex	.04	.01	.21	.002			
Pregaming	.05	.01	.27	< .001			
Fraternity	.04	.02	.14	.04			
Residence Hall/Dorm vs. Other Locations							
Step 1					16.65 (1, 206)*	.08	.07
Sex	.06	.01	.27	< .001			
Step 2					15.41 (2, 205)*	.13 ^Δ	.12 ^Δ
Sex	.05	.01	.24	< .001			
Pregaming	.05	.01	.24	< .001			
Step 3					17.90 (3, 204)*	.21 ^Δ	.20 ^Δ
Sex	.04	.01	.18	.01			
Pregaming	.06	.01	.29	< .001			
Residence hall/dorm	-.06	.01	-.29	< .001			
Off-Campus Housing vs. Other Locations							
Step 1					16.65 (1, 206)*	.08	.07
Sex	.06	.01	.27	< .001			
Step 2					15.41 (2, 205)*	.13 ^Δ	.12 ^Δ
Sex	.05	.01	.24	< .001			
Pregaming	.05	.01	.24	< .001			
Step 3					12.21 (3, 204)*	.15 ^Δ	.14 ^Δ
Sex	.05	.01	.23	.001			
Pregaming	.05	.01	.24	< .001			
Off-campus housing	.03	.01	.15	.02			
Bar/Restaurant vs. Other Locations							
Step 1					16.65 (1, 206)*	.08	.07
Sex	.06	.01	.27	< .001			
Step 2					15.41 (2, 205)*	.13 ^Δ	.12 ^Δ
Sex	.05	.01	.24	< .001			
Pregaming	.05	.01	.24	< .001			
Step 3					10.30 (3, 204)*	.13	.12
Sex	.05	.01	.24	< .001			
Pregaming	.05	.01	.24	< .001			
Bar/restaurant	.01	.03	.03	.66			

Note. Adj. = adjusted. * $p < .001$. ^ΔChange in R^2 was significant at $p < .05$.

$R^2 = .14$]. In the final model, drinking at a bar/restaurant did not account for unique variance in event BAC after accounting for pregaming behavior [$t(204) = 0.44; p = .66; 95\% CI = -.04, .06; Adj. R^2 = .12$]. Complete statistical data for regression models are presented in Table 2.

Discussion

To our knowledge, this is the first study to examine the importance of various on- and off-campus drinking locations in predicting event-level alcohol intoxication after accounting for pregaming behavior. Consistent with previous research (Harford et al., 2002; Merrill et al., 2013), drinking at fraternities or off-campus housing and

pregaming were associated with higher levels of intoxication among college students mandated to an alcohol intervention. Contrary to hypotheses, however, pregaming did not moderate the association between drinking location and event BAC, and the majority of drinking locations remained significant predictors of event BAC after accounting for pregaming behavior.

Our findings regarding individual differences in drinking locations and pregaming were generally consistent with previous research. Participants were most likely (44%) to report drinking in off-campus housing prior to the referral event, but the heaviest drinking took place at fraternities (e.g., Harford et al., 2002). Similar to previous studies (Harford et al., 2002; Clapp et al., 2006), older students and those living off-campus were more likely to drink in public locations, such as a bar or restaurant; however, neither age nor residence were significant predictors of event BAC. The only significant demographic predictor of event BAC in the current study was birth sex. Females were more likely than males to report pregaming prior to the referral event, and they reported significantly higher event BACs. This seems to contradict findings of a previous study with non-mandated college students, in which women were more likely than men to pregame but showed significantly lower levels of intoxication on drinking days (Barnett, Orchowski, Read, & Kahler, 2013). The difference in event BAC outcomes between these two studies may be explained in part by the nature of the two samples: Students who have been mandated to intervention following violation of campus alcohol policy seem to consume alcohol at greater quantities than nonmandated students (Merrill, Carey, Lust, Kalichman, & Carey, 2014). Therefore, females in the current study may have reached higher event BACs due to a combination of heavy drinking quantities and biological differences in alcohol metabolism.

As predicted, participants drinking at fraternities and off-campus locations reported significantly higher event BACs than those drinking at a residence hall/dorm; however, pregaming did not moderate the association between drinking location and event BAC. Rather, individuals who pregame prior to the referral event (regardless of drinking location) reported higher event BACs than those who did not, and individuals at fraternities and off-campus locations (regardless of pregaming) reported significantly higher event BACs than those in a residence hall/dorm. Taken together, these findings suggest that drinking location and pregaming are distinct predictors of event BAC. After accounting for pregaming behavior, drinking in fraternities and off-campus locations were small but significant unique predictors of increased intoxication, while

drinking in a residence hall/dorm was a stronger predictor of lower event BAC. This is consistent with findings that heavy drinking tends to occur at fraternity parties (Harford et al., 2002) and off-campus locations (Demers et al., 2002) and suggests that analysis of public versus private drinking locations (Clapp et al., 2006) may not sufficiently depict the range of drinking venues that may be associated with alcohol-related risk among college students. Current findings also support earlier research with US college students (Harford et al., 2002) in suggesting that students drink less heavily in residence halls/dorms. This may be due in part to the legal age limit for drinking in the United States, common policies against drinking on campus, and the general tendency for hall monitors to be present in residence halls, even on weekends. This finding does not imply that drinking in places that have greater supervision is necessarily risk-free, however, as students drinking in the residence halls/dorms averaged event BACs well above the legal limit.

These findings inform prevention and intervention efforts for college student drinking in several ways. First, although campus policies against alcohol consumption on university property do not prevent all drinking on the premises, they do seem to deter some drinking in the dorms, in comparison to that reported in fraternities and off-campus housing. Consistent enforcement of these policies may improve their effectiveness (Wagenaar, Toomey, & Erickson, 2005). However, colleges and universities must also deal with the apparent paradox of alcohol regulation on campus: strict regulations limiting alcohol consumption may actually create an environment where pregaming off-campus is more likely (Wells, Graham, & Purcell, 2009). Second, the importance of pregaming in predicting alcohol intoxication indicates that prevention and intervention strategies may also need to assess and address pregaming specifically. Normative interventions, which are designed to correct misperceptions of how much and how often one's peers consume alcohol (Neighbors, Larimer, & Lewis, 2004), may be particularly well-suited to reduce pregaming among undergraduate students, as college students tend to overestimate how often their peers pregame and how much alcohol they consume while doing so (Burger, LaSalvia, Hendricks, Mehdipour, & Neudeck, 2011; DeJong et al., 2010; Pedersen & LaBrie, 2008; Rutledge, McCarthy, & Lendyak, 2014). However, attention to other risk factors that may account for intoxication among college students (e.g., peers, alcohol policies and enforcement, accessibility)—and appropriate strategies to limit such risk— is also warranted, given that pregaming accounted

for a small amount of variability in event BAC. Interventions targeting *where* (or perhaps with whom) one drinks are likely also important in preventing high intoxication among college students.

Results should be interpreted in light of the study's limitations. First, current data were cross-sectional and, therefore, cannot determine direct or indirect causes of behavior. Longitudinal studies examining within-person changes in drinking outcomes across various drinking locations would allow for more direct examination of the importance of drinking location in alcohol-related risk. Second, the limited number of participants reporting alcohol use at various drinking locations may limit the stability of results, which need to be replicated in future studies in order for strong conclusions to be made regarding their importance. In particular, participants drinking at a bar/restaurant prior to their referral events ($n = 19$) reached event BACs equivalent to those in the off-campus housing group; therefore, analyses were likely underpowered to detect significant effects for those drinking at a bar/restaurant. Similarly, although a large number of students in the current sample reported pregaming on the night of the referral incident, only a few reported drinking in two separate locations; therefore, it is plausible that the 'drinking' locations described in this study were 'pregaming' locations for some participants. Third, participants in the current sample were recruited from a single campus, were predominantly White, and were mandated to treatment; therefore, results may not generalize to more diverse or non-college student populations, who should be included in future studies. It is also possible that pregaming was overrepresented in the current sample. Specifically, participants in this study may have been detained for violation of alcohol policy prior to reaching their final drinking destination; therefore, future research may compare pregaming behaviors in mandated and non-mandated students. Fourth, data were collected via retrospective self-report. Although self-reported alcohol use has been found to be strongly correlated with biomarkers of alcohol use among college students (Leffingwell et al., 2013), mandated students have been found to slightly underreport their use of alcohol (Borsari & Muellerleile, 2009). Therefore, true drinking quantities may be underestimated.

Conclusion

Regardless of pregaming behavior, drinking at a fraternity house or off-campus house/apartment was associated with higher levels of intoxication among college students who were mandated to intervention

following violation of campus alcohol policy. Female birth sex, pregaming, and drinking at a fraternity house or off-campus house/apartment predicted higher event BACs on the night of the referral incident, while drinking in a residence hall/dorm predicted lower levels of intoxication. Findings suggest that drinking location and pregaming are distinct predictors of alcohol intoxication among college students and that both may be important targets in future prevention and intervention efforts.

Glossary

Brief motivational intervention (BMI): A method of decreasing health risk behaviors that utilizes Motivational Interviewing and objective feedback to encourage individuals' thoughtful consideration of current behaviors (e.g., alcohol use) and related consequences; typically delivered in one to two sessions.

Drinking location: The place where each participant reported consuming alcohol prior to the referral incident (i.e., fraternity house, residence halls/dorm; off-campus house/apartment, or public location, such as bar, restaurant, or tailgate).

Heavy episodic drinking: For men, consumption of five or more drinks on one occasion. For women, consumption of four or more drinks on one occasion.

Pregaming: Consuming alcohol prior to attendance of a social event where additional alcohol may or may not be available and/or consumed (also known as frontloading, prepartying, or predrinking).

Referral incident: The drinking-related event for which the college students was required to complete an alcohol-focused intervention. All referral incidents involved a violation of campus alcohol policy.

Declaration of interest

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

Funding

Brian Borsari's contribution to this manuscript was supported by National Institute on Alcohol Abuse and Alcoholism (NIAAA) Grants R01-AA015518 and 01-AA017874 and VISN1 Career Development Award VICDA2012-18. Anne Fernandez's and Ali Yurasek's contributions to this manuscript were supported by the National Institute on Drug Abuse (NIDA) grant T32 DA016184. John Hustad's contribution was supported by the National Center for Advancing Translational Sciences (NCATS) and the National Institutes of Health (NIH) through Grants UL1 TR000127 and KL2 TR000126 to Lawrence Sinoway. The contents of this article do not represent the views of the National Institutes of Health, the Department of Veterans Affairs, or the United States Government.

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