Many College Freshmen Drink at Levels Far Beyond the Binge Threshold

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Background: Binge drinking is a dichotomous variable that allows researchers to sort students into categories based upon a specific threshold of consumption, commonly 4 (females) or 5 (males) drinks. Crossing the binge threshold increases the risk of negative alcohol-related consequences. The use of such thresholds has played a vital role in the study of college drinking. While extremely valuable, the dichotomous nature of binge drinking variables removes information about how heavily students actually drink, leaving the characterization of college drinking incomplete. The present study examined patterns of alcohol use beyond the binge threshold.

Methods: The data set consisted of self-reported 2-week drinking histories from 10,424 first-semester freshmen at 14 schools across the United States during the fall of 2003. The number of students who reached the 4+/5+ binge-drinking threshold was calculated, as was the number who reached 2 times (8+/10+ drinks) or 3 times (12+/15+ drinks) the binge threshold. Logistic regression analyses were used to explore gender differences and to assess whether frequent binge drinkers (3+ binges per 2 weeks) were more likely than infrequent binge drinkers (1–2 binges per 2 weeks) to reach high peak levels of consumption.

Results: Roughly 1 of 5 males consumed 10+ drinks and 1 of 10 females consumed 8+ drinks, twice the binge threshold, at least once in the previous 2 weeks. Gender differences were observed at every drinking level and were particularly large at higher peak levels. Frequent binge drinkers were more likely than infrequent binge drinkers to consume 2 or 3 times the binge threshold.

Discussion: A surprisingly large percentage of students, particularly males, drink at peak levels well beyond the binge threshold. Such findings suggest that schools might make additional progress in the battle against alcohol misuse by focusing on extreme drinking practices in addition to binge drinking per se.

Key Words: Binge, Alcohol, College Drinking, High Risk.

ALCOHOL MISUSE REMAINS a pervasive problem on American college campuses. Three students at Colorado schools alone died from overdoses during the first few months of the fall 2004 semester (USA Today, 2004). Thirty-four students were treated for alcohol poisoning at a single, medium-sized university in Delaware during that same time period (UDaily, 2004). Reports of sexual assaults, memory blackouts, vandalism, alcohol-fueled riots, and other deleterious outcomes associated with drinking have become increasingly common (Perkins, 2002; Wechsler et al., 1998; White et al., 2002).

In recent years, research and media reports about college drinking have focused largely on *binge drinking*. When

used colloquially, the term binge drinking implies consuming large amounts of alcohol in a relatively short period of time. In studies of college drinking, the term refers to a dichotomous variable defined by meeting or exceeding a threshold, such as 4 or more drinks (4+) for females and 5 or more drinks (5+) for males (Wechsler et al., 1994). Research by Henry Wechsler and colleagues (Wechsler et al., 2002) at the Harvard School of Public Health, the main proponents of the 4+/5+ measure of binge drinking, suggests that roughly 45% of students nationwide meet or exceed this threshold at least once every 2 weeks. If consumed rapidly, 4 or 5 drinks could potentially produce blood alcohol concentrations (BACs) of 0.08% or higher, although field studies suggest that drinking at these levels often results in much lower BACs (Thombs et al., 2003). Statistically, students who meet or exceed the binge threshold are at greater risk of experiencing negative alcohol-related consequences than non–binge drinkers (Wechsler et al., 2002). The number of times within a 2-week period that students cross the binge threshold also provides useful information about the likelihood that students will experience negative alcohol-related consequences. Research indicates that binge drinking frequently (3 or more times in a 2-week period) leads to a

greater risk of negative consequences than binge drinking infrequently (1 or 2 times per 2-week period) or drinking but not binging (Wechsler et al., 2002).

Without question, the use of binge drinking thresholds yields valuable information about alcohol consumption on college campuses. Unfortunately, one limitation of this approach is that it removes data regarding how heavily students actually drink (Alexander and Bowen, 2004). Indeed, several authors have suggested that the intense focus on binge drinking in recent years has led some researchers to overlook other important aspects of alcohol use among college students, including levels of consumption beyond the binge threshold (Gruenewald et al., 2003). The same level of risk is assigned to all students who cross the threshold regardless of how far beyond the threshold they go. For instance, the measure places students who consume 5 drinks and 25 drinks in the same category despite the fact that the risks associated with these disparate levels of consumption are far from equivalent. Thus, while extremely useful, binge drinking measures simply cannot completely characterize the drinking habits of college students.

The purpose of the current study was to examine patterns of alcohol use on college campuses beyond the binge threshold. Survey data from 10,424 first-semester freshmen at 14 United States colleges and universities were examined. It was hypothesized that frequent binge drinkers might be more likely than infrequent binge drinkers to consume high peak levels of alcohol, which could help account for the higher incidence of consequences among such students. Findings from the study could yield much-needed insight into the magnitude of alcohol misuse on American campuses.

METHODS

Subjects and Data Collection

Self-reported drinking data were collected via an online survey administered to freshmen before their participation in an alcohol education and prevention course. Universities utilized the course for educational purposes and therefore did not require students to sign a research consent form. When logging onto the course for the first time, each student was provided with the confidentiality policy of the online course provider, which included a guarantee of full anonymity. The use of the data in the current article is consistent with that policy and all analyses were performed retrospectively on fully anonymous aggregate data. Subjects were not compensated for their participation. The project was approved by the Institutional Review Board at the researchers' institution.

Twenty-three schools across the United States instructed all of their freshmen, a total of 13,718 students, to complete the survey and the online course during the fall semester of 2003. Enforcement methods varied considerably from school to school, leading to variability in the percentages of freshmen who complied. To provide the most accurate snapshot possible of freshmen drinking habits, analyses were based on data from schools at which at least 70% of all freshmen completed the survey. This process resulted in a total sample of 10,424 students representing 14 schools. Response rates at the schools ranged from 70 to 98%, with an average response rate

of 82%. By geographic region, 5 schools were located in the Mid-Atlantic states, 4 in the Northeast, 3 in the Southeast, 1 in the Midwest, and 1 in the West.

Students were asked to indicate how many drinks they consumed during each day of the 2 weeks preceding the survey. A drink was defined as a 12 oz of 5% beer, 5 oz of 12% wine, or 1.5 oz of 40% liquor in a shot or mixed drink.

Fifty-two percent of the students in the sample were female. Caucasian students represented 69.3% of the sample, 8.4% of students were African American, 10.1% Asian or Pacific Islanders, 6.7% Hispanic or Latino, and 1.3% Native American Indian. The average age was 18.14 (SD = 0.44). All but 100 students (0.9%) were 18 or 19 years old. In addition to demographic questions, students were asked to indicate how much alcohol they consumed during each day of the previous 2 weeks. Those data were the focus of the analyses in the current paper.

Variables and Statistical Analyses

The number of students who reached the binge-drinking threshold as defined in the Harvard College Alcohol Study (4+ drinks for females/5+ drinks for males), as well as the number who reached twice (8+/10+ drinks) or 3 times (12+/15+ drinks) the binge threshold, was calculated.

Logistic regression analyses were used to explore gender differences in peak drinking levels and to determine whether frequent binge drinkers (3 or more binge episodes in a 2-week period) were more likely than infrequent binge drinkers (1 or 2 binge episodes) to consume 2 or 3 times the binge threshold.

RESULTS

Roughly 55% of all students drank alcohol in the 2 weeks before the survey. Among these students, the average number of drinking occasions was 4.35 (SD = 2.99) for males and 3.35 (SD = 2.32) for females [$t(5,647) = 14.01$, $p < 0.001$]. Males drank an average of 5.97 (SD = 3.93) drinks per occasion while females consumed an average of 3.84 (SD = 2.54) drinks per occasion [$t(5,647) = 24.29$, $p < 0.001$]. The average maximum number of drinks during any single drinking occasion was 8.25 (SD = 5.72) for males and 4.98 (SD = 3.46) for females [$t(5,646) = 26.10$, $p < 0.001$]. Overall, 41% of males and 34% of females met or exceeded the threshold for binge drinking at least once in the previous 2 weeks (see Table 1).

Approximately 1 of 5 males (19.9%) consumed 10+ drinks, twice the binge threshold, at least once during the previous 2 weeks (see Table 1). This represents nearly half of all males labeled as binge drinkers according to the Harvard criteria. As can be seen in Table 1, males were more likely than females to drink at levels 2 and 3 times the binge threshold.

Frequent binge drinkers were more likely than infrequent binge drinkers to report peak levels of consumption 2 or 3 times the binge threshold (see Table 2). Overall, frequent binge drinkers consumed an average peak level of 10.10 (SD = 5.15) drinks relative to an average peak level of 6.91 (SD = 3.62) drinks for infrequent binge drinkers [$t(3,854) = 21.96$, $p < 0.001$]. Thus, there are clear differences in the drinking habits of frequent and infrequent

Table 1. Drinking Habits of Male ($N = 6,362$) and Female ($N = 7,356$) First-Semester Freshmen During a 2-Week Period in the Fall of 2003

Drinking levels in the previous 2 weeks	Males %[a]	Females %[a]	OR[b] (95% CI)	χ^2	p-value
Did not drink	44.7	46.8	0.92 (0.85,0.99)	4.53	<0.05
Non-binge-drinkers	14.7	19.5	0.71 (0.64,0.78)	41.95	<0.0001
Binge drinkers					
$\geq 1\times$ binge threshold[c]	40.6	33.7	1.34 (1.24,1.46)	52.77	<0.0001
$\geq 2\times$ binge threshold[d]	19.9	8.2	2.78 (2.46,3.13)	298.11	<0.0001
$\geq 3\times$ binge threshold[e]	7.6	1.8	4.40 (3.51,5.50)	197.26	<0.0001

Note. OR, odds ratio; CI, confidence interval.
[a]Each percentage value is relative to the total sample of males or females.
[b]Values significantly greater than 1 indicate a higher likelihood for males while values significantly less than 1 indicate a higher likelihood for females.
[c]Equals 4+ drinks at a time for females or 5+ for males.
[d]Equals 8+ drinks at a time for females or 10+ for males.
[e]Equals 12+ drinks at a time for females or 15+ for males.

binge drinkers beyond how often they meet or exceed the binge threshold.

DISCUSSION

The principal findings of this study are that a significant percentage of college students who report binge drinking actually consume 2 or more times the established binge drinking threshold and that frequent binge drinkers are more likely than infrequent binge drinkers to drink at levels 2 or more times the binge threshold. Roughly half of all males categorized as binge drinkers actually consumed 10 or more drinks, twice the binge threshold, at least once in the 2 weeks before the survey. The results suggest that, while binge drinking thresholds are quite valuable, grouping all students who cross the 4+/5+ binge drinking threshold into the same category obscures the fact that a relatively large percentage of students, particularly males, drink at levels far beyond the binge threshold.

Placing all students who cross the binge threshold into the same category also implies that the level of risk associated with alcohol use remains constant beyond 4 or 5 drinks. Clearly, this is not the case. Samantha Spady, a freshman who died of an alcohol overdose at Colorado State University in the fall of 2004, is thought to have consumed upward of 40 drinks, an amount 10 times the binge threshold for females, on the night that she died. Obviously, there is a difference in the level of risk posed by consuming 4 drinks and 40 drinks.

Wechsler et al. (2002) suggest that frequent binge drinking, meeting, or exceeding the binge threshold 3 or more times in a 2-week period, places a student at a particularly high risk for experiencing deleterious alcohol-related outcomes. This hypothesis is supported by data showing a relationship between the frequency of binge drinking and the likelihood of experiencing consequences. Frequent binge drinkers are more likely than infrequent binge drinkers (1 or 2 binge episodes in a 2-week period) to experience a wide range of alcohol-related consequences, such as getting into arguments and fights, being the victim of sexual assaults, being injured in accidents, etc. (Wechsler et al., 2002). While frequency of binge drinking might account for the increased likelihood of experiencing consequences that occur at relatively low or moderate BACs, it is less likely that the frequency of binge drinking per se could account for the increased probability of catastrophic consequences, such as experiencing an overdose requiring medical assistance. The data presented here suggest that frequent binge drinkers not only binge more often, they are also more likely than infrequent binge drinkers to drink at peak levels 2 and 3 times the binge threshold. In cases involving tragic overdoses, perhaps extreme drinking practices, rather than the frequency of binge drinking per se, is the true culprit (Gruenewald et al., 2003). This issue clearly needs to be examined more closely.

A recent study by Knight et al. (2002) suggests that approximately 6% of college students meet the criteria for alcohol dependence. The risk is particularly high for

Table 2. Frequent Binge Drinkers ($N = 2051$) are Far More Likely Than Infrequent Binge Drinkers ($N = 1806$) to Drink at Extremely High Levels

Peak number of drinks in past 2 weeks	Infrequent binge[a] %	Frequent binge[b] %	OR[c] (95% CI)	χ^2	p-value
$\geq 2\times$ binge threshold[d]	19.2	53.1	3.54 (3.11,4.03)	472.33	<0.0001
$\geq 3\times$ binge threshold[e]	4.5	19.4	5.42 (4.24,6.94)	193.82	<0.0001

Note. OR, odds ratio; CI, confidence interval.
[a]Drinking 4+ (females) or 5+ (males) drinks 1 or 2 times in a 2-week period.
[b]Drinking 4+ (females) or 5+ (males) drinks 3 or more times in a 2-week period.
[c]Values significantly greater than 1 indicate a higher likelihood for frequent binge drinkers relative to infrequent binge drinkers.
[d]Equals 8+ drinks at a time for females or 10+ for males.
[e]Equals 12+ drinks at a time for females or 15+ for males.

frequent binge drinkers, a group in which roughly 20% could meet the criteria. The relationship between binge drinking, particularly frequent binge drinking, and alcohol dependence helps validate the use of the 4+/5+ threshold as an index of risky drinking. Data from the current study suggest that high peak levels of consumption could constitute a component of the relationship between frequent binge drinking and alcohol dependence. In the current study, 1 in 5 frequent binge drinkers, the same proportion of frequent binge drinkers categorized as alcohol dependent by Knight et al. drank at levels 3 or more times the binge threshold at least once in the 2 weeks before being surveyed. The relationship between peak drinking levels and a diagnosis of alcohol dependence among college students is certainly worth exploring.

A panel assembled by the NIAAA recently recommended modifying the Harvard CAS definition of binge drinking to take BAC into consideration (NIAAA, 2004). The modified definition specifies that a binge involves consuming 4+ (females) or 5+ (males) drinks within a 2-hour period, which would theoretically lead the average male or female to achieve a peak BAC level of roughly 0.08%. While this definition represents a minor improvement over the Harvard CAS definition, it does not address the issues raised by the current data. The use of 0.08% BAC as a threshold for sorting students into categories makes intuitive sense, given the legal importance of this threshold for operating motor vehicles. However, like the Harvard CAS definition, the new definition would still place all drinkers who reach a certain threshold into the same category. A student who barely reaches the legal limit for operating a motor vehicle would be classified the same as a student who dies from an alcohol overdose. Additional limitations of the new definition include the fact that the weight of the subject, variability in rates of alcohol metabolism, the amount of food in the stomach before the drinking session, and other factors that could lead to peak BACs significantly higher or lower than 0.08% are not taken into consideration. The definition also requires students to recall the amount of time that elapsed while drinking as well as the number of drinks they consumed, increasing the likelihood that errors in recall could lead a student to be placed in the wrong category. Finally, while a BAC of 0.08% represents the current legal limit for operating a motor vehicle for individuals aged 21 and older, the limit does not apply to the masses of students below the age of 21.

The use of survey data to categorize students as binge drinkers requires the assumption that self-report data are accurate. White et al. (2003, 2005) recently conducted 2 studies worth mentioning in this context in which they asked students to pour single servings of different types of alcohol beverages into cups of various sizes. Overall, students poured drinks that were too large. When asked to simply define standard drinks in terms of fluid ounces, students tended to overstate the number of ounces that should be present. The average number of ounces of liquor in student-defined mixed drinks was 4.5 oz rather than the 1.25 or 1.5 oz in actual standard drinks (White et al., 2005). When students were provided with feedback regarding the discrepancies between their definitions of drinks and the actual definitions of drinks, they tended to revise their self-reported levels of consumption to reflect their new knowledge. This led to a significant increase in self-reported levels of consumption. Such findings strongly suggest that students tend to underestimate how much they drink. This suggests that the percentage of students drinking at peak levels well beyond the binge threshold could be even higher than observed in the current study.

Data used in the current study were collected electronically rather than via paper and pencil, as in many studies on college drinking. Recent studies comparing traditional (e.g., paper and pencil) and electronic means of data collection suggest that the general approaches typically yield similar outcomes (Boyer et al., 2002; Jones and Pitt, 1999). For instance, in a comparison of web-based and paper-and-pencil survey approaches, Knapp and Kirk (2003) found no differences in outcomes, suggesting that web-based surveys do not diminish the accuracy or honesty of responses. In fact, in some instances, it appears that subjects might actually feel more comfortable answering personal questions truthfully when completing questionnaires electronically (Turner et al., 1998).

In summary, the data presented here suggest that a fairly large subset of college freshmen, particularly males, drink at levels well beyond the 4+/5+ binge drinking threshold. While binge drinking is clearly associated with a wide range of negative outcomes, it seems far more likely that the extreme, or catastrophic, consequences of drinking occur among the subset of students drinking at levels well beyond the binge threshold. If this is the case, then media reports and statements from researchers blaming the spate of recent alcohol-related deaths and serious accidents on binge drinking are only partially correct. Given the relatively modest BAC levels observed in students who consume 4 (females) or 5 (males) drinks (Alexander and Bowen, 2004) such events are very unlikely to occur when students drink at or close to the binge threshold. Clearly, much more work needs to be performed to address these issues fully.

While the data presented in the current study suggest that binge-drinking measures might be incomplete, the data *do not* suggest that common binge-drinking measures are without utility. Clearly, the measures provide valid means of predicting the likelihood that a student will experience consequences from drinking. The data presented here simply suggest that the relationships between peak drinking levels, frequency of binging, and the occurrence of alcohol-related consequences should be examined more thoroughly. If it is determined that peak drinking levels account for more variance in alcohol-related consequences than the frequency of binging alone, then perhaps

the frequent binge-drinking measure could somehow be modified to take peak levels of consumption into consideration.

Until a superior way of assessing risks associated with various levels of consumption is developed, schools interested in diminishing the consequences of drinking might make more progress by focusing on extreme drinking practices in addition to binge drinking per se. Indeed, such an approach might be more likely to win the support of students, many of whom seem to fear that administrators are trying to eradicate drinking from campuses altogether. Strong support from students could help alter the culture of alcohol use on campuses such that excessive drinking is no longer tolerated.

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