Beyond the “Binge” threshold: Heavy drinking patterns and their association with alcohol involvement indices in college students

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Abstract

Despite its ubiquity, the term “Binge” drinking has been controversial. Among other things, the grouping of drinkers into a single risk category based on a relatively low threshold may not capture adequately the nature of problem drinking behaviors. The present study is an initial examination of the utility of delineating heavy drinkers into three groups; those who typically drink below the traditional “Binge” cutoff (less than 4+/5+ drinks per occasion for women/men), those who met traditional “Binge” drinking criteria, and a higher “Binge” cutoff of 6+/7+ (women, men). We examined differences in drunkenness, drinking frequency, and unique types of alcohol problems. Participants (N=356; 184 women) were regularly drinking college students at a mid-sized U.S. university who completed a battery of self-report measures including a calendar of daily alcohol consumption, and the 8-domain Young Adult Alcohol Consequences Questionnaire (YAACQ). Estimated Blood Alcohol Levels (eBALs) were calculated. We found that the standard 4+/5+ drink “Binge” cutoff distinguishes drinkers across some but not all indices of alcohol involvement. “Binge” drinkers differed from their “Non-Binge” counterparts on eBAL, but for other indicators (drinking frequency, total alcohol consequences), only “Heavy Binge” drinkers differed significantly from “Non-Binge” drinkers. Importantly, “Heavy Binge” drinkers experienced higher levels of those specific consequences associated with more problematic alcohol involvement. Findings suggest that not all “Binge” drinkers drink alike, are equally drunk, or experience similar consequences. As such, there may be utility in distinguishing among heavy drinkers, in order to focus appropriately on those at greatest risk for different types of consequences.

Keywords: College drinking; Binge; Drinking consequences

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1. Introduction

The term “Binge drinking” is widely used to categorize a pattern of drinking in which five or more (4 or more for women) drinks are consumed in a single occasion (Naimi et al., 2003; Wechsler, Dowdall, Maenner, Gledhill-Hoyt, & Lee, 1998; Wechsler & Nelson, 2001). This term has been used most commonly to describe the drinking behaviors of college students, a population unique in developmental life stage, culture, and environment (Arnett, 2000; Sher & Gotham, 1999), and has been so ubiquitous as to define the problem of heavy drinking on college campuses in both the scientific and popular press.

Despite its ubiquity, the 4+/5+ “Binge” definition has been controversial for a number of reasons, and it has been suggested that use of this term may misrepresent the scope of the problem of heavy alcohol consumption on college campuses. Among the many criticisms of the “Binge” drinking term is the fact that such a conceptualization does not include the drinker’s weight, sex, or time period over which the alcohol was consumed (DeJong, 2003) — all factors that contextualize the drinking episode, and allow for estimation of intoxication levels. The handful of studies that have been conducted to examine differences in actual intoxication (Blood Alcohol Level; BAL) based on a 4+/5+ cutoff have suggested that this criterion is perhaps an inadequate way to identify risk drinking, with results from several studies indicating that a substantial percentage of so-called “Binge” drinkers fail to reach blood alcohol concentration levels generally indicative of intoxication (i.e., .08; Beirness, Foss, & Vogel-Sprott, 2004; Lange & Voas, 2001; Perkins, DeJong, & Linkenbach, 2001). Moreover, other important aspects of students’ drinking behaviors generally are not assessed. For example, recent data suggest frequency and not just quantity to be an important indicator of risky drinking in college students (Presley & Pimentel, 2006), and specific types of alcohol consequences (e.g., dependence symptoms, impaired control) may be predictive of later diagnosable alcohol use disorders (Chung & Martin, 2002; Nelson, Little, Heath, & Kessler, 1996; O’Neill & Sher, 2000). Yet despite this, drinking frequency and types of consequences associated with drinking at different levels of intoxication seldom have been examined.

It also has been noted that grouping drinkers into a single category of risk based on a relatively low threshold may provide too blunt a descriptive instrument to adequately capture problem drinking behaviors (e.g., Gruenewald, Johnson, Light, & Salz, 2003). Data from White, Kraus, and Swartzwelder (2006) show a substantial portion of college students drink at levels well beyond the standard “Binge” threshold, supporting the idea that clearer delineation of heavy episodic drinking might be useful. Similarly, Turner, Bauerle, and Shu (2004) observed that the odds of experiencing various types of alcohol consequences increased with higher levels of drunkenness, pointing again to the utility of discriminating more finely either amount of alcohol consumed, or degree of drunkenness achieved. Yet, to date, little is known about those drinkers whose typical drinking patterns are higher than the 4+/5+ cutoff, or about whether and how this group of drinkers may be similar to or different from other drinking groups.

In sum, though used widely, the “Binge” drinking criterion may fail to accurately describe the phenomenon of heavy drinking on college campuses and, more importantly, may be missing important information regarding which students are at greatest risk.

1.1. The present study

In the present study, we built on previous work by further evaluating the utility and meaning of the binge drinking criteria in a group of drinkers for whom this term is most commonly used, college students. In addition, we sought to provide an initial examination of the utility of delineating heavy drinkers into
two groups; those who met traditional “Binge” drinking criteria based on a cutoff of 4+/5+ (for women/men) for a typical drinking occasion, and a higher “Binge” cutoff of 6+/7+ (women/men) on a typical drinking occasion. In addition to differences in eBAL, we also examined the relationship between “Binge” and drinking frequency, and unique types of alcohol-related problems.

2. Method

2.1. Participants

Participants (N=356; 184 women) were regularly drinking college students at a mid-sized university in the northeastern United States. Students were recruited through the University’s research participant pool. The majority of the participants were White (n=299, 84%). Detailed demographic information is provided in Table 1.

2.2. Procedure

Eligible students had to be regular drinkers, defined as drinking alcohol at least once a week over the past 3 months. Participants were screened for eligibility via a mass-testing procedure in the first week of each school semester (Fall and Spring semesters of academic year 2003–2004). Eligible students (those who fell into regular drinker status) were contacted by email and invited to participate in the study.

Experimental sessions were conducted in mixed-sex groups of 10–20 participants. After providing informed consent, students completed a series of self-report questionnaires, which assessed demographics, drinking and drinking consequence behaviors. The students received academic credit for their participation. All procedures were approved by the SUNY at Buffalo Institutional Review Board.
2.3. Measures

2.3.1. Demographic information
Demographic data gathered from this study included gender, age, ethnicity, year in school, work and residential status, height, weight, grade point average and affiliation with a fraternity or sorority.

2.3.2. Alcohol consumption
Prior to completing all alcohol consumption questionnaires, a ‘standard drink conversion chart’ was given to each participant. This defines one ‘standard drink’ and gives specific examples for aggregating alcohol consumption (e.g., how a mixed-drink, a ‘party’ tumbler of beer, or a ‘shooter’ of liquor would be categorized). Participants were asked to think of their drinking quantity in terms of the ‘standard drink’ definition that was provided to them. They were also instructed to direct questions pertaining to quantity estimates to the research staff who were available in the room.

A calendar-based self-report measure based on the well-validated Time Line Follow Back (Sobell & Sobell, 1992) was used to assess daily alcohol consumption and blood alcohol level. Using this calendar, participants were asked to report on number of drinks consumed each day in the past 90 days, and number of hours over which they consumed those drinks. Prior to each data collection session, the exact dates of the assessment period of interest were provided on each calendar. As with the TLFB, these dates served as recall anchors to enhance the accuracy of the information provided. Additionally, important dates within the university (e.g., school breaks, exam weeks, holidays) were also denoted on the drinking calendars to facilitate recall. Data on typical quantity, and frequency of heavy episodic (“Binge”) drinking, and estimates of blood alcohol level were derived from this self-report calendar.

2.3.3. Estimated blood alcohol levels
The estimated Blood Alcohol Levels (eBALs) were calculated for each participant on each day of drinking. For this, we used the equation \([\frac{c}{2} \times \frac{GC}{w} - 0.02 \times t]\), where \(c\) = total standard drinks consumed, \(GC\) = gender constant (9.0 for women, 7.5 for men), \(w\) = weight in pounds and \(t\) = total hours spent drinking. Hustad and Carey (2005) found this equation produced retrospective blood alcohol levels that were most similar to actual breath samples.

2.3.4. Alcohol consequences
2.3.4.1. Young Adult Alcohol Consequences Questionnaire (YAACQ). This 48-item, self-report measure assesses a broad range of alcohol-related consequences experienced by college students. Consequences are categorized according to eight distinct dimensions (Read, Kahler, Strong, & Colder, 2006; Social–interpersonal consequences, impaired control, self-perception, self-care, risk behaviors, academic/occupational consequences, physical dependence, and blackout drinking). All factors load on a single, higher-order factor. Response options are rated dichotomously (yes/no) based on whether the individual experienced that consequence within the past year. Coefficient alpha for this measure in this sample was .89. Internal reliabilities for each of the YAACQ subscales ranged from .79 to .86.

2.4. Analyses
Based on the self-report calendar, participants were classified into “Binge” groups. Individuals who reported drinking less than 4 (women) or 5 (men) drinks on a typical drinking occasion were categorized as
Non-Binge drinkers. “Binge” drinkers were categorized using the criteria typically used in the college drinking literature, that is, 4+/5+ for women and men, respectively. Finally, as some have suggested that the traditional minimum of 4 drinks/5 drinks “Binge” criterion is too liberal, we also calculated a “Heavy Binge” cutoff, based on approximately 1/2 a standard deviation (i.e., 2 drinks) of the average number of drinks participants in this sample drank on a typical day. As such, those classified in the “Heavy Binge” group were those who reported (6+/7+ drinks per typical occasion). In summary, “Non-Binge” drinkers drank less than 4/5 (women/men) drinks per typical drinking occasion, “Binge” drinkers were those who reported drinking between 4 and 5 drinks (women) or 5 to 6 drinks (men) on an average drinking occasion, and “Heavy Binge” drinkers were those who reported drinking 6+/7+ drinks (women/men) on a typical occasion in the past 90 days. In this sample, there were 91 “Non-Binge”, 107 “Binge”, and 158 “Heavy Binge” drinkers.

We calculated descriptive statistics depicting typical drinking behaviors of our sample, and then conducted frequencies of typical eBAL by “Binge” group status. We then compared the three “Binge” drinking groups on alcohol involvement indices including drinking frequency, typical blood alcohol content, and alcohol problems. Typical alcohol consumption by “Binge” group is reported in Table 2.

### 3. Results

#### 3.1. Alcohol involvement: sample description

Participants reported drinking alcohol an average of 28 (SD=14.7) of the past 90 days, and drank just under 7 (SD=3.5) drinks per drinking occasion. The typical estimated blood alcohol level per drinking occasion was .05 (.03).

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<table>
<thead>
<tr>
<th>Alcohol involvement indices</th>
<th>“Binge” group mean (SD)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>“Non-Binge”</td>
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<tr>
<td><strong>Alcohol consumption (past 90 days)</strong></td>
<td></td>
</tr>
<tr>
<td>Drinks per drinking occasion</td>
<td>3.15 (.96)</td>
</tr>
<tr>
<td>Typical eBAC</td>
<td>.05 (.03)</td>
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<tr>
<td>Drinking frequency (# of days)</td>
<td>23.79 (16.18)</td>
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<table>
<thead>
<tr>
<th>Alcohol problems (past year)</th>
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<tbody>
<tr>
<td>YAAACQ total score</td>
<td>12.26 (7.27)</td>
<td>13.56 (6.56)</td>
<td>16.85 (8.3)</td>
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<td>YAAACQ problem domains</td>
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<td></td>
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<tr>
<td>Social/interpersonal</td>
<td>2.01 (1.43)</td>
<td>2.39 (1.49)</td>
<td>2.67 (1.52)</td>
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<tr>
<td>Academic/occupational</td>
<td>.79 (1.13)</td>
<td>.74 (.97)</td>
<td>1.25 (1.42)</td>
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<td>Alcohol dependence symptoms</td>
<td>.45 (.61)</td>
<td>.60 (.80)</td>
<td>.82 (.71)</td>
</tr>
<tr>
<td>Blackout drinking</td>
<td>2.99 (1.92)</td>
<td>3.84 (1.94)</td>
<td>4.61 (1.93)</td>
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<td>Impaired control</td>
<td>1.85 (1.52)</td>
<td>1.89 (1.36)</td>
<td>2.43 (1.54)</td>
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<tr>
<td>Self-perception</td>
<td>.78 (1.01)</td>
<td>.61 (1.10)</td>
<td>.65 (.98)</td>
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<tr>
<td>Self-care</td>
<td>1.19 (1.44)</td>
<td>1.24 (1.50)</td>
<td>1.46 (1.77)</td>
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<tr>
<td>Risky Behaviors</td>
<td>2.20 (1.78)</td>
<td>2.25 (1.64)</td>
<td>2.97 (2.09)</td>
</tr>
</tbody>
</table>

*a* Inferential tests not conducted across groups, as group membership was based on this index.

*b* Significantly different from “Non-Binge”.

*c* Significantly different from “Binge”.

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occasion was .11 (SD = .06). The length of the typical drinking episode was 3.30 h (SD = 1.2), indicating that participants drank an average of about two drinks per hour on a typical drinking occasion. Average score on the YAACQ was 14.7 (SD = 7.8). This indicates that a typical participant had experienced approximately 15 negative alcohol consequences in the past year.

3.2. Blood alcohol estimates by “Binge” status

Though there is much individual variability, functional impairment occurs at blood alcohol levels as low as .06, with cutoffs for intoxicated driving in most states set at .08, and more significant impairment and observable changes in behavior and functioning occurring at BALs of .10 or higher (e.g., McKnight, Langston, Marques, & Tippetts, 1997). Accordingly, we examined the number (percent) of drinkers from each group to achieve eBALs of (1) less than .06, (2) .06 – .079, (3) .08 – .099 and (4) .10 and above. In general, a pattern emerged in which successively higher eBALs were observed with each “Binge” group (Fig. 1).

3.3. Comparisons across alcohol involvement indices by “Binge” drinking status

We examined group differences among “Non-Binge”, “Binge”, and “Heavy Binge” drinkers on alcohol involvement indices. In ANOVA models, we examined group differences in typical blood alcohol level per drinking day (past 90 days), frequency of drinking (past 90 days), and alcohol problems (YAACQ, past year). To obtain a more detailed picture of the types of consequences different groups of “Binge” drinkers typically experience, in MANOVA models, we examined differences across the three groups on unique types of alcohol problems, as measured by YAACQ subscales.

3.3.1. Alcohol consumption

The omnibus $F$ test for the ANOVA examining typical BAL as the dependent variable, was significant, $F(2, 345) = 166.85, p < .0001$. Tukey’s follow-up comparisons revealed significant differences in typical BAL across all “Binge” groups. Means and standard deviations are presented in Table 2.
Examination of drinking frequency in the past 90 days also yielded a significant omnibus $F$ test for the ANOVA model, $F(2, 348)=6.66, p<.01$. Follow-up comparisons for this variable revealed significant differences in drinking frequency only between “Heavy Binge” drinkers and “Non-Binge” drinkers. Means and standard deviations are presented in Table 2.

3.3.2. Alcohol-related consequences

The overall ANOVA model examining differences in total number of consequences experienced according to “Binge” status was significant, $F(2,337)=11.83, p<.0001$. Examination of follow-up comparisons indicated that the “Heavy Binge” drinkers differed significantly from both “Binge” and “Non-Binge” drinkers. However, “Binge” drinkers and “Non-Binge” drinkers did not report experiencing significantly different total numbers of consequences.

The between-subjects multivariate analysis of variance conducted with the 8 YAACQ subscales as the dependent variables yielded a significant Wilk’s criterion, $F(16,660)=4.07, p<.001$. Univariate follow-up tests were conducted with each subscale. To minimize the risk of type I error resulting from multiple comparisons, we applied a Bonferroni-adjusted alpha (.006) to these tests. Follow-up comparisons revealed significant differences on the Impaired Control and Blackout Drinking subscales, with trend-level differences (ps=.008) for the Academic–Occupational and Dependence subscales. Univariate follow-up tests with each of these four subscales were conducted. For both Impaired Control and Academic/Occupational Consequences, mean consequences for the “Heavy Binge” were significantly higher than for the “Binge” and the “Non-Binge” groups. “Binge” drinkers did not differ from “Non-Binge” drinkers. For the Alcohol Dependence subscale, both “Heavy Binge” and “Binge” drinkers showed significantly greater number of symptoms than “Non-Binge” Drinkers. The two “Binge” groups did not, however, differ from each other. For the Blackout Drinking subscale, all drinking groups differed significantly from one another. Means and standard deviations for each subscale are presented in Table 2.

4. Discussion

The present study represents a preliminary effort to offer a more fine-grained description of various drinking patterns among college students, and to identify particular patterns that are linked to more problematic alcohol involvement. To accomplish this, we examined differing levels of inebriation (i.e., BAL) and other indices of alcohol involvement, including functional outcomes such as alcohol consequences according to different patterns of typical drinking, including a “Heavy Binge” group.

Overall, we found that the standard 4+/5+ drink “Binge” cutoff distinguishes drinkers across some but not all indices of alcohol involvement. “Binge” drinkers differed from their “Non-Binge” counterparts on actual drunkenness (measured by eBAL). Of note is that, not only did “Binge” and “Heavy Binge” drinkers differ from “Non-Binge” drinkers on this outcome, but they also differed significantly from each other. This suggests that those categorized as “Heavy Bingers” typically get drunker than those closer to the standard “Binge” cutoff.

For other indicators of alcohol involvement such as total alcohol consequences, and drinking frequency, it was only those in the “Heavy Binge” drinking category who differed significantly from “Non-Binge” drinkers. Importantly, those in the “Heavy Binge” category reported experiencing an average of more than 3 additional unique types of consequences in the past year, compared to those in the “Non-Binge” and “Binge” categories who reported approximately 12 and 13 1/2 consequences,
respectively. At least some previous work has found the 4+/5+ cutoff to be significantly associated with drinking consequences (e.g., Midanik, Tam, Greenfield, & Caetano, 1996; Wechsler, Davenport, Dowdall, Moeykens, & Castillo, 1994). One possible explanation for the divergence in our findings is that those who drink more heavily (identified here as “Heavy Bingers”) have traditionally been included in the “Binge” categories delineated by a minimum of 4+/5+ drinks, and it is these drinkers who are in fact experiencing the greatest drinking consequences. Alternatively, it may be that “Non-Binge” and “Binge” drinkers do in fact differ in their alcohol consequences, but that the relatively high levels of drinking among our “Non-Bingers” obscured this effect. The heavy drinking nature of our sample and its implications are discussed in greater detail below.

Our examination of specific types of drinking consequences yielded some interesting findings. Of the eight YAACQ subscales, Blackout Drinking, Impaired Control, and Dependence symptoms are those that are most strongly and conceptually linked to problematic alcohol involvement. For two of these three subscales (Impaired Control, Blackout Drinking), “Heavy Binge” drinkers differed significantly not only from “Non-Binge” drinkers, but also from “Binge” drinkers. This pattern also was observed for Academic/Occupational consequences. “Binge” and “Heavy Binge” drinkers differed from “Non-Binge” drinkers on Dependence consequences, though the two binge groups did not differ from each other. These data are consistent with findings from Cranford, McCabe, and Boyd (2006) who also found a more rigorous (i.e., 4+/5+ drinks in a 2 h time period) “Binge” drinking categorization to be associated with higher level consequences such as blackouts and academic/occupational consequences. The “Binge” group did not differ from “Non-Binge” on Impaired Control or Academic/Occupational consequences. This again underscores that the traditional “Binge” cutoff may not be optimally likely to detect problem drinking.

Recently, White et al. (2006) suggested that the most severe alcohol consequences may well occur among those students drinking not just at the traditional “Binge” threshold, but for those who routinely drink beyond this level. Our data are consistent with this; though more severe consequences occur for both binge groups in our sample, they occurred more among the heavier group of drinkers.

This study has a number of strengths, including assessment of drinking behavior using a strong measure of alcohol consumption across a longer (i.e., 3 months) period of time than has been examined in other studies on this topic, evaluation of differences based on “Binge” drinking status across multiple indices of alcohol involvement, examination of unique types of alcohol consequences, and tests of a higher “Binge” drinking threshold than has previously been examined. This study also has several weaknesses. Foremost among these is that our data are cross-sectional. Though we have daily alcohol consumption data assessed through the TLFB, we are not able to link drinking on particular days to the experience of consequences on those days. As such, we cannot establish a temporal link between engaging in “Binge” drinking at any level, and incurring alcohol-related consequences.

Another limitation is our reliance on retrospective self-report of alcohol consumption and time spent drinking in order to calculate BAL. Though it has been argued (Turner et al., 2004) that estimations of BAL are a potentially useful method for describing alcohol use among college students, producing BAL estimates that correlate strongly with measured blood alcohol levels, in vivo biological measurement of BAL ultimately remains the gold-standard index of blood alcohol level.

Though we did not intentionally screen for heavy drinkers, our decision to include only regular drinkers resulted in a fairly heavy drinking sample. As such, our findings may say more about those students who drink alcohol on a regular basis than they do about all college students. Studies of “Binge” drinking among college students typically include light drinkers, and sometimes include even non-
drinkers. Perhaps most relevant to the interpretation of our findings is the possibility that our “Non-Binge” drinkers may not be reflective of “Non-Binge” drinkers in the general student population, as our “Non-Binge” group does not include very light or non-drinkers.

Though not necessarily a limitation, an important caveat to our findings is that the “Heavy Binge” category examined here is but one of many possible ways of delineating among heavy drinkers. We found our “Heavy Binge” cutoff to be useful in examining the ways in which consumption patterns heavier than those traditionally considered to be “Binge” are distinctive. Yet, there are a number of ways in which such fine-grained distinctions could be made. Our delineation of “Binge” groups resulted in greater variability in drinking among the “Heavy Binge” drinkers than either of the other two categories. As such, the possibility remains that those heaviest drinkers, even beyond the 6+/7+ cutoff are accounting for the differences that we observed here. Our objective in this preliminary investigation was not necessarily to arrive at the single best way of identifying heavier drinkers, but instead to provide an initial investigation into the utility of such a distinction. Tests of different characterizations of drinking patterns and their associations with actual risk and outcome using techniques such as relative operating curves will be an important next step in future investigations.

Despite its limitations, the present study adds to a growing body of literature that suggests that the 4+/5+ “Binge” drinking threshold alone may fail to adequately capture the true nature of heavy drinking and its consequences in college student populations. Specifically, our findings suggest that not all “Binge” drinkers drink alike, are equally drunk, or experience similar consequences. As such, there may be utility in distinguishing among heavy drinkers, in order to focus appropriately on those at greatest risk for different types of consequences. Categorizing drinkers along those dimensions that are associated with greater risk takes into account the large numbers of college students who drink well beyond the traditional “Binge” threshold, and may offer a more fine-grained description and identification of those particular drinking patterns that are associated with more problematic alcohol involvement.

References


