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In with the Old and Out with the New? A comparison of the Old and New Binge Drinking Standards

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Abstract

Objective: There is consistent evidence that the binge drinking standard of 5+ drinks per drinking occasion for men (4+ for women) is associated with risk for negative consequences. Yet, many have questioned the adequacy of this measure as an index of intoxication (e.g., a blood alcohol concentration (BAC) of .08 g%). In response to these concerns, an NIAAA task force recommended adding a time-qualifier of 2 hours to this criterion. Although conceptually appealing, there has been little effort to determine whether this new measure better captures drinking that leads to negative consequences.

Method: This study examined the new binge standard (2-hour period) and old binge standard (no time qualifier) in relation to frequency of drinking to an estimated BAC of .08 g% and the experience of negative drinking consequences. These relations were examined within both a social drinking sample of adults (N = 200) and a sample of heavy drinking young adults (N = 168) participating in a randomized clinical trial for drinking reduction.

Results: Contrary to the purpose of adding a time qualifier, the new binge measure was not more strongly correlated with drinking to an estimated BAC of .08 g% relative to the old binge measure. In addition, when both measures were entered simultaneously into a regression model, only the old binge measure accounted for significant variance in negative drinking consequences.

Conclusions: These empirically based results suggest that the original binge standard without a time-qualifier may be preferable to the two-hour standard as a marker for risk. The findings also suggest that further efforts are needed to identify a brief measure that effectively captures drinking to intoxication and related risk for negative consequences.

Keywords

Binge Drinking; Consequences; Time-Qualifier; Intoxication; NIAAA

Introduction

Binge drinking among college students and other young adults remains a leading public health concern. This behavior has been implicated in a substantial proportion of alcohol related deaths on campus (Hingson et al., 2005), as well as numerous adverse consequences including blackouts, injuries, hangovers, missed classes, trouble with police, and sexually transmitted infections (e.g., Bergen et al., 2012; Perkins, 2002). The severity of these consequences has led researchers to become increasingly interested in conceptualizing binge drinking so that it can be distinguished adequately from other, lower risk forms of alcohol use (Wechsler et al., 2000; NIAAA, 2004).

The criterion for what constitutes a binge episode has been defined in a variety of ways. For over 20 years, the most commonly used standard was at least 5 alcoholic drinks consumed during the same session (Cahalan et al., 1969). The Monitoring the Future (MTF; Johnston et al., 2013) study adopted this criterion in 1975 and a number of other large longitudinal epidemiologic studies followed suit including the Behavioral Risk Factor Surveillance System (BRFSS; CDC, 2013), Youth Risk Behavior Surveillance System (YRBSS; CDC, 2012), and National Survey on Drug Use and Health (NSDUH; SAMHSA, 2013). Although the MTF, NSDUH and YRBSS continue to use this standard, the BRFSS began using a gender-specific standard in 2006, and the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) also adopted a gender specific criterion (Dawson et al., 2005).

The gender specific approach was introduced roughly a decade earlier by researchers conducting the Harvard College Alcohol Study (CAS) who sought to address gender differences in weight and alcohol metabolism. The criterion of 5 or more drinks in a row for men remained, but the binge threshold for women was changed to 4 or more drinks in a row (Wechsler et al., 1994). Studies from the BRFSS before and after the change to the gender specific standard suggest that the change was successful in increasing identification of hazardous drinking in women (Chavez et al., 2011). Recent evidence from the NESARC study also supports the validity of the gender specific definition, indicating that past year consumption of 5 or more drinks for males (4 or more for females) was optimal for balancing sensitivity and specificity (Dawson, Pulay, & Grant, 2010). Similarly, gender specific low risk daily drinking guidelines of 4/3 drinks for men/women performed optimally within the NESARC data, and weekly drinking limits added little predictive validity when examining aggregate categories of harm (Dawson et al., 2012). Although there is considerable evidence to support the utility of the 5/4 binge standard, some researchers have questioned its utility as an index of intoxication. For example, in a study of college students prior to and following trips to bars, Lang and Voas (2001) found that those who met this criterion had blood alcohol concentrations (BACs) that were well below .08 g%.

These and similar findings led the National Institute on Alcohol Abuse and Alcoholism (NIAAA) to consider adopting a new binge standard. In 2004, an NIAAA task force recommended that a binge episode be defined as a pattern of drinking that results in a blood alcohol concentration \geq .08 g%. Researchers using self-report measures were advised to operationalize a binge episode as the consumption of 5/4 standard drinks within a 2-hour

period (National Institute on Alcohol Abuse and Alcoholism, 2004). The presumption from this new recommendation is that the new binge standard should be more strongly correlated with BACs and should be a better predictor of negative consequences than the previous definition. Unfortunately, little research has examined these issues or the utility of the revised measure.

The only study to date on the relation between the new binge standard and BAC levels suggests that the new measure may not, in fact, be capturing BACs exceeding .08 (Beirness et al., 2004). Using a random sample of individuals leaving campus bars, Beirness and colleagues found that students who reported $\geq 5/4$ drinks in 2 hours had a mean BAC of .067, which was *lower* (though not significantly) than the mean BAC of .079 reported by individuals who reported $\geq 5/4$ drinks consumed over a period longer than 2 hours. These results suggest that the old standard (without a time qualifier) may be a better indicator of BACs $\geq .08$ g% than the new standard. Further, only 7% (9/130) of the individuals who reported consuming $\geq 5/4$ drinks did so in under 2 hours (Beirness et al., 2004), suggesting that the new standard may fail to capture the majority of heavy drinking episodes. Although the results of the Beirness and colleagues (2004) study raise important questions about the utility of the new binge standard, there are a number of features of the study that could have accounted for the observed findings. Perhaps most critical, this study assessed drinking on a single occasion. Although this approach may provide more accurate estimates of acute episodes of drinking, it is unclear if the findings would generalize to large epidemiologic studies in which binge drinking is assessed over a longer period of time (e.g., past month or past year).

In addition to establishing BAC levels captured by retrospective reports using the old and new binge standard, it is important to determine their relative predictive utility with respect to negative consequences of drinking. Although Cranford and colleagues (2006) found that binge drinking frequency as measured by the new standard was associated with negative alcohol consequences above and beyond the old binge measure, the time frame over which participants reported binge episodes differed across the 2 measures (1 year for the new standard vs. 2 weeks for the old standard). Further, the measure of $5/4$ drinks in a two-hour period was derived from reports of the maximum number of drinks in a two-hour period rather than an actual measure of frequency of consuming $5/4$ in a two-hour period.

In another relevant study, Fillmore and Jude (2011) found that using a .08-based definition for binge drinking failed to detect over half of those with alcohol-related problems using the Alcohol Use Disorders Identification Test, whereas a binge drinking standard without a time-qualifier detected over 80% of these individuals. These findings suggest that the old standard may in fact be a stronger predictor of alcohol-related problems. However, it is important to note that this study used a BAC-based binge measure based on quantity, duration, and body weight rather than $\geq 5/4$ drinks in a 2-hour time period. Although this type of measure may better reflect the spirit of the NIAAA recommendations, its complexity may limit its utility in large epidemiologic studies.

Thus, the goals of the current study were to: a) examine relations between the old and new binge measures and frequency of drinking to an estimated BAC of .08 g%, and b)

examine the strength of relations between the old and new binge measures and negative consequences of alcohol use. Given the time-qualifier, we initially anticipated that the new binge measure would be more closely related to the frequency of drinking to an estimated BAC of .08 g%. Regarding prediction of negative consequences, we hypothesized that the old binge measure would have a stronger relationship to negative consequences than the new measure, consistent with the findings of Fillmore and Jude (2011). To determine whether these relationships were similar across different drinking populations, we replicated the analyses across 2 distinct samples of young adults (social and heavy drinkers).

Materials and Methods

Study 1: Social Drinking Sample of Young Adults

Participants—Two-hundred thirty-three participants completed a large self-report survey examining engagement in a range of behaviors including alcohol use, eating and gambling. Participants were required to be at least 18 years old in order to be eligible for the study. In the analyses, 13 participants were excluded because they reported no lifetime history of alcohol use, 10 were excluded due to missing data, and 10 were excluded due to a pattern of responses that indicated a failure to understand the binge drinking questions (i.e. reports of more binge episodes using the new relative to the old standard). Table 1 provides demographics and alcohol use data for the final sample (n = 200).

Procedure—Individuals over the age of 18 were invited to the lab to complete a series of online self-report measures. Consent was obtained upon arrival, and weight was measured. Participants then completed the questionnaires. All participants who provided consent were compensated \$10, regardless of whether or not they completed all study measures.

Measures

Criteria-based binge episodes.: Two questions, corresponding to the old and new binge criteria, assessed frequency of binge drinking. The old binge question asked participants to report the number of times in the past 3 months they had 5 or more drinks *in a sitting*, whereas the new binge measure specified *within a two hour period* rather than *in a sitting*. Response options ranged from 0 to 30 with a final response option of >30. Individuals with values greater than 30 were given a value of 31.

Frequency of Drinking to an Estimated BAC of .08 g%.: A variable for frequency of drinking to an estimated BAC of .08 g% was created using weight, gender, and typical weekly drinking. The Daily Drinking Questionnaire-Revised (Collins et al., 1985; Kruse MI, Corbin WR, Fromme K, unpublished data) was used to measure typical drinking over the past 3 months. The DDQ-R assessed (1) the number of drinking days per week (mean = 2.03 (SD = 1.78), and (2) the number of drinks per drinking day (mean = 3.63; SD = 3.76). Participants also reported the average number of hours over which the drinking took place. Average BACs for each day of the week were calculated using a modification of the Widmark formula (National Highway Traffic Safety Administration, 1994). A standard drink was given a value of .6 ounces of pure alcohol (e.g. 1.5 ounces of 80-proof liquor) and an average rate of alcohol metabolism per hour (.015) was used in the calculations. BACs

with negative values were recoded to a value of zero and BAC values greater than .30 were recoded to a value of .31. The frequency of drinking to an estimated BAC of .08 g% in the past 3 months was calculated by summing the number of days on which a BAC \geq .08 was reached.

Negative Drinking Consequences.: The Rutgers Alcohol Problem Index (RAPI; White & Labouvie, 1989) assessed negative drinking consequences. The RAPI asked participants to rate how frequently [0 (Never) to 4 (more than 10 times)], during the last 3 months, they experienced each of 23 alcohol-related social or health problems. The RAPI evidenced good internal consistency ($\alpha = .94$) in the current sample.

Study 2: Heavy Drinking Sample from a Clinical Trial

Participants—Two-hundred thirty-six participants between the ages of 18 and 25 were recruited to participate in a non-abstinence based, randomized, double-blind, placebo-controlled clinical trial of naltrexone in combination with brief motivational counseling. The current analyses are based on data collected during intake assessment, and include anyone who met initial eligibility requirements and completed the assessment battery, regardless of whether or not they were enrolled in the trial. Complete data on the variables of interest was provided by 181 participants (137 of 140 of randomized participants; 97.9%). Of the 181 participants with complete data, 13 were excluded due to a failure to understand the binge questions (See Study 1). Thus, the final sample for analyses comprised 168 individuals. See Table 1 for demographic and alcohol use data.

Procedure—Individuals who met initial criteria assessed during a phone or web-based pre-screening were invited to attend an intake appointment where eligibility was further assessed and baseline data were collected. At intake, participants provided informed consent and underwent clinical interviews including diagnostic evaluations for substance use disorders and other psychiatric issues. Participants had to report consuming 5 or more standard drinks for men (4 or more for women) on 4 or more of the past 28 days to be included in the trial. Physical screening measures consisted of physical examination, blood work, urine drug testing, and pregnancy testing for women.

Following the interviews and physical assessments, participants completed a battery of online self-report assessments. Individuals who were deemed ineligible based on failure to meet heavy drinking inclusion criteria, current DSM-IV-TR (American Psychiatric Association, 2000) diagnosis of dependence on drugs (other than nicotine), pregnancy, or illicit drug use (other than cannabis) did not complete self-report measures.

Measures

Criteria-based binge episodes.: The binge drinking questions were similar to those used in Study 1. For the old binge standard participants were asked to report on the number of times in the past 3 months they had 5/4 drinks containing any kind of alcohol *in a day*. For the new binge standard, *in a day* was replaced with *within a two-hour period*. For both questions, participants responded using an 8-point scale ranging from 1 to 2 days in the past 3 months to every day. These values were converted into frequencies for consistency with Study 1

(e.g. 1–2 days in the past 3 months was given a value of 1.5 and every day was given a value of 90).¹ Similar procedures have been utilized by other investigators (e.g., Gallagher et al., 2010) and found to yield reliable estimates (Sobell & Sobell, 1995).

Frequency of Drinking to an Estimated BAC of .08 g%.: The same formula used in study 1 was employed to derive estimates of the frequency of drinking to an estimated BAC of .08 g%. However, timeline followback (TLFB) interviews were used rather than the DDQ-R. The TLFB (Sobell & Sobell, 2003; Sobell and Sobell, 2003; L.C. Sobell and M.B. Sobell, Alcohol consumption measures. In: J.P. Allen and V. Wilson, Editors, *Assessing alcohol problems* (2nd ed.), National Institute on Alcohol Abuse and Alcoholism, Rockville, MD (2003), pp. 75–99.) is the retrospective alcohol use measure currently endorsed by the NIAAA. The number of drinks consumed (if any) and the number of hours over which the drinks were consumed were assessed for each of the past 30 days. For consistency with study 1, frequency of drinking to an estimated BAC of .08 g% in the past 30 days was divided by 4.286 to yield a weekly index.

Negative Drinking Consequences.: Negative alcohol-related consequences were measured using the Young Adult Alcohol Consequences Questionnaire (YAACQ; Read et al., 2006), a 48-item self-report measure. The YAACQ features dichotomous yes/no items designed to capture 8 categories of consequences experienced over the past year. The total YAACQ score demonstrated excellent internal consistency reliability ($\alpha = .92$) in this sample.

Results

Study 1

Examination of variable distributions indicated that both binge measures, frequency of drinking to a BAC of .08 g% and negative drinking consequences were significantly positively skewed. Log-transformations were performed to normalize these variables. Pearson's correlation coefficients were examined to test the hypothesis that the new measure of binge drinking would more strongly relate to estimated BACs exceeding .08 g%. Contrary to hypotheses, the old measure demonstrated a slightly stronger positive correlation, $r = .54$, $p < .001$, with frequency of drinking to an estimated BAC of .08 g% than did the new measure, $r = .50$, $p < .001$. The Fisher transformation and a subsequent z test (Steiger, 1980) indicated that this difference was not statistically significant ($z = 1.13$, $p = .26$; see Table 2).

Next, hierarchical multiple regression was used to determine the relative predictive utility of the old and new binge measures in relation to negative drinking consequences. First we tested the predictive utility of the old and new binge measures in separate models, followed by a combined model that examined the relative predictive utility of each measure when entered simultaneously. In each model, gender was entered in block 1 with the binge measures (individually or together) entered in block 2. In block 3, the frequency of drinking to an estimated BAC of .08 g% was added to the model. Prior to testing the regression models, indices of multicollinearity were examined and found to be adequate against the

¹Analyses were also run using the actual scaled responses endorsed by the participants (i.e., non-converted). The pattern of results remained the same, with no variables in the model dropping from significance and no additional variables reaching significance.

standard cutoffs of less than 10 for the Variance Inflation Factor (VIF) and greater than .10 for tolerance (Tabachnik & Fidell, 2007).

Separate Regression Analyses for the Old and New Binge Standards—In step 1 of the model for the old binge measure, gender accounted for significant variation in negative drinking consequences, $F(1,198) = 8.15, p = .005$, with men reporting more consequences than women ($\beta = -.20$). The addition of the old binge measure in step 2 accounted for incremental variability, $F(1,197) = 63.38, p < .001$, with greater frequency of binge drinking associated with more negative drinking consequences ($\beta = .50$). The addition of drinking to an estimated BAC of .08 g% in step 3 did not account for additional variability, $F(1,196) = 1.33, p = .25$, and the old binge measure remained a significant predictor of drinking consequences ($\beta = .45, p < .001$).

For the model examining the new binge standard, step 1 (entry of gender) was identical to the model for the old binge standard. In step 2, the addition of the new binge measure accounted for unique variance in negative drinking consequences, $F(1,197) = 45.01, p < .001$, with greater frequency of binge drinking associated with more negative consequences ($\beta = .44$). The addition of drinking to an estimated BAC of .08 g% in step 3 accounted for additional variability in alcohol-related consequences, $F(1,196) = 4.26, \beta = .15, p = .04$, but the new binge measure remained a significant predictor in step 3 ($\beta = .36, p < .001$).

Although the standardized regression coefficient for the old binge standard was larger than for the new binge standard, the Fisher transformation and z test (Steiger, 1980) indicated that this difference was not statistically significant ($z = 1.6, p = .11$).

Regression Analysis Including both the Old and New Binge Standards—As in the separate models, gender was a significant predictor of negative drinking consequences, $\beta = -.20, p = .56$, in step 1. In step 2, the two binge measures accounted for unique variance in negative drinking consequences ($F(2,196) = 32.47, p < .001$). The old binge measure significantly predicted negative drinking consequences, $\beta = .41, p < .001$, whereas the new binge measure did not ($\beta = .12, p = .24$). At step 3, the addition of drinking to an estimated BAC of .08 g% did not account for additional variance ($F(1,195) = .97, p = .33$). The old binge measure remained a significant predictor in step 3, $\beta = .38, p < .001$, and the new binge measure remained non-significant ($\beta = .11, p = .31$). All regression coefficients for the combined model are presented in Table 3.

Study 2

Consistent with the results of Study 1, although the new measure was significantly correlated with drinking to an estimated BAC of .08 g%, $r = .53, p < .001$, the old measure demonstrated a stronger correlation, $r = .58, p < .001$ (see Table 2). The Fisher transformation and z test (Steiger, 1980) indicated that this difference was not statistically significant ($z = .87, p = .38$).

Separate Regression Analyses for the Old and New Binge Standards—In step 1 of the model examining the old binge standard, gender did not account for significant variability in negative drinking consequences ($F(1,166) = .35, p = .56$). In step 2, the old

binge measure accounted for significant variability, $F(1,165) = 14.83, p < .001$, with more frequent binge drinking associated with more negative drinking consequences ($\beta = .29$). At step 3, drinking to an estimated BAC of .08 g% did not account for unique variance, $F(1,164) = .45, p = .51$, and the old binge measure remained a significant predictor of drinking consequences ($\beta = .25, p = .007$).

In the model for the new binge standard, the coefficient for gender was identical and non-significant. In step 2, the new binge standard was a significant predictor, $F(1,165) = 4.59, p = .03$, with more frequent binge drinking associated with more negative drinking consequences ($\beta = .16$). In step 3, drinking to an estimated BAC of .08 g% was a marginally significant predictor of drinking consequences, $F(1,164) = 3.47, \beta = .17, p = .06$, and the new binge measure was no longer a significant predictor with the inclusion of the estimated BAC measure ($\beta = .08, p = .41$).

A comparison of the standardized regression coefficients for the old and new binge standards identified a marginally significant effect, $z = 1.92, p = .06$, with the old binge standard more strongly predicting negative drinking consequences.

Regression Analysis Including both the Old and New Binge Standards—As in the separate models, gender was not a significant predictor in step 1 ($\beta = -.05, p = .56$). In step 2, the addition of the two binge measures accounted for significant variance ($F(2,164) = 7.43, p = .001$). The old binge measure significantly predicted negative drinking consequences, $\beta = .31, p = .002$, whereas the new binge measure did not ($\beta = -.03, p = .75$). At step 3, the addition of drinking to an estimated BAC of .08 g% did not account for additional variance, $F(1,163) = .61, p = .44$, and the old binge measure remained a significant predictor of negative consequences ($\beta = .28, p = .009$). All regression coefficients for the combined model are presented in Table 4.

Discussion

The current study set out to determine if the old (no time qualifier) or new (2 hour time period) binge measure was a better marker of risk for alcohol-related problems. As hypothesized, the binge measure without a time-qualifier was a better predictor of negative drinking consequences across both social drinking and heavy drinking samples. Our findings also indicated that, relative to the old definition, the new operational definition of binge drinking does not actually have a stronger relationship to frequency of drinking to an estimated BAC of .08%. Thus, although other researchers have found that the old measure of binge drinking may not reliably capture high BACs (Lange & Voas, 2001), our results suggest that restricting binges to episodes that take place over 2 hours does not improve upon the ability to identify drinking episodes that lead to high BACs.

Although the results provide evidence supporting the old measure of binge drinking, it is not clear why this measure better predicts negative consequences. It may be that binge drinking episodes that take place over 2 hours are qualitatively different than those that take place over longer durations. Binge episodes occurring in a 2-hour period may be the result of opportunity (e.g. access to alcohol in underage drinkers) or may take place in settings in

which such drinking is socially accepted (e.g., a typical college party). In contrast, heavy drinking episodes that occur over longer periods of time may be more heterogeneous. For example, an individual might spend 4 or 5 hours in a bar drinking or they might have 4 or 5 drinks at home in an evening after a difficult day. Although this is a plausible hypothesis, future studies are needed to determine the ways in which shorter and longer episodes of heavy drinking may differ with respect to access, setting, and motives.

An alternative explanation for the greater predictive utility of the old binge measure is that longer drinking episodes simply present a longer time period during which negative events may occur. It is also possible that the new binge measure misses episodes that involve very high blood alcohol concentrations (e.g., more than double the legal limit) reached over a longer period of time. Relations between the number of drinks consumed and negative consequences are typically linear (Wechsler & Nelson, 2001), such that very heavy drinking occasions are associated with even greater risk for negative consequences. Future studies examining differences in absolute BAC levels and negative consequences experienced within single drinking episodes that do or do not meet the 2-hour time qualifier are needed to evaluate these hypotheses.

Although the results of the current study have important implications for future research, there are several limitations that must be considered. Multiple participants were dropped from analyses because they reported a greater number of binge episodes under the new versus the old criterion, which is logically impossible and suggests a potential failure of participants to understand the questions. While these participants were excluded from the analyses, we cannot rule out the possibility that other participants may have misunderstood the questions. More broadly, retrospective report bias and inaccurate recall may have systematically led to underreporting on the new measure, as participants are required to remember more information surrounding the episode. It is possible that participants are less able to reliably report this type of detailed information.

It is also important to note that two different measures were used to assess estimated BACs $> .08$ g% (DDQ-R in study 1 and TLFB in study 2). The use of different measures may have led to different results across studies, and the DDQ-R is not an ideal measure for calculating estimated BACs as it relies on average levels of consumption for a particular day of the week which are likely to be downward biased (Stockwell et al., 2008). The wording for the old binge standard was also slightly different across the two studies with study 1 referring to 5/4 drinks “in a sitting” and study 2 referring to 5/4 drinks “in a day.” Although one might expect the former wording to minimize the discrepancy between the old and new binge measures, the discrepancy was actually larger in study 1 (1.93 times the rate using the old versus the new standard), than in study 2 (1.51). Despite the difference in magnitude, rates of reported binge drinking based on the old standard were considerably higher than rates based on the new standard across both studies (See Table 1). Nonetheless, it will be important in future studies to determine the potential impact of different definitions that do not include a specific time period (e.g. in a sitting, on a single occasion, in a day) to determine the optimal strategy. Finally, the samples used in the current study were young adults, limiting generalizability to samples of older adults. Although young adults are at

particularly high risk for binge drinking, nearly 70% of binge drinking episodes in the U.S. occur among those over the age of 25 (Naimi et al., 2003).

Despite the limitations, replication of the findings across 2 separate samples using different measures of alcohol consumption and negative consequences lends confidence to the reliability and validity of the pattern of results. Further, unlike previous research, we were able to unambiguously compare the predictive validity of a time-qualified and time-unqualified binge assessment, as both measures were assessed over the same 3-month period. The results have important implications for future studies of binge drinking. Across both social drinking and heavy drinking samples, the old binge measure was a better predictor of negative drinking consequences, suggesting that researchers selecting a limited number of alcohol-related questions for either large epidemiologic studies or studies of high risk samples should consider retaining the old binge measure. This is particularly true for ongoing epidemiologic studies given that changes to the binge standard would create difficulties for tracking trends in binge drinking across time. Changes in these studies would require clear evidence for the superiority of the new binge measure, which the current study clearly does not provide.

Although the findings call into question the value of the new binge measure as currently operationalized, the construct the NIAAA Task Force sought to capture may still have utility using an alternate operationalization. One alternative would be to use a more subjective evaluation of drinking to intoxication. Jackson and colleagues have argued persuasively for this approach and many researchers already combine objective (binge drinking) and subjective (intoxication) measures to capture the latent construct of heavy drinking (e.g. Corbin et al., 2011). Regardless of the approach, future studies are needed to determine the measure or combination of measures of heavy drinking that account for the greatest variability in negative drinking outcomes.

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References

- American Psychiatric Association (2000) Diagnostic and Statistical Manual of Mental Disorders, 4th edn. Text Revision, Author, Washington, DC.
- Beirness DJ, Foss RD, Vogel-Sprott M (2004) Drinking on Campus: Self-Reports and Breath Tests. *J Stud Alcohol* 65:600–604. [PubMed: 15536769]
- Bergen G, Shults RA, Beck LF, Qayad M (2012) Self-reported alcohol-impaired driving in the U.S., 2006 and 2008. *Am J Prev Med* 42:142–149. [PubMed: 22261210]
- Cahalan D, Cisin IH, Crossley HM (1969) American drinking practices: A national study of drinking behavior and attitudes. *Monographs of the Rutgers Center of Alcohol Studies* 6:260.
- Centers for Disease Control and Prevention (CDC). (2012). Youth Risk Behavior Surveillance – United States, 2011. *MMWR*; 61(No. SS-4): 168 pp.
- Centers for Disease Control and Prevention (CDC). (2013). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

- Chavez PR, Nelson DE, Naimi TS, Brewer RD (2011) Impact of a new gender-specific definition for binge drinking on prevalence estimates for women. *Am J PrevMed* 40:468–471.
- Collins RL, Parks GA, Marlatt GA (1985) Social determinants of alcohol consumption: The effects of social interaction and model status on the self-administration of alcohol. *J Consult Clin Psychol* 53:189–200. [PubMed: 3998247]
- Corbin WR, Iwamoto DK, Fromme K (2011) A comprehensive longitudinal test of the acquired preparedness model for alcohol use and related problems. *J Stud Alcohol Drugs* 72:602–610. [PubMed: 21683042]
- Cranford JA, McCabe SE, Boyd CJ (2006) A new measure of binge drinking: Prevalence and correlates in a probability sample of undergraduates. *Alcohol Clin Exp Res* 30:1896–1905. [PubMed: 17067355]
- Dawson DA, Grant BF, Li TK. (2005). Quantifying the risks associated with exceeding recommended drinking limits. *Alcohol Clin Exp Res* 29:902–908. [PubMed: 15897737]
- Dawson DA, Pulay AJ, Grant BF (2010) A comparison of two single-item screeners for hazardous drinking and alcohol use disorder. *Alcohol Clin Exp Res* 34:364–374. [PubMed: 19951291]
- Dawson DA, Smith SM, Pickering RP, Grant BF (2012). An empirical approach to evaluating the validity of alternative low-risk drinking guidelines. *Drug Alcohol Rev* 335:141–150.
- Fillmore MT, Jude R (2011) Defining “binge” drinking as five drinks per occasion or drinking to a .08% BAC: Which is more sensitive to risk? *Am J Addict* 20:468–475. [PubMed: 21838847]
- Gallagher KE, Huddephol AD, Parrott DJ (2010) Power of being present: The role of mindfulness on the relation between men’s alcohol use and sexual aggression toward intimate partners. *Aggressive Behav* 36:405–413.
- Hingson R, Heeren T, Winter M, Wechsler H (2005) Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: Changes from 1998 to 2001. *Annu Rev Public Health* 26:259–279. [PubMed: 15760289]
- Jackson KM, Sher KJ, Gotham HJ, Wood PK (2001) Transitioning into and out of large-effect drinking in young adulthood. *J Abnorm Psychol* 110:378–391. [PubMed: 11502081]
- Johnston LD, O’Malley PM, Bachman JG, Schulenberg JE (2013). Monitoring the Future national survey results on drug use, 1975–2012. Volume II: College students and adults ages 19–50, 400 pp. Institute for Social Research, The University of Michigan, Ann Arbor.
- Lange JE, Voas RB (2001) Defining binge drinking quantities through resulting blood alcohol concentrations. *Psychol Addict Behav* 15:310–316. [PubMed: 11767262]
- Naimi TS, Brewer RD, Mokdad A, Denny C, Serdula MK, Marks JS (2003). Binge drinking among US adults. *JAMA* 289:70–75. [PubMed: 12503979]
- National Highway Traffic Safety Administration (1994) Computing a BAC Estimate. U.S. Department of Transportation, Washington, D.C.
- National Institute on Alcohol Abuse and Alcoholism (2004). NIAAA Council Approves Definition of Binge Drinking. NIAAA Newsletter, No. 3. National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD.
- Perkins HW (2002) Surveying the damage: A review of research on consequences of alcohol misuse in college populations. *J Stud Alcohol Suppl* 14:91–100.
- Read JP, Kahler CW, Strong DR, Colder CR (2006) Development and Preliminary Validation of the Young Adult Alcohol Consequences Questionnaire. *J Stud Alcohol* 67:169–177. [PubMed: 16536141]
- Sobell LC, Sobell MB (1995) Alcohol consumption measures, in *Assessing Alcohol Problems: A Guide for Clinicians and Researchers*, (Allen JP, Columbus M eds), pp 55–73. National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD.
- Sobell LC, Sobell MB (2003) Alcohol consumption measures, in *Assessing Alcohol Problems: A Guide for Clinicians and Researchers, Second Edition* (Allen JP, Columbus M eds), pp 75–99. National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD.
- Steiger JH (1980) Tests for comparing elements of a correlation matrix. *Psychol Bull* 87:245–251.
- Stockwell T, Zhao J, Chikritzhs T, Greenfield T (2008). What did you drink yesterday? Public health relevance of a recent recall method used in the 2004 Australian National Drug Strategy Household Survey. *Addiction* 103:919–929. [PubMed: 18482414]

- Substance Abuse and Mental Health Services Administration (2013). Results from the 2012 National Survey on Drug Use and Health: Summary of National Findings, NSDUH Series H-46, HHS Publication No. (SMA) 13-4795. Substance Abuse and Mental Health Services Administration, Rockville, MD.
- Tabachnick BG, Fidell LS (2007) Using multivariate statistics (5th ed.). Allyn & Bacon/Pearson Education, Boston, MA.
- Wechsler H, Davenport A, Dowdall G, Moeykens B, Castillo S (1994) Health and behavioral consequences of binge drinking in college: A national survey of students at 140 campuses. *JAMA* 272:1672-1677. [PubMed: 7966895]
- Wechsler H, Kuo M (2000) College students define binge drinking and estimate its prevalence: Results of a national survey. *J of ACH* 49:57-64.
- Wechsler H, Nelson TF (2001) Binge drinking and the American college students: What's five drinks? *Psychol Addict Behav* 15:287-291. [PubMed: 11767258]
- White HR, Labouvie EW (1989) Towards the assessment of adolescent problem drinking. *J Stud Alcohol* 50:30-37. [PubMed: 2927120]

Table 1

Descriptive statistics and frequency counts for participants included in Study 1 (social drinkers) and Study 2 (heavy drinkers).

	Study 1		Study 2	
	M	SD	M	SD
Binge frequency, old criteria	4.61	6.29	41.63	18.51
Binge frequency, new criteria	2.39	4.39	27.66	17.95
Weekly Frequency of Drinking to BACs \geq .08 g%	1.01	1.35	2.27	1.17
RAPI/YAACQ Consequences	6.37	9.30	21.25	9.48
Age	23.83	6.50	21.50	2.12
	N	%	N	%
Gender				
Male	83	41.5	117	69.6
Female	117	58.5	51	30.4
Race/Ethnicity				
Caucasian (non-Hispanic)	102	51.0	132	79.5
Hispanic	13	6.5	13	7.8
African American	19	9.5	11	6.6
Asian/Asian American	47	23.5	3	1.8
Mixed or other	19	9.5	7	4.2

Note. Binge frequency for old and new criteria refers to the number binge episodes reported over the past three months. RAPI/YAACQ consequences refers to alcohol problems in the past 3 months as measured by the RAPI in study 1 (max possible score of 92) and alcohol problems in the past year as measured by the YAACQ in study 2 (max possible score = 48). $n = 166$ for Race/Ethnicity in Study 2 as 2 participants declined to provide this information.

Table 2.

Correlations between relevant variables for study 1 (above the diagonal) and study 2 (below the diagonal).

		Binge (Old)	Binge (New)	.08 BAC frequency	Negative Consequences
		Study 1			
Binge (Old)		_____	.80 **	.54 **	.52 **
Binge (New)		.64 **	_____	.50 **	.46 **
.08 BAC frequency	Study 2	.58 **	.53 **	_____	.33 **
Negative Consequences		.29 **	.16 *	.21 **	_____

*Note.**
 $p < .05$;**
 $p < .01$.

Table 3.

Summary of regression analyses for binge measures on negative consequences in a social drinking sample of young adults (Study 1).

Regression step	<i>B</i>	<i>SE</i>	β	<i>P</i>
Step 1				
Gender	-.188	.066	-.199	.005
Step 2				
Gender	-.055	.060	-.058	.361
Binge frequency (old)**	.430	.106	.408	.000
Binge frequency (new)	.147	.123	.120	.236
Step 3				
Gender	-.065	.061	-.069	.283
Binge frequency (old)	.398	.111	.378	.000
Binge frequency (new)	.128	.125	.105	.305
BAC-based binge frequency	.133	.135	.073	.326

Note. *N* = 200. Adjusted $R^2 = .035^{**}$ for Step 1; Adjusted $R^2 = .233^{**}$ for Step 2; Adjusted $R^2 = -.001$ for Step 3.

Table 4

Summary of regression analyses of binge measures on negative consequences in a heavy-drinking sample (Study 2).

Regression step	<i>B</i>	<i>SE</i>	β	<i>P</i>
Step 1				
Gender	-.936	1.594	-.046	.558
Step 2				
Gender	-1.037	1.536	-.050	.501
Binge frequency (old)**	.157	.050	.307	.002
Binge frequency (new)	-.017	.051	-.032	.745
Step 3				
Gender	-.901	1.547	-.044	.561
Binge frequency (old)*	.142	.054	.277	.009
Binge frequency (new)	-.027	.053	-.052	.606
BAC-based binge frequency	.141	.181	.075	.437

Note. *N* = 168. Adjusted $R^2 = -.004$ for Step 1; Adjusted $R^2 = .072^{**}$ for Step 2; Adjusted $R^2 = -.002$ for Step 3.