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Free Alcohol Use and Consequences: Gender Differences Among Undergraduates

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Abstract

Objective—To examine gender differences in obtaining free alcohol, high-risk drinking, and consequences.

Methods—Web-based surveys were administered annually (2003–2005) to random samples of undergraduates (N=10,729).

Results—Gender, race, age under 21, sorority/fraternity membership, lower disposable income, and relationship status were significant predictors of obtaining free alcohol. Frequent obtainers had greater odds of heavy episodic drinking and consequences compared to infrequent obtainers. Females were less likely to report heavy episodic drinking; however, frequently obtaining females were more likely to report heavy episodic drinking.

Conclusions—Approximately 25% of undergraduates frequently obtained free alcohol. Females obtained more often, had higher odds of high-risk drinking, and experienced fewer consequences compared to males.

Keywords

alcohol; gender differences; college students; undergraduates; alcohol availability

National surveys of college students show that about 4 out of 5 college students consume alcohol and between 32 and 44% report binge or heavy episodic drinking.^{1,2} Each year, alcohol is responsible for 1825 student deaths, almost 600,000 unintentional injuries, almost 700,000 student assaults, and 2.8 million cases of driving under the influence (DUI).^{3,4} High-risk alcohol use on college campuses has prompted response from federal agencies such as the National Institute of Alcohol Abuse and Alcoholism⁵ and the US Department of Health and Human Services,⁶ as well as local efforts from community coalitions and college administrators.

Despite these efforts and laws that prohibit alcohol use by those under the age of 21, studies consistently report that underage drinkers easily obtain alcohol, often for free.^{7–11} For example, data from SAMHSA's 2008 National Survey on Drug Use and Health (NSDUH) revealed that almost 70% of current underage drinkers, ages 12–20, obtained alcohol for free the last time they drank and most often from nonrelatives, ages 21 or older. Although social access tends to slightly decrease as underage drinkers age, this pattern remained for individual age-groups in the study. For example, among 18-to-20-year-old drinkers, almost 64% reported obtaining their last alcohol for free and most often from an of-age nonrelative.¹² Researchers have examined this pattern among college students and found that among those who reported it was easy to obtain alcohol for free or at a reduced price, they most often reported getting it from a peer of legal drinking age, a sorority/fraternity party, or a bar.¹³

The ability for underage drinkers to obtain alcohol at a reduced price is an important factor for consideration in reducing underage access and overall use, as studies have indicated that price influences alcohol consumption.¹⁴ However, only a handful of studies have examined this association in the college environment, where students have multiple access points and are routinely targeted with special drink promotions at local venues. These studies have shown that paying a very low price for alcohol (ie, \$1 or less per drink), a set price for unlimited drinks, or obtaining alcohol for free is associated with heavy episodic drinking among college students.^{13,15} Chaloupka and Wechsler¹⁶ examined drinking practices of college students as it related to price and found that among females, underage drinking and binge drinking decreased as beer price increased. Male drinking practices, however, were not responsive to price.

It is not surprising, then, that male college students drink more often and in larger quantities compared to female college students.^{17–19} However, the literature suggests females are consuming more alcohol when they drink, even before entering college—a time when alcohol consumption typically increases for both genders.^{18,20} In a cross-sectional study, Wallace and colleagues²¹ showed the gender gap for heavy episodic drinking decreased among high school students between 1975 and 2001 from 23% to 12%. Among college students, the prevalence of 30-day alcohol use by college-age females is now equivalent to, or exceeding, that of their male counterparts.^{22,23} Additionally, the prevalence of high-risk alcohol use among college women has been rising since the 1990s^{23,24} so that we now see virtually the same proportion of males and females reporting binge drinking on a typical drinking occasion.²³

Recent evidence also suggests that a gender discrepancy exists in obtaining free alcohol, with underage females obtaining for free more often than males do. Among 12-to-20-year-

olds, 76.4% of females, compared to 63.2% of males, reported that they did not pay for alcohol the last time they drank. In addition, over 30% of females reported obtaining alcohol for free from a nonrelative, aged 21 or older, compared to only 22% of males.¹²

This is an alarming trend, as females are at increased risk for a multitude of physical and social consequences as a result of increase alcohol consumption. For example, females have increased toxic effects of alcohol on the brain and increased risks for reproductive health consequences, such as infertility, sexual dysfunction, and amenorrhea, as well as breast cancer and alcohol-related cirrhosis.^{25–27} These are in addition to the increased risk of date fighting and rape^{28,29} as well as physical assault,³⁰ suicide,³¹ academic problems³² and death from alcohol-related injuries, such as traffic crashes.³³

Even though studies show that gender differences exist in patterns of drinking, alcohol acquisition, and alcohol-related consequences, gender differences in free-alcohol acquisition and its association with heavy episodic drinking and alcohol-related consequences have not been explored within the college student population. This is an important area for investigation as the college environment provides easy access to cheap alcohol in multiple venues, such as fraternity/sorority parties, tailgating events, and special promotions at local bars and restaurants. The purposes of this paper are to explore the prevalence of obtaining free alcohol among college students, examine gender differences in obtaining free alcohol, and determine whether free drinkers are at increased risk for heavy episodic drinking and alcohol-related negative consequences.

METHODS

Sample

The sample for this study consisted of college students from 10 universities in North Carolina (NC) participating in a group-randomized trial designed to reduce high-risk drinking and alcohol-related consequences among college students. Participating campuses ranged in size from 5375 to 44,841 total students. Eight of the universities were public institutions, whereas 2 were private. Each year, approximately 1200 students from each campus, divided equally by class year, were randomly selected from a list of total undergraduate student enrollment provided by the institution. The random sample of students received an invitation to complete a Web-based survey. The target sample each year was to have 416 students (104 per class) from each institution complete the survey. The original study was powered to detect an effect size of 0.168 between intervention groups with 80% power assuming mean number of binge drinking days was 1.0 (sd=2.0). The number of students invited to participate was based on study power calculations, as well as the expectation from previous surveys and previous waves of the survey that 30–35% of students would complete the survey within the fielding period.³⁴

An e-mail protocol was established, which included frequent reminders, based on the Dillman approach.³⁵ E-mails were sent informing participants of the study and providing a link to a secure Web site where the survey could be completed. All students who completed the survey were awarded \$10 in PayPal dollars. Additionally, a \$100 lottery was offered at each school as an additional incentive. Each year, after the sample size was attained using the quota sampling method, the Web-based survey was closed. Campuses varied in the time it took for students to respond to the e-mail invitations. Some schools exceeded the target sample within 48 hours. Other schools, however, required us to use the full 4-week fielding period and 4 reminder e-mails to reach the target sample. The response rate across the 10 schools was 25.8% (2003), 31.3% (2004), and 31% (2005), which is consistent with rates in other surveys of college students.³⁵

The protocol was approved by the Wake Forest University School of Medicine Institutional Review Board (WFUSM IRB). Participating schools required either IRB review and approval at their individual school or set up oversight agreements with the WFUSM IRB.

Survey Instrument

The College Drinking Survey (CDS) had 287 items with multiple skip patterns based on the absence of reported behaviors. The Web-based survey was adapted from items previously used in the Harvard School of Public Health College Alcohol Survey,³⁶ the Core Institute Drug and Alcohol Survey³⁷ and the youth survey used in the National Evaluation of the Enforcing Underage Drinking Laws Program.^{38,39} The survey took about 25 minutes to complete, depending on the skip patterns of each student. Respondents could skip any question that they did not feel comfortable answering.

Demographic characteristics included age, sex, race/ethnicity, and academic classification (freshman, sophomore, junior, and senior), part or full-time student status, and residence type (including single-sex residence hall/dorm, coeducational residence hall/dorm, on-campus sorority/fraternity housing, and off-campus housing), mother's highest education level (some college or more/high school diploma or less) and father's highest education level.

The survey assessed alcohol consumption behaviors, including being a current drinker (defined as past-30-day use), getting drunk at least once in a typical week, and engaging in heavy episodic drinking (≥ 5 drinks in row for males, ≥ 4 drinks for females in past 30 days). Students were also asked whether in the last 30 days they had experienced any negative consequences as a result of their drinking or the drinking of others. Consequences were separated into moderate and severe consequences, and a sum score was created for each category. Moderate consequences included did something later regretted, strained a relationship, had unprotected sex, vomited, damaged property, got into a verbal argument, had a hangover, missed class, and performed poorly on a test. Severe consequences included being taken advantage of sexually, taking advantage of another sexually, driving under the influence of alcohol, riding with a driver who was under the influence of alcohol, being hurt or injured, or requiring medical treatment.

The survey measured free alcohol with the following question: "During the past 30 days, how often did you drink alcohol without paying for it?" Response options included "very often," "often," "sometimes," "seldom," "never," or "I don't drink."

Statistical Analysis

The objectives of the statistical analyses were to (1) estimate the prevalence of obtaining free alcohol among college students, (2) test for associations between obtaining free alcohol and demographic characteristics, (3) test for a gender interaction with obtaining free drink, (4) test for an association between obtaining free alcohol and heavy episodic drinking, and (5) test for associations between obtaining free alcohol and moderate and severe consequences. Response options for drinking free alcohol were collapsed into 4 categories: nondrinkers, never free drink (drinkers who never drank for free), seldom/sometimes free drink, and often/very often free drink. Indicator variables were created for year, treatment group, gender, race/ethnicity, under 21 years old, campus residence, pledge or member of a sorority or fraternity, relationship status (ie, single no partner, single with a steady partner, married), low disposable income (ie, less than \$100 average monthly disposable income), and self-reported living < 0.5 mile to the nearest bar/tavern.

Descriptive and bivariate analyses using mixed-effects ordinal logistic regression were performed to determine which behaviors were associated with obtaining free drinks.

Multivariable analysis of heavy episodic drinking and drinking-related consequences was performed using mixed-effects logistic regression. Adjusted odds ratios (AOR) and 95% confidence intervals were estimated. The models adjusted for age, race/ethnicity, residence location, survey year, other student characteristics such as sorority/fraternity member/pledge and school. Modeling of alcohol-related consequences additionally adjusted for heavy episodic drinking in order to examine the effects of free drinking while adjusting for a measure of student drinking. All covariates were adjusted for as fixed effects except for school, which was included as a random effect to explicitly account for the within-school clustering on the site/university level. Mixed-effects models have been used extensively in analysis of data from group-randomized trials.^{40–43} The observed clustering effects of school were similar to those in other study analyses. Estimates of the school ICC from multivariable modeling for binge drinking, moderate and severe consequences were 0.022, 0.004, and 0.010, respectively (0.024, 0.006, and 0.017 in unadjusted bivariate modeling). A 2-sided P-value<0.05 was considered statistically significant. All analyses were performed using Stata v10.1.

RESULTS

A combined total of 10,729 students responded to the survey over the 3 years that we used for the analyses reported in this paper. Over 68% (N=7372) of the sample reported being current drinkers, with a mean age of 20.3 (SD=2.6). The majority of the sample was non-Hispanic white, and approximately 60% were female. Females were more likely than males to report obtaining free alcohol seldom/sometimes as well as often/very often in the past 30 days (P<0.001).

Almost 25% of the sample reported free drinking often or very often (2648 of 10,729 (24.7%); 95% Wilson CI=[23.9%, 25.5%]). Among past-30-day drinkers, this corresponded to an estimated proportion of 35.9% (2648 of 7372; 95% Wilson CI=[34.8%, 37.0%]). For the other free-drink categories and among all students, 31.3% were not past-30-day drinkers (and therefore not free drinkers), 8.6% reported never free drinking among drinkers, and 35.4% reported free drinking seldom or sometimes among drinkers. The rates of often/very often free drinking across the 5 schools ranged from 19.6% to 37.9%.

In bivariate analyses, variables associated with obtaining free alcohol often or very often included gender, race/ethnicity, age (under 21 years), being a pledge or member of a sorority or fraternity, and being single (ie, not married or with a steady partner). See Table 1 for sample demographics by free-drink status.

Gender Interactions

To test whether drinking status would predict drinking outcomes by gender, analyses adding interaction terms between gender and free-drinking status of drinkers were conducted for heavy episodic drinking, and moderate and severe consequences (Table 2). An interaction with gender occurred in only one of the models: heavy episodic drinking. This analysis revealed that even though females were less likely than males to report heavy episodic drinking in the past 30 days, females who reported obtaining free drinks often or very often were more likely to report heavy episodic drinking compared to female drinkers who never drink for free.

Figure 1 below illustrates the interaction effects. Males who never obtain free drinks have a higher predicted probability of heavy episodic drinking than do females who never obtain free drinks. This pattern extends to the seldom/sometimes free drinkers, with a smaller difference between the genders. However both genders that frequently free drink have

almost the same risk for heavy episodic drinking. Here females have a slightly higher predicted probability of reporting heavy episodic drinking.

We also examined the association between free-drink status and moderate and severe consequences. In the mixed-effects logistic regression model for moderate consequences, respondents who reported obtaining free alcohol seldom or sometimes had twice the odds of experiencing moderate consequences compared to drinkers who paid for their alcohol (95% CI: 1.65–2.46; $P<0.001$). Similarly, drinkers who reported obtaining alcohol for free often or very often had 2.84 greater odds of experiencing moderate consequences (95% CI: 2.25–3.59; $P<0.001$) compared to drinkers who paid for their alcohol (Table 3). In addition, the often/very often free drinkers had significantly higher moderate and severe alcohol-related consequences compared to the seldom/sometimes free drinkers. Females were less likely than males to experience moderate consequences (AOR=0.70; $P<0.001$), whereas drinkers who were under the age of 21, part of a sorority/fraternity, or reported past-30-day heavy episodic drinking were more likely to experience moderate consequences.

There was a similar pattern of results for severe consequences, with frequent free obtainers having 2.67 greater odds of experiencing them (95% CI: 1.99–3.57, $P<0.001$) compared to paying drinkers. Infrequent free drinkers also had greater odds (AOR: 1.84) of experiencing severe consequences compared to drinkers who paid for their alcohol (95% CI: 1.39–2.45, $P<0.001$) (Table 4). Females were less likely than males to experience severe consequences (AOR=0.65; $P<0.001$), as were those who were married or in a steady relationship (AOR=0.71; $P<0.001$). Again, drinkers under the age of 21 (AOR=1.40, $P<0.001$) and those who reported past-30-day heavy episodic drinking (AOR=1.12; $P<0.001$) were also more likely to experience severe consequences. The effects of free-drink status did not depend upon gender for moderate or severe consequences.

DISCUSSION

In our sample of undergraduate students from 10 North Carolina colleges and universities, we found that approximately one quarter (24.6%) of the students frequently obtained free alcohol. This equates to over one third of past-30-day drinkers (35.9%) frequently obtaining alcohol without paying for it. A number of characteristics were found to be significantly associated with regularly obtaining free drinks in bivariate analyses, including being female, white, under 21 years of age, single, and part of a sorority/fraternity.

Frequent free-obtainers had greater odds of heavy episodic drinking in the past 30 days compared to non-free drinkers. This is consistent with existing literature regarding the association between low alcohol price and heavy episodic drinking.^{13,15} We also found a gender interaction for heavy episodic drinking and free-drink status. In our study, among the non-free drinkers, females had a lower adjusted predicted probability of heavy episodic drinking compared to males. Among the seldom/sometimes free drinkers, the difference between genders was smaller, but males continued to have a higher predicted probability compared to females. However, the difference between genders virtually disappeared for frequent free drinkers, with females having a slightly higher predicted probability of reporting heavy episodic drinking compared to males (Figure 1).

In examination of female student drinkers only, those who frequently drank for free had more than double the predicted risk of heavy episodic drinking compared to female students who never drank for free. Males' risk also increased, but not as substantially, suggesting that females may be more susceptible to low alcohol pricing compared to males, a similar finding to that of Chaloupka and colleagues.¹⁶

There also appears to be a dose relationship, as often/very often free drinkers reported significantly more heavy episodic drinking *and* moderate and severe alcohol-related consequences compared to the seldom/sometimes free drinkers. These findings are in contrast to SAMHSA's 2008 NSDUH Report, which showed that current alcohol users ages 18–20 who paid for their alcohol the last time they drank consumed more drinks on average (6.0 drinks) compared to those who obtained the alcohol for free (4.3 drinks).¹² This discrepancy could be due to a several reasons. First, our study's population is college students, whereas the NSDUH study includes persons of college age in their sample, not necessarily students in college. Therefore, the association we found among frequent free-obtainers of alcohol having higher risk of heavy episodic drinking and alcohol-related consequences could be unique to college students and the alcohol-promoting environment. Another reason for the discrepancy could be due to the study questions measuring 2 distinct constructs. In our study, the question focused on the frequency or pattern of drinking for free in the past month among respondents, whereas the NSDUH survey examined the issue of drinking for free on the last drinking occasion.

Frequent free-drinkers also had greater odds of experiencing moderate and severe consequences compared to non-free drinkers in our study. This is not surprising, given our previous finding of increased odds of heavy episodic drinking among free drinkers compared to non-free drinkers. Interestingly, however, females in our study obtained free alcohol more often than males did and had higher odds of high-risk drinking, but reported fewer alcohol-related consequences compared to males. One possible explanation for fewer consequences is that females use protective behavioral strategies, such as using a designated driver, eating during or before drinking, and switching between alcohol and non-alcoholic beverages, more often than males do.⁴⁴ This could also be due to the increased drinking of women, in general. In secondary analysis of over 43,000 participants in the US National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), Keyes and colleagues⁴⁵ found that gender differences in alcohol disorders were decreasing simply because women were drinking more. Therefore, not finding gender differences is an alarming sign that females' drinking patterns are becoming more similar to their male peers, and thus females are experiencing alcohol-related consequences at the same rate.

We would like to highlight that free drinkers in our study could obtain alcohol from a variety of sources, including free or otherwise. Our findings of increased odds of heavy episodic drinking and negative alcohol-related consequences among free drinkers could be due to free drinkers' drinking more and more often, resulting in a greater likelihood of negative alcohol-related outcomes. Therefore, obtaining free alcohol may be a proxy for a more intense drinking pattern that leads to negative outcomes. Additional research is needed to clarify the role of free alcohol in high-risk use and associated consequences.

Limitations

The proposed study has several limitations. Although we have shown that frequently obtaining free drinks is associated with heavy episodic drinking and associated consequences, the relationship could also be a result of situational effects; specifically, those who drink more are in situations in which free drinks are provided more often. Additionally, the data reported in this study are from repeated cross-sections, limiting any causal inferences. It is our hope that future studies, prospective in nature and perhaps tracking the same individuals longitudinally, can give additional insight into how the relationships appear to be.

In addition, because the data are self-reported, bias in over- or underestimation of alcohol use could result. Although self-report data have been validated in previous studies of alcohol

use in college students, different patterns or levels of drinking may be associated with different response biases.^{46,47}

Finally, even though the sample size is large, it is geographically limited to college students in North Carolina. Participating institutions have a lower minority population than the national average, which resulted in a lower minority representation for the survey. Although this limits the generalizability of our results, post hoc analyses confirmed that the sample reflected the ethnic, racial, and gender profile of the institutions participating in the larger study. Furthermore, the demographic profile of this sample reflects that of undergraduate students in the United States.⁴⁸

Conclusions

Despite these limitations, the current study highlighted some areas of concern and in need of further investigation. Perhaps most alarming is that almost one quarter of college students reported obtaining alcohol for free in the past 30 days. Additionally, those students who frequently obtained free alcohol had greater odds of high-risk drinking and experiencing moderate and severe alcohol-related consequences, suggesting a possible dose relationship between frequency of obtaining free alcohol and high-risk use and consequences.

A surprising finding is that even though females reported obtaining free alcohol more often than males did, putting females at greater risk of heavy episodic drinking, they reported fewer alcohol-related consequences. This points to the need for further investigation as to why their high-risk drinking does not result in more alcohol-related consequences when it is obtained for free.

These findings also highlight the need to better understand social acquisition of alcohol among college students and explore interventions that can reduce the amount of free or reduced-price alcohol available in the college environment. This issue is especially important for this population, as alcohol use tends to increase during this critical transition period, especially for females, who are the largest acquirers of alcohol through social avenues. Reducing occasions that underage drinkers use to acquire free alcohol, such as sorority/fraternity parties and tailgating events, is a key intervention opportunity for college leaders and community advocates.

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References

1. Johnston, LD.; O'Malley, PM.; Bachman, JG., et al. Monitoring the Future National Survey Results on Drug Use, 1975–2008: Volume I, Secondary school students. Bethesda: National Institute on Drug Abuse; 2009. NIH Publication 09–7402
2. Wechsler H, Nelson TF. What we have learned from the Harvard School Of Public Health College Alcohol Study: focusing attention on college student alcohol consumption and the environmental conditions that promote it. *J Stud Alcohol Drugs*. Jul; 2008 69(4):481–490. [PubMed: 18612562]
3. Hingson RW, Zha W, Weitzman ER. Magnitude of and trends in alcohol-related mortality and morbidity among U.S. college students ages 18–24, 1998–2005. *J Stud Alcohol Drugs Suppl*. Jul. 2009 (16):12–20. [PubMed: 19538908]
4. National Institute on Alcohol Abuse and Alcoholism. What Colleges Need to Know Now: An Update on College Drinking Research. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism; 2007.

5. National Institute on Alcohol Abuse and Alcoholism. A Call to Action: Changing the Culture of Drinking at US Colleges. Apr. 2002 NIH Publication No. 02-5010
6. United States Department of Health and Human Services. [Accessed November 20, 2009.] The Surgeon General's Call to Action To Prevent and Reduce Underage Drinking. Available at: <http://www.surgeongeneral.gov/topics/underagedrinking/calltoaction.pdf>
7. Hearst MO, Fulkerson JA, Maldonado-Molina MM, et al. Who needs liquor stores when parents will do? The importance of social sources of alcohol among young urban teens. *Prev Med.* Jun; 2007 44(6):471-476. [PubMed: 17428525]
8. Dent CW, Grube JW, Biglan A. Community level alcohol availability and enforcement of possession laws as predictors of youth drinking. *Prev Med.* Mar; 2005 40(3):355-362. [PubMed: 15533551]
9. Harrison PA, Fulkerson JA, Park E. The relative importance of social versus commercial sources in youth access to tobacco, alcohol, and other drugs. *Prev Med.* Jul; 2000 31(1):39-48. [PubMed: 10896842]
10. Smart RG, Adlaf EM, Walsh GW. Procurement of alcohol and underage drinking among adolescents in Ontario. *J Stud Alcohol.* Jul; 1996 57(4):419-424. [PubMed: 8776684]
11. Wagenaar AC, Toomey TL, Murray DM, et al. Sources of alcohol for underage drinkers. *J Stud Alcohol.* May; 1996 57(3):325-333. [PubMed: 8709591]
12. Substance Abuse and Mental Health Services Administration. The NSDUH Report: Underage Alcohol Use: Where Do Young People Get Alcohol? (No NSDUH08-1120). Rockville, MD: 2008.
13. Weitzman ER, Nelson TF, Wechsler H. Taking up binge drinking in college: the influences of person, social group, and environment. *J Adolesc Health.* Jan; 2003 32(1):26-35. [PubMed: 12507798]
14. Manning WG, Blumberg L, Moulton LH. The demand for alcohol: the differential response to price. *J Health Econ.* Jun; 1995 14(2):123-148. [PubMed: 10154654]
15. Wechsler H, Kuo M, Lee H, et al. Environmental correlates of underage alcohol use and related problems of college students. *Am J Prev Med.* Jul; 2000 19(1):24-29. [PubMed: 10865160]
16. Chaloupka FJ, Wechsler H. Binge drinking in college: the impact of price, availability, and alcohol control policies. *Contemporary Economic Policy.* Oct 1; 1996 14(4):112-124.
17. Clements R. Prevalence of alcohol-use disorders and alcohol-related problems in a college student sample. *J Am Coll Health.* Nov; 1999 48(3):111-118. [PubMed: 10584445]
18. O'Malley PM, Johnston LD. Epidemiology of alcohol and other drug use among American college students. *J Stud Alcohol Suppl.* Mar.2002 (14):23-39. [PubMed: 12022728]
19. Read JP, Wood MD, Davidoff OJ, et al. Making the transition from high school to college: the role of alcohol-related social influence factors in students' drinking. *Subst Abus.* Mar; 2002 23(1):53-65. [PubMed: 12444360]
20. Sher KJ, Rutledge PC. Heavy drinking across the transition to college: predicting first-semester heavy drinking from precollege variables. *Addict Behav.* Apr; 2007 32(4):819-835. [PubMed: 16860940]
21. Wallace JM Jr, Bachman JG, O'Malley PM, et al. Tobacco, alcohol, and illicit drug use: racial and ethnic differences among U.S. high school seniors, 1976-2000. *Public Health Rep.* 2002; 117(Suppl 1):S67-75. [PubMed: 12435829]
22. Johnston, L.; O'Malley, P.; Bachman, J., et al. Monitoring the Future national Survey Results on Drug Use, 1975-2005: Volume II, College Students and Adults aged 19-45. Bethesda, MD: National Institute on Drug Abuse; 2007.
23. The National Center on Addiction and Substance Abuse at Columbia University. Wasting the Best and the Brightest. Substance Abuse at America's Colleges and Universities; 2007.
24. Ham LS, Hope DA. College students and problematic drinking: a review of the literature. *Clin Psychol Rev.* Oct; 2003 23(5):719-759. [PubMed: 12971907]
25. Deal S, JSG. Are women more susceptible than men to alcohol-induced cirrhosis? *Alcohol Health and Research World.* 1994; 18:189-191.
26. Longnecker MP. Alcoholic beverage consumption in relation to risk of breast cancer: meta-analysis and review. *Cancer Causes Control.* Jan; 1994 5(1):73-82. [PubMed: 8123780]

27. Ammendola A, Gemini D, Iannaccone S, et al. Gender and peripheral neuropathy in chronic alcoholism: a clinical-electroneurographic study. *Alcohol Alcohol*. Jul-Aug;2000 35(4):368–371. [PubMed: 10906002]
28. Champion H, Wagoner K, Song EY, et al. Adolescent date fighting victimization and perpetration from a multi-community sample: associations with substance use and other violent victimization and perpetration. *Int J Adolesc Med Health*. Oct-Dec;2008 20(4):419–429. [PubMed: 19230442]
29. National Center on Addiction and Substance Abuse at Columbia University (CASA). *Women Under the Influence*. Baltimore: The Johns Hopkins Press; 2006.
30. Hingson R, Heeren T, Winter M, et al. Magnitude of alcohol-related mortality and morbidity among U.S. college students ages 18–24: changes from 1998 to 2001. *Annu Rev Public Health*. 2005; 26:259–279. [PubMed: 15760289]
31. Chatterji P, Dave D, Kaestner R, et al. Alcohol abuse and suicide attempts among youth. *Econ Hum Biol*. Jun; 2004 2(2):159–180. [PubMed: 15464000]
32. Grunbaum JA, Kann L, Kinchen S, et al. Youth risk behavior surveillance--United States, 2003. *MMWR Surveill Summ*. May 21; 2004 53(2):1–96. [PubMed: 15152182]
33. Hingson RW, Assailly JP, Williams AF. Underage drinking: frequency, consequences, and interventions. *Traffic Inj Prev*. Sep; 2004 5(3):228–236. [PubMed: 15276923]
34. Reed MB, Wang R, Shillington AM, et al. The relationship between alcohol use and cigarette smoking in a sample of undergraduate college students. *Addict Behav*. Mar; 2007 32(3):449–464. [PubMed: 16844313]
35. Dillman, D. *Mail and Internet Surveys: The Tailored Design Method*. New York: John Wiley; 2000.
36. Wechsler H, Davenport A, Dowdall G, et al. Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses. *Jama*. Dec 7; 1994 272(21):1672–1677. [PubMed: 7966895]
37. Presley CA, Meilman PW, Lyster R. Development of the Core Alcohol and Drug Survey: initial findings and future directions. *J Am Coll Health*. May; 1994 42(6):248–255. [PubMed: 8046164]
38. Wolfson, M.; Altman, D.; DuRant, RH., et al. *National Evaluation of the Enforcing Underage Drinking Laws Program: Year 4 Report*. Winston-Salem, NC: Wake Forest University School of Medicine; 2004.
39. Preisser JS, Young ML, Zaccaro DJ, et al. An integrated population-averaged approach to the design, analysis and sample size determination of cluster-unit trials. *Stat Med*. Apr 30; 2003 22(8): 1235–1254. [PubMed: 12687653]
40. Donner A, Birkett N, Buck C. Randomization by cluster. Sample size requirements and analysis. *Am J Epidemiol*. Dec; 1981 114(6):906–914. [PubMed: 7315838]
41. Murray DM. Statistical models appropriate for designs often used in group-randomized trials. *Stat Med*. May 15–30; 2001 20(9–10):1373–1385. [PubMed: 11343359]
42. Murray, DM. *Design and analysis of group-randomized trials*. Vol. 27. New York, NY: Oxford; 1998.
43. Koepsell TD, Martin DC, Diehr PH, et al. Data analysis and sample size issues in evaluations of community-based health promotion and disease prevention programs: a mixed-model analysis of variance approach. *J Clin Epidemiol*. 1991; 44(7):701–713. [PubMed: 2066748]
44. Sutfin EL, Light LS, Wagoner KG, et al. Protective behaviors and high-risk drinking among entering college freshmen. *Am J Health Behav*. Sep-Oct;2009 33(5):610–619. [PubMed: 19296751]
45. Keyes KM, Grant BF, Hasin DS. Evidence for a closing gender gap in alcohol use, abuse, and dependence in the United States population. *Drug Alcohol Depend*. Jan 11; 2008 93(1–2):21–29. [PubMed: 17980512]
46. Dowdall GW, Wechsler H. Studying college alcohol use: widening the lens, sharpening the focus. *J Stud Alcohol Suppl*. Mar.2002 (14):14–22. [PubMed: 12022719]
47. DelBoca F, Darkes J. The validity of self-reports of alcohol consumption: state of the science and challenges for research. *Addiction*. 2003; 98(Suppl 2):1–12.
48. United States Department of Education. *US Department of Education Digest of Educational Statistics 2005*. Washington, DC: National Center for Educational Statistics; 2006.

Figure 1.
Interaction Effects of Gender and Free-Drink Status on Past-30-Day Heavy Episodic Drinking, Among Drinkers

Table 1

Demographics and Risk Behaviors by Free-Drink Status (N=10,729)

Characteristic N (col %)	Total N	Nondrinkers N=3357 (31%)	Never Free Drink N=923 (9%)	Seldom/Sometimes Free Drink N=3801 (35%)	Often/Very Often Free Drink N=2648 (25%)	P-value*
Year						
2003	3882	1326 (34)	270 (07)	1317 (34)	969 (25)	2 df P=.929
2004	2617	763 (29)	240 (09)	974 (37)	640 (25)	
2005	4230	1268 (30)	413 (10)	1510 (36)	1039 (24)	
Treatment Group						
Intervention	5577	1840 (33)	453 (8.1)	1909 (34)	1375 (25)	.205
Control	5129	1505 (29)	469 (9.1)	1887 (37)	1268 (25)	
Gender						
Male	3982	1105 (28)	371 (9.3)	1747 (44)	759 (19)	<.001
Female	6689	2231 (33)	554 (8.3)	2027 (30)	1877 (28)	
Race/Ethnicity						
White	8490	2383 (28)	759 (8.9)	3242 (38)	2106 (25)	4 df P<.001
African American	881	457 (52)	65 (7.4)	162 (18)	197 (22)	
Hispanic	378	106 (28)	24 (6.3)	127 (34)	121 (32)	
Asian American	461	207 (45)	29 (6.3)	113 (25)	112 (24)	
Other	492	199 (40)	43 (8.7)	144 (29)	106 (22)	

Table 2

Mixed-effects Logistic Regression for Past-30-Day Heavy Episodic Drinking* (N=7064)

Characteristic	AOR**	95% CI for AOR	P-value
Free-Drink status			
Never (RC [†])	-		
Seldom/Sometimes	3.14	(2.46, 4.01)	<.001
Often/Very Often	3.61	(2.71, 4.80)	<.001
Gender			
Male [†]	-		
Female	0.58	(0.44, 0.77)	<.001
Interaction Effects			2 df P<.001
Free drink never x gender [†]	-		
Free drink sometimes/seldom x gender	1.10	(0.80, 1.52)	.547
Free drink often/very often x gender	1.75	(1.23, 2.50)	.002
Year			2 df P=.495
2003 [†]	-		
2004	0.92	(0.80, 1.06)	.242
2005	0.95	(0.84, 1.08)	.456
Treatment group			
Control [†]	-		
Intervention	0.83	(0.68, 1.02)	.066
Race/Ethnicity			4 df P<.001
White [†]	-		
African American	0.36	(0.27, 0.48)	<.001
Hispanic	0.26	(0.21, 0.33)	<.001
Asian/Pacific Islander	0.67	(0.51, 0.88)	.004
Other	0.69	(0.52, 0.90)	.006
Under 21 years old			
No [†]	-		
Yes	1.25	(1.09, 1.43)	.001
Sorority/fraternity member/pledge			
No [†]	-		
Yes	1.70	(1.44, 2.02)	<.001
Relationship status			
Married/with steady partner [†]	-		
Single	1.48	(1.32, 1.65)	<.001

Characteristic	AOR**	95% CI for AOR	P-value
Average monthly spending money			
\$100 or more [†]	-		
Less than \$100	0.70	(0.62, 0.79)	<.001
Distance live from bar/tavern			
More than ½ mile [†]	-		
½ mile or less	1.04	(0.91, 1.18)	.603
Campus Residence:			
Off campus [†]	-		
On campus	0.88	(0.77, 1.01)	.064

* Heavy episodic drinking: # days in past 30 with 5+ drinks in a row for males/4+ for females;

** AOR = adjusted odds ratio;

[†] Reference Category

Table 3Mixed-effects Logistic Regression for Moderate Consequences ($\alpha=.86$; N=6998)

Characteristic	AOR*	95% CI for AOR	P-value
Free-Drink status			2 df P<0.001
Never [†]	-		
Seldom/Sometimes	2.01	(1.65, 2.46)	<0.001
Often/Very Often	2.84	(2.25, 3.59)	<0.001
Gender			
Male [†]	-		
Female	0.70	(0.59, 0.83)	<0.001
Treatment group			
Control [†]	-		
Intervention	0.79	(0.62, 1.01)	0.060
Year			2 df P=0.918
2003 [†]	-		
2004	0.98	(0.80, 1.20)	0.851
2005	0.96	(0.80, 1.15)	0.679
Race/Ethnicity			4 df P=0.342
White [†]	-		
African American	1.16	(0.87, 1.53)	0.311
Hispanic	0.76	(0.52, 1.11)	0.150
Asian/Pacific Islander	0.83	(0.57, 1.21)	0.345
Other	1.10	(0.75, 1.60)	0.630
Under 21 years old			
No [†]	-		
Yes	1.23	(1.02, 1.48)	0.033
Campus Residence			
On campus [†]	-		
Off campus	0.90	(0.74, 1.10)	0.295
Sorority/fraternity member/pledge			
No [†]	-		
Yes	1.45	(1.11, 1.89)	0.006
Relationship status			
Single [†]	-		
Married/with steady partner	1.01	(0.86, 1.18)	0.945
Average monthly spending money			

Characteristic	AOR*	95% CI for AOR	P-value
\$100 or more [†]	-		
Less than \$100	0.92	(0.77, 1.08)	0.305
Distance live from bar/tavern			
More than ½ mile [†]	-		
½ mile or less	0.93	(0.78, 1.13)	0.477
# days 5/4 heavy episodic drinking*	3.49	(3.14, 3.87)	<0.001

[†]Reference Category

* Heavy episodic drinking is defined as # days in past 30 with 5+ drinks in a row for males/4+ drinks in a row for females.

** AOR = adjusted odds ratio

Table 4Mixed-effects Logistic Regression for Severe Consequences ($\alpha=.79$; N=6996)

Characteristic	AOR**	95% CI for AOR	P-value
Free-Drink status			2 df P<0.001
Never †	-		
Seldom/Sometimes	1.84	(1.39, 2.45)	<0.001
Often/Very Often	2.67	(1.99, 3.57)	<0.001
Gender			
Male †	-		
Female	0.65	(0.56, 0.74)	<0.001
Treatment group			
Control †	-		
Intervention	0.99	(0.76, 1.30)	0.959
Year			2 df P=0.499
2003 †	-		
2004	0.91	(0.77, 1.08)	0.275
2005	0.93	(0.80, 1.09)	0.370
Race/Ethnicity			4 df P=0.123
White †	-		
African American	1.10	(0.81, 1.49)	0.537
Hispanic	0.67	(0.45, 1.00)	0.047
Asian/Pacific Islander	0.86	(0.57, 1.30)	0.480
Other	1.28	(0.92, 1.77)	0.144
Under 21 years old			
No †	-		
Yes	1.40	(1.19, 1.66)	<0.001
Campus Residence			
On campus †	-		
Off campus	1.08	(0.92, 1.27)	0.354
Sorority/fraternity member/pledge			
No †	-		
Yes	1.18	(0.99, 1.41)	0.062
Relationship status			
Single †	-		
Married/with steady partner	0.71	(0.62, 0.81)	<0.001
Average monthly spending money			

Characteristic	AOR**	95% CI for AOR	P-value
\$100 or more [†]	-		
Less than \$100	0.87	(0.75, 1.02)	0.085
Distance live from bar/tavern			
More than ½ mile [†]	-		
½ mile or less	1.06	(0.90, 1.25)	0.464
# days 5/4 heavy episodic drinking [*]	1.12	(1.11, 1.14)	<0.001

[†]Reference Category

^{*}Heavy episodic drinking is defined as # days in past 30 with 5+ drinks in a row for males/4+ drinks in a row for females.

^{**}AOR = adjusted odds ratio