High-Intensity Drinking by Underage Young Adults in the United States

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ABSTRACT

Aims. To estimate (1) the prevalence of underage binge drinking, high-intensity drinking, and intoxication among young adults aged 19/20; (2) change in these behaviors across the transition out of high school and across historical time; and (3) associations between these behaviors and key covariates, including college status.

Design, Setting, & Participants. Longitudinal data from the U.S. nationally representative Monitoring the Future study included 1,657 respondents first surveyed as 12th graders (modal age 18) in 2005–2013 and again at modal age 19/20 in 2006-2014.

Measurements. Self-reported measures of alcohol use, demographics, college attendance, and living situation.

Findings. Binge drinking (5+ drinks on one occasion) was reported by 24.2% (95% confidence interval (CI)=22.0, 26.5) of young adults aged 19/20; 10.3% (CI=8.7, 11.9) reported high-intensity drinking of 10+ drinks; 4.2% (CI=3.1, 5.2) reported 15+ drinks. Usual moderate/high intoxication when drinking was reported by 33.1% (CI=30.6, 35.6); 29.6% (CI=27.2, 32.0) reported usual sustained intoxication of 3+ hours. Significant variability ($p<.001$) in these behaviors from ages 18 to 19/20 was observed. Significant decreases ($p<.05$) across historical time in 5+ and 10+ drinking were found. Four-year college students not residing with parents had significantly higher odds of moderate/high intoxication, binge drinking, and high-intensity drinking compared with other groups ($p<.001$).

Conclusions. Young adult underage binge drinking (5+ drinks on one occasion), high-intensity drinking (10+ and 15+ drinks), and intoxication are relatively common in the USA, and show meaningful variability across the transition out of high school. Four-year college students and those who do not live with their parents are more likely to engage in high-intensity drinking than their peers.

Key words: high-intensity drinking, extreme binge drinking, alcohol, intoxication, college, young adult, underage

INTRODUCTION

Underage alcohol use is a leading cause of morbidity and mortality worldwide [1, 2]. Underage alcohol use—particularly high-risk use—increases the probability of negative alcohol use consequences including severe injury, altered brain development, and death [3, 4]. In 2013, an estimated 29% of 18- to 20-year-olds in the U.S. reported having 5+ drinks in a row at least once during the past 30 days [5]. High-intensity drinking—sometimes called "extreme binge drinking"—is defined here as consuming two or three times the number of drinks captured by the typical 5+ binge drinking measure, i.e., 10+ or 15+ drinks in a row [6, 7]. High-intensity drinking is likely to increase intoxication to at least 4 times the legal limit of .08% BAC [8]. High-intensity drinking is beginning to be documented for young adults [8-10]. Data across 14 U.S. universities in 2003, for instance, showed that 8% of first-semester college women had 8+ drinks and 20% of men had 10+ drinks in a row in the past two weeks [11]. While there is a growing body of research suggesting high-intensity drinking is not uncommon during the transition to adulthood [9, 11, 12], national data are needed to address underage young adult high-intensity drinking among both those attending and those not attending college.

Another indicator of high-risk alcohol use is the usual level of perceived intoxication when drinking. Intoxication is clearly a risk for alcohol-related consequences but is subject to number of drinks, time-frame of consumption, and other factors such as developed tolerance to repeated alcohol use [13]. Research indicates low accuracy of estimating specific intoxication levels (e.g., BAC) while intoxicated [14]; yet, self-reported perceptions of usual drinking

patterns and alcohol use that result in high levels of intoxication provide additional information about young adult high-risk drinking patterns.

Stability and Change in High-Risk Drinking

Documenting the within-person stability and change in high-intensity drinking and intoxication during the transition out of high school, as well as the historical stability and change in prevalence of these behaviors, will provide important information about individual development and national rates of very high levels of alcohol use among underage young adults. Well-researched individual trajectories of alcohol use and binge drinking tend to show increased use from late adolescence through early young adulthood [15, 16]. Participation in high-intensity drinking and intoxication may follow this pattern, but the degree to which it actually persists, increases, or decreases immediately after high school has not been studied. Early alcohol initiation (prior to age 15) is associated with increased likelihood of both alcohol abuse and dependence from age 18 onwards [17], and may be associated with high-risk drinking after age 18.

Alcohol use among adolescents and young adults also varies as a function of historical cohort [18-20]. Despite recent overall declines in youth alcohol use [20], initial evidence suggests that very high-intensity drinking rates (15+ drinks) among high school students have remained unchanged for several years [9]. The extent of historical change in high-intensity drinking and intoxication among underage young adults in the U.S. has not yet been examined.

College Status

Seven out of ten high school graduates attend post-secondary education in the fall after high school [21]. While this massive migration to college campuses ultimately results in a great diversity of educational pathways [22], beginning college is generally associated with increased alcohol use [11, 23, 24]. However, there is conflicting evidence: some studies demonstrate little or no difference in overall drinking quantity [25, 26], whereas others find that those in college drink with greater quantity and frequency than noncollege peers [11, 23, 27]. In fact, college and noncollege differences in alcohol use may be larger than previously recognized because differences may be masked by selection effects for attending college [28]. Controls for such selection effects (e.g., parental education) are included as control variables in this study.

Nuanced aspects of college attendance (e.g. full-time vs. part-time; type of college) may be important when examining underage young adult alcohol use, rather than using a simple college attendance vs. non-attendance dichotomy [29]. Binge drinking in high school does not predict likelihood of college attendance, for instance, but does predict 4-year college graduation among those who attend [22]. In addition, living arrangements have been found to moderate the association between college attendance and substance use, with those living with parents having much lower alcohol use [30, 31], likely because young adults who move out of their parents' home generally move into living situations with other young adults who may support alcohol use [32]. The current study compares high-risk alcohol use behaviors across underage young adults engaged in full-time 2-year college, full-time 4-year college, part-time education, and no

postsecondary education, and considers living arrangements as a possible moderator of associations between college attendance and high-risk drinking.

Demographic Differences

There are known differences in alcohol use patterns by gender, race/ethnicity, and parent education. Men drink more in frequency and quantity than women [33]. White American and Hispanic American adults tend to have higher rates of alcohol disorders than Black Americans and Asian Americans [34, 35]. Parent education can be used as a proxy for socioeconomic status as it shows similar relationships with substance use as do wealth and income [36]. Among 12th graders, students with college-educated parents were more likely to report 5+ binge drinking but less likely to report 15+ high-intensity drinking [9]. This finding suggests that parent education has differential effects for adolescents at the highest levels of alcohol use but it is not known whether these differences persist into young adulthood.

Research Aims

Research aims were to estimate: (1) the prevalence of binge drinking (5+ drinks), high-intensity drinking (10+ and 15+ drinks), moderate/high intoxication, and sustained intoxication (3+ hours) among U.S. young adults age 19/20; (2) change in these behaviors across the transition out of high school and across historical time; and (3) associations between these behaviors and key covariates, including demographics (i.e., gender, race/ethnicity, parental education), college attendance (4-year, 2-year, part-time, or none), and living with parents.

METHODS

Sample

The study uses data from the Monitoring the Future (MTF) study [19], a national cohort-sequential study in which a representative sample of approximately 15,000 high school seniors (modal age 18) from about 130 schools is surveyed annually. Self-administered surveys are completed by students at school. A subsample of about 2,400 12th graders from all initially-included high schools is selected annually for longitudinal follow-up; substance users are oversampled, accounted for in weighted analyses. Using mailed questionnaires, a random half of the follow-up sample is surveyed in odd-numbered years (starting at modal age 19) and the other in even-numbered years (starting at modal age 20). (We explored the possibility of interactions between age and covariates. A total of 92 interaction terms were tested in regressions for the 5 outcomes; 16 were significant and only 1 resulted in estimates that were significant but in opposite directions. We therefore pool ages 19 and 20 in presented analyses.) The current study includes respondents in 12th-grade cohorts from 2005 through 2013 (earlier cohorts were not asked all alcohol-related behaviors used in the present analyses).

Alcohol-related outcomes used in the current analyses were included on one of six questionnaire forms (distributed randomly). A total of 3,408 high school seniors from the 2005-2013 cohorts responded to the questionnaire form containing the alcohol-related outcomes used in the current analyses and were selected for participation in the longitudinal study. Of these, 1,719 individuals (50.4%) responded to the follow-up survey at modal age 19/20. This response rate is considered to be typical for recent mail data collection efforts [37] and within expected

ranges for mean 2-year attrition rates in substance abuse prevention research [38]. Attrition from the study occurred primarily as a result of undeliverable or unreturned questionnaires. Eighteen individuals were excluded from these analyses because they were 21 years of age or older or were missing data to confirm age. An additional 44 respondents were missing data on the key age 18 binge and high-intensity covariates. Thus, the total analytical sample included 1,657 respondents. Adjustments for attrition are discussed in the Analysis section below.

Measures

Alcohol use. *Grade of alcohol initiation* was measured at age 18 with the question, "When (if ever) did you first do each of the following things? Try an alcoholic beverage—more than just a few sips?" (coded as before high school [grade 8 or below], during high school [grades 9-12], or high school abstainer [no lifetime alcohol use reported in grade 12]). Binge and high-intensity drinking were measured at ages 18 and 19/20. One item examined *binge drinking* ("During the last two weeks, how many times have you had…5 or more drinks in a row?" and two items examined *high-intensity drinking* ("During the last two weeks, how many times have you had…10 or more drinks in a row?; …15 or more drinks in a row?") Each measure was dichotomized as 0=none, 1=any. The dichotomous binge and high-intensity drinking measures also were combined into a categorical measure indicating whether respondents reported no binge drinking, having 5+ drinks (but not 10+), having 10+ (but not 15+), or having 15+ drinks in a row during the last two weeks. Two additional alcohol use behaviors were measured at age 19/20: *Moderate/high intoxication* was measured with the question, "When you drink alcoholic

beverages, how drunk or high do you usually get?" (coded as 0=not at all/a little; 1=moderately/very drunk). *Sustained intoxication* was assessed by asking, "How long do you usually stay drunk or high?" (coded as 0=two or fewer hours, or usually don't get drunk; 1=three or more hours).

Additional age 18 measures. Gender was coded as male or female. Self-identified race/ethnicity was coded as White, Black, Hispanic, or Other (combined due to sample size limitations). Parental education indicated whether at least one parent had graduated from college. Cohort indicated the year of the respondent's high school survey, coded as 2005-2006, 2007-2008, 2009-2010, or 2011-2013.

Additional age 19/20 measures. Modal age at follow-up indicated whether each respondent was randomly assigned to follow-up survey participation one year after high school (modal age 19, coded as 0) or two years after high school (modal age 20, coded as 1). College status combined information on (a) attending a 2- or 4-year college, and (b) attending full-time or less. The resulting categorical measure was coded as follows: attending full-time at a 4-year college, attending full-time at a 2-year college, attending part-time/other at any type of college, or not attending. Living with parents was coded as yes (1) or no (0).

Data Analysis

All analyses were conducted using SAS 13.2. The relationship between age 18 and 19/20 categorical binge and high-intensity drinking was examined using PROC FREQ. Bivariate and multivariable models regressing a single age 19/20 alcohol use behavior on covariate(s) were

estimated using PROC LOGISTIC. All analyses were weighted using attrition weights,

calculated as the inverse of the probability of participation [39] and based on the following

covariates measured at modal age 18: gender, race/ethnicity, college plans, high school grades,

number of parents in the home, religiosity, parental education, alcohol use, cigarette use,

marijuana use, region, cohort, and the sampling weight accounting for over-sampling of

substance users. Previous research has indicated that while the effects of attrition within the MTF

panel data are statistically significant, they are small in magnitude [15]. Missing data on

covariates were modeled by coding all covariates as categorical with a separate category

identifying cases with missing data. Analyses then included all possible cases by including

missing data indicators.

RESULTS

Prevalence of Underage Young Adult High-Risk Alcohol Use Behaviors (Aim 1)

Descriptive statistics for all covariates and high-risk underage young adult drinking

outcomes are presented in Table 1. One-quarter of 19/20-year-old respondents (24.2%) reported

binge drinking in the past two weeks. High-intensity drinking among underage young adults was

reported by 10.3% for 10+ drinks and by 4.2% for 15+ drinks in a row in the past two weeks.

One-third (33.1%) of 19/20-year-olds reported usual moderate/high intoxication and 29.6%

reported usual sustained intoxication.

Stability and Change in High-Risk Drinking (Aim 2)

Change across the transition out of high school. Meaningful change occurred in levels of binge and high-intensity drinking between ages 18 and 19/20 (Table 2). Among those who reported 5+ (but not 10+) drinking in high school, 23.5% reported high-intensity drinking at age 19/20; among high school non-bingers, 5.4% reported high-intensity drinking at age 19/20. High-intensity drinkers at age 18 were more likely to be high-intensity drinkers at age 19/20, although less than half persisted: 34.5% of 10+ (but not 15+) high school drinkers and 48.4% of 15+ high school drinkers remained high-intensity drinkers at age 19/20.

Weighted cell percentages (Table 3) and bivariate and multivariable logistic regression analyses (Tables 4-5) indicate that grade of alcohol initiation was a significant predictor of all age 19/20 high-risk alcohol use behaviors. High school abstainers had lower odds of all alcohol use behaviors at 19/20. (Of high school abstainers, none went on to report 15+ drinks.) Initiation prior to (versus during) high school predicted greater odds of binge and high-intensity drinking at age 19/20, but did not predict intoxication variables.

High school 5+ drinking (versus no binge drinking) was associated with higher odds of all age 19/20 alcohol behaviors (see Tables 3-5). Reporting 10+ (vs. 5+) drinking at age 18 was associated with higher odds of reporting both 10+ and 15+ drinking at age 19/20, but did not predict differences in 5+ drinking or intoxication. Reporting 15+ (vs. 5+) drinking at age 18 was associated at age 19/20 with significantly *higher* odds of both 10+ and 15+ drinking and *lower* odds of moderate/high intoxication (no significant differences in 5+ drinking or sustained intoxication were observed).

Historical changes from 2005-2013. Historical decreases in 5+ drinking (from 28.0% in 2005-2006 to 20.9% in 2011-2013) and 10+ high-intensity drinking (from 12.2% to 8.5%) were found, but there were no such declines for 15+ drinks, moderate/high intoxication, or sustained intoxication. Multivariable models (Tables 4-5) found that the decreases in 5+ and 10+ drinking across the 2005-2013 cohorts were significant (and confirmed no significant changes for 15+ drinking or intoxication).

Demographics, College Status, and Living with Parents (Aim 3)

Demographic differences. Tables 4-5 show that age at first follow-up was not significantly related to high-intensity (10+, 15+) or intoxication outcomes. Individuals who were age 20 (vs. 19) at follow-up were significantly more likely to report 5+ drinking in bivariate and multivariable models. Men had greater odds of 5+, 10+, and 15+ drinking in bivariate and multivariable models, but there were no significant gender differences in intoxication. In multivariable models, compared to Whites, Blacks had lower odds for 5+ drinks and moderate/high intoxication; Hispanic young adults had lower odds of intoxication intensity and duration. For high-intensity (10+ and 15+) drinking, all non-White respondents were collapsed into a single group due to very low prevalence. Whites had greater odds of high-intensity drinking, although differences were not significant in the 15+ multivariable model. Higher parental education was associated with greater odds of binge drinking and moderate/high intoxication in bivariate models only. Higher parental education was associated with lower odds of 15+ drinks in the multivariable model.

College attendance and living arrangements. Tables 4-5 show that in multivariable models, 4-year students had greater odds of reporting 5+, 10+, and 15+ drinks, compared to non-attenders and 2-year students, but not compared to those attending part-time/other. Regarding intoxication, 4-year college students had: (a) greater odds than those not attending college of reporting moderate/high and sustained intoxication; (b) greater odds than 2-year college students of moderate/high but not sustained intoxication; and (c) greater odds than part-time/other students of reporting sustained intoxication but not moderate/high intoxication. At age 19/20, young adults who lived with their parents had significantly lower odds of all alcohol use behaviors than those who did not reside with parents.

Interactions between college status and living arrangements were tested by including an indicator of 4-year college student status, an indicator of living with parents, and an interaction of the two terms; all prior alcohol use and demographic covariates were also included. Significant interactions were observed for three of the five outcomes, shown in Table 6: 5+ drinks (p=.0002), 10+ drinks (p=.0433), and moderate/high intoxication (p=.0054). All three behaviors were significantly more prevalent among 4-year college students who did not live with their parents, compared to all other groups.

DISCUSSION

In this sample of U.S. young adults under the legal drinking age of 21, high-risk alcohol use was relatively common: 24% reported having 5+ drinks, 10% reported having 10+ drinks, and 4% reported having 15+ drinks in a row in the past two weeks. Approximately one-third

reported moderate/high or sustained intoxication. However, the vast majority—three-quarters of 19/20 year-olds in the U.S.—did not report high-risk drinking. These drinking levels were comparable to behavior reported by high school students [9], although there was meaningful variability in high-intensity drinking across the transition out of high school.

Variability in binge and high-intensity drinking across the transition out of high school was high, with less than half of high school high-intensity drinkers reporting high-intensity drinking at age 19/20. Despite instability in reported behaviors across the transition out of high school, binge and high-intensity drinking at age 18 were reliable predictors of age 19/20 high-risk drinking. Contrary to expectations, 15+ high school drinkers were less likely to report moderate/high intoxication at 19/20; this warrants replication and could represent desistance, higher alcohol tolerance, or altered interpretation of drunkenness over time. Delaying alcohol use initiation until at least after high school was associated with dramatic reductions in high-risk alcohol use at age 19/20, similar to previous research on early alcohol use initiation (pre-high-school) and adult alcohol abuse and dependence [40]. Our results suggest early intervention to delay alcohol initiation and specific intervention to guide the transition out of high school may be especially well-situated.

College students are known to experience clinically significant consequences of alcohol dependence, and their noncollege peers are at particular risk for longer-term consequences [26, 41]. In this study, full-time 4-year college students were most likely to engage in alcohol use (29% reported 5+, 12% reported 10+, and 5% reported 15+ drinks). Full-time 2-year college

attenders were at lower risk (18% reported 5+, 8% reported 10+, and 3% reported 15+ drinks); non-attenders and part-time attenders fell in between. Living situation moderated the effect of college status on alcohol use (see also [30, 31]). Full-time 4-year college students not living with parents reported the highest rates of alcohol use (34% reported 5+ and 14% 10+ drinking; 43% reported moderate/high intoxication), supporting the hypotheses that living among peers is a driving factor for elevated drinking among college students [32, 42]. This builds on evidence that alcohol use among college students is significantly associated with both direct (i.e., offers to drink) and indirect (i.e., social modeling and descriptive norms) social influences [43, 44]. Research into possible additional differences between college students who do and do not reside with their parents is also warranted.

This present study is the first to assess potential historical changes in high-intensity drinking among underage young adults in the U.S. We found a non-linear decrease in 5+ and 10+ drinking among 19/20 year-olds, comparing high school cohorts of 2011-2013 to 2005-2006. No historical change was found in 15+ drinking, moderate/high intoxication, or sustained intoxication among underage young adults. This suggests that very high risk alcohol use among underage young adults is an enduring public health issue.

Prevalence of alcohol use behaviors varied based on key demographic indicators. Similar to previous research on gender differences [33], men were more likely to report high-intensity drinking. White young adults were more likely to engage in high-intensity use, extending previous work on racial/ethnic differences in alcohol use [34, 35]. Bivariate results replicated

research finding more binge drinking among those with college-educated parents [9, 36], although this was not significant after controlling for previous alcohol use and college attendance. Results also replicated evidence that 15+ high-intensity drinking was associated with lower parental education [9], suggesting a different risk profile for the most extreme alcohol use.

Limitations and Future Directions

Study limitations included the exclusion of high school drop-outs and the inability to examine high-intensity drinking for all race/ethnicity categories due to sample size. In addition, measurement limitations included that (1) high-intensity drinking was not assessed with gender-specific cut-offs, (2) information was not available regarding over what time period the drinking occurred, (3) the time period for binge and high-intensity drinking was limited to the past two weeks, and (4) all data were self-reported. These limitations notwithstanding, the current analyses provide previously missing data on high-risk alcohol use—including high-intensity drinking and intoxication—among underage young adults who do and do not attend college. Longitudinal data controlling for high school alcohol initiation and level of use document that 4-year college attendance and not living with parents are associated with particularly intense alcohol use. Future research should continue to examine high-intensity drinking among underage young adults with a focus on the stability and change in these behaviors across the transition out of high school.

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Table 1. Descriptive Statistics for Covariates and Underage Young Adult Alcohol Use Behaviors

	%[a]	(n)[b]	95% CI
Age 18 Measures			
Male	48.6	(705)	45.9, 51.3
Race/ethnicity			
White	62.0	(1163)	59.3, 64.7
Black	9.1	(110)	7.3, 10.8
Hispanic	15.4	(189)	13.3, 17.6
Asian/other	11.5	(172)	9.8, 13.3
Missing indicator[c]	1.9	(23)	1.0, 2.8
Parental education			
College degree	51.3	(916)	48.6, 54.0
Missing indicator	4.6	(56)	3.3, 6.0
Cohort			
2005-2006	23.6	(402)	21.4, 25.8
2007-2008	24.8	(453)	22.6, 27.0
2009-2010	23.1	(372)	20.8, 25.4
2011-2013	28.6	(430)	26.0, 31.1
Alcohol use initiation			
Before high school	20.4	(360)	18.2, 22.5
During high school	49.3	(806)	46.6, 52.0
High school abstainer	22.7	(385)	20.6, 24.9
Missing indicator	7.6	(106)	6.0, 9.1
Binge and high-intensity drinking in past 2 weeks			
No binge drinking	81.3	(1304)	79.2, 83.4
5+ drinks (but not 10+)	10.1	(179)	8.4, 11.7
10+ drinks (but not 15+)	4.0	(81)	3.0, 4.9
15+ drinks	4.7	(93)	3.6, 5.7
Age 19/20 Measures			
Age			
19	56.2	(913)	53.6, 58.9
20	43.8	(744)	41.1, 46.4
College status			
Not attending	26.9	(409)	24.4, 29.4
Part-time/other	11.3	(157)	9.4, 13.1
2-year college (full-time)	18.5	(296)	16.4, 20.6

4-year college (full-time)	41.4	(772)	38.9, 44.0
Missing indicator	1.9	(23)	1.0, 2.7
Living with parents			
Yes	51.7	(797)	49.0, 54.3
Missing indicator	0.5	(7)	0.1, 0.8

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In past 2 weeks, number of drinks in a row:

5+	24.2	(424)	22.0, 26.5
10+	10.3	(185)	8.7, 11.9
15+	4.2	(78)	3.1, 5.2

When drink, usually get:

Moderately/very drunk (moderate/high intoxication)	33.1	(579)	30.6, 35.6
Drunk for 3+ hours (sustained intoxication)	29.6	(527)	27.2, 32.0

Notes: Total N (unweighted) for all measures other than age 19/20 alcohol use outcomes = 1,657; for age 19/20 alcohol use outcomes = 1,605 five or more drinks in a row; 1,608 for both 10 and 15 or more drinks in a row; 1,603 usually get moderately/very high; 1,600 usually get high for 3+ hours. Missing data on covariates modeled with missing data indicators as shown.

[a]Weighted percentage.

[b]Unweighted n per cell.

[c]Missing indicators identify the percentage of the sample with missing data on the noted measure; these cases were included in relational analyses by use of a separate categorical indicator.

Table 2. Associations between Age 18 and Age 19/20 Past Two-Week Binge and High-Intensity Drinking

	% Reporting Each Level of Drinking at Age 19/20:								
	No binge		5+ (but not 10+)		10+ (but not 15+)		15+		p[b]
	%	(n)[a]	%	(n)	%	(n)	%	(n)	
Reported level of drinking at age 18:									<.001
No binge drinking	83.2	(1042)	11.3	(150)	3.9	(54)	1.5	(20)	
5+ (but not 10+)	45.6	(77)	30.8	(56)	17.0	(29)	6.5	(12)	
10+ (but not 15+)	38.6	(27)	26.9	(22)	10.0	(11)	24.5	(18)	
15+	40.0	(34)	11.6	(12)	19.7	(14)	28.7	(28)	

Notes: Total N (unweighted) = 1,606.
[a]Unweighted n per cell.
[b]Significance of chi-square test.

Table 3. Percentages of Respondents Reporting High-Risk Underage Alcohol Use at Modal Age 19/20 by Covariates

	Number of drinks in a row (past 2 weeks):						When drink, usually:			
							Moderate/High Intoxication		Sustained Intoxication	
	5+		10+		15+					
	%	(n)[a]	%	(n)	%	(n)	%	(n)	%	(n)
Age 18 measures										
Gender										
Female	20.4	(211)	5.4	(63)	1.3	(20)	31.3	(320)	27.8	(290)
Male	28.3	(213)	15.7	(122)	7.3	(58)	35.1	(259)	31.5	(237)
Race/ethnicity										
White	28.3	(340)	12.8	(151)	5.2	(66)	38.0	(454)	34.9	(420)
Black	6.2	(8)	--	--	--	--	20.1	(22)	13.9	(17)
Hispanic[b]	19.0	(37)	--	--	--	--	21.1	(42)	17.4	(34)
Asian/Other	24.0	(36)	--	--	--	--	33.1	(53)	29.8	(49)
Black/Hispanic/Asian/Other[c]	--	--	6.4	(34)	2.5	(12)	--	--	--	--
Parental education										
No college degree	22.2	(165)	10.1	(74)	4.3	(33)	31.3	(232)	28.5	(214)
College degree	25.9	(245)	11.2	(109)	4.2	(44)	35.8	(334)	31.2	(299)
Cohort										
2005-2006	28.0	(114)	12.2	(51)	4.0	(17)	34.9	(151)	29.7	(129)
2007-2008	25.4	(123)	11.1	(57)	3.8	(21)	32.5	(152)	31.0	(148)
2009-2010	23.2	(91)	9.8	(39)	5.0	(22)	30.3	(119)	31.0	(123)
2011-2013	20.9	(96)	8.5	(38)	4.0	(18)	34.6	(157)	27.2	(127)
Alcohol use initiation										
Before high school	36.4	(137)	21.1	(80)	10.5	(41)	42.5	(166)	40.0	(162)
During high school	29.6	(248)	11.2	(96)	4.0	(36)	42.5	(353)	37.1	(309)
High school abstainer	6.1	(24)	0.9	(4)	0.0	(0)	10.1	(41)	8.1	(34)
Heavy and high-intensity drinking at age 18										
No binge drinking	16.8	(224)	5.4	(73)	1.5	(20)	25.6	(349)	23.6	(321)
5+ (but not 10+)	53.9	(95)	23.0	(41)	6.4	(12)	69.7	(124)	52.8	(107)
10+ (but not 15+)	61.5	(51)	34.5	(29)	24.5	(18)	67.9	(53)	61.6	(47)
15+ drinks	60.0	(54)	48.4	(42)	28.7	(28)	56.2	(53)	58.9	(52)
Age 19/20 measures										
Age										
19	20.8	(208)	9.4	(97)	3.6	(40)	32.2	(321)	28.8	(291)
20	28.7	(216)	11.6	(88)	4.9	(38)	34.4	(258)	30.6	(236)
College status										

Not attending	21.5	(91)	9.0	(41)	3.5	(17)	32.0	(141)	28.1	(128)
Part-time/other	22.9	(39)	10.9	(18)	4.6	(8)	29.2	(50)	21.8	(40)
Full-time (2-year college)	18.4	(60)	7.6	(26)	3.0	(11)	27.5	(89)	27.0	(84)
Full-time (4-year college)	29.3	(231)	12.4	(98)	5.1	(41)	38.1	(297)	34.6	(274)
Living with parents										
No	30.6	(266)	12.9	(117)	5.5	(52)	38.9	(342)	36.3	(321)
Yes	18.3	(157)	7.8	(67)	3.0	(26)	27.7	(236)	23.4	(205)

Notes: Total N (unweighted): moderate/high intoxication = 1,603; sustained intoxication = 1,600; 5+ drinks = 1,605; 10+ drinks = 1,608; 15+ drinks = 1,608. Data indicate the weighted percentage of cases in each specified covariate category that report the specific outcome. Missing data on non-outcome measures handled with the use of missing data indicators (percentages for missing data indicators not shown).
[a]Unweighted *n* per cell.
[b]Percentages estimated separately for Black, Hispanic, and Asian/Other subgroups for all outcomes other than 10+ and 15+ drinks in a row.
[c]Due to very low prevalence for 10+ and 15+ drinks in a row for racial/ethnic subgroups other than Whites, percentages estimated for non-white subgroups combined.

Table 4. Associations between Covariates and Underage Binge and High-Intensity Alcohol Use at Modal Age 19/20

	In Past Two Weeks, Number of Drinks in a Row:					
	5 or more		10 or more		15 or more	
	OR[a] (95% CI) p	AOR[b] (95% CI) p	OR (95% CI) p	AOR (95% CI) p	OR (95% CI) p	AOR (95% CI) p
Age 18 measures						
Gender						
Female	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Male	1.54 (1.29, 1.84) <.001	1.38 (1.13, 1.69) 0.002	3.27 (2.49, 4.30) <.001	2.88 (2.12, 3.89) <.001	6.02 (3.63, 9.98) <.001	4.63 (2.68, 8.00) <.001
Race/ethnicity						
White	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Black[c]	0.17 (0.10, 0.29) <.001	0.32 (0.18, 0.57) 0.000	--	--	--	--
Hispanic[c]	0.60 (0.46, 0.78) 0.000	0.77 (0.56, 1.05) 0.093	--	--	--	--
Asian/Other[c]	0.80 (0.60, 1.06) 0.118	1.03 (0.75, 1.41) 0.867	--	--	--	--
B/H/A/O[d]	--	--	0.48 (0.36, 0.64) <.001	0.67 (0.48, 0.94) 0.021	0.48 (0.31, 0.76) 0.002	0.68 (0.40, 1.15) 0.147
Parental education (college degree)						
No degree	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Degree	1.23 (1.03, 1.48) 0.025	0.99 (0.80, 1.23) 0.906	1.13 (0.88, 1.45) 0.356	0.83 (0.62, 1.12) 0.220	0.97 (0.66, 1.42) 0.875	0.56 (0.35, 0.88) 0.013
Cohort						
2005-2006	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
2007-2008	0.88 (0.69, 1.12) 0.290	0.81 (0.61, 1.07) 0.132	0.90 (0.64, 1.26) 0.533	0.81 (0.55, 1.19) 0.285	0.94 (0.54, 1.65) 0.829	1.05 (0.55, 2.01) 0.874
2009-2010	0.78 (0.60, 1.00) 0.048	0.78 (0.58, 1.03) 0.080	0.79 (0.55, 1.11) 0.175	0.73 (0.49, 1.08) 0.112	1.26 (0.74, 2.14) 0.389	1.60 (0.86, 2.97) 0.135
2011-2013	0.68 (0.53, 0.87) 0.002	0.73 (0.55, 0.97) 0.030	0.67 (0.48, 0.95) 0.025	0.62 (0.41, 0.93) 0.021	1.00 (0.59, 1.70) 0.994	1.07 (0.56, 2.01) 0.846
Alcohol use initiation						
During HS[e]	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Before HS	1.36 (1.11, 1.68) 0.004	1.37 (1.08, 1.74) 0.009	2.11 (1.62, 2.76) <.001	2.02 (1.49, 2.74) <.001	4.24 (2.89, 6.22) <.001	3.60 (2.28, 5.67) <.001

HS abstainer	0.16 (0.11, 0.22) <.001	0.23 (0.16, 0.33) <.001	0.07 (0.03, 0.17) <.001	0.13 (0.06, 0.30) <.001	--[f]	--
Heavy and high-intensity drinking at age 18						
5+ (but not 10+)	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
No binge	0.17 (0.13, 0.22) <.001	0.23 (0.17, 0.31) <.001	0.19 (0.14, 0.27) <.001	0.27 (0.19, 0.38) <.001	0.23 (0.13, 0.41) <.001	0.28 (0.15, 0.52) <.001
10+ (but not 15+)	1.36 (0.87, 2.14) 0.180	1.39 (0.86, 2.25) 0.175	1.76 (1.09, 2.85) 0.021	1.80 (1.07, 3.03) 0.028	4.76 (2.49, 9.10) <.001	6.01 (2.95, 12.25) <.001
15+ drinks	1.28 (0.83, 1.98) 0.260	1.23 (0.78, 1.96) 0.375	3.14 (2.00, 4.92) <.001	2.52 (1.53, 4.14) 0.000	5.91 (3.18, 10.95) <.001	4.71 (2.37, 9.34) <.001
<u>Age 19/20 measures</u>						
Age						
19	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
20	1.53 (1.29, 1.83) <.001	1.48 (1.21, 1.81) 0.000	1.27 (0.99, 1.62) 0.061	1.11 (0.83, 1.47) 0.485	1.38 (0.95, 2.00) 0.094	1.19 (0.78, 1.84) 0.424
College status						
Not attending	0.66 (0.53, 0.82) 0.000	0.57 (0.44, 0.75) <.001	0.70 (0.51, 0.95) 0.022	0.52 (0.36, 0.76) 0.001	0.68 (0.43, 1.10) 0.114	0.42 (0.24, 0.75) 0.004
PT[g]/other	0.72 (0.53, 0.96) 0.028	0.85 (0.60, 1.22) 0.383	0.86 (0.58, 1.29) 0.474	0.92 (0.57, 1.49) 0.724	0.89 (0.49, 1.63) 0.711	0.81 (0.40, 1.68) 0.578
2-yr FT[h]	0.55 (0.42, 0.71) <.001	0.56 (0.41, 0.77) 0.000	0.58 (0.40, 0.84) 0.004	0.50 (0.32, 0.79) 0.003	0.57 (0.32, 1.01) 0.054	0.36 (0.18, 0.73) 0.005
4-yr FT[i]	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Living with parents						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	0.51 (0.43, 0.61) <.001	0.62 (0.49, 0.77) <.001	0.57 (0.45, 0.74) <.001	0.66 (0.48, 0.91) 0.010	0.53 (0.36, 0.79) 0.002	0.53 (0.33, 0.85) 0.008

Notes. Total N (unweighted): 5+ drinks = 1,605; 10+ drinks = 1,608; 15+ drinks = 1,608. Missing data on non-outcome measures handled with the use of missing data indicators. Bivariate and adjusted odds ratios for missing data indicators not shown.

[a]OR = Bivariate odds ratio.

[b]AOR = Adjusted odds ratio obtained from models simultaneously including all listed covariates.

[c]Odds ratios estimated separately for Black, Hispanic, and Asian/Other subgroups (in comparison with White) for all outcomes other than 10+ and 15+ drinks in a row.

[d]B/H/A/O = Black, Hispanic, and Asian/Other subgroups combined. Due to very low prevalence for 10+ and 15+ drinks in a row for racial/ethnic subgroups

[e]HS = High school.

[f]No individuals who reported being high school abstainers went on to report 15+ drinks at age 19/20; thus, estimates for this association are not available.

Other than Whites, odds ratios estimated for non-white subgroups combined in comparison with White.

[g]PT = Part-time.

[h]2-yr FT = Full-time at 2-year college.

[i]4-yr FU = Full-time at 4-year college.

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Table 5. Associations between Covariates and Underage Usual Perceived Intoxication at Modal Age 19/20

	Moderate/High Intoxication		Sustained Intoxication	
	OR[a] (95% CI) p	AOR[b] (95% CI) p	OR (95% CI) p	AOR (95% CI) p
Age 18 measures				
Gender				
Female	(ref)	(ref)	(ref)	(ref)
Male	1.19 (1.01, 1.39) 0.034	1.12 (0.93, 1.35) 0.220	1.20 (1.01, 1.41) 0.033	1.12 (0.93, 1.35) 0.231
Race/ethnicity				
White	(ref)	(ref)	(ref)	(ref)
Black	0.41 (0.30, 0.57) <.001	0.75 (0.52, 1.07) 0.115	0.30 (0.21, 0.44) <.001	0.51 (0.34, 0.77) 0.001
Hispanic	0.44 (0.34, 0.56) <.001	0.49 (0.37, 0.66) <.001	0.40 (0.30, 0.52) <.001	0.47 (0.35, 0.63) <.001
Asian/Other	0.81 (0.63, 1.05) 0.106	0.98 (0.74, 1.31) 0.912	0.79 (0.61, 1.03) 0.087	0.95 (0.71, 1.26) 0.706
Parental education				
No college degree	(ref)	(ref)	(ref)	(ref)
College degree	1.22 (1.04, 1.44) 0.016	1.01 (0.83, 1.22) 0.926	1.14 (0.96, 1.35) 0.130	0.90 (0.74, 1.10) 0.308
Cohort				
2005-2006	(ref)	(ref)	(ref)	(ref)
2007-2008	0.90 (0.72, 1.13) 0.359	0.82 (0.64, 1.06) 0.133	1.06 (0.84, 1.34) 0.631	1.04 (0.80, 1.34) 0.771
2009-2010	0.81 (0.64, 1.02) 0.078	0.83 (0.64, 1.07) 0.149	1.06 (0.84, 1.35) 0.614	1.19 (0.91, 1.54) 0.199
2011-2013	0.99 (0.79, 1.23) 0.916	1.13 (0.88, 1.45) 0.338	0.88 (0.70, 1.11) 0.287	1.04 (0.80, 1.35) 0.766
Alcohol use initiation				
During high school	(ref)	(ref)	(ref)	(ref)
Before high school	1.00 (0.82, 1.22) 0.995	1.01 (0.81, 1.25) 0.955	1.13 (0.92, 1.39) 0.234	1.15 (0.92, 1.43) 0.221
High school abstainer	0.15 (0.12, 0.20) <.001	0.20 (0.15, 0.26) <.001	0.15 (0.11, 0.20) <.001	0.18 (0.13, 0.25) <.001
Heavy and high-intensity drinking at age 18				

5+ (but not 10+)	(ref)	(ref)	(ref)	(ref)
No binge drinking	0.15 (0.11, 0.20) <.001	0.19 (0.15, 0.26) <.001	0.28 (0.21, 0.36) <.001	0.39 (0.29, 0.51) <.001
10+ (but not 15+)	0.92 (0.57, 1.48) 0.723	0.86 (0.52, 1.41) 0.553	1.43 (0.91, 2.25) 0.120	1.44 (0.89, 2.31) 0.136
15+ drinks	0.56 (0.36, 0.87) 0.010	0.50 (0.32, 0.80) 0.004	1.28 (0.83, 1.98) 0.262	1.17 (0.74, 1.85) 0.499
Age 19/20 measures				
Age				
19	(ref)	(ref)	(ref)	(ref)
20	1.10 (0.94, 1.30) 0.231	1.10 (0.92, 1.32) 0.305	1.09 (0.92, 1.28) 0.317	1.04 (0.87, 1.26) 0.648
College status				
Not attending	0.77 (0.63, 0.93) 0.007	0.70 (0.55, 0.88) 0.003	0.74 (0.61, 0.91) 0.004	0.68 (0.53, 0.86) 0.002
Part-time/other	0.67 (0.51, 0.88) 0.004	0.74 (0.53, 1.03) 0.073	0.53 (0.39, 0.71) <.001	0.61 (0.43, 0.85) 0.004
Full-time (2-year college)	0.62 (0.49, 0.78) <.001	0.65 (0.49, 0.85) 0.002	0.70 (0.56, 0.88) 0.003	0.78 (0.59, 1.03) 0.074
Full-time (4-year college)	(ref)	(ref)	(ref)	(ref)
Living with parents				
No	(ref)	(ref)	(ref)	(ref)
Yes	0.60 (0.51, 0.70) <.001	0.77 (0.63, 0.94) 0.011	0.53 (0.45, 0.63) <.001	0.67 (0.55, 0.83) 0.000

Notes. Total N (unweighted): moderate/high intoxication = 1,603; sustained intoxication = 1,600. Missing data on non-outcome measures handled with the use of missing data indicators. Bivariate and adjusted odds ratios for missing data indicators not shown.

[a]OR = Bivariate odds ratio.

[b]AOR = Adjusted odds ratio obtained from models simultaneously including all listed covariates.

Table 6: Associations between Combined College Status and Living Arrangements Situations and Underage High-Risk Alcohol Use at Modal Age 19/20

Living with parents	4-year college full-time	%[a]	(n)[b]	AOR[c] (95% CI)	p
5+ Drinks in a row in past 2 weeks					
No	Yes	34.0	196	(ref)	
Yes	Yes	16.0	35	0.34 (0.23, 0.51)	<.001
Yes	No	19.2	121	0.38 (0.30, 0.49)	<.001
No	No	24.2	68	0.42 (0.31, 0.57)	<.001
10+ Drinks in a row in past 2 weeks					
No	Yes	14.1	83	(ref)	
Yes	Yes	7.5	15	0.42 (0.24, 0.73)	0.002
Yes	No	8.1	52	0.39 (0.28, 0.56)	<.001
No	No	10.6	32	0.42 (0.28, 0.65)	<.001
Usual Moderate/High Intoxication					
No	Yes	42.5	243	(ref)	
Yes	Yes	25.9	54	0.53 (0.38, 0.74)	<.001
Yes	No	28.8	181	0.53 (0.42, 0.66)	<.001
No	No	32.7	98	0.53 (0.41, 0.70)	<.001

Notes: Total N (unweighted): moderate/high intoxication = 1,603; 5+ drinks = 1,605; 10+ drinks = 1,608. Only associations that were indicated by significant college status x living arrangement interaction terms shown. Missing data on non-outcome measures handled with the use of missing data indicators. Adjusted odds ratios for missing data indicators not shown.
[a]Unadjusted percentages.
[b]Unweighted n per cell.
[c]AOR = Adjusted odds ratio obtained from models simultaneously including covariates measured at modal age 18 and 19/20.