

# Prevalence of High-Intensity Drinking from Adolescence through Young Adulthood: National Data from 2016-2017

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**ABSTRACT:** High-intensity drinking (HID; ie, having 10+ drinks in a row) is a recognized public health concern due to the individual and public risks (eg, alcohol-related injuries, alcohol poisoning, memory loss, sexual risk) associated with consumption of a large quantity of alcohol over a relatively short time period. Using nationally representative samples of US 8th, 10th, and 12th grade students, and follow-up of subsamples of 12th graders, we present overall and sex-specific prevalence estimates of past 2-week HID from 29966 individuals at the modal ages of 14 to 30 in 2016-2017. Similar data for the more commonly studied measure of binge drinking (having 5+ drinks in a row) is provided for comparison. HID prevalence ranged from 1% to 11.5% and was significantly higher for males than females at all ages other than modal age 14 (8th grade). Binge drinking prevalence ranged from 3.5% to 32.5%; males reported a higher prevalence than females at approximately half of the ages examined. Peak binge drinking and HID age for males was earlier (modal age 21/22) than that for females (modal age 21-24 for binge drinking and 25/26 for HID). The observed rapid increase in HID from adolescence through the early to mid-20s highlights the importance of prevention and intervention efforts targeted to these ages.

**KEYWORDS:** Binge drinking, high-intensity drinking, adolescent, young adult, alcohol, sex, gender

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## Introduction

High-intensity drinking (HID), generally defined as the consumption of 10 or more drinks in a row during a single drinking occasion,<sup>1</sup> has been acknowledged as a high public health priority<sup>2</sup> due to the associated individual and public risks (eg, alcohol-related injuries, alcohol poisoning, memory loss, sexual risk).<sup>3</sup> In studies that report prevalence, HID increases sharply across late adolescence,<sup>4-7</sup> peaks during the early 20s,<sup>8-11</sup> and then decreases through adulthood.<sup>8-11</sup> Physiological and social changes associated with adolescence may differentially affect males and females regarding progression to high-risk alcohol use, with males at higher risk.<sup>12</sup> Sex differences in HID at specific ages have been documented during adolescence<sup>4-7,10,13</sup> and adulthood,<sup>9,10,11,14</sup> but these differences have been reported for different ages during different years. Alcohol use behaviors (including HID) are subject to historical variation<sup>4-6,10,11,13,14</sup> due to social trends and policy changes.<sup>15-17</sup> The extent to which sex differences in HID are consistent across age has not been examined. Using consistent measurement of individuals surveyed from mid-adolescence through young adulthood in a national US study,<sup>6,11</sup> this short report examines (1) overall prevalence estimates of HID by age in 2016-2017, (2) age-specific prevalence estimates by sex, and (3) similar data for the more common measure of binge drinking (5+ drinks in a row) for comparison.

## Methods

### *Data collection and participants*

The Monitoring the Future study (MTF; approved by the University of Michigan Institutional Review Board)<sup>6,11</sup> collected the 2016 and 2017 data from cross-sectional samples of US 8th, 10th, and 12th graders (approximately 33 600, 29 400, and 26 000, respectively) with classroom-administered questionnaires across about 250 schools per grade. The average student response rates for the 8th, 10th, and 12th grades (at modal ages 14, 16, and 18) were 89.5%, 87.5%, and 81.5%, respectively. The question on HID was asked of a random one-third of students in each grade; these students also answered the question on binge drinking.

Since 1976, approximately 2400 12th graders have been selected for longitudinal follow-up each year (8th/10th grade students are not followed longitudinally), with half surveyed 1 year and half surveyed 2 years after 12th grade. They are surveyed biennially to age 30, resulting in 6 follow-up surveys at modal ages 19/20, 21/22, 23/24, 25/26, 27/28, and 29/30. Follow-up questionnaires were mailed in the spring with a modest monetary incentive. A random one-third of the follow-up sample (approximately 1500 respondents at each of the 6 modal ages in 2016-2017) were asked about HID, with an average response rate across the 6 age groups of 38.0% (range: 34.3%-43.1%) in 2016-2017. Of the 33 279



**Table 1.** Prevalence of high-intensity and binge drinking among US adolescents and young adults, 2016-2017.

MODAL AGE	N (TOTAL)	OVERALL		MALES		FEMALES		P <sup>a</sup>
		PERCENTAGE	(95% CI)	PERCENTAGE	(95% CI)	PERCENTAGE	(95% CI)	
<i>High-intensity drinking<sup>b</sup></i>								
14	9872	1.0	(0.8, 1.3)	1.1	(0.8, 1.5)	1.0	(0.7, 1.3)	.4486
16	8875	3.2	(2.7, 3.8)	3.8	(3.0, 4.5)	2.7	(2.1, 3.3)	.0127
18	7595	5.4	(4.7, 6.2)	7.7	(6.4, 9.0)	3.3	(2.7, 4.0)	<.0001
19/20	497	6.7	(4.4, 8.9)	10.5	(6.1, 14.9)	3.5	(1.6, 5.3)	.0007
21/22	543	11.5	(8.3, 14.8)	17.0	(11.2, 22.9)	6.2	(3.6, 8.9)	.0001
23/24	600	8.9	(6.5, 11.3)	12.3	(8.2, 16.3)	5.6	(3.0, 8.3)	.0067
25/26	583	10.5	(7.7, 13.3)	14.5	(9.2, 19.7)	7.1	(4.4, 9.7)	.0062
27/28	637	9.1	(6.6, 11.6)	12.7	(8.2, 17.1)	5.8	(3.3, 8.3)	.0049
29/30	571	9.0	(6.3, 11.7)	12.7	(8.2, 17.2)	6.0	(2.7, 9.2)	.0197
<i>Binge drinking<sup>c</sup></i>								
14	9831	3.6	(3.1, 4.0)	3.5	(2.8, 4.1)	3.6	(3.0, 4.3)	.6755
16	8781	9.7	(8.7, 10.7)	9.2	(8.1, 10.3)	10.2	(8.9, 11.5)	.2085
18	7483	14.0	(12.6, 15.4)	16.4	(14.5, 18.2)	11.8	(10.4, 13.3)	<.0001
19/20	492	19.3	(15.4, 23.1)	22.1	(15.6, 28.6)	16.8	(12.5, 21.2)	.1738
21/22	537	32.5	(27.9, 37.1)	38.3	(30.9, 45.7)	27.1	(21.8, 32.4)	.0144
23/24	597	26.2	(22.5, 29.9)	25.3	(19.7, 30.9)	27.1	(22.1, 32.0)	.6378
25/26	578	30.0	(25.7, 34.3)	34.7	(27.3, 42.0)	26.1	(21.3, 31.0)	.0536
27/28	635	27.5	(23.5, 31.5)	35.0	(28.2, 41.7)	20.7	(16.4, 24.9)	.0003
29/30	569	24.5	(20.7, 28.4)	31.4	(24.9, 37.9)	18.8	(14.3, 23.3)	.0015

CI, confidence interval.

<sup>a</sup>P-values for sex comparisons obtained from Rao-Scott chi-square tests.

<sup>b</sup>High-intensity drinking defined as 10 or more drinks in a row in the past 2 weeks.

<sup>c</sup>Binge drinking defined as 5 or more drinks in a row in the past 2 weeks.

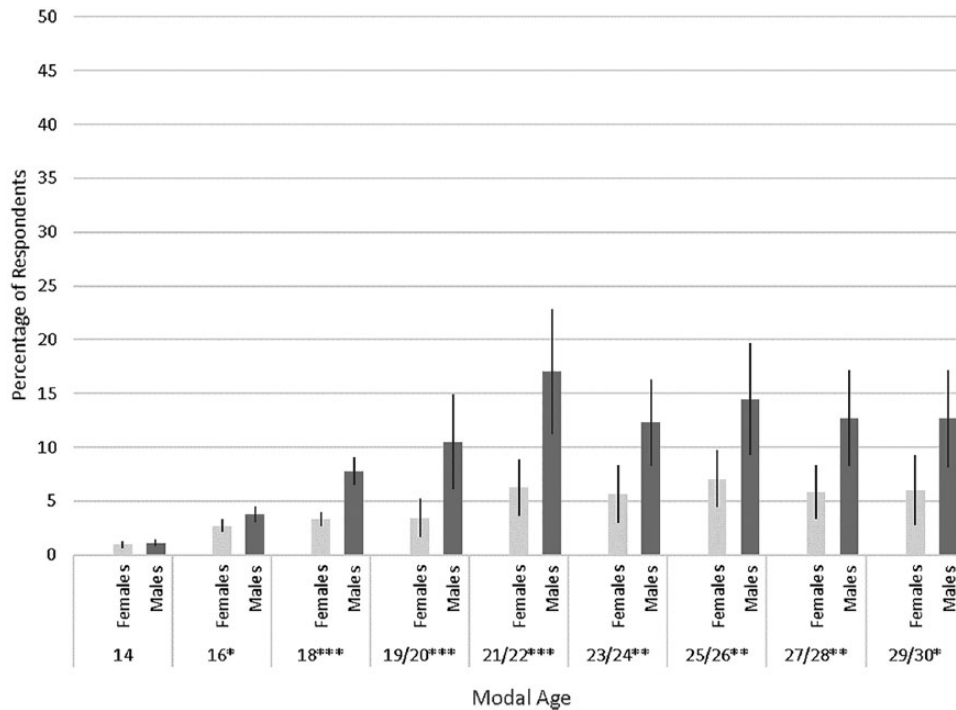
individuals aged 14 to 30 who received both HID and binge drinking questions in 2016-2017, 29 773 (90.0%) provided valid data on sex and binge drinking and/or HID, as well as logically consistent responses to HID and being drunk (respondents with missing data on sex, binge drinking, and HID, or who reported any past 2-week HID but also reported never being drunk in the past 30 days, were excluded). Adjustments for attrition are discussed below.

### Measures

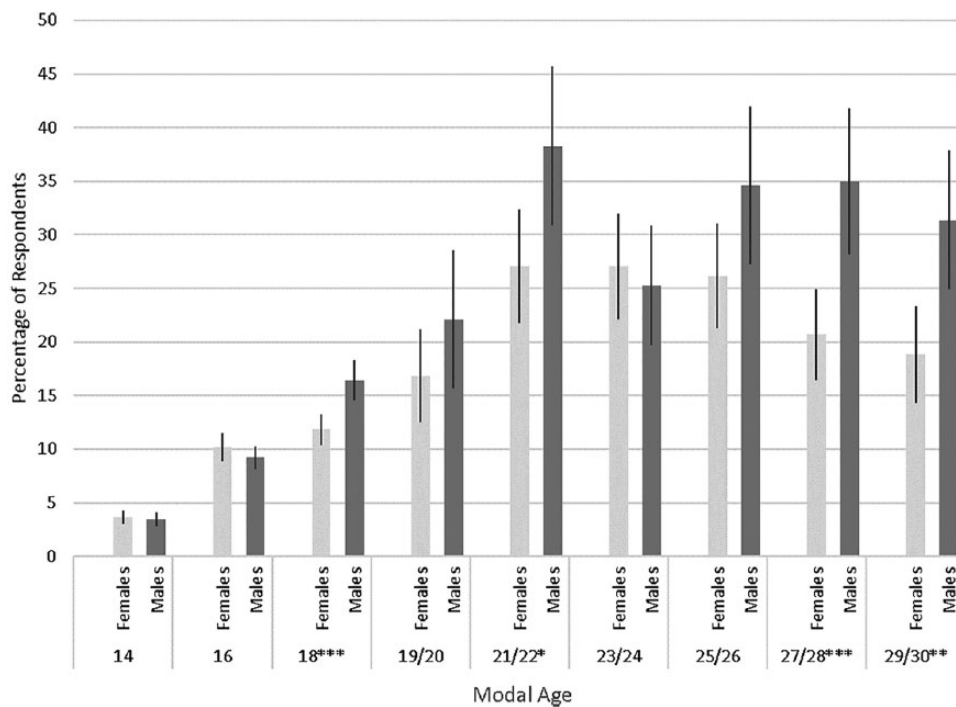
Sex was self-reported as male or female. Respondents were asked: "During the last two weeks, how many times (if any) have you had [5 or more; 10 or more] drinks in a row?" (example definitions provided for a "drink" included a glass of wine, a can or bottle of beer, a wine cooler, a shot glass of liquor, a mixed drink). Binge drinking (any 5+ drinking versus none) and HID (any 10+ drinking versus none) were dichotomized.

### Statistical analysis

All analyses were conducted using SAS v.9.4. The SURVEYFREQ procedure was used to obtain prevalence estimates accounting for the complex sample design. Bivariate sex prevalence comparisons were conducted using the Rao-Scott chi-square test (a design-adjusted version of the Pearson chi-square test, used to identify meaningful differences between the observed and expected frequencies<sup>18</sup>). For analyses involving the 8th, 10th, and 12th grade data, sample weights were used to account for differential probability of selection. Data from ages 19 to 30 were weighted with age-specific attrition weights (calculated as the inverse of the probability of participation based on age 18 measures including sex, race/ethnicity, college plans, high school grades, number of parents in the home, religiosity, parental education, alcohol use, cigarette use, marijuana use, geographic region, cohort, and the sampling weight accounting for oversampling of substance users for follow-up).



**Figure 1.** Sex differences in high-intensity drinking among US adolescents and young adults, 2016-2017. 95% confidence intervals are indicated by vertical lines in each bar. Asterisks indicate the significance of sex comparisons by modal age. \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .



**Figure 2.** Sex differences in binge drinking among US adolescents and young adults, 2016-2017. 95% confidence intervals are indicated by vertical lines in each bar. Asterisks indicate the significance of sex comparisons by modal age. \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

**Results**

At each age, the sample was roughly evenly divided by sex, ranging from 45.3% male at age 29/30 to 49.0% at age 16. Table 1 presents the prevalence estimates of past 2-week binge and HID by age, overall, and by sex. Figures 1 and 2 present sex comparisons.

Overall HID prevalence was the lowest at age 14 at 1%, grew through age 21/22 to 11.5%, and ranged between 8.9% and 10.5% for ages 23/24 through 29/30. Whereas HID prevalence did not vary significantly between boys and girls at age 14 ( $P = .45$ ), males reported significantly higher HID prevalence than females from ages 16 through 29/30 ( $P < .05$ ). Among

males, HID prevalence grew from 1.1% at age 14 to 17.0% at age 21/22 and ranged between 12.3% and 14.5% thereafter. Among females, HID prevalence grew from 1.0% at age 14 to 7.1% at age 25/26, thereafter dropping to about 6% through age 29/30.

For comparison, overall binge drinking prevalence was 3.6% at age 14 but grew to 32.5% by age 21/22. Between ages 23/24 and 29/30, binge drinking prevalence ranged between 24.5% and 30.0%. No significant sex differences in binge drinking prevalence were observed at ages 14, 16, 19/20, 23/24, or 25/26. Males reported significantly higher ( $P < .05$ ) prevalence than females at ages 18, 21/22, 27/28, and 29/30. Binge drinking prevalence was the highest for males at ages 21/22 (38.3%) and for females at ages 21/22 and 23/24 (both at 27.1%).

## Discussion and Conclusions

Using national data from adolescents and young adults, this study found approximately 1% HID prevalence (and 4% binge drinking prevalence) among both boys and girls at modal age 14. HID prevalence was significantly higher for males than females at all ages from 16 to 30. In contrast, binge drinking prevalence was significantly higher for males than for females only at ages 18, 21/22, and 27–30. Males reported peak levels of binge and HID use at earlier ages (21/22 for both binge drinking and HID) than females (ages 21–24 for binge drinking and 25/26 for HID). The widest sex gap for binge drinking was at age 27/28: 35.0% among males versus 20.7% among females. In contrast, the widest sex gap for HID was at age 21/22 (when 17.0% of males vs 6.2% of females reported HID). For HID, the sex gap diminished by age 30 after a decline among men (to 12.7% at age 29/30) but not among women (at 6.0% at age 29/30). Thus, the results of this study extended our understanding of sex differences in HID<sup>4,7,9–11,13,14</sup> by showing a variation in sex differences across age with contemporary data in 2016–2017. Results also supported prior research findings of no gender differences in binge drinking during early adolescence<sup>6</sup> and similarity in binge drinking between young adult men and women at some ages in recent years.<sup>11</sup> For both HID and binge drinking, sex differences were observed in late adolescence and were the strongest for HID at the ages of 21/22 and for binge drinking at ages 27/28.

The data from this study are subject to limitations including self-reported data, school-based sampling, and attrition. However, strengths include national samples of adolescents through young adults with consistent measurement across ages. Monitoring sex differences in high-level alcohol consumption is crucial to understanding high-risk drinking. In fact, most binge drinkers report having more than 5 drinks per binge episode,<sup>19,20</sup> with individuals 18 to 24 years old reporting the highest intensity (an average of 8.3 drinks per binge episode in 2015<sup>21</sup>). Furthermore, negative consequences of alcohol use (eg, drinking and driving, risky sexual behaviors, violence) are positively associated with increasing blood alcohol content,<sup>2,22</sup>

so that those who engage in HID are a particularly high-risk subset. The observed age-related increase in HID from adolescence through the early to mid-20s for both males and females highlights the importance of prevention and intervention efforts targeted to these ages. Future research could examine the extent to which sex and gender are associated with HID<sup>23</sup> and how key covariates related to sex differences in alcohol use<sup>12</sup> influence HID over the life course.

## Author Contributions

MEP developed the study conception and drafted the manuscript; YMTM undertook statistical analyses and assisted with drafting the manuscript. Both authors contributed to the revision of the manuscript and have approved its final version.

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## REFERENCES

- Patrick ME. A call for research on high-intensity alcohol use. *Alcohol Clin Exp Res*. 2016;40:256–259. doi:10.1111/acer.12945.
- Hingson R, White A. Trends in extreme binge drinking among US high school seniors. *JAMA Pediatr*. 2013;167:996–998. doi:10.1001/jamapediatrics.2013.3083.
- Patrick ME, Azar B. High-intensity drinking. *Alcohol Clin Exp Res*. 2017;39:e1–e7.
- Johnston LD, Miech RA, O'Malley PM, Bachman JG, Schulenberg JE. *Demographic Subgroup Trends Among Adolescents in the Use of Various Licit and Illicit Drugs, 1975–2017* (Monitoring the future occasional paper series, paper 90). Ann Arbor, MI: Institute for Social Research, University of Michigan; 2018. <http://monitoringthefuture.org/pubs/occpapers/mtf-occ90.pdf>. Accessed June 30, 2018.
- Kann L, McManus T, Harris WA, et al. Youth risk behavior surveillance—United States, 2017. *MMWR Surveill Summ*. 2018;67:1–114. doi:10.15585/mmwr.ss6708a1.
- Miech RA, Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE, Patrick ME. *Monitoring the Future National Survey Results on Drug Use, 1975–2017* (Volume I, secondary school students). Ann Arbor, MI: Institute for Social Research, University of Michigan; 2018. [http://monitoringthefuture.org/pubs/monographs/mtf-vol1\\_2017.pdf](http://monitoringthefuture.org/pubs/monographs/mtf-vol1_2017.pdf). Accessed August 15, 2018.
- Patrick ME, Terry-McElrath YM, Miech RA, O'Malley PM, Schulenberg JE, Johnston LD. Current high-intensity drinking among 8th and 10th grade students in the United States. *Am J Prev Med*. 2017;53:904–908. doi:10.1016/j.amepre.2017.06.027.
- Linden-Carmichael AN, Vasilenko SA, Lanza ST, Maggs JL. High-intensity drinking versus heavy episodic drinking: prevalence rates and relative odds of alcohol use disorder across adulthood. *Alcohol Clin Exp Res*. 2017;41:1754–1759. doi:10.1111/acer.13475.
- Patrick ME, Terry-McElrath YM, Kloska DD, Schulenberg JE. High-intensity drinking among young adults in the United States: prevalence, frequency, and developmental change. *Alcohol Clin Exp Res*. 2016;40:1905–1912. doi:10.1111/acer.13164.
- Patrick ME, Terry-McElrath YM, Miech RA, Schulenberg JE, O'Malley PM, Johnston LD. Age-specific prevalence of binge and high-intensity drinking among U.S. young adults: changes from 2005 to 2015. *Alcohol Clin Exp Res*. 2017;41:1319–1328. doi:10.1111/acer.13413.
- Schulenberg JE, Johnston LD, O'Malley PM, et al. *Monitoring the Future National Survey Results on Drug Use, 1975–2017* (Volume II, college students and adults ages 19–55). Ann Arbor, MI: Institute for Social Research, The University of Michigan; 2018. [http://monitoringthefuture.org/pubs/monographs/mtf-vol2\\_2017.pdf](http://monitoringthefuture.org/pubs/monographs/mtf-vol2_2017.pdf). Accessed August 28, 2018.
- Schulte MT, Ramo D, Brown SA. Gender differences in factors influencing alcohol use and drinking progression among adolescents. *Clin Psychol Rev*. 2009;29:535–547. doi:10.1016/j.cpr.2009.06.003.
- Patrick ME, Schulenberg JE, Martz ME, Maggs JL, O'Malley PM, Johnston LD. Extreme binge drinking among 12th-grade students in the United States: prevalence and predictors. *JAMA Pediatr*. 2013;167:1019–1025. doi:10.1001/jamapediatrics.2013.2392.

14. Patrick ME, Terry-McElrath YM. High-intensity drinking by underage young adults in the United States. *Addiction*. 2017;112:82–93. doi:10.1111/add.13556.
15. Jager J, Keyes KM, Schulenberg JE. Historical variation in young adult binge drinking trajectories and its link to historical variation in social roles and minimum legal drinking age. *Dev Psychol*. 2015;51:962–974. doi:10.1037/dev0000022.
16. Jager J, Schulenberg JE, O'Malley PM, Bachman JG. Historical variation in drug use trajectories across the transition to adulthood: the trend toward lower intercepts and steeper, ascending slopes. *Dev Psychopathol*. 2013;25:527–543. doi:10.1017/S0954579412001228.
17. Patrick ME, Terry-McElrath YM, Lanza ST, et al. Shifting age of peak binge drinking prevalence: historical changes in normative trajectories among young adults aged 18 to 30. *Alcohol Clin Exp Res*. In press.
18. SAS Institute Inc. *SAS/STAT 13.2 User's Guide*. Cary, NC: SAS Institute Inc; 2012.
19. Kanny D, Liu Y, Brewer RD, et al. Vital signs: binge drinking prevalence, frequency, and intensity among adults—United States, 2010. *MMWR Morb Mortal Wkly Rep*. 2012;61:14–19.
20. Naimi TS, Nelson DE, Brewer RD. The intensity of binge alcohol consumption among U.S. adults. *Am J Prev Med*. 2010;38:201–207. doi:10.1016/j.amepre.2009.09.039.
21. Kanny D, Naimi TS, Liu Y, Lu H, Brewer RD. Annual total binge drinks consumed by U.S. adults, 2015. *Am J Prev Med*. 2018;54:486–496. doi:10.1016/j.amepre.2017.12.021.
22. Neal DJ, Fromme K. Event-level covariation of alcohol intoxication and behavioral risks during the first year of college. *J Consult Clin Psychol*. 2007;75:294–306. doi:10.1037/0022-006X.75.2.294.
23. Peralta RL, Mulhollem LM, Blue C, Stewart BC. The association between heavy episodic drinking and gender orientation among U.S. college students: the significance of masculinity. *Subst Use Misuse*. 2018;53:910–920. doi:10.1080/10826084.2017.1385081.