

Binge Drinking Among US Adults

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ALCOHOL ABUSE, WHICH KILLS approximately 100 000 Americans annually, is the third leading preventable cause of death in the United States.¹ *Binge drinking*, generally defined as the consumption of 5 or more alcoholic beverages on 1 occasion,^{2,3} generally results in acute impairment and causes a substantial fraction of all alcohol-related deaths.^{4,5} Adverse health effects specifically associated with binge drinking include unintentional injuries (eg, motor vehicle crashes, falls, drowning, hypothermia, and burns), suicide, sudden infant death syndrome⁶ alcohol poisoning, hypertension, acute myocardial infarction, gastritis, pancreatitis, sexually transmitted diseases, meningitis, and poor control of diabetes. Many consequences of binge drinking have especially high social and economic costs, including interpersonal violence (eg, homicide, assault, domestic violence, rape, and child abuse), fetal alcohol syndrome, unintended pregnancy, child neglect, and lost productivity.^{7,8}

Reducing binge drinking among adults is one of the leading health indicators in Healthy People 2010.⁹ Recent reports have indicated that prior declines in alcohol consumption reached a plateau in the early 1990s (M. K. S., written communication, December 12, 2002)¹⁰ and that the preva-

Context Binge drinking (consuming ≥ 5 alcoholic drinks on 1 occasion) generally results in acute impairment and has numerous adverse health consequences. Reports indicate that binge drinking may be increasing in the United States.

Objectives To quantify episodes of binge drinking among US adults in 1993-2001, to characterize adults who engage in binge drinking, and to describe state and regional differences in binge drinking.

Design, Setting, and Participants The Behavioral Risk Factor Surveillance System, a random-digit telephone survey of adults aged 18 years or older that is conducted annually in all states. The sample size ranged from 102 263 in 1993 to 212 510 in 2001.

Main Outcome Measures Binge-drinking prevalence, episodes, and episodes per person per year.

Results Between 1993 and 2001, the total number of binge-drinking episodes among US adults increased from approximately 1.2 billion to 1.5 billion; during this time, binge-drinking episodes per person per year increased by 17% (from 6.3 to 7.4, P for trend = .03). Between 1995 and 2001, binge-drinking episodes per person per year increased by 35% (P for trend = .005). Men accounted for 81% of binge-drinking episodes in the study years. Although rates of binge-drinking episodes were highest among those aged 18 to 25 years, 69% of binge-drinking episodes during the study period occurred among those aged 26 years or older. Overall, 47% of binge-drinking episodes occurred among otherwise moderate (ie, non-heavy) drinkers, and 73% of all binge drinkers were moderate drinkers. Binge drinkers were 14 times more likely to drive while impaired by alcohol compared with non-binge drinkers. There were substantial state and regional differences in per capita binge-drinking episodes.

Conclusions Binge drinking is common among most strata of US adults, including among those aged 26 years or older. Per capita binge-drinking episodes have increased, particularly since 1995. Binge drinking is strongly associated with alcohol-impaired driving. Effective interventions to prevent the mortality and morbidity associated with binge drinking should be widely adopted, including screening patients for alcohol abuse in accordance with national guidelines.

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lence of binge drinking and adverse health outcomes associated with binge drinking have increased recently.^{11,12} Because people who binge drink may do so repeatedly, the percentage of adults who binge drink represents only the tip of the iceberg relative to the actual number of binge-drinking episodes among US adults. We used data from the Behavioral Risk Factor Surveillance System (BRFSS) survey from 1993 to 2001 to quantify episodes of binge drinking among US adults and to characterize adult binge drinkers. Although BRFSS

has been used to estimate the prevalence of binge drinking, we are not aware of any previous studies that re-

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port population-based estimates of binge-drinking episodes in the US. Furthermore, the large sample size of BRFSS provided a unique opportunity to generate state-specific estimate of per capita binge-drinking episodes and enabled us to assess binge drinkers by a variety of demographic and sociocultural factors.

METHODS

The BRFSS, a series of state-based health surveys coordinated by the Centers for Disease Control and Prevention, in conjunction with state health departments, is a cross-sectional random-digit telephone survey of US adults 18 years or older who are not institutionalized. Details of the sampling, purpose, and method of analysis have been published elsewhere.¹³⁻¹⁵ We analyzed BRFSS data from 49 states for 1993 and from 50 states for 1995, 1997, 1999, and 2001. Wyoming, the 50th BRFSS state, which was added in 1994, accounted for less than 0.2% of binge-drinking episodes in those years in which it was included.

The alcohol section of the BRFSS questionnaire first asks respondents whether they had any alcoholic beverages in the past 30 days. Those who respond yes are asked how frequently they drank alcohol (measured as days per week or month) and how many drinks they had on days they drank. Separately, they also are asked how often they consume 5 or more drinks on a single occasion (ie, binge-drinking episodes) in the past 30 days. The BRFSS survey itself does not use the term *binge drinking*.

Binge drinking was defined as the consumption of 5 or more drinks on at least 1 occasion in the previous 30 days.³ We calculated binge-drinking episodes per respondent per year by multiplying the number of self-reported binge-drinking episodes for each respondent by 12. Because BRFSS interviews a representative, stratified sample of US adults each month, combining all data for 12 months yields a representative sample for the entire year. In addition, seasonal variations in

binge drinking are accounted for when episodes reported for 12 months are aggregated for all respondents. To generate estimates of binge-drinking episodes per capita (ie, episodes per person per year) for various population strata, we divided the number of binge-drinking episodes for each stratum by census-based estimates of the relevant population denominator for the year in question.

Moderate drinking was defined as consuming an average of 2 drinks per day or less for a man and 1 drink per day or less for a woman.¹⁶ *Heavy drinking* was defined as consuming alcohol in excess of moderate levels. To calculate average daily drinks, we multiplied the proportion of days the respondent drank alcohol by the average number of drinks on days when alcohol was consumed, and divided by 30. Alcohol-impaired driving was defined as a non-zero response to the question: "During the past 30 days, how many times have you driven after having had perhaps too much [alcohol] to drink?"

The BRFSS sample size ranged from 102 263 for 1993 to 212 510 for 2001, with those not providing information on alcohol consumption excluded from analysis. For the study period, the response rate (completed interviews divided by the sum of completed interviews, terminated interviews, and refusals) ranged from 68.4% to 82.1%. Analyses were conducted using SAS (SAS Institute Inc, Cary, NC) and SUDAAN software.¹⁷

RESULTS

Between 1993 and 2001, the total number of binge-drinking episodes among US adults increased from approximately 1.2 billion to 1.5 billion; during this time, binge-drinking episodes per person per year increased by 17% (from 6.3 to 7.4, P for trend = .03) (TABLE 1 and FIGURE 1). Between 1995 and 2001, binge-drinking episodes per person per year increased by 35% (P for trend = .005). During the study period, similar changes were noted for most population strata by sex, age, race/ethnicity, and education. In 2001,

14.3% of US adults had at least 1 binge-drinking episode during the previous 30 days.

Binge drinking rates were highest among younger age groups, and declined with increasing age (Table 1). In 2001, young adults aged 21 to 25 years (18.0 episodes/person/year) and underage drinkers aged 18 to 20 years (15.3 episodes/person/year) had the highest rates of binge-drinking episodes. During the study period, underage drinkers had the largest increase (56%) in the rate of binge-drinking episodes. However, the rate of binge-drinking episodes among respondents aged 26 to 55 years also increased by approximately 25% during this period. Those older than 55 years had the lowest rate of binge-drinking episodes (<3 episodes/person/year). Although older age groups had lower rates of binge drinking, the majority of binge-drinking episodes occurred among those who were 26 years or older (Figure 1), with 69% of binge-drinking episodes occurring among this same age group.

During the study period, men accounted for 81% of all binge-drinking episodes (Table 1), and they were approximately 3 times as likely as women to report binge drinking (eg, 22.7% vs 7.2% in 2001). However, among women of childbearing age (18-44), 11.8% reported binge drinking; each woman who binge drank averaged 36.6 episodes in 2001 (results not shown in Table 1). Whites accounted for 78% of all binge-drinking episodes (Table 1), although Hispanics had the highest rate of binge-drinking episodes per person for most years of the study (eg, 8.4 episodes/person/year in 2001). Blacks consistently had the lowest rate of binge-drinking episodes per capita, averaging less than 5 episodes per person per year. College graduates had slightly lower rates of binge drinking compared with other educational strata. Heavy drinkers were more likely to binge drink and had far higher rates of binge-drinking episodes than moderate drinkers. However, moderate drinkers accounted for 47% of binge-drinking episodes, including 639 million binge-drinking episodes in 2001.

Table 1. Prevalence, Total Number, and Rate of Binge-Drinking Episodes Among US Adults, 1993-2001*

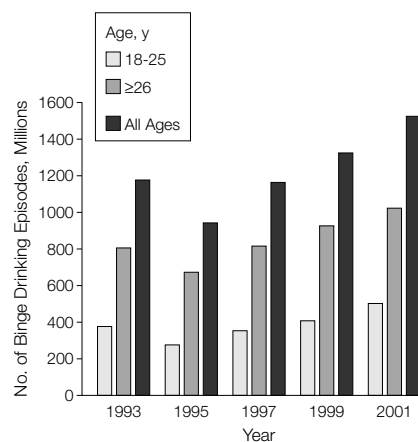
Characteristics	Binge Drinkers, %†					No. Binge-Drinking Episodes (Millions/Year)					Rate of Binge-Drinking Episodes (Episodes/Person/Year)				
	1993	1995	1997	1999	2001	1993	1995	1997	1999	2001	1993	1995	1997	1999	2001
	(n = 102 464)	(n = 113 934)	(n = 135 582)	(n = 159 989)	(n = 212 510)										
All respondents	14.2	12.7	13.2	14.6	14.3	1179	945	1170	1334	1520	6.3	5.5	6.1	6.9	7.4
Sex															
Male	21.8	19.9	20.8	22.7	22.2	961	765	955	1078	1235	10.8	9.40	10.5	11.6	12.5
Female	7.3	6.3	6.3	7.1	7.2	218	180	215	256	285	2.2	2.0	2.2	2.5	2.7
Age, y															
18-20	23.0	19.6	22.0	26.0	26.1	94	76	116	132	157	9.8	8.8	12.0	13.7	15.3
21-25	30.0	26.5	27.4	32.2	32.2	279	196	236	276	339	14.1	11.6	13.4	15.6	18.0
26-34	20.7	19.5	20.2	21.3	21.0	320	248	275	299	314	8.4	7.6	7.9	9.0	9.2
35-54	12.4	11.7	12.5	13.6	13.6	355	327	419	468	539	5.4	5.1	5.7	6.2	6.7
≥55	4.2	3.8	3.9	4.7	4.3	130	95	122	158	166	2.5	1.9	2.1	2.8	2.7
Race/ethnicity															
White	14.7	13.4	13.6	14.9	14.7	971	778	918	1026	1098	6.6	5.8	6.4	7.1	7.4
Black	8.9	8.7	9.0	10.2	9.8	69	65	74	89	106	4.2	4.0	4.0	4.8	5.4
Hispanic	16.1	11.7	15.8	17.2	16.8	105	69	120	160	197	7.0	5.1	6.4	7.2	8.4
Other	11.3	10.1	10.8	12.2	13.4	31	25	51	48	108	5.2	4.1	6.0	6.3	8.2
Education															
Some high school	10.7	8.5	10.3	11.8	12.8	162	123	143	181	209	6.0	4.7	5.5	6.8	8.0
High school graduate	14.3	13.3	13.2	14.8	14.4	412	331	409	481	522	6.6	5.8	6.6	7.7	8.2
Some college	16.2	15.0	15.2	16.4	16.2	357	291	380	389	462	7.3	6.4	7.2	7.5	8.3
College graduate	13.9	12.2	12.8	13.8	13.3	247	199	237	282	325	5.2	4.6	4.7	5.4	5.4
Alcohol intake‡															
Moderate	23.1	23.0	21.6	23.1	21.6	587	485	539	608	639	6.7	6.5	6.3	6.9	6.4
Heavy	73.7	74.8	67.2	68.4	76.0	592	459	630	725	881	70.1	69.8	60.7	62.2	81.9

*Binge drinking is defined as consuming ≥5 alcohol-containing drinks on 1 occasion.

†Percentage of Behavioral Risk Factor Surveillance System respondents who reported binge drinking in the past 30 days.

‡Moderate alcohol intake is defined as consuming an average of ≤1 alcohol-containing drink per day for a woman or ≤2 for a man; heavy alcohol intake, consuming an average of >1 alcohol-containing drink per day for a woman or >2 for a man.

Figure 1. Binge-Drinking Episodes by Age in US Adults, 1993-2001



In 2001, 101 million (49%) of 205 million American adults consumed alcohol (data not shown). More than 60% of adult male drinkers 18 to 25 years

reported binge drinking; males in this age group averaged 39 binge-drinking episodes in 2001 (TABLE 2). By race/ethnicity, Hispanic drinkers had the highest prevalence of binge drinking, including 45.3% of Hispanic males. Overall, 22% of moderate-drinking US adults reported binge drinking, including 30.1% of male adults who were moderate drinkers. In 2001, all US moderate drinkers averaged 6.4 binge-drinking episodes per capita. Among heavy drinkers, 76% reported binge drinking, and each heavy drinker averaged approximately 1.5 binge-drinking episodes each week.

Among US adults who consumed alcohol in 2001, binge drinkers were younger, more likely to be male, and less likely to have had any college education compared with non-binge drinkers (TABLE 3). Although binge drinkers consumed an average of approximately

1 drink per day more than non-binge drinkers, 72.9% of all binge drinkers were moderate drinkers. Binge drinkers also were approximately 14 times as likely to report alcohol-impaired driving than non-binge drinkers in 1999 (this question was not asked in the BRFSS survey in 2001).

In 2001, rates of binge-drinking episodes varied considerably by state. FIGURE 2 shows unadjusted rates for all states, which ranged from 3.1 episodes per person per year in Tennessee to 12.3 episodes per person per year in Wisconsin. Overall, per capita rates were higher in the northcentral and western US, and lower in the southeastern US. To determine the extent to which state and regional differences were due to demographic factors, we adjusted the age, sex, and race/ethnicity data for each state to the US population. After adjustment, the range of episodes per person per year

(3.9-12.5) was similar to that of the unadjusted data, and the state and regional differences persisted. Using the cut points chosen to generate Figure 2, 39 (78%) of 50 states remained in the same category as that determined by the unadjusted data. Adjusted rates changed 3 states (Florida, New York, and Texas) from the intermediate category of binge drinking to the highest category, changed 1 state (Iowa) from highest to intermediate, changed 4 states (Arkansas, Louisiana, Maryland, and Washington) from lowest to intermediate, changed 2 states (New Mexico and Colorado) from intermediate to lowest, and changed 2 states (Montana and Wyoming) from highest to lowest.

COMMENT

To our knowledge, this is the first US study to quantify binge-drinking episodes. Overall, there were approximately 1 billion or more episodes of binge drinking annually from 1993 to 2001. Especially high rates of binge-drinking episodes were observed among men, young adults, and heavy drinkers. However, about 70% of binge-drinking episodes were reported among those 26 years or older, and approximately half of all binge-drinking episodes were reported among moderate (ie, non-heavy) drinkers.

Our finding that binge drinking rates are highest among young age groups is consistent with other studies.^{10,18} However, we found that binge drinking is by no means confined to young age groups. Although those aged 18 to 25 years had the highest number of binge-drinking episodes per capita, rates remained high throughout the study period (approximately 8 episodes per year) among respondents aged 26 to 34 years, contributing to the large proportion (70%) of total episodes that were observed among persons 26 years or older. Although efforts to prevent youth access to alcohol and binge drinking on college campuses are critical, they need to be complemented by interventions that will reduce binge drinking among adults of all ages, particularly those younger than 55 years.

Our finding that there are almost as many binge drinking episodes among moderate drinkers as heavy drinkers has been noted in other countries,¹⁹ and is largely because there are more moderate drinkers than heavy drinkers in the general population. However, these findings also emphasize why it is important to assess binge alcohol use independent of average daily alcohol con-

sumption, and underscores why binge drinking is a key indicator of alcohol abuse among both moderate and heavy drinkers.^{7,20}

Although males accounted for most binge-drinking episodes, the high rate of binge drinking reported among women of childbearing age is concerning because of alcohol's harmful effects on the developing fetus, particu-

Table 2. Binge Drinking Among US Adults Who Consumed Alcohol, 2001*

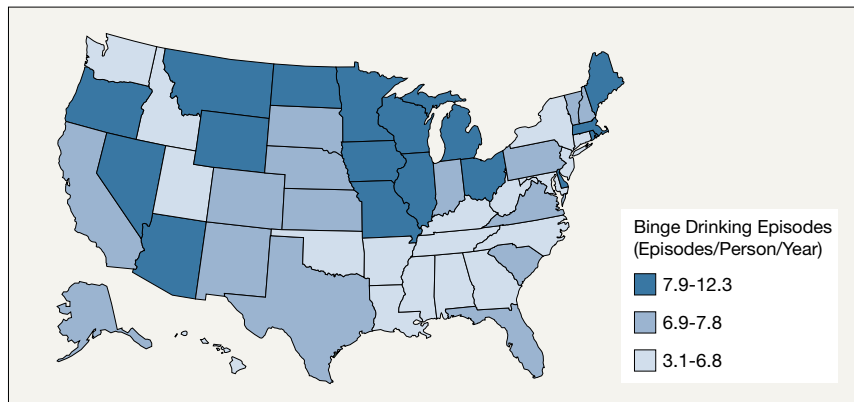
Characteristic	Males (n = 57 654)		Females (n = 46 811)		Total (N = 104 465)	
	%†	Rate‡	%†	Rate‡	%	Rate
All respondents	35.9	20.1	15.7	5.8	26.8	13.7
Age, y						
18-20	61.1	39.0	37.7	17.6	51.3	30.0
21-25	61.9	38.7	32.0	12.5	48.6	27.1
26-34	44.2	20.8	20.2	6.5	34.1	14.8
35-54	33.3	17.9	13.5	4.7	24.2	11.9
≥55	15.0	10.4	4.7	1.8	10.2	6.4
Race/ethnicity						
White	34.6	19.3	15.6	5.6	25.8	13.0
Black	33.4	20.7	14.1	5.1	24.4	13.4
Hispanic	45.3	23.5	18.1	7.0	35.1	17.3
Other	37.2	24.1	15.3	6.6	29.0	17.6
Education						
Some high school	45.3	29.8	23.1	10.1	37.5	23.0
High school graduate	41.9	26.3	16.6	6.2	30.7	17.4
Some college	38.5	21.6	17.8	7.0	28.3	14.4
College graduate	27.0	11.9	11.7	3.6	20.3	8.2
Alcohol intake§						
Moderate	30.1	9.5	11.3	2.5	21.6	6.4
Heavy	88.2	113.8	59.6	37.9	76.0	81.9

*Binge drinking is defined as consuming ≥5 alcohol-containing drinks on 1 occasion.
 †Percentage of US adults drinkers who had at least 1 binge-drinking episode in the past 30 days.
 ‡Number of episodes of binge drinking per person per year (among drinkers for the given demographic group).
 §Moderate alcohol intake is defined as consuming an average of ≤1 alcohol-containing drink per day for a woman or ≤2 for a man; heavy alcohol intake, consuming an average of >1 alcohol-containing drink per day for a woman or >2 for a man.

Table 3. US Adults Who Consumed Alcohol, by Binge-Drinking Status, 2001

Characteristic	Binge Drinkers* (n = 27 997)	Non-Binge Drinkers (n = 76 468)	Total (N = 104 465)
Age, mean (SE), y	35.1 (0.15)	45.5 (0.10)	42.5 (0.09)
Male, %	73.8	48.4	55.1
White, %	74.1	78.1	77.1
College, %†	57.8	67.6	65.0
Moderate drinker, %‡	72.9	96.9	90.4
Mean (SE) drinks/day, No.	1.6 (0.02)	0.4 (0.005)	0.7 (0.01)
Impaired driver, %§	13.8	1.0	4.6

*Binge drinking is defined as consuming ≥5 alcohol-containing drinks on 1 occasion.
 †At least some college education.
 ‡Moderate alcohol intake is defined as consuming an average of ≤1 alcohol-containing drink per day for a woman or ≤2 for a man; heavy alcohol intake, consuming an average of >1 alcohol-containing drink per day for a woman or >2 for a man.
 §Impaired drivers were those drinkers who provided a non-zero response to the question: "During the past 30 days, how many times have you driven after having had perhaps too much [alcohol] to drink?" Impaired driving estimates are from 1999 data, since the impaired driving questions were not asked in 2001.

Figure 2. Binge-Drinking Episodes per US Adult per Year, 2001

Adults are those 18 years or older.

larly in the first trimester.⁷ Increasing evidence indicates that even intermittent exposure to high levels of alcohol is an important risk factor for adverse fetal outcomes.²¹⁻²³ Since the average pregnancy is not recognized until 5 to 6 weeks after conception,²⁴ a woman who binge drinks may unknowingly expose her fetus to high blood alcohol concentrations during this time. Thus, recent reports of increases in binge drinking by young women are especially troubling.²⁵⁻²⁷

There are considerable state and regional differences in binge drinking rates that persisted after adjustment for demographic factors. Although possible reasons for these differences are unclear, they may be due to variations in social norms, religion, socioeconomic status, alcohol control policies, activities by advocacy and professional groups, or other factors.²⁸

Our data may underestimate the true number of binge-drinking episodes in the United States. First, the BRFSS survey does not include persons younger than 18, many of whom are frequent binge drinkers as demonstrated in other studies.²⁹ Second, survey data in general^{30,31} and BRFSS data in particular³² underestimate alcohol consumption by the general public through a combination of sampling noncoverage and underreporting of alcohol use.³³ Third, persons without telephones, who cannot participate in BRFSS, may have above-average rates of binge drinking.

Fourth, to define binge drinking in women, BRFSS uses a threshold of 5 drinks instead of 4 drinks (the latter is usually used to define binge drinking in women), resulting in a conservative estimate of binge-drinking episodes among women.² Finally, college students, who are known to have high rates of binge drinking,³⁴ were likely undersampled because many live in dormitories and are therefore ineligible for inclusion in BRFSS.

Given the extent of binge drinking and its close link with alcohol-impaired driving,³⁵ we recommend the adoption of effective interventions to reduce binge drinking and alcohol-impaired driving. Effective community-based strategies to reduce binge drinking include multiple administrative and legal intervention strategies.³⁶⁻³⁹ Evidence-based recommendations to reduce deaths from alcohol-impaired driving, which largely focus on measures to curb the effects of binge drinking, have been published previously.⁴⁰ Increasing alcohol taxes has been shown to decrease both binge drinking and alcohol-impaired driving.⁴¹⁻⁴⁵ However, inflation-adjusted taxes on alcohol, particularly beer, have declined substantially since the 1960s,²⁸ despite the fact that beer is the most common type of alcohol used by binge drinkers.⁴⁶ Finally, the US Preventive Services Task Force⁴⁷ recommends screening all adults and adolescents for alcohol abuse (inclusive of binge drinking), despite the fact that physicians often fail to do so.⁴⁸ Brief

physician advice has been shown to reduce the number of binge-drinking episodes by more than 40% among men and women.⁴⁹

For public health or clinical interventions to be effective in reducing binge drinking, significant social obstacles to those interventions also need to be acknowledged and addressed. One of these is the widespread marketing of beer and wine via television and print media, where a disproportionate share of the audience may be below the legal drinking age^{50,51} and particularly likely to binge drink. Another obstacle is that much of the general public considers alcohol intoxication to be either humorous or a rite of passage.^{52,53} Were public attitudes to become less accepting of the consequences of binge drinking, the chances of successfully combating its harmful effects would likely improve.

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