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**Heavy and Binge Drinking
in Rural America: A Comparison
of Rural and Urban Counties
from 1995/1997 through 1999/2001**

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by

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Heavy and Binge Drinking in Rural America: A Comparison of Rural and Urban Counties from 1995/1997 through 1999/2001

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ABSTRACT

OBJECTIVE

To estimate the prevalence of and recent trends in alcohol use among U.S. adults in rural areas.

METHODS

Random-digit telephone survey of adults aged 18 years or older residing in states participating in the Behavioral Risk Factor Surveillance System (BRFSS), in the years 1995/1997 (n=247,255) and 1999/2001 (n=363,077). During the previous 30 days, any, moderate or heavy alcohol use, or at least one alcohol binge, were assessed from self-report. Heavy alcohol use was defined as an average of more than two drinks per day for men or more than one per day for women, moderate use as an average daily intake of less than these amounts. An alcoholic binge was defined as five or more drinks on one occasion.

RESULTS

Urban counties led rural counties for moderate and heavy drinking in 1999/2001, and also saw the largest increases in heavy drinking between 1995/1997 and 1999/2001. Binge drinking was nearly as high in remote rural counties with a large town as in urban counties, and increased the most for remote rural counties with a large town. Urban whites were more likely than any other racial/ethnic group to report moderate or heavy drinking, while American Indians in remote rural counties with a large town were the most likely to report binge drinking. Significant increases in heavy and binge drinking were highest for rural residents in the Northeast and Midwest and lowest in the South Census region.

CONCLUSIONS

Heavy drinking was highest and increased the most in urban counties; however, binge drinking increased the most in remote rural counties with a large town, and heavy and binge drinking increased for rural counties of all types. Because of the difficulties in accessing and administering substance abuse treatment in rural areas, special attention needs to be given to tailoring interventions to the needs of rural residents.

INTRODUCTION

Light to moderate alcohol use has been shown to improve heart health in adults.¹⁻³ For many Americans, however, the risks of alcohol consumption may outweigh its benefits.⁴ Long-term, heavy drinking is associated with a host of health problems, including high blood pressure, heart disorders, cancer,⁵ and liver disease.⁶ Alcohol consumption is linked to accidental injuries and deaths, as from automobile accidents and falls,⁷ as well as to antisocial behaviors like homicide and domestic violence.⁸ Alcohol is the third leading actual cause of death in the United States and it is estimated that alcohol consumption is responsible for 100,000 deaths per year.⁹ Finally, alcohol abuse is economically costly in terms of lost productivity, health care costs, and other adverse outcomes.^{10,11}

A substantial proportion of U.S. adults drink to excess at least occasionally. In 1992 more than half of all adults reported consuming more than five drinks on one day at least once over the prior year, and almost 20 percent of those who drank reported consuming more than one drink per day on average.¹² There are substantial differences in the prevalence of alcohol use, as well as racial/ethnic differentials in the effects of alcohol use. In 1998, whites were more likely to use alcohol than Hispanics or African Americans, though American Indians/Alaska Natives experienced a far higher prevalence of death from alcohol-related motor vehicle accidents than any other racial/ethnic group.¹³ Alcohol abuse has been found to have a negative, indirect impact on educational attainment¹⁴ and income^{15,16} even as educational attainment is negatively associated with subsequent heavy drinking.^{14,17}

Rural Healthy People 2010 identifies substance abuse as being a particular area of concern for the rural population, in part because of significant barriers to receiving substance abuse treatment.¹⁸ Rural areas

receive less funding per capita than urban areas even though alcohol dependence is more prevalent among persons in rural areas.¹⁹ However, the per capita costs of substance abuse treatment are higher in rural compared to urban areas because of lower population densities,²⁰ and in the 1990s a higher proportion of rural counties than urban counties had no mental health facilities or mental health professionals.^{21,22} Rural residents are less likely than similar urban residents to seek treatment because of higher costs and the longer travel distances for treatment.²³ The stigma associated with substance abuse treatment is often stronger in rural than in urban areas.²⁴ Finally, rural residents are more prone to driving while intoxicated because of the need to travel relatively large distances and their greater reliance on automobile transportation compared to urban residents.²⁵

The aim of this study is to examine the prevalence of and trends in heavy drinking and binge drinking among adults living in three types of rural locations as well as urban locations, using several years of data from the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS). By combining several years of BRFSS data, prevalence of heavy drinking can be ascertained even for persons living in relatively remote rural locations.

METHODS

SAMPLE AND SUBJECTS

In 1984, the CDC established BRFSS for monitoring health risk behaviors.²⁶ BRFSS collects data annually on health-related behaviors that are useful for planning, initiating, monitoring, and evaluating health promotion and disease prevention programs. BRFSS is a state-based, random-digit-dialed telephone survey of the non-institutionalized U.S. adult population aged 18 years and older. BRFSS is conducted in the 50 states as well as the District of Columbia, Guam, Puerto Rico, and the Virgin Islands. This study focuses on 49 states and the District of Columbia. We obtained non-public use data retaining all county-level Federal Information Processing Standards (FIPS) codes²⁷ from the CDC. Alaska was excluded because necessary county-level FIPS codes were not available, making it impossible to deal with it in parallel with other states per the study's rural and urban definitions. To increase statistical power, multiple years of BRFSS data were combined. Data from 1995 combined with 1997 (n=247,255) and from 1999 combined with 2001 (n=363,077) were examined; the study's alcohol questions were not asked in all states in 1996, 1998, or 2000. The median response rate by state was 68.4 percent (range: 48.6 to 84.5%) in 1995 and 51.1 percent (range: 33.3 to 81.5%) in 2001. BRFSS is administered by telephone and its estimates for heavy

drinking are comparable to estimates obtained by other survey methods. For instance, the BRFSS national estimate for heavy drinking for 1999 and 2001 combined of 5.6 percent was similar to, though somewhat higher than the estimate of 4.6 percent produced by the National Health Interview Survey (NHIS) for 1999-2001, an in-home survey with a response rate of 69.6 percent in 1999.²⁸ For the same periods, the BRFSS estimate of heavy drinking among whites of 5.9 percent is higher than the corresponding NHIS estimate of 4.9 percent by approximately the same amount as the overall figures. However, for African Americans the BRFSS and NHIS estimates are quite close, 3.2 percent compared to 3.5 percent heavy drinkers, respectively.

DEPENDENT MEASURE

Alcohol use over the prior 30 days was determined through self-report; respondents were asked, "During the past 30 days/one week, how often have you had at least one drink of any alcoholic beverage?" and, "On the days when you drank, about how many drinks did you drink on the average?" These measures were combined to yield a daily average number of drinks consumed; heavy drinking was defined as a daily average of more than two drinks for men and more than one drink for women. Respondents were also asked, "How many times during the past 30 days did you have 5 or more drinks on an occasion?" From this question we constructed a dichotomous measure for whether the respondent had consumed at least 5 drinks on at least one occasion ("binge" drinking) during the prior 30 days.

INDEPENDENT MEASURES

Rural residence was ascertained by classifying county FIPS codes available on the BRFSS. These were broadly grouped as metropolitan (urban) or non-metropolitan (rural) county of residence based on the widely used standard Office of Management and Budget (OMB) taxonomy, and the rural classification was further categorized using the 1993 Urban Influence Code (UIC) groupings of the Economic Research Service of the United States Department of Agriculture²⁹ as follows: (1) "Rural Adjacent"—geographically adjacent to a metropolitan area; (2) "Large Rural Non-Adjacent"—not adjacent to a metropolitan county and with a city of 10,000 residents or greater; and (3) "Small Rural Non-Adjacent"—not adjacent to a metropolitan county and without a city of 10,000 residents or greater. UIC adjacency is determined by county boundaries and minimum work commuting. Other measures included: race/ethnicity (Hispanic, African American, American Indian, Asian/Pacific Islander, and non-Hispanic white); sex; age (18-34, 35-49, 50-64, and 65 years or older); educational attainment (less than high school degree, high school degree or equivalent, greater than

high school degree); annual household income (less than \$25,000, \$25,000-\$49,999, \$50,000-\$74,999, \$75,000 or greater); employment status (employed, unemployed, out of the workforce); and Census Region (Northeast, South, Midwest, West).

ANALYTICAL PLAN

Analyses were weighted using the BRFSS weighting formula by the sex, age, and race/ethnicity distributions of the population in each area to make estimates nationally representative. Significance tests and 95 percent confidence intervals (CIs) were calculated by using SUDAAN software,³⁰ which adjusts standard errors to account for the complex sample design of the BRFSS, yielding more conservative statistical tests. Logistic and multiple-outcome logistic regression analyses were performed to calculate the prevalence of any, moderate, heavy and binge drinking for each rural-urban category; analyses present the interaction of rural-urban status with each factor individually. To facilitate interpretation of regression results, predicted percentages (i.e., marginal effects) are presented.³¹ Temporal changes in prevalence of drinking behaviors were analyzed by comparing estimates from 1995/1997 against those from 1999/2001.

RESULTS

In the United States in 1999/2001, 52.7 percent of adults reporting consuming at least one alcoholic beverage during the prior 30 days; 47.1 percent reported moderate levels of drinking, 5.6 percent drank heavily, and 14.7 percent had at least one alcohol binge (results not reported in tables). Table 1 shows the estimated percentage of adults consuming alcoholic beverages during the previous month for 1999/2001. Overall, urban dwellers were more likely to report consuming alcohol (55.3%) while those living in small, remote rural locales were least likely to report this behavior (40.7%). Whites living in urban areas had the highest prevalence of all groups (59.0%); African Americans in rural areas of all kinds had the lowest prevalence (range: 31.0 – 32.4%). Men's prevalence was 16 to 19 percentage points higher than women's and prevalence of alcohol consumption dropped with age in all rural/urban areas. The prevalence of alcohol consumption in all rural/urban areas rose substantially with education level and income. The unemployed in all areas were less likely to report drinking than the employed, and those out of the labor force were least likely of all to report

Table 1: Percentage of Drinkers by Rural/Urban and Selected Characteristics (1999/2001)

Factor	Number of Respondents	Percentage of Adult Pop.	Non-Adjacent							
			Urban		Adjacent Rural		Large Rural		Small Rural	
			%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Overall	343,634		55.3	(54.9 , 55.6)	44.4	(43.6 , 45.1)	47.1	(46.1 , 48.1)	40.7	(39.8 , 41.5)
Race										
White	275,360	73.2	59.0	(58.7 , 59.4)	45.7	(44.9 , 46.5)	48.5	(47.4 , 49.6)	41.5	(40.6 , 42.4)
African American	27,061	9.7	42.4	(41.4 , 43.4)	32.4	(29.7 , 35.1)	31.5	(27.5 , 35.5)	31.0	(27.3 , 34.8)
Asian/Pacific Islander	6,908	2.7	45.2	(42.7 , 47.6)	47.3	(35.3 , 59.4)	38.1	(31.0 , 45.2)	40.6	(30.1 , 51.2)
American Indian	4,206	1.0	45.2	(41.0 , 49.3)	39.4	(33.3 , 45.5)	49.2	(37.5 , 60.8)	37.8	(32.0 , 43.5)
Hispanic	21,644	11.8	49.0	(47.7 , 50.2)	41.1	(37.3 , 44.9)	49.3	(44.7 , 53.9)	38.2	(33.6 , 42.8)
Gender										
Male	139,431	48.1	63.3	(62.8 , 63.8)	54.3	(53.1 , 55.5)	56.7	(55.2 , 58.2)	50.3	(49.0 , 51.6)
Female	204,203	51.9	47.8	(47.3 , 48.2)	35.7	(34.8 , 36.6)	38.5	(37.2 , 39.7)	32.2	(31.2 , 33.2)
Age										
18-34	91,406	31.3	62.3	(61.7 , 62.9)	53.4	(51.8 , 55.0)	57.9	(56.1 , 59.8)	50.3	(48.3 , 52.2)
35-49	109,281	30.5	58.7	(58.1 , 59.3)	50.1	(48.8 , 51.3)	51.0	(49.2 , 52.8)	45.7	(44.2 , 47.2)
50-64	74,980	20.5	51.3	(50.6 , 52.1)	39.4	(37.9 , 40.8)	42.6	(40.5 , 44.6)	37.2	(35.6 , 38.8)
65+	65,616	17.7	40.6	(39.8 , 41.4)	29.3	(27.8 , 30.7)	27.9	(26.0 , 29.9)	27.2	(25.7 , 28.8)
Education										
< high school	40,178	13.4	36.0	(34.8 , 37.1)	27.5	(25.7 , 29.2)	31.0	(27.7 , 34.3)	23.9	(22.1 , 25.6)
High school	203,150	58.6	53.5	(53.0 , 53.9)	44.9	(44.0 , 45.8)	46.6	(45.3 , 47.9)	41.9	(40.8 , 42.9)
College degree	99,614	28.1	66.4	(65.8 , 66.9)	56.8	(55.2 , 58.3)	58.1	(56.3 , 60.0)	54.1	(52.2 , 56.0)
Income										
< 25K	92,655	25.5	43.7	(42.9 , 44.4)	35.9	(34.6 , 37.2)	40.1	(38.2 , 42.0)	31.5	(30.1 , 32.8)
>= 25K, < 50K	104,288	29.4	55.7	(55.1 , 56.3)	47.9	(46.6 , 49.2)	49.2	(47.5 , 51.0)	46.4	(44.9 , 47.9)
>= 50K, < 75K	48,582	14.7	64.0	(63.2 , 64.8)	55.7	(53.7 , 57.8)	59.2	(56.6 , 61.8)	52.5	(49.9 , 55.1)
75K +	47,428	15.5	73.1	(72.4 , 73.8)	64.0	(61.6 , 66.4)	67.2	(64.2 , 70.1)	63.1	(59.9 , 66.2)
Missing	50,681	15.0	41.9	(41.0 , 42.8)	30.8	(29.2 , 32.5)	34.7	(32.3 , 37.1)	31.1	(29.0 , 33.2)
Employment status										
Employed	216,384	63.3	61.8	(61.4 , 62.2)	52.0	(51.0 , 52.9)	54.3	(53.1 , 55.6)	48.5	(47.3 , 49.6)
Unemployed	11,997	4.1	50.9	(49.1 , 52.7)	47.3	(43.5 , 51.2)	44.2	(38.6 , 49.9)	44.4	(39.6 , 49.3)
Out of labor force	114,652	32.6	42.6	(42.0 , 43.2)	31.5	(30.3 , 32.7)	34.8	(33.0 , 36.5)	28.2	(27.0 , 29.5)
Census region										
Northeast	68,433	19.5	57.0	(56.2 , 57.7)	53.9	(51.8 , 56.0)	58.3	(53.2 , 63.4)	51.2	(47.1 , 55.2)
South	119,872	35.6	50.9	(50.4 , 51.4)	36.1	(35.1 , 37.0)	37.6	(35.9 , 39.3)	29.5	(28.3 , 30.7)
Midwest	80,668	22.9	57.6	(56.9 , 58.3)	50.1	(48.6 , 51.6)	51.0	(49.2 , 52.8)	49.1	(47.5 , 50.6)
West	74,661	22.1	57.9	(57.0 , 58.8)	52.1	(49.9 , 54.3)	54.1	(52.6 , 55.7)	51.5	(49.8 , 53.2)

drinking. However, the difference between urban and small remote rural counties in prevalence of alcohol consumption was smallest for the unemployed compared to the employed and those not in the labor force (absolute difference of 6.5% compared to 13.3% and 14.4%, respectively). The Census region with the lowest reported prevalence of alcohol consumption in all rural/urban areas, as well as the largest difference between urban and rural areas, was the South region, with an absolute difference of 21.4% between urban and small remote rural counties.

Table 2 gives estimated prevalence of moderate and heavy drinking during the prior 30 days in 1999/2001. Estimated prevalence for both moderate and heavy drinking followed similar patterns to any drinking. Moderate and heavy drinking were highest in urban counties by a significant amount, and second highest in non-adjacent rural counties with a large town. Whites, particularly urban, reported more moderate and heavy drinking in most areas than other racial/ethnic groups, while African Americans reported the least. Men reported more moderate and heavy

Table 2: Percentage of Moderate and Heavy Drinkers by Rural/Urban and Selected Characteristics (1999/2001)

Factor	Urban				Adjacent Rural			
	Mod. Drinkers		Heavy Drinkers		Mod. Drinkers		Heavy Drinkers	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Overall	49.1	(48.7 , 49.4)	6.1	(5.9 , 6.2)	40.7	(40.0 , 41.3)	4.1	(3.9 , 4.3)
Race								
White	51.9	(51.5 , 52.2)	6.8	(6.6 , 7.0)	41.9	(41.2 , 42.6)	4.2	(4.0 , 4.4)
African American	38.7	(37.9 , 39.6)	3.6	(3.5 , 3.8)	30.2	(27.8 , 32.6)	2.4	(2.1 , 2.7)
Asian/Pacific Islander	40.5	(38.5 , 42.5)	4.0	(3.6 , 4.3)	41.9	(32.6 , 51.1)	4.2	(2.4 , 6.0)
American Indian	42.8	(38.8 , 46.7)	4.4	(3.6 , 5.2)	36.8	(31.4 , 42.2)	3.3	(2.5 , 4.2)
Hispanic	44.8	(43.7 , 45.9)	4.8	(4.5 , 5.1)	38.3	(34.9 , 41.7)	3.6	(3.0 , 4.1)
Gender								
Male	54.9	(54.5 , 55.4)	7.8	(7.6 , 8.0)	49.2	(48.3 , 50.2)	5.8	(5.5 , 6.1)
Female	43.6	(43.2 , 44.0)	4.4	(4.3 , 4.6)	33.1	(32.3 , 33.9)	2.7	(2.6 , 2.8)
Age								
18-34	54.7	(54.2 , 55.1)	7.7	(7.5 , 8.0)	48.7	(47.3 , 50.0)	5.7	(5.3 , 6.1)
35-49	51.5	(51.0 , 52.0)	6.5	(6.3 , 6.7)	45.5	(44.4 , 46.5)	4.9	(4.6 , 5.1)
50-64	46.2	(45.5 , 46.8)	5.0	(4.9 , 5.2)	36.5	(35.2 , 37.7)	3.2	(3.0 , 3.4)
65+	37.5	(36.8 , 38.2)	3.4	(3.2 , 3.5)	27.3	(26.0 , 28.7)	2.1	(1.9 , 2.2)
Education								
< high school	33.9	(32.8 , 34.9)	2.8	(2.7 , 3.0)	26.0	(24.4 , 27.6)	1.9	(1.7 , 2.1)
High school	48.4	(48.0 , 48.8)	5.5	(5.4 , 5.7)	41.6	(40.7 , 42.4)	4.0	(3.9 , 4.2)
College degree	56.1	(55.6 , 56.5)	8.3	(8.1 , 8.5)	49.8	(48.7 , 51.0)	6.0	(5.6 , 6.3)
Income								
< 25K	40.8	(40.1 , 41.5)	3.7	(3.6 , 3.9)	34.0	(32.8 , 35.3)	2.7	(2.6 , 2.9)
>= 25K, < 50K	50.2	(49.6 , 50.7)	5.8	(5.6 , 6.0)	44.2	(43.1 , 45.2)	4.4	(4.1 , 4.6)
>= 50K, < 75K	55.5	(54.9 , 56.1)	7.6	(7.3 , 8.0)	49.5	(48.0 , 51.1)	5.6	(5.2 , 6.0)
75K +	60.1	(59.6 , 60.6)	10.3	(10.0 , 10.6)	55.3	(53.8 , 56.8)	7.6	(6.9 , 8.2)
Missing	38.7	(37.9 , 39.5)	3.4	(3.2 , 3.5)	29.0	(27.5 , 30.6)	2.1	(2.0 , 2.3)
Employment status								
Employed	53.9	(53.5 , 54.3)	7.3	(7.1 , 7.5)	47.1	(46.4 , 47.9)	5.2	(5.0 , 5.4)
Unemployed	47.1	(45.6 , 48.6)	5.2	(4.8 , 5.6)	44.7	(41.2 , 48.1)	4.6	(3.9 , 5.4)
Out of labor force	39.4	(38.8 , 39.9)	3.6	(3.5 , 3.8)	29.5	(28.4 , 30.6)	2.3	(2.1 , 2.4)
Census region								
Northeast	50.0	(49.4 , 50.6)	6.3	(6.0 , 6.5)	48.3	(46.7 , 49.9)	5.8	(5.3 , 6.2)
South	45.7	(45.2 , 46.1)	5.1	(4.9 , 5.2)	33.6	(32.7 , 34.4)	2.9	(2.8 , 3.0)
Midwest	50.6	(50.0 , 51.1)	6.4	(6.2 , 6.7)	45.3	(44.1 , 46.5)	5.0	(4.7 , 5.3)
West	51.9	(51.2 , 52.6)	6.9	(6.6 , 7.2)	47.3	(45.5 , 49.1)	5.5	(5.0 , 6.0)

drinking in all areas than women, and moderate and heavy drinking declined with age and increased with education and income in all county types. Finally, prevalence of heavy and moderate drinking followed the pattern of any drinking by employment status and census region. Differences in heavy drinking by income were greatest in urban counties; however, the gender differences in moderate drinking were greater in rural counties than urban.

Table 3 shows the estimated percentage of persons who consumed five or more drinks on at least one occasion (i.e., binge drinkers) during the prior 30 days. Like reported moderate and heavy drinking, reported binge drinking was highest in urban counties and second highest in non-adjacent rural counties with a large town. The lack of statistical power makes it difficult to determine whether some apparently large differences by race/ethnicity are real; the group with the highest estimate for prevalence of binge drinking in most counties was American Indian, however, they

Table 2 continued

Factor	Non-Adjacent Large Rural				Non-Adjacent Small Rural			
	Mod. Drinkers		Heavy Drinkers		Mod. Drinkers		Heavy Drinkers	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Overall	43.0	(42.1 , 43.9)	4.6	(4.3 , 4.8)	37.5	(36.8 , 38.2)	3.5	(3.4 , 3.7)
Race								
White	44.1	(43.2 , 45.1)	4.7	(4.4 , 4.9)	38.3	(37.5 , 39.1)	3.6	(3.4 , 3.7)
African American	29.4	(25.8 , 32.9)	2.3	(1.9 , 2.7)	29.0	(25.6 , 32.5)	2.3	(1.9 , 2.7)
Asian/Pacific Islander	36.3	(29.0 , 43.7)	3.3	(2.1 , 4.4)	37.0	(28.3 , 45.7)	3.4	(2.0 , 4.7)
American Indian	47.2	(33.8 , 60.5)	5.4	(2.0 , 8.8)	35.6	(30.4 , 40.8)	3.2	(2.4 , 3.9)
Hispanic	45.3	(41.2 , 49.5)	4.9	(4.0 , 5.9)	35.6	(31.5 , 39.6)	3.2	(2.5 , 3.8)
Gender								
Male	51.0	(49.7 , 52.2)	6.3	(5.9 , 6.7)	45.9	(44.8 , 47.0)	4.9	(4.7 , 5.2)
Female	35.7	(34.6 , 36.8)	3.1	(2.9 , 3.3)	30.1	(29.2 , 31.0)	2.4	(2.2 , 2.5)
Age								
18-34	52.0	(50.6 , 53.4)	6.7	(6.2 , 7.2)	45.9	(44.3 , 47.5)	5.0	(4.6 , 5.4)
35-49	46.2	(44.6 , 47.8)	5.0	(4.6 , 5.4)	41.8	(40.6 , 43.1)	4.1	(3.9 , 4.4)
50-64	39.3	(37.5 , 41.0)	3.7	(3.3 , 4.0)	34.7	(33.2 , 36.2)	3.0	(2.7 , 3.2)
65+	26.1	(24.3 , 27.9)	1.9	(1.7 , 2.1)	25.5	(24.1 , 26.9)	1.9	(1.7 , 2.0)
Education								
< high school	29.8	(26.3 , 33.2)	2.3	(1.9 , 2.7)	22.7	(21.0 , 24.3)	1.6	(1.4 , 1.7)
High school	42.9	(41.8 , 44.0)	4.3	(4.1 , 4.5)	38.9	(37.9 , 39.8)	3.6	(3.4 , 3.7)
College degree	51.0	(49.6 , 52.4)	6.3	(5.8 , 6.8)	47.8	(46.3 , 49.2)	5.4	(5.0 , 5.8)
Income								
< 25K	38.0	(36.2 , 39.9)	3.3	(3.0 , 3.6)	29.9	(28.6 , 31.1)	2.2	(2.1 , 2.4)
>= 25K, < 50K	45.1	(43.7 , 46.6)	4.6	(4.2 , 4.9)	42.5	(41.3 , 43.8)	4.1	(3.8 , 4.3)
>= 50K, < 75K	51.5	(49.7 , 53.4)	6.2	(5.6 , 6.8)	47.2	(45.1 , 49.2)	5.0	(4.5 , 5.5)
75K +	57.9	(55.9 , 59.9)	8.8	(7.7 , 10.0)	55.2	(53.0 , 57.3)	7.5	(6.6 , 8.4)
Missing	32.6	(30.4 , 34.7)	2.6	(2.3 , 2.8)	29.3	(27.3 , 31.3)	2.2	(1.9 , 2.4)
Employment status								
Employed	48.8	(47.8 , 49.8)	5.6	(5.3 , 5.9)	44.2	(43.2 , 45.1)	4.5	(4.3 , 4.7)
Unemployed	42.6	(37.1 , 48.1)	4.2	(3.1 , 5.3)	41.9	(37.5 , 46.3)	4.1	(3.3 , 4.9)
Out of labor force	32.7	(31.0 , 34.3)	2.7	(2.4 , 2.9)	26.6	(25.5 , 27.7)	2.0	(1.8 , 2.1)
Census region								
Northeast	52.1	(48.2 , 55.9)	7.0	(5.6 , 8.3)	46.2	(43.0 , 49.5)	5.2	(4.4 , 6.0)
South	34.9	(33.3 , 36.4)	3.1	(2.8 , 3.3)	27.8	(26.7 , 28.9)	2.2	(2.0 , 2.3)
Midwest	46.0	(44.6 , 47.5)	5.2	(4.8 , 5.5)	44.3	(43.1 , 45.6)	4.8	(4.5 , 5.1)
West	48.7	(47.4 , 50.0)	5.9	(5.5 , 6.3)	46.3	(44.9 , 47.7)	5.2	(4.9 , 5.6)

were significantly different from Hispanics only in non-adjacent counties without a large town. Likewise, Asians/Pacific Islanders had the lowest reported prevalence of binge drinking in most areas, but their prevalence was significantly different from that of African Americans only in urban counties. Men were considerably more likely than women to report binge drinking in any type of county, and reported binge drinking fell precipitously with age in all areas. Those with a high school diploma had higher reported binge drinking than either those without or college graduates; however, the difference in prevalence between those without a high school diploma and high school graduates increased steadily from urban counties (2.3% absolute difference) to rural counties (3.6%, 4.3%, 5.0%, respectively). Income and reported binge drinking had little relationship in any rural/urban area; the lowest income group (< \$25,000) had somewhat lower estimated prevalence of reported

binge drinking in most areas, and in the area with the most significant differences (nonadjacent small) there was no trend apparent. The employed were significantly less likely to report binge drinking than the employed in adjacent rural and non-adjacent small rural counties; in urban and non-adjacent large rural counties there was no difference in binge drinking between the employed and the unemployed. As with moderate and heavy drinking, binge drinking was least likely to be reported in the South Census Region, and the difference between this region and others was least in urban counties, and greatest in small nonadjacent rural counties.

Table 4 classifies rural areas of states by heavy drinking prevalence in 1999/2001 and change in heavy drinking between 1995/1997 and 1999/2001.

“Current” prevalence divides states into three equal-sized groups, low, moderate and high. Change in

Table 3: Percentage of Binge Drinkers by Rural/Urban and Selected Characteristics (1999/2001)

Factor	Urban		Adjacent Rural		Non-Adjacent			
	%	(95% CI)	%	(95% CI)	Large Rural		Small Rural	
					%	(95% CI)	%	(95% CI)
Overall	15.1	(14.8 , 15.3)	13.3	(12.8 , 13.8)	15.0	(14.2 , 15.8)	12.2	(11.6 , 12.9)
Race								
White	15.5	(15.2 , 15.8)	13.5	(12.9 , 14.1)	14.8	(14.0 , 15.7)	12.2	(11.5 , 12.9)
African American	10.5	(9.9 , 11.2)	9.4	(7.6 , 11.1)	10.2	(7.8 , 12.6)	10.6	(7.1 , 14.0)
Asian/Pacific Islander	8.8	(7.5 , 10.0)	6.6	(2.9 , 10.4)	12.7	(6.9 , 18.6)	8.3	(4.5 , 12.0)
American Indian	18.4	(15.1 , 21.7)	18.5	(13.7 , 23.4)	30.9	(16.4 , 45.4)	17.3	(13.2 , 21.4)
Hispanic	17.6	(16.5 , 18.6)	15.5	(12.7 , 18.2)	19.8	(15.6 , 24.0)	13.3	(10.3 , 16.3)
Gender								
Male	23.1	(22.6 , 23.6)	21.3	(20.3 , 22.2)	23.5	(22.0 , 25.0)	20.0	(18.9 , 21.2)
Female	7.6	(7.4 , 7.8)	6.4	(5.9 , 6.8)	7.3	(6.6 , 8.0)	5.3	(4.8 , 5.8)
Age								
18-34	25.9	(25.3 , 26.5)	24.2	(22.7 , 25.6)	26.8	(25.0 , 28.7)	22.7	(20.9 , 24.5)
35-49	14.9	(14.4 , 15.3)	15.1	(14.2 , 16.1)	16.2	(14.5 , 17.9)	13.8	(12.8 , 14.9)
50-64	8.5	(8.0 , 8.9)	7.1	(6.4 , 7.9)	7.0	(5.9 , 8.1)	7.8	(6.8 , 8.8)
65+	3.2	(2.8 , 3.5)	2.6	(2.1 , 3.1)	2.0	(1.5 , 2.5)	2.9	(2.3 , 3.4)
Education								
< high school	13.7	(12.8 , 14.6)	10.7	(9.4 , 11.9)	12.1	(9.1 , 15.2)	8.6	(7.4 , 9.8)
High school	16.0	(15.7 , 16.4)	14.3	(13.6 , 15.0)	16.4	(15.3 , 17.4)	13.6	(12.7 , 14.5)
College degree	13.9	(13.5 , 14.3)	12.2	(11.1 , 13.2)	13.1	(11.7 , 14.5)	10.9	(9.6 , 12.1)
Income								
< 25K	14.5	(13.9 , 15.0)	12.3	(11.3 , 13.3)	15.6	(13.9 , 17.2)	10.7	(9.8 , 11.6)
>= 25K, < 50K	16.5	(16.1 , 17.0)	15.4	(14.4 , 16.3)	16.3	(14.8 , 17.9)	14.6	(13.3 , 15.9)
>= 50K, < 75K	17.0	(16.3 , 17.7)	15.5	(14.0 , 17.0)	15.7	(13.5 , 18.0)	12.7	(11.1 , 14.4)
75K +	16.7	(16.1 , 17.3)	14.8	(13.1 , 16.6)	16.5	(13.5 , 19.5)	16.1	(13.4 , 18.9)
Missing	9.1	(8.5 , 9.6)	7.8	(6.7 , 8.8)	9.5	(8.0 , 10.9)	8.6	(7.0 , 10.1)
Employment status								
Employed	18.6	(18.2 , 18.9)	17.1	(16.4 , 17.9)	18.3	(17.3 , 19.4)	15.9	(15.0 , 16.9)
Unemployed	18.8	(17.3 , 20.2)	20.9	(17.5 , 24.4)	20.0	(15.4 , 24.6)	23.6	(18.8 , 28.4)
Out of labor force	7.6	(7.2 , 7.9)	6.2	(5.5 , 6.9)	8.6	(7.1 , 10.1)	5.3	(4.6 , 6.0)
Census region								
Northeast	14.8	(14.3 , 15.3)	15.6	(14.1 , 17.0)	18.2	(13.5 , 22.8)	14.3	(11.4 , 17.3)
South	13.5	(13.1 , 13.9)	10.5	(9.8 , 11.2)	11.7	(10.3 , 13.1)	8.9	(8.0 , 9.7)
Midwest	17.9	(17.4 , 18.5)	16.5	(15.3 , 17.6)	17.0	(15.5 , 18.4)	15.5	(14.1 , 16.8)
West	15.1	(14.5 , 15.8)	14.2	(12.6 , 15.7)	16.9	(15.6 , 18.1)	14.3	(13.1 , 15.5)

Table 4: Absolute Change in Rural Heavy Drinking Prevalence from 1995/1997 to 1999/2001 by Rural Heavy Drinking Prevalence in 1999/2001*

Absolute Change, 1995/1997 to 1999/2001	Current Prevalence (1999/2001)		
	Highest Prevalence (5.75 – 12.00%)	Moderate Prevalence (4.00 – 5.74%)	Lowest Prevalence (2.00 – 3.99%)
Highest Absolute Increase (2.00 – 3.99%)	<i>Arizona</i> <i>Delaware</i> <i>New Hampshire</i> <i>Indiana</i> <i>Maryland</i> <i>Michigan</i> <i>Nevada</i> <i>New York</i> <i>Washington</i> <i>Wisconsin</i>	<i>Maine</i> <i>Missouri</i> <i>Montana</i>	
Moderate Absolute Increase (1.00 – 1.99%)	Connecticut <i>Hawaii</i> Minnesota	<i>Georgia</i> Illinois Texas <i>Wyoming</i>	<i>Arkansas</i> <i>Mississippi</i> <i>Nebraska</i> Oklahoma Tennessee Utah
Lowest Absolute Increase (0.00 – 0.99%)	Vermont	Colorado Iowa Kansas New Mexico Pennsylvania South Carolina	Idaho Kentucky North Carolina North Dakota Ohio South Dakota West Virginia
Absolute Decrease (-2.30 – 0.01%)	California Rhode Island†	Florida Massachusetts Oregon	Alabama Louisiana Virginia

* Does not include Alaska (county FIPs codes unavailable), or New Jersey and the District of Columbia (no rural counties); states in italics had a significant change in heavy drinking ($p < 0.05$).

† Rhode Island had 1 nonmetropolitan county under the 1993 urban influence code classifications used in this study.

prevalence has four groups, those with a decrease, and those with an increase divided into three roughly equal-sized groups corresponding to low, moderate and high increases. Rural areas of states in the South Census region were concentrated in the lowest prevalence group (2.00 to 3.99%), and none of the low prevalence group experienced a high increase over the period. The majority of states with the highest prevalence of heavy drinking in rural areas also experienced a high absolute increase. States with the highest increases or highest prevalences in rural heavy drinking were concentrated in the Northeast Census

region and in the northern parts of the South and Midwest Census regions. States with a significant change ($p < 0.05$) in rural heavy drinking each had a moderate or high increase in heavy drinking prevalence.

Table 5 shows the same classification scheme as Table 4, but for binge drinking. Similar to heavy drinking, states in the South Census region concentrated in the group with the lowest prevalence of rural binge drinking, while Northeast and Midwest Census region states dominated groups with the highest prevalence or highest increase in rural binge

Table 5: Absolute Change in Rural Binge Drinking Prevalence from 1995/1997 to 1999/2001 by Rural Binge Drinking Prevalence in 1999/2001*

Absolute Change, 1995/1997 to 1999/2001	Current Prevalence (1999/2001)		
	Highest Prevalence (15.30 – 26.00%)	Moderate Prevalence (12.60 – 15.29%)	Lowest Prevalence (5.00 – 12.59%)
Highest Absolute Increase (2.50 – 7.20%)	<i>Indiana</i> <i>Maryland</i> <i>Montana</i> <i>North Dakota</i>	<i>Delaware</i> <i>Maine</i> <i>New York</i>	<i>Mississippi</i> <i>Ohio</i>
Moderate Absolute Increase (1.50 – 2.49%)	Michigan Minnesota Wisconsin Wyoming	Missouri New Mexico	<i>Arkansas</i> <i>North Carolina</i> Oklahoma
Lowest Absolute Increase (0.00 – 1.49%)	New Hampshire Nevada Pennsylvania South Dakota Vermont	Louisiana Oregon Texas Washington	Arizona <i>Georgia</i> Tennessee Utah West Virginia
Absolute Decrease (-3.50 – 0.01%)	California Massachusetts Rhode Island†	Colorado Connecticut Hawaii Idaho Illinois Iowa Nebraska	Alabama Florida Kansas Kentucky South Carolina Virginia

* Does not include Alaska (county FIPs codes unavailable), or New Jersey and the District of Columbia (no rural counties); states in italics had a significant change in binge drinking ($p < 0.05$).

† Rhode Island had 1 nonmetropolitan county under the 1993 urban influence code classifications used in this study.

drinking. Many more states registered a decrease for rural binge drinking than for heavy drinking, though none of the decreases was statistically significant ($p < 0.05$). There were also fewer states with significant increases in rural binge drinking than there were for rural heavy drinking, though five of the nine states with significant increases in rural binge drinking were states in the South Census region (Arkansas, Delaware, Maryland, Mississippi, and North Carolina), and three of these fell into the highest increase group.

A few states in particular showed overlapping patterns in problematic drinking behaviors in rural counties. Indiana and Maryland were the only states to appear in the highest prevalence and highest absolute increase groups for both heavy drinking and binge drinking. Delaware, Maine, Montana and New York had high, significant increases in heavy and binge drinking, and either high or moderate prevalence for both. Michigan and Wisconsin had high prevalence for both heavy and

binge drinking, and high, significant increases in heavy drinking. Arkansas and Mississippi, both southern states, had low prevalences of both heavy and binge drinking; however, both states experienced moderate significant increases in heavy drinking and Mississippi had a high significant increase, and Arkansas a moderate significant increase, in binge drinking.

Figures 1 through 4 show the change in the estimated prevalence of alcohol use, comparing rural and urban counties for the 1995/1997 and 1999/2001 time periods. These analyses were adjusted for respondent characteristics (age, sex, race, educational attainment, household income, employment status, Census region, general health, and whether the respondent had a health plan). Any, moderate and heavy reported alcohol use, as well as likelihood of reporting a binge all increased in all areas between 1995/1997 and 1999/2001, and all increases over time were

Figure 1: Percentage Consuming Alcohol in Past 30 Days, Regression Adjusted, by Type of Rural/Urban County

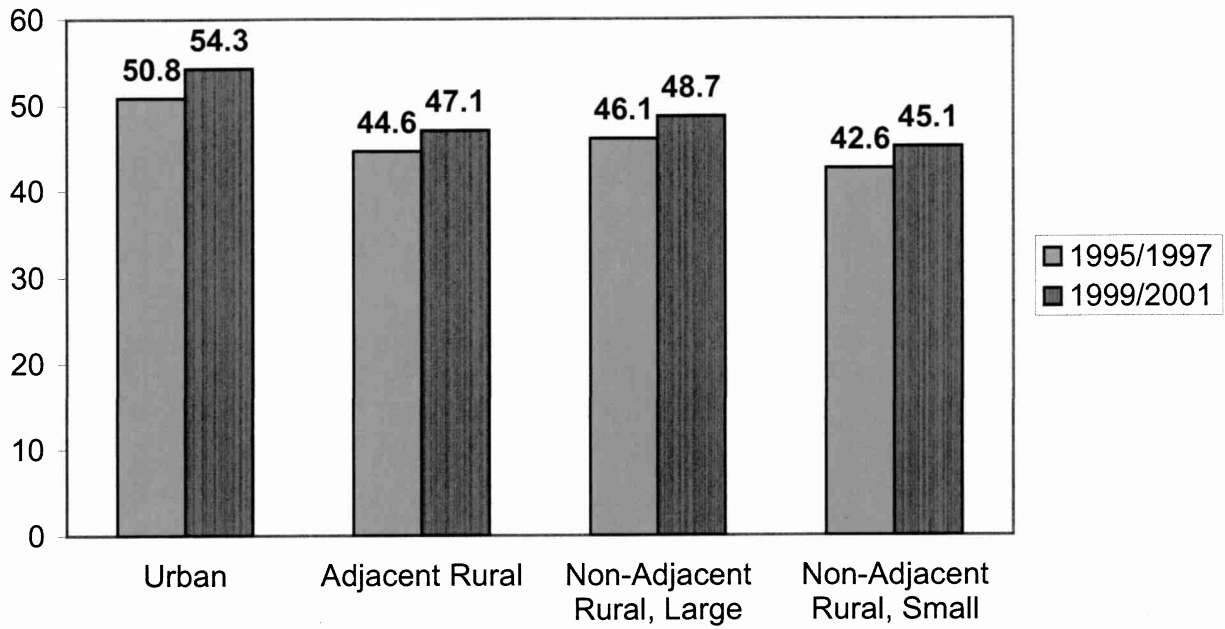


Figure 2: Percentage Moderate Drinkers, Regression Adjusted, by Type of Rural/Urban County

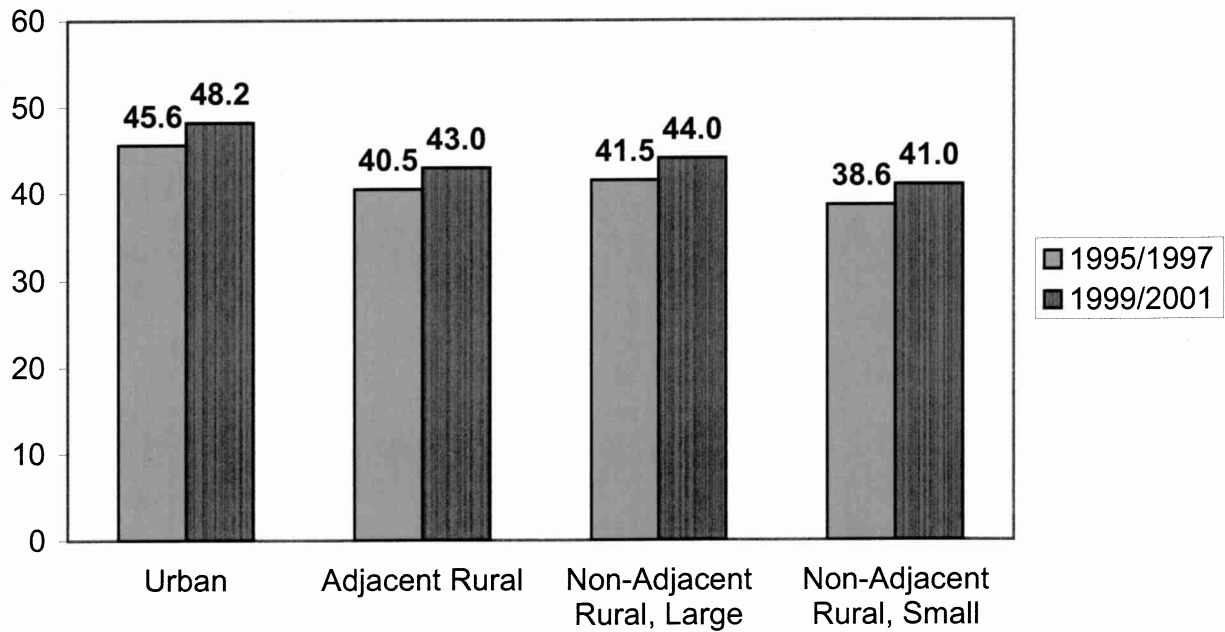


Figure 3: Percentage Heavy Drinkers, Regression Adjusted, by Type of Rural/Urban County

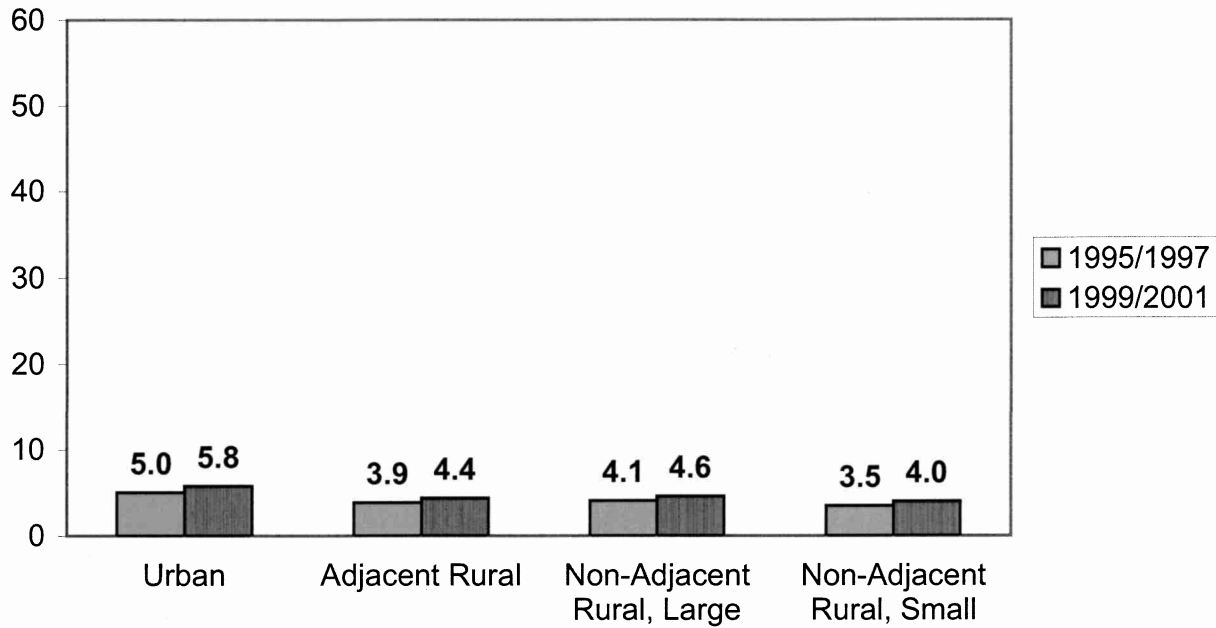
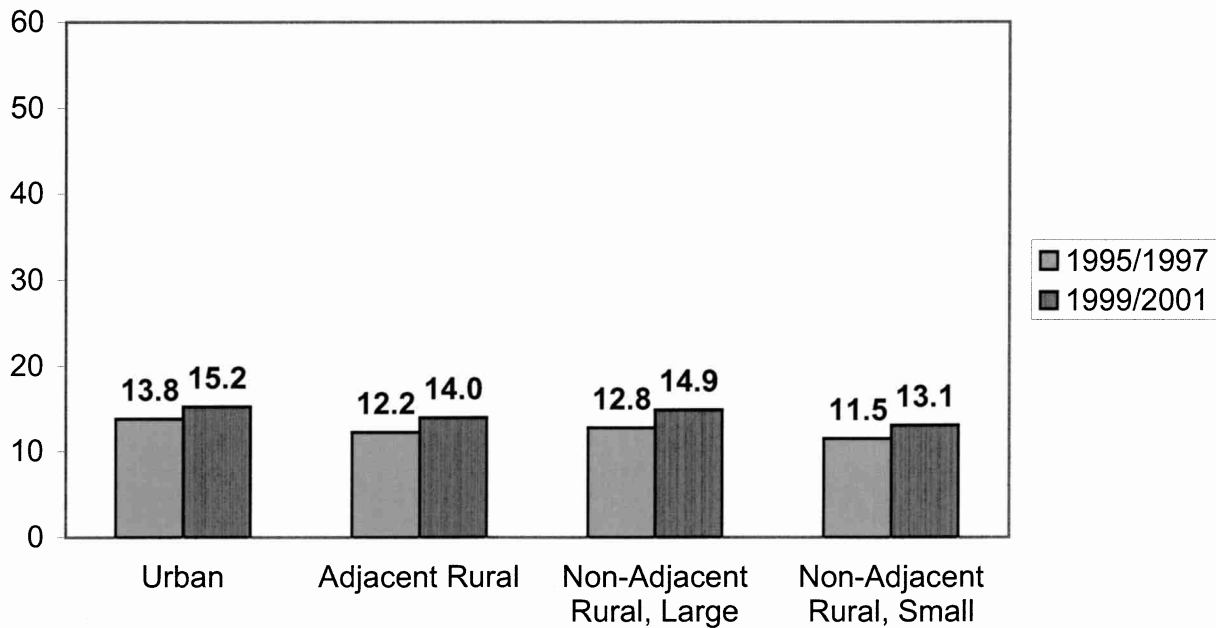


Figure 4: Percentage Binge Drinkers, Regression Adjusted, by Type of Rural/Urban County



statistically significant ($p < 0.05$). Adjustment for respondent characteristics attenuated the relationship between rural/urban residence and alcohol use for all drinking behaviors in 1999/2001. The increase in the prevalence of reporting any alcohol use (Figure 1) was slightly greater in urban counties (3.5% absolute difference) compared to rural counties (2.5 to 2.6%). For moderate drinking, there was little difference in the increase between rural (absolute change ranging from 2.4% to 2.5%) and urban areas (absolute increase of 2.6%). Absolute increases in reported heavy drinking (Figure 3) were modest, though in relative terms they were somewhat greater than for any or moderate reported alcohol use. In urban areas heavy reported alcohol use increased 0.8 percentage points to a prevalence of 5.8 percent in 1999/2001, the largest increase and highest prevalence. All rural areas increased by 0.5 percentage points, for current prevalences between 4.0 and 4.6 percent. Binge drinking followed a different pattern than other drinking behaviors. Reported prevalence of binge drinking (Figure 4) increased the most for non-adjacent rural counties with a large town (2.1% absolute increase), raising it to nearly the level of urban binge drinking (14.9% compared with 15.2%, respectively). Binge drinking was the only alcohol behavior investigated for which prevalence in a rural area approached that of urban counties, and for which the increase was smallest in urban counties.

DISCUSSION

The raw and adjusted prevalence of any, moderate, heavy, and binge drinking was higher in urban counties compared with rural counties of all types. Drinking behaviors of all kinds increased in all county types between 1995/1997 and 1999/2001, and heavy drinking increased in rural areas of most states.

1999/2001 PERIOD

There are a few key differences in alcohol use between those living in rural versus urban counties. In the 1999/2001 period the prevalence of alcohol use was highest in urban counties, though the differential between urban and rural areas varied with the type of behavior. Any and moderate alcohol use showed regular though small relative differences between urban and rural counties. Rural counties lagged behind urban counties in prevalence of heavy drinking, while non-adjacent large rural counties appear to be overtaking urban counties in reported binge drinking. However, the majority of the absolute difference in overall alcohol use between urban and rural counties is accounted for by higher prevalence of moderate drinking in urban areas, with quite small differences in heavy drinking. Overall, living in an urban locale tended to suppress the differences in prevalence of

alcohol consumption behaviors between different groups, and while urban counties led prevalence in most alcohol behaviors, binge drinking was nearly as prevalent in non-adjacent rural counties with a large town. Moreover, binge drinking appeared to be a particular problem for some rural groups.

Whites living in urban areas had the highest overall prevalence of any, moderate, or heavy alcohol consumption, though binge drinking was uniformly highest among American Indians in any rural/urban area, particular in non-adjacent rural counties with a large town. African Americans reported comparatively low prevalence of alcohol consumption at any level in all areas. Women were less likely than men to report drinking at all, as well as less likely to report moderate, heavy or binge drinking, though the gender difference in moderate drinking was less pronounced in urban counties. The prevalence of all drinking behaviors declined steadily and evenly with age in all county types.

Likelihood of drinking at all, or drinking moderately or heavily increased with educational attainment, while binge drinking peaked among those with only a high school diploma. Likewise, the prevalence of any, moderate, or heavy drinking all increased with income level, while the relationship of binge drinking to income was unclear in any rural/urban setting. The unemployed were less likely than the employed to report drinking at all, moderately or heavily, but in rural counties they were more likely to report binge drinking than the employed. Those living in the South Census region were least likely to report any of the drinking behaviors, though the differences between this region and others were less pronounced in urban counties than in rural.

STATES AND TEMPORAL CHANGE

States with significant, high increases in heavy or binge drinking in rural counties tended to be located in the Northeast and Midwest Census regions, while South Census region states typically experienced low to moderate prevalence and low increases or even decreases in both behaviors. However, notable exceptions to the general southern pattern of low and steady prevalence of alcohol use in rural counties were Arkansas, Delaware, Maryland and Mississippi, where prevalence, increase, or both, for both heavy and binge drinking, were high, and all increases were statistically significant. Other states with potentially worrisome patterns in heavy and binge drinking were Indiana, Maine, Michigan, Montana, New York and Wisconsin. While many states showed decreases in prevalence of heavy or binge drinking in rural counties, these decreases were never statistically significant.

Adjusted analyses for all drinking behaviors show similar rural/urban patterns in 1999/2001 prevalence

as for unadjusted analyses. All types of counties experienced increases in prevalence for all behaviors, and urban counties led all types of rural counties in prevalence and increase for any, moderate, and heavy drinking in 1999/2001. The prevalence of binge drinking, however, increased the most in rural counties with a large town, to a 1999/2001 prevalence similar to that of urban counties.

LIMITATIONS

These findings are subject to several limitations. BRFSS does not sample persons living in institutions or persons living in households without a telephone. Persons living in households without a telephone may be less likely to consume alcohol or may consume less alcohol, as having a telephone reflects socioeconomic status. Prevalence estimates and trend data could have been affected by low response rates; however, demographic characteristics of BRFSS responders are consistent with U.S. Census data. The race/ethnicity groupings available in BRFSS data would not allow any important differences between heterogeneous subgroups within these broad categories to be revealed. Another limitation is the use of self-reported alcohol consumption for determining heavy drinking. Reports of alcohol consumption vary with the season,³² and telephone surveys are more likely than self-administered surveys to yield self-report of alcohol consumption that is biased by social expectations.³³ Moreover, retrospective self-reports may underestimate the degree of heavy drinking.³⁴

Finally, just as within-state variation in health risk factors is a concern,³⁵ care must also be taken in drawing conclusions based on data aggregated by county, as there is a significant degree of variation in population characteristics between sub-county areas that are invisible when county-level measures are employed. Counties with at least one metropolitan area may also encompass rural populations of substantial size, while many primarily rural counties have towns large enough to experience prevalence of alcohol use similar to metropolitan areas. This would tend to have the effect of attenuating the rural/urban difference in prevalence of drinking behaviors by county, since many county-level estimates will include both rural and urban components. Therefore, our study may underestimate the difference in the prevalence of heavy and binge drinking between rural and urban areas if these areas were to be more precisely delineated.

CONCLUSION

Residents of rural counties are less likely to engage in moderate alcohol consumption than urban residents, which may mean that they are missing out on some of its cardiovascular benefits.¹⁻³ However, programs that would encourage moderate drinking in rural areas could have adverse consequences that outweigh any benefit. Recent large increases in binge drinking in rural counties may put rural residents at higher risk for health problems and accidents associated with alcohol abuse.⁵⁻⁷ The scarcity of substance abuse services in many rural counties, the reluctance of rural residents to seek treatment, and issues around privacy in small communities make it more difficult to target these populations,¹⁸⁻²⁴ and some rural groups with comparatively high prevalence of binge drinking, such as American Indians and the unemployed, may have additional barriers to seeking treatment.

Even though this report and other studies³⁶ show lower incidence of alcohol use and abuse in rural areas compared with urban, the greater difficulties in identifying and treating substance abusers in rural communities means that interventions designed specifically for the needs of rural residents deserve attention. Several studies demonstrate that brief physician advice regarding problem drinking can influence drinking behavior in desired ways;^{37,38} this approach is most viable for rural residents with access to primary care. Incidental contact between rural residents and a variety of institutions and services (e.g., emergency rooms, jails, churches) can serve as “addiction treatment gateways,” particularly for those persons who may not recognize a problem or who may be reluctant to seek assistance.²³ Also, programs that do not require rural residents to travel great distances (e.g., residential treatment or telepsychiatry) may help remove this considerable obstacle to completing treatment.²³ Finally, efforts to reduce the social stigma of substance abuse treatment and to counteract the common belief that substance abuse is a uniquely urban problem may make it easier to identify problem drinkers in rural communities and to treat them. Such efforts are especially important given the overall increase in rural drinking across the time frame of this study.

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