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US trends in light, moderate and heavy drinking episodes from 2000 to 2010

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Abstract

Background—Risks and potential benefits associated with alcohol use vary with the amount of alcohol consumed on a drinking occasion. Over time, changes in the absolute and relative numbers of light or heavy drinking episodes may occur, impacting health and social problems.

Methods—Analyses of the 2000, 2005 and 2010 NAS surveys focus on trends in the volumes of alcohol consumed on days where the drinker had 1–2, 3–4 or 5 or more drinks separately. These volume measures were obtained from graduated frequency questions with adjustments for estimated drink alcohol content for each drinker based on reported beer brand, spirits drink and pour method, contexts of drinking and demographic characteristics. Respondents with especially high alcohol content drinks were adjusted up one category and those with especially low alcohol content drinks were adjusted down one category. Trend significance was tested with adjusted Wald tests and in negative binomial models with 2000 as the reference year, indicators for race/ethnicity group and interactions between these and survey year, and adjustments for age, educational attainment, income, employment status and wetness region. Analyses were conducted both in the overall sample including abstainers, and in the current drinker sample only.

Results—Overall trend results indicate an increase in drink-alcohol-content-adjusted alcohol volume of 25% from 2000 to 2010 with similar changes between 2000 to 2005 and 2005 to 2010. Most of the increase from 2000 to 2005 resulted from increased volume from light (1–2 drink) days for men and women and moderate to heavy (3–4 drink) days for women, while the change from 2005 to 2010 resulted mostly from volume from heavy drinking days (5+ drinks per day) for men. Black and Hispanic women were found not to have participated in the overall trend of increased alcohol volume.

Conclusions—Findings highlight shifts in drinking patterns suggesting increased heavy occasion drinking in 2010, particularly among men.

Keywords

Heavy occasions; drink alcohol content; disparities; trends

Introduction

This study is focused on changes in the patterns of alcohol use in the US over the 10 year period from 2000 to 2010. Our estimates, based on NIAAA apparent consumption data, show that per capita alcohol sales over the 2000 to 2008 period increased 5% from 2.17 gallons of ethanol to 2.28 gallons before declining in 2009 to 2.24 gallons and in 2010, returning to 2.17 gallons. (Kerr et al., 2006; LaVallee and Yi, 2011; The Beverage Information Group, 2010) Sales data also show that between 2000 and 2010 per capita consumption increases occurred for wine and spirits, while beer consumption declined. However, sales data cannot be used to distinguish between drinker characteristics or the patterns in which drinkers consume the alcohol that was sold. (Greenfield and Kerr, 2008) In order to understand consumption trends in terms of subgroups such as those defined by gender and race/ethnicity or in terms of the proportions of consumption made up by heavier and more moderate drinking occasions, survey data are needed. Trend analyses require consideration of both sales statistics and general population survey results as neither can give a completely accurate picture of population alcohol consumption due to methodological limitations of various types. (Greenfield and Kerr, 2003; Greenfield and Kerr, 2008; Meier et al., 2013)

Concurrent with observed fluctuations in per capital alcohol sales, economic conditions from 2008 through 2011 have been historically severe in terms of housing prices, foreclosure activity, income loss, and persistently high rates of unemployment. Unemployment rates rose quickly through 2008 and 2009 and were above 9% from the spring of 2009 through the fall of 2011. (United States Department of Labor, 2013) Long-term unemployment, defined as being out of work for 27 weeks or longer, affected about 6 million persons in each quarter from late 2009 through 2011, comprising over 40% of the unemployed during this period. (United States Department of Labor, 2013) Importantly, unemployment, foreclosures, and other economic impacts were not evenly divided across age and race/ethnicity groups, as young people, African Americans and Hispanics were especially impacted. Analyses of the 2010 national alcohol survey found that African Americans experienced greater job loss and trouble with rent or mortgage payments than Whites, and among those experiencing such problems they were at much greater risk for alcohol dependence and drinking-related consequences. (Zemore et al., 2013b)

Two recent analyses of the National Alcohol Survey series have considered trends through 2010. A study of alcohol consumption trends in an age-period-cohort analysis found that those under age 25 in the 2010 National Alcohol Survey drank much less than those in the 2000 and 2005 surveys, consistent with other national data showing declines in young adult heavy drinking (Burgard, 2012). By contrast, those in their 30s and 40s drank more through increases in heavy occasions. Results suggest that poor economic prospects may reduce drinking for young people while increasing heavy occasions among the middle-aged. (Kerr et al., 2013a) The latter is supported by our individual-level analyses indicating strong, persistent associations between recession-related economic loss and heavy drinking and alcohol problems among the middle-aged as opposed to younger and older adults. (Mulia et al., in press) A second study of trends in alcohol problems found significant increases from 2000 to 2010 in the prevalence of alcohol dependence and, among women only, alcohol-

related consequences, although these increases were not seen among Latinos. (Zemore et al., 2013a)

In the present study, we focus on decomposing recent alcohol consumption trends into episodes where 1–2, 3–4 and 5+ drinks were consumed. The current study thus extends our prior trend analyses by detailing changes in the mix of such episodes over time. These distinctions matter because 1–2 drinks are light to moderate for everybody, 3–4 drinks are moderate for some and heavier for others with increased risk of health and social problems, and 5+ occasions are heavy drinking episodes with increased risks for all types of alcohol-related problems and no potential for beneficial effects. (Greenfield and Kerr, 2008; Kerr et al., 2011) Decomposing overall consumption trends in this way allows us to detect underlying shifts towards more or less risky drinking patterns. The measures of alcohol volume in this study also incorporate drink alcohol content adjustments not utilized in previous NAS trend studies due to the absence of needed measures in older surveys. These adjustments are important, as they have been shown to add significantly to alcohol volume estimates and to improve survey coverage of alcohol sales (Kerr et al., 2005; Kerr et al., 2008) as well as to differ by race/ethnicity group. (Kerr et al., 2009a) Analyses evaluate trends in adjusted alcohol volume from occasions where 1–2, 3–4 or 5 or more adjusted drinks were consumed, and also consider overall gender and racial/ethnic disparities in consumption at these levels and differences in trends.

Methods

Data

The National Alcohol Surveys (NAS) three most recent waves collected in 2000, 2005, and 2010 were utilized in these analyses. All three surveys involved computer-assisted telephone interviews of a national probability sample of U.S. adults 18 years and older, selected via random digit dialing augmented by oversamples of Blacks and Latinos, as well as respondents from sparsely populated U.S. states. Additionally, the 2010 NAS included a cell phone sample constituting about 14% of the total sample (N=1,012) to address the increasing numbers of households without landlines. (Lee et al., 2010) This sampling strategy is estimated to have provided coverage of 97.5% of the US households. (Blumberg and Luke, 2009) Respondents were interviewed in their choice of English or Spanish. The 2000 NAS had 7,612 respondents (4,905 Whites, 1,361 Blacks, 994 Latinos), the 2005 NAS had 6,919 respondents (3,967 Whites, 1,054 Blacks, 1,610 Latinos), and the 2010 NAS had 7,969 respondents (4,599 Whites, 1,595 Blacks, 1,453 Latinos). Cooperation rates were 58% in 2000, 56% in 2005, and 52% in 2010, consistent with those from other recent telephone surveys. (Curtin et al., 2005) All surveys are weighted to the general population of the US at the time they were conducted taking account of age, sex, ethnic group and geographic area. Methodological studies comparing the 2000 NAS sample with a household-recruited face-to-face version with a higher response rate did not find evidence of bias in the alcohol measures used here. (Midanik and Greenfield, 2003) Analyses of replicates with differing response rates in the 2005 NAS also found no evidence of bias. (Greenfield et al., 2006)

Measures

Past year alcohol volume was based on responses to the Graduated Frequency series, (Greenfield, 2000; Greenfield et al., 2009) which, after asking the maximum (Greenfield et al., 2006) on any day in the prior 12 months, asks separately about frequencies of each relevant quantity level: 12 or more drinks, 8–11, 5–7, 3–4 and 1–2 drinks in a day over the past year. Reported drinks were adjusted into US standard drinks (0.6oz. or 14 gram of ethanol) for estimated drink alcohol content utilizing two methods. For the 2000 survey, no specific drink alcohol content questions were asked and so estimates of beverage-specific drink alcohol content derived from our 2003 and 2006 NAS Methods studies and 2007 Bar study (Kerr et al., 2008; Kerr et al., 2009b) were applied based on membership in groups defined by gender, age and race/ethnicity and measures of the proportion of volume from beer, wine and spirits and the proportion drunk in off-premise and on-premise contexts. For the 2005 and 2010 surveys, questions on usual beer brand or type, malt liquor use, usual spirits drink and home spirits pour method were included, and these were utilized instead of the demographic measure for beer and spirits drink alcohol content. Mean adjustment factors using the two methods are somewhat larger on average in the 2005 and 2010 surveys (~1.15) than in the 2000 survey (~1.075). Total alcohol volume in the past year was then partitioned into volume consumed during occasions with 1–2, 3–4 and 5 or more drinks. Drink alcohol content estimates were used to reclassify occasions into higher or lower categories for especially high or low drink alcohol content adjustment factors. For example, if the drink adjustment factor was greater than 1.43 then reports of 3–4 drinks were counted as 5–7 drinks.

Racial/ethnic self-identification was categorized as White (Caucasian), Black (African American), Hispanic (Latino) and all others. Additional demographic measures included gender, age, marital status (married or living as married; separated; widowed; divorced; or never married), employment status (employed full-time, employed part-time, unemployed, or not in the workforce), annual household income in 2005 dollars (\$0–\$20,000; \$20,001–\$40,000; \$40,001–\$70,000; \$70,001 or more; or missing), educational attainment (less than high school; high school graduate; some college; or college degree or higher), an indicator for US nativity and region of the US in three wetness categories (Kerr, 2010).

Analyses

Means of each measure were estimated using survey weights and standard errors were estimated using weights and accounting for the survey designs. Significant differences between volume estimates from each survey were tested in a pair-wise fashion using adjusted Wald F-test statistics. (Stata Corp., 2009) Models predicting total volume and 1–2, 3–4 and 5+ occasion volume measures were estimated separately for men and women utilizing negative binomial models for the population including abstainers, and separately for current drinkers only. All models were adjusted for all demographic measures listed above. Indicator measures for the 2005 and 2010 surveys and interactions between Black and Hispanic race/ethnicity and survey year indicators were used to evaluate significant changes over time and differential change between groups.

Results

Overall population trend results presented in Table 1 indicate an increase in alcohol volume of 25% from 2000 to 2010 with similar changes between 2000 to 2005 and 2005 to 2010. Most of the increase from 2000 to 2005 resulted from increasing days with 1–2 drinks in particular, as well as 3–4 drinks per day. By contrast, the change from 2005 to 2010 resulted mostly from increased volume from days with 5+ drinks per day. Importantly, the temporal pattern of changes differed by gender, with women accounting for most of the increase from 2000 to 2005 and men accounting for most of the 2005 to 2010 increase. During the latter period, following a decline from 2000 to 2005, the mean volume from 5+ days increased substantially among men from 176 drinks in 2005 to 232 drinks in 2010, as compared to the increase among women from 38 drinks in 2005 to 51 drinks in 2010. It is notable that more than half of total alcohol volume came from days where 5 or more drinks were consumed in 2000 and 2010, while less than half came from such days in 2005. This pattern is more pronounced for men, among whom between 55% and 62% of total alcohol volume came from 5+ days.

The overall patterns observed in Table 1 parallel changes among White men, while somewhat different patterns were seen for other groups as shown in Figure 1. Trends and disparities in population group mean alcohol consumption patterns were evaluated in models controlling for key socio-demographic measures. Among Black men, an increase in total volume due to large increases in 1–2 drink a day volume and 5+ drinks a day volume occurred from 2000 to 2005, and a decline in volume coming mainly from 5+ days occurred from 2005 to 2010. For Latino men a different pattern was seen where alcohol volume was about the same in 2000 and 2010 while 2005 was much lower, primarily reflecting a decline in volume from 5+ days. Multivariate models for men, shown in Table 2, found significantly higher total volume in 2010 compared to 2000 with no significant interactions of race by survey year. For volume from 1–2 drinks, significant increases relative to 2000 for the White reference group were found in both 2005 and 2010 with a larger increase in 2005. For volume from 3–4 drinks a significant increase for the White reference group was found for 2010 only (relative to 2000). Racial disparities in alcohol volume persisting over the three surveys were not significant, with the exception of Hispanic men having significantly higher volume of alcohol from days with 5+ drinks in the 2000 reference period. Further, the only additional significant effects in the models (not shown) including only current drinkers also found higher volume from days with 5+ drinks as well as lower volume from days with 1–2 drinks for Hispanic men in the 2000 reference period, suggesting a heavier drinking pattern for that group.

Figure 1 shows that differential patterns were seen among women as well. For White women, a change similar to that for White men occurred from 2000 to 2005 with increased volume from moderate drinking days. From 2005 to 2010, overall volume did not change but a shift from volume on 1–2 drink days to volume on 5+ days occurred. For Black women, alcohol volume declined from 2000 to 2005 with a shift from volume from days with 5+ and 3–4 drinks to volume from days with 1–2 drinks. However, from 2005 to 2010 Black women's volume increased, mainly in volume from 1–2 and 3–4 drink days. For Latino women a trend similar to Black men was seen with increased volume from 1–2 and

5+ days from 2000 to 2005, and reduced volume from 5+ days from 2005 to 2010. Multivariate models, shown in Table 2, found significantly higher total volume for 2005 and 2010 compared to 2000. However, negative race by survey year interactions suggest that these temporal increases in overall volume were generally smaller or non-significant among Hispanic and Black women compared to white women. This is particularly the case for overall volume in 2010 (vs. 2000). Similarly, significant increases in volume from 1–2, 3–4, and 5+ drink days, respectively, were greatest among white women.

Discussion

In summary, the NAS indicates an upward trend in US alcohol consumption from 2000 to 2010 with a 25% increase in volume characterized by a shift toward more moderate drinking patterns from 2000 to 2005, and a shift towards heavier drinking patterns from 2005 to 2010. This increase in reported alcohol volume in the NAS exceeded the per capita sales-based increase from 2000 to 2005 and does not show the recession-induced decline (Ruhm and Black, 2002) in sales from 2005 to 2010. Survey-based estimates of population consumption do not typically account for all of alcohol sales, and coverage rates compared to sales in US surveys range from around 30% for the BRFSS (Nelson et al., 2010) to over 50% for the 2000 NAS. (Kerr and Greenfield, 2007) Surveys in other countries using detailed questions on beverage types contexts of use and containers sizes have found coverage rates of 77% for Australia (Stockwell et al., 2004) and 94% for New Zealand, (Casswell et al., 2002) indicating the possibility that higher rates can be achieved. This gap in coverage of sales allows for some degree of drift in survey estimates over time due to methodological issues in sampling or the relevance of question formats to underlying patterns of drinking, or to changes in response bias related to social norms regarding alcohol. (Greenfield and Kerr, 2003) While per capita sales are important for understanding the meaning of survey trends, the lack of close correspondence does not invalidate survey results. The changes in drinking patterns observed across the three surveys offer an important perspective on the riskiness of alcohol use in the US even though the results clearly overstate the increase in consumption. It may be that increased heavy drinking occasions results in better survey coverage of sales as compared to more distributed drinking.

Our analyses also highlight differences in the drinking patterns and trends across the largest US racial and ethnic groups. Figure 1 illustrates the difficulty of evaluating disparities in alcohol consumption patterns, as a number of sub-groups converged or changed in rankings over time. The only clear finding was that Hispanic men had a heavier pattern of drinking than white men in the 2000 reference period, with significantly greater alcohol volume from 5+ occasions and, non-significantly, lower alcohol volume from 1 to 2 drink occasions. This is in line with our finding that Hispanic men, compared to white and black men, had the highest alcohol dependence rates across the three survey years. (Zemore et al., 2013a) No consistent and significant time-independent differences were found among women. Importantly, trend results for the overall sample were similar to those for white men and women, likely reflecting the very large subgroup of whites in the sample. Modeled results suggest some (non-significant) attenuation of consumption increases for Black and Hispanic men. Additionally, significant negative interaction terms for Black and Hispanic women

show that increases in drinking among white women were not mirrored among minority women.

This study is subject to limitations including reliance on only three surveys collected with 5-year gaps precluding examination of year-to-year trends, which may be especially important in the 2005–2010 period where per capita consumption rose and declined, and the consideration of only broad racial/ethnic categorizations, which likely include considerable heterogeneity among ethnic sub-groups, and the difficulty of categorizing those of mixed backgrounds. Results also highlight the difficulty of clearly determining disparities in behavioral patterns and caution against extrapolating overall U.S. trends in alcohol use patterns to major sub-groups. Similar analyses in larger and more frequent survey series should be undertaken to confirm our findings.

Findings highlight the importance of heavy drinking occasions for understanding both the level of US alcohol consumption and recent trends, with high proportions of alcohol volume coming from 5+ days, particularly for men in general, for Hispanic men in particular, and in the most recent survey year. The proportion of alcohol volume from heavy, moderate and lighter drinking occasions was found to vary across the three surveys with results indicating that between 40 and 60% of total volume comes from days where five or more drinks were consumed. The proportion of volume from heavy drinking days is higher for men, nearing two thirds in the 2000 and 2010 NAS, while for women it is always below half and as low as one third of total volume in 2005. Policy options aimed at reversing this trend toward increased heavy drinking include raising alcohol taxes (Wagenaar et al., 2009) or instituting minimum prices (Stockwell et al., 2012; Stockwell et al., 2013) to address the dramatic reduction in real tax rates and related increases in alcohol affordability that have occurred over time, (Kerr et al., 2013b) and addressing alcohol availability (Gruenewald, 2011; Livingston et al., 2007; Popova et al., 2009; Stockwell et al., 2011) through reducing outlet density and hours of sale. An important area for future research is the differential effectiveness of alcohol policies across gender and racial and ethnic sub-groups. Understanding potential differences would inform choices on the most effective policy mix for particular states. The gradual increases in alcohol consumption that occurred up to the 2008 recession are likely to have resumed in 2011, exacerbated by the shift toward more harmful drinking patterns observed in the 2010 NAS. A strengthened alcohol policy environment is needed to reign in increases in harms likely to occur with economic growth (Gerdtam and Ruhm, 2006) and the aging of heavier drinking birth cohorts (Kerr et al., 2013a).

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Figure 1.

Table 1

Population percentage of current drinkers, mean number of standard drinks per year and mean number of standard drinks from days with 1–2, 3–4 and 5+ drinks.

	Population	95% CI	Men	95% CI	Women	95% CI
% Drinkers						
2000	60.7%	(59.4–62.0)	65.8%	(63.9–67.6)	56.1%	(54.3–57.9)
2005	67.2% ¹	(65.8–68.6)	70.9% ¹	(69.0–72.7)	63.8% ¹	(61.8–65.7)
2010	65.9% ¹	(64.4–67.4)	72.2% ¹	(70.0–74.4)	59.9%	(57.8–61.9)
Total Volume						
2000	199.9	(184.1–215.7)	316.6	(287.1–346.1)	92.4	(80.2–104.6)
2005	225.1 ¹	(208.7–241.5)	322.2	(292.5–351.8)	134.2 ¹	(119.8–148.6)
2010	251.9 ¹	(228.1–275.7)	376.7 ^{1,2}	(333.0–420.5)	133.5 ¹	(114.8–152.1)
Volume 1–2						
2000	45.9	(43.1–48.8)	60.4	(55.6–65.2)	32.7	(29.4–35.9)
2005	78.8 ¹	(74.2–83.3)	91.1 ¹	(84.6–97.6)	67.2 ¹	(60.9–73.5)
2010	65.1 ^{1,2}	(61.1–69.2)	76.3 ^{1,2}	(69.6–82.9)	54.5 ^{1,2}	(49.8–59.3)
Volume 3–4						
2000	36.1	(33.0–39.3)	55.2	(49.5–60.9)	18.6	(15.6–21.5)
2005	41.7 ¹	(37.7–45.8)	55.0	(48.7–61.4)	29.3 ¹	(24.2–34.3)
2010	45.3 ¹	(40.7–50.0)	63.7	(55.7–71.8)	27.9 ¹	(23.1–32.6)
Volume 5+						
2000	117.7	(103.2–132.3)	201.0	(173.4–228.6)	41.1	(30.3–51.9)
2005	104.6	(90.1–119.1)	176.0	(148.4–203.7)	37.7	(27.9–47.5)
2010	139.3 ²	(116.9–161.7)	232.4 ²	(190.3–274.4)	51.1	(34.6–67.5)

¹ Indicates significant difference from 2000 at 95% confidence level.

² Indicates significant difference from 2005 at 95% confidence level.

Table 2

Model-based population estimates of significant disparities and trends in alcohol volume measures controlling for key socio-demographic measures.¹

Variable	Total Volume	Volume 1–2	Volume 3–4	Volume 5+
Men	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
White (Reference)				
Black	–0.230 (0.16)	–0.129 (0.15)	0.058 (0.19)	–0.135 (0.29)
Hispanic	0.190 (0.15)	–0.281 (0.15)	–0.010 (0.17)	0.555* (0.25)
2000 (Reference)				
2005	0.140 (0.07)	0.308* (0.06)	0.051 (0.10)	0.171 (0.15)
2010	0.168* (0.08)	0.192* (0.08)	0.253* (0.11)	0.220 (0.14)
Black × 2005	0.268 (0.03)	0.011 (0.20)	0.064 (0.27)	0.340 (0.39)
Black × 2010	–0.302 (0.26)	0.167 (0.27)	–0.535 (0.34)	–0.433 (0.45)
Hispanic × 2005	–0.279 (0.19)	0.110 (0.17)	–0.164 (0.22)	–0.457 (0.34)
Hispanic × 2010	–0.441 (0.24)	–0.034 (0.24)	–0.225 (0.28)	–0.513 (0.41)
Women				
White (Reference)				
Black	–0.285 (0.24)	–0.254 (0.15)	–0.257 (0.25)	–0.259 (0.39)
Hispanic	–0.426 (0.25)	–0.205 (0.19)	–0.327 (0.24)	–0.735 (0.50)
2000 (Reference)				
2005	0.434* (0.09)	0.690* (0.08)	0.490* (0.16)	0.597* (0.23)
2010	0.426* (0.10)	0.452* (0.09)	0.408* (0.18)	1.038* (0.24)
Black × 2005	–0.576 (0.30)	–0.477* (0.21)	–0.606 (0.38)	–0.525 (0.54)
Black × 2010	–0.671* (0.29)	0.027 (0.27)	–0.312 (0.36)	–1.231* (0.53)
Hispanic × 2005	–0.205 (0.32)	–0.459 (0.25)	–0.476 (0.33)	0.469 (0.75)
Hispanic × 2010	–0.807* (0.35)	–0.629* (0.25)	–0.968* (0.42)	–0.518 (0.75)

¹ Models control for age, employment status, educational attainment, household income, marital status, region of the US, other ethnicity and US nativity.

* Indicates significance at the 95% confidence level.