Epidemiology of Alcohol Use in Rural Men in Two Provinces of China*

LIANG ZHOU, M.D., PH.D.,[†] KENNETH R. CONNER, PSY.D., M.P.H.,[†] ERIC D. CAINE, M.D.,[†] SHUIYUAN XIAO, M.D., PH.D., LINYONG XU, PH.D., YU GONG, M.D., RUILING ZHANG, M.D., PH.D.,[†] AND MICHAEL R. PHILLIPS, M.D.[†]

School of Public Health, Central South University, 110 Xiangya Road, Changsha, Hunan, China, 410078

ABSTRACT. Objective: Alcohol use in China has substantially increased during the last three decades. The objectives of this study were to examine the sociodemographic patterning of alcohol consumption and to explore the relationship between (a) heavy drinking and frequent acute intoxication and (b) type of alcohol consumed. **Method:** A cross-sectional survey of 18- to 60-year-old men in Hunan and Henan Provinces in 2007 used multistage, randomized clustered sampling to identify 11,884 subjects; 9,866 (83.0%) of them were interviewed. **Results:** The weighted prevalence of 3-month drinking was 61.4% in Hunan and 68.2% in Henan. Among current drinkers, the median daily consumption of pure alcohol in Hunan and Henan were 16.5 ml and 17.9 ml, respectively; 16.6% in Hunan and 22.3% in Henan met criteria for heavy drinking (average daily pure alcohol consumption ≥ 50 ml);

and 3.0% in Hunan and 7.3% in Henan reported frequent intoxication. Adult men with lower education in Hunan and those with higher family incomes in Henan were more likely to engage in heavy drinking; those who were unmarried in Hunan and those with higher incomes in Henan were more likely to be intoxicated frequently. In both provinces, those who consumed distilled spirits were at higher risk for heavy drinking and frequent intoxication. **Conclusions:** The majority of rural adult men in both provinces drink alcohol and a substantial minority—particularly those who consume distilled spirits—are heavy drinkers and report more frequent acute intoxication. The consumption of distilled spirits may be a useful target of intervention to reduce the prevalence of heavy drinking and the experience of intoxication. (*J. Stud. Alcohol Drugs*, 72, 333-340, 2011)

ALCOHOL USE IS A LEADING CAUSE of global mortality and morbidity. In 2002, the World Health Organization (WHO) estimated that 1.8 million worldwide deaths (3.2% of total) and 58.3 million lost disability-adjusted life years (4% of total) were attributable to alcohol use and alcohol-related conditions (WHO, 2002). Based on estimates by the Chinese National Bureau of Statistics, alcohol production in China increased more than 20-fold from 1978 to 2006 (National Bureau of Statistics of China, 1979, 2007), and epidemiological surveys suggest that the increase in production has been accompanied by a parallel increase in consumption. A 1994 survey by Hao and colleagues (1999) in selected areas of China ($N = 23,513$) reported 12-month drinking rates of 84.1% among men and 29.3% among women and an annual per capita consumption of 3.60 L of pure alcohol. A repeat survey 7 years later, in 2001 ($n = 24,992$), found similar rates of drinking (74.9% in men and 38.8% in women), but the per capita annual consumption had increased by 24% to 4.47 L (Hao et al., 2004). A national study ($N = 159,117$) reported that the rates of current drinking, defined as drinking at least once a week on average, were 21.0% in the whole sample, 39.6% in

men, and 4.5% in women (Ma et al., 2005). Two surveys on alcohol use in Wuhan city (Hubei Province) found that the 12-month prevalence of drinking behavior among the whole sample age 15-65 years increased from 68.2% in 2002 ($n = 2,327$) to 73.6% in 2005 ($n = 2,613$) (Zhang et al., 2008). Consistent with prior reports, these investigators also showed large gender differences in the rate of drinking and in the overall alcohol consumption.

The volume of alcohol plays an important role in the association of drinking and health outcomes. Low to moderate alcohol consumption seems to be protective for coronary heart disease, type II diabetes, and ischemic stroke, whereas heavy drinking—typically defined in terms of exceeding a certain daily volume or quantity per occasion—is related to more than 60 adverse health outcomes (Klatsky, 2007; Rehm et al., 2003). In the studies about alcohol consumption in China by Hao and colleagues, gender differences were observed in alcohol consumption: Male drinkers consumed 18.6 times more alcohol than female drinkers in the 1994 survey (Hao et al., 1999), and in the 2001 survey, the average alcohol consumption among male and female 1-year drinkers was 10.1 and 1.5 L, respectively (Hao et al., 2004).

Received: January 25, 2010. Revision: September 2, 2010.

*This project was part of the Small Grants Program to Improve the Quality and Implementation of Research Projects About Suicide in China, which was supported by the China Medical Board of New York grant 05-813 and coordinated by Michael R. Phillips of the Beijing Hui Long Guan Hospital and Xue Zhang of Peking Union Medical College. This project was also supported by National Institute of Health grants D43 5D43TW005814 and P20 5P20MH071897 awarded to Eric D. Caine during the preparation of the article.

[†]Correspondence may be sent to Liang Zhou at the above address or via email at: zhouliang1976@gmail.com. Kenneth R. Conner and Eric D. Caine are with the Department of Psychiatry, University of Rochester Medical Center, Rochester, NY. Ruiling Zhang is with the Second Affiliated Hospital, Xinxiang Medical College, Xinxiang, Henan, China. Michael R. Phillips is with the Departments of Psychiatry and Epidemiology, Columbia University, New York, NY, and the World Health Organization Coordinating Center for Research and Training in Suicide Prevention, Beijing Suicide Research and Prevention Center, Beijing Hui Long Guan Hospital, Beijing, China.

Heavy drinking—defined as consuming 50 ml (40 g) or more of pure alcohol daily—occurred among 12.5% of alcohol users in 1994 and 15.3% in 2001 (Hao et al., 1999, 2004), but data on the gender differences in heavy drinking were not provided. Zhang et al. (2008) reported “large-quantity drinkers”—defined as men who consume 90 ml or more and women who consume 60 ml or more on a typical drinking occasion—in 29.0% (35.4% of men and 16.7% of women) of individuals who consumed alcohol within the past year.

Acute intoxication also is related to a number of deleterious outcomes, including unintentional injuries, suicide, violence, and sudden cardiac death (Britton and McKee, 2000; Gmel and Rehm, 2003). Hao et al. (1999, 2004) reported a threefold increase in the rates of acute intoxication: The prevalence of acute intoxication of all respondents in the most recent 3 months was 2.6% (5.16% for men and 0.02% for women) in 1994 and 8.3% (14.24% for men and 0.75% for women) in 2001.

There have been only a few studies reporting the association between current alcohol use and sociodemographic characteristics other than age and gender, and the results have been inconsistent. Zhu et al. (2007) reported 12-month drinking behavior was more prevalent in those who had higher education or had divorced, but no difference was found among different income groups. A survey in Henan province showed that higher income and higher education were associated with current drinking, but no difference was found among those who had different marital statuses (Yang et al., 2008).

In summary, the prevalence of alcohol consumption and the rates of heavy drinking and intoxication among drinkers have increased markedly in China during recent years. But prior studies in China have not considered a range of sociodemographic variables (e.g., age, marital status, and income) that have been shown to be associated with alcohol consumption in other countries (Nielsen et al., 2004), nor have they stratified results by beverage type—an important consideration in light of data showing that alcohol-related morbidity is associated with beverage type even after accounting for overall consumption (Barglietto et al., 2006).

The current report uses data from two large community samples of rural adult Chinese men, one from the central-southern province of Hunan and one from the central-northern province of Henan. Sampling from the North and South is important because of anecdotal evidence that people living in northern China have a higher level of alcohol consumption (Cochrane et al., 2003). These two provinces were chosen because they are both agricultural provinces and the gross domestic products per capita in 2008 were similar. The survey was limited to men because of their much higher rates of alcohol use. We screened for lifetime and current (within the last 3 months) alcohol use and then did a more detailed assessment of the demographic characteristics, type of alcohol consumed (including homemade alcohol; Hao et

al., 2004), and pattern of drinking of current drinkers. To the best of our knowledge, this is the first large epidemiological survey in China to examine the sociodemographic patterning of alcohol consumption, heavy drinking, and frequent acute intoxication and the relationship between (a) heavy drinking and frequent acute intoxication and (b) type of alcohol consumed.

Method

Sample and sampling

The survey was carried out from June to September 2007. Subjects were from rural areas of Shuangfeng county of Hunan province and Weihui city (a rural county, although it is administratively classified as a city) of Henan province. The PROC SURVEYSELECT procedure of SAS 9.13 (SAS Institute Inc., Cary, NC) was used to perform multistage, randomized cluster sampling methods. In the first stage, three of the 17 townships in Shuangfeng county and two of the 13 townships in Weihui city were randomly selected. All 139 villages in the five towns were involved, and 18,187 households were then randomly selected from 36,380 total households that were registered in the 139 villages. All male adults age 18–60 years old who lived in the target village for at least 6 months in the 12 months before the interview in each selected household were identified, and one per household was chosen using a random numbers table for the interview.

Among the 18,187 households, no one was at home in 2,762 households (15.2%), and no male adults 18–60 years of age could be identified in 3,541 households (19.5%), either because no male adult lived in the household or the male adult(s) had not lived in the household for at least 6 months in the year before the interview. One adult man was randomly selected from each of the remaining 11,884 households: 66 (0.6%) were excluded who were unable to finish an interview because of severe mental or physical illness, 1,743 (14.7%) were not at home at the time of three separate visits to the household, 94 (0.8%) refused to participate, 114 (0.9%) only completed part of the interview, and 9,866 (83.0%) completed the full interview. Overall response rate was 54.2%: Household response rate was 65.3% and individual response rate was 83.0%. Identified subjects who completed the interview were on average about 3 years older than noncompleters ($M_{\text{age}} = 44.2$ years, $SD = 11.1$ vs. $M_{\text{age}} = 41.3$ years, $SD = 10.5$, respectively, $p < .001$).

Instruments and measurements

The questionnaire used in this study was a translated and adapted version of the WHO survey used by Hao and colleagues (1999, 2004) in two large-scale investigations in China that was expanded to include additional sociodemographic characteristics of respondents. All questions were ad-

ministered to subjects orally after respondents provided oral informed consent during a face-to-face interview. The study was approved by the Institutional Review Board of Xiangya Medical School, Central South University at Changsha City, Hunan Province, China.

Prevalence of drinking. All subjects were asked if they had ever consumed alcoholic beverages. Those who answered yes were defined as lifetime drinkers. These individuals were asked if they had consumed alcoholic beverages in the last 3 months, and subjects reporting yes were categorized as current drinkers and asked a series of detailed questions about their use of alcohol (Hao et al., 2004).

Type and amount of alcoholic beverage(s) consumed. Current drinkers were asked to report the type of alcoholic beverage(s) they had consumed during the prior 3 months, the average frequency of drinking, and the average amount of each type of beverage consumed per occasion of drinking. The alcohol content of different types of beverages in China is known (Cochrane et al., 2003; Hao et al., 2004); therefore, the amount of pure alcohol consumed was calculated based on the reported frequency and amount of drinking. In China, high-content distilled spirits have an ethanol content of 50%-55%; low-content distilled spirits, 30%-38%; beer, approximately 4.5%; grape wine, approximately 12%; and yellow wine (a type of nondistilled alcoholic beverage made of rice), 15%-18%. Homemade wine has an ethanol content of 15%-16%. Midpoints of each of the ranges were used to calculate pure alcohol content of each type of beverage in this study.

Heavy drinking. Average monthly and average daily consumption of pure alcohol over the 3 months before the interview were computed. "Heavy drinking" was defined as an average daily consumption of 50 ml or more of pure alcohol (roughly equivalent to four or more standard drinks per day; Hao et al., 2004).

Acute intoxication. Current drinkers were asked to report the frequency of acute alcohol intoxication in the last 3 months. Intoxication was defined conservatively as "drinking so much that you could not maintain your balance while walking or you could not speak clearly." Respondents were provided with seven response options to this question: 6 days a week or every day, 3-5 days a week, 1-2 days a week, 2-3 days a month, 1 day a month, less than 1 day a month, or never. Those who reported acute intoxication 1 day a month or more frequently were categorized as having "acute intoxication." In analyses, individuals were categorized as subjects reporting intoxication 1 day a month or more (monthly intoxication present) or never or less than 1 day a month (absent).

Quality control

A total of 44 interviewers who were medical students were involved in the investigation. They were provided standardized training (by the same researchers) for 5 days. Pilot studies were conducted after training in both sites. Inter-rater

agreement (κ value) of lifetime alcohol consumption and 3-month alcohol consumption were .933 and .967 in Hunan Province and .900 and .927 in Henan Province by repeated examinations of 30 cases during the pilot phase.

Interviewers were divided into five groups of 8-10 interviewers. Each group was supervised by an experienced psychiatrist or epidemiologist. After each interview, the questionnaire was checked by the interviewer, and then after each day of data collection, the supervisors checked the questionnaires completed by their corresponding groups for missing or inconsistent information. Any missed item or inconsistent information was revised or confirmed by reinterviewing the subject.

During the survey, 210 respondents were randomly selected for reinterview by an interviewer who was blinded to the results of the first interview. The κ values for lifetime drinking, 3-month drinking, heavy drinking, and frequent intoxication were .81, .88, .76, and .70, respectively.

Statistical analysis

SAS Version 9.13 was used to adjust for the complex sample design. PROC SURVEYFREQ, chi-square tests, and the Mann-Whitney *U* test were used to describe and compare sociodemographic characteristics and drinking behaviors between Hunan and Henan Provinces. The sample was also weighted according to the age distribution of Chinese men in 2005 when calculating the prevalence of current (3-month) and lifetime drinking behaviors (National Bureau of Statistics of China, 2007). Using PROC SURVEYLOGISTIC process, adjusted odds ratios and 95% confidence intervals derived from unconditioned multiple logistic regression models were used to identify the relationships of demographic characteristics and type of consumed beverage with current drinking behavior, heavy drinking, and acute intoxication. To provide sufficient numbers in different strata for multivariate analyses, the two youngest age groups were combined into one group (age 18-34) and the marital statuses of "separated/divorced/widowed" and "single" were combined to form the "not currently married" group. Family annual income was divided by the number of family members to emerge mean annual per capita family income, and then tertiles were used to divide the whole sample into three subgroups: lowest ($\leq$ U.S. \$167), middle (U.S. \$168-326), and highest ($\geq$ U.S. \$327). The significance level of the study was .05.

Results

Sociodemographic characteristics of subjects

Sociodemographic characteristics of the 9,866 subjects who completed the survey are shown in Table 1. Older men were over-represented, particularly in Hunan, probably

TABLE 1. Sociodemographic characteristics of 18- to 60-year-old male participants in an alcohol use survey conducted in Hunan and Henan Provinces, China, 2007

Characteristics	Hunan (<i>n</i> = 5,351) <i>n</i> (unweighted %)	Henan (<i>n</i> = 4,515) <i>n</i> (unweighted %)
Age		
18-24	91 (1.7%)	413 (9.1%)
25-34	423 (7.9%)	1,163 (25.8%)
35-44	1,469 (27.5%)	1,451 (32.1%)
45-54	1,599 (29.9%)	878 (19.4%)
55-60	1,769 (33.1%)	610 (13.5%)
Marital status		
Married	5,002 (93.5%)	4,228 (93.6%)
Divorced/ separated/ widowed	141 (2.6%)	31 (0.7%)
Never married	208 (3.9%)	256 (5.7%)
Years of education		
<7	2,495 (46.6%)	1,239 (27.4%)
7-9	2,046 (38.2%)	2,589 (57.3%)
>9	810 (15.1%)	687 (15.2%)
Mean annual per capita family income, in U.S. \$		
≤\$167	1,594 (29.8%)	1,695 (37.5%)
\$168-\$326	1,496 (28.0%)	1,912 (42.3%)
≥\$327	2,261 (42.3%)	908 (20.1%)

Note: All between-province differences among these four sociodemographic characteristics reached statistical significance ($p < .05$).

because younger rural men were more likely to work as transient laborers in urban areas and, thus, were unavailable at the time of the survey. Compared with respondents from Henan, respondents from Hunan were older, less educated, and more likely to be unmarried and had a higher mean family income (all $ps < .05$). Given the demographic differences of respondents by province, we decided to describe and analyze male drinking behavior in the provinces separately.

Prevalence of lifetime and current drinking

Unweighted lifetime and current drinking prevalence were 75.3% and 62.2% in Hunan and 80.7% and 67.2% in Henan, respectively. The weighted prevalence of lifetime and current drinking were 74.2% and 61.4%, respectively, in Hunan: the corresponding rates in Henan—81.6% and 68.2%—were significantly higher (both $ps < .01$).

Association of current drinking and sociodemographic factors

Table 2 shows the relationships between current drinking and age, marital status, educational level, and family income. In Hunan, the highest prevalence of current drinking was in the 45-54 age group and the lowest was in the 18-34 age group. In Henan, men in the 35-44 age group, those who were currently married, and those with a higher education level had higher rates of current drinking.

Volume of pure alcohol consumption

The mean monthly consumption of pure alcohol per capita among the total sample was 0.67 L ($SD = 1.72$) in Hunan and 0.80 L ($SD = 1.68$) in Henan. Among current drinkers, the median (interquartile range) daily consumption of pure alcohol in Hunan and Henan was 16.5 ml (2.6-37.6 ml) and 17.9 ml (5.1-43.8 ml), respectively (Mann-Whitney rank test $Z = -6.312$, $p < .001$).

Current drinkers were divided into four groups based on average daily alcohol consumption: less than 25 ml (20 g), 25-49.9 ml (20-39.9 g), 50-74.9 ml (40-59.9 g), and 75 ml

TABLE 2. Prevalence and predictors of current alcohol use among men age 18-60 in Hunan and Henan Provinces, China, 2007

Predictors	Hunan (<i>n</i> = 5,351)		Henan (<i>n</i> = 4,515)	
	Prevalence	AOR [95% CI]	Prevalence	AOR [95% CI]
Age, in years				
18-34	56.0%	0.77 [0.60, 0.92]	68.8%	1.78 [1.43, 2.20]
35-44	59.8%	0.85 [0.72, 1.01]	72.8%	2.03 [1.69, 2.55]
45-54	66.1%	1.19 [1.03, 1.40]	64.7%	1.40 [1.12, 1.74]
55-60	62.4%	1.00 (ref.)	53.6%	1.00 (ref.)
Marital status				
Currently married	62.6%	1.00 (ref.)	68.0%	1.00 (ref.)
Not currently married	56.4%	0.84 [0.69, 1.05]	56.1%	0.48 [0.35, 0.62]
Years of formal education				
<7	62.8%	1.00 (ref.)	60.6%	1.00 (ref.)
7-9	62.6%	1.05 [0.92, 1.19]	69.9%	1.24 [1.05, 1.43]
>9	59.3%	0.94 [0.80, 1.10]	69.1%	1.28 [1.08, 1.60]
Annual per capita family income, in U.S. \$				
Lowest tertile	61.9%	1.00 (ref.)	66.3%	1.00 (ref.)
Middle tertile	60.4%	0.98 [0.86, 1.14]	67.6%	1.02 [0.88, 1.18]
Highest tertile	63.6%	1.15 [0.99, 1.32]	68.3%	1.14 [0.93, 1.38]

Notes: AOR = adjusted odds ratio (adjusted for all predictors in the model); 95% CIs = 95% confidential intervals; ref. = reference category.

TABLE 3. Monthly pure alcohol consumption among current alcohol users

Daily alcohol consumption	Hunan		Henan	
	Prevalence <i>n</i> (%)	Consumed alc. in L (% of total)	Prevalence <i>n</i> (%)	Consumed alc. in L (% of total)
<25 ml	1,851 (55.6%)	655.4 (16.9%)	1,775 (58.5%)	482.4 (13.3%)
25-49.9 ml	925 (27.8%)	978.7 (25.4%)	583 (19.2%)	622.7 (17.1%)
50-74.9 ml	219 (6.6%)	410.2 (10.6%)	231 (7.6%)	430.2 (11.8%)
≥75 ml	332 (10.0%)	1,815.9 (47.1%)	447 (14.7%)	2,096.9 (57.7%)
Total	3,327 (100%)	3,860.4 (100%)	3,036 (100%)	3,632.2 (100%)

Note: L = liters.

(60 g) or greater. Table 3 shows the consumption of pure alcohol and the percentage in total consumed pure alcohol of all current drinkers among each group. In both provinces, the heaviest drinkers (≥75 ml) were in the minority (10.0% in Hunan and 14.7% in Henan) but consumed about half of total pure alcohol.

Consumption of different types of alcoholic beverages among current drinkers

Table 4 shows the prevalence of consuming different types of alcoholic beverages among current drinkers and the monthly pure alcohol consumption of each type of beverage. Types of consumed alcoholic beverages differed between the two research sites. In Hunan, the three most commonly used beverages were homemade wine, beer, and high-content spirits. In Henan, they were beer, high-content spirits, and low-content spirits.

Prevalence and sociodemographic correlates of heavy drinking behavior

The percentage of current drinkers who met criteria for heavy drinking was lower in Hunan than in Henan (16.6% vs. 22.3%), $\chi^2(1) = 50.02$, $p < .001$. Prevalence rates, adjusted odds ratios, and 95% confidence intervals of heavy drinking by sociodemographic characteristics and types of

alcoholic beverages consumed are shown in Table 5. The odds ratios were adjusted for all other sociodemographic characteristics and beverage types. In Hunan, individuals with the highest level of education (>9 years) were less likely to be heavy drinkers than individuals with the lowest level of education, and in Henan, individuals with the highest level of family income were more likely to engage in heavy drinking than those with the lowest level of family income. In both provinces, those who had consumed high- or low-content spirits were more likely to be heavy drinkers.

Prevalence and sociodemographic correlates of acute intoxication

The percentage of current drinkers who reported acute intoxication at least monthly over the last 3 months was significantly lower in Hunan than in Henan (3.0% vs. 7.3%), $\chi^2(1) = 70.15$, $p < .001$. Prevalence rates, adjusted odds ratios, and 95% confidence intervals of acute intoxication by sociodemographic characteristics and types of consumed alcoholic beverages are shown in Table 5. In Hunan, unmarried men were more likely than men who had been married to report acute intoxication; in Henan, those with a higher family income were more likely to report intoxication. In both provinces, those who had consumed high- or low-content spirits had a higher risk of acute intoxication.

TABLE 4. Monthly consumption of different types of alcoholic beverages among current male alcohol users 18-60 years of age in Hunan and Henan Provinces, China, 2007

Types of alcoholic beverages	Hunan		Henan	
	Prevalence <i>n</i> (%)	Pure alcohol L (%)	Prevalence <i>n</i> (%)	Pure alcohol L (%)
High-content spirits	809 (24.3%)	1,399.8 (36.3%)	991 (32.6%)	1,362.6 (37.5%)
Low-content spirits	154 (4.6%)	166.4 (4.3%)	659 (21.7%)	677.9 (18.7%)
Beer	1,885 (56.7%)	516.3 (13.4%)	2,845 (93.7%)	1,578.9 (43.5%)
Grape wine	30 (0.9%)	2.5 (0.1%)	33 (1.1%)	8.7 (0.2%)
Yellow wine	18 (0.5%)	2.9 (0.1%)	0 (0%)	0 (0%)
Homemade wine	2,721 (81.8%)	1,772.5 (45.9%)	6 (0.2%)	4.1 (0.1%)
Total	3,327 (100%)	3,860.4 (100%)	3,036 (100%)	3,632.2 (100%)

Notes: The sum of the prevalence rates by type of beverage exceed 100% because many drinkers consumed more than one type of alcohol. L = liters.

TABLE 5. Prevalence (prev.) and predictors of heavy drinking and frequent acute intoxication among current male alcohol users 18-60 years of age from Hunan and Henan Provinces, China, 2007

		Hunan (<i>n</i> = 3,327)				Henan (<i>n</i> = 3,036)				
		Heavy drinking		Acute intoxication		Heavy drinking		Acute intoxication		
Predictors	<i>n</i>	Prev. %	AOR [95% CI]	Prev. %	AOR [95% CI]	<i>n</i>	Prev. %	AOR [95% CI]	Prev. %	AOR [95% CI]
Age										
18-34	288	9.4%	0.61 [0.39, 1.03]	2.1%	0.85 [0.30, 2.25]	1,085	19.6%	1.32 [0.93, 1.88]	6.2%	1.21 [0.72, 2.09]
35-44	878	15.0%	0.89 [0.62, 1.20]	2.5%	0.87 [0.46, 1.60]	1,056	25.0%	1.31 [0.93, 1.84]	8.0%	1.32 [0.77, 2.22]
45-54	1,057	19.0%	1.20 [0.93, 1.56]	2.9%	0.89 [0.59, 1.44]	568	22.9%	1.08 [0.79, 1.57]	8.5%	1.37 [0.80, 2.41]
55-60	1,104	17.3%	1.00 (ref.)	3.8%	1.00 (ref.)	327	21.7%	1.00 (ref.)	6.4%	1.00 (ref.)
Marital status										
Married	3,130	16.4%	1.00 (ref.)	2.8%	1.00 (ref.)	2,875	22.9%	1.00 (ref.)	7.4%	1.00 (ref.)
Unmarried	197	19.8%	1.33 [0.89, 1.98]	6.1%	2.15 [1.17, 4.07]	161	11.8%	0.56 [0.34, 0.95]	5.6%	0.95 [0.44, 2.01]
Education years										
<7	1,567	18.0%	1.00 (ref.)	3.8%	1.00 (ref.)	751	24.5%	1.00 (ref.)	7.5%	1.00 (ref.)
7-9	1,280	16.4%	0.97 [0.77, 1.18]	2.4%	0.74 [0.44, 1.21]	1,810	20.9%	0.85 [0.68, 1.10]	7.2%	0.98 [0.68, 1.40]
>9	480	12.3%	0.66 [0.48, 0.93]	2.1%	0.55 [0.26, 1.17]	475	24.2%	0.97 [0.74, 1.34]	7.2%	0.82 [0.50, 1.28]
Income										
Lowest	986	18.2%	1.00 (ref.)	4.0%	1.00 (ref.)	1,123	20.6%	1.00 (ref.)	6.5%	1.00 (ref.)
Medium	904	16.4%	0.94 [0.71, 1.23]	2.7%	0.72 [0.41, 1.22]	1,293	21.8%	1.10 [0.88, 1.35]	6.5%	1.01 [0.74, 1.42]
Highest	1,437	15.6%	0.92 [0.68, 1.17]	2.6%	0.78 [0.46, 1.27]	620	26.6%	1.38 [1.10, 1.81]	10.3%	1.66 [1.15, 2.32]
High-content spirit										
Yes	809	42.0%	7.55 [6.08, 9.33]	6.2%	2.74 [1.80, 4.46]	991	41.5%	10.57 [7.32, 13.66]	12.3%	4.48 [3.19, 6.55]
No	2,518	8.4%	1.00 (ref.)	2.0%	1.00 (ref.)	2,045	13.1%	1.00 (ref.)	4.8%	1.00 (ref.)
Low-content spirit										
Yes	154	34.4%	2.05 [1.39, 3.28]	10.4%	3.28 [1.88, 6.52]	659	38.4%	8.30 [5.85, 10.90]	14.1%	4.79 [3.41, 7.24]
No	3,173	15.7%	1.00 (ref.)	2.7%	1.00 (ref.)	2,377	17.9%	1.00 (ref.)	5.4%	1.00 (ref.)
Beer										
Yes	1,885	17.3%	0.87 [0.69, 1.08]	2.7%	0.70 [0.48, 1.10]	2,845	21.1%	0.98 [0.72, 1.38]	6.9%	0.92 [0.63, 1.45]
No	1,442	15.6%	1.00 (ref.)	3.5%	1.00 (ref.)	191	39.3%	1.00 (ref.)	13.6%	1.00 (ref.)
Homemade wine										
Yes	2,721	16.6%	1.03 [0.81, 1.34]	3.0%	0.98 [0.62, 1.68]	6	N.A.	N.A.	N.A.	N.A.
No	606	16.3%	1.00 (ref.)	3.3%	1.00 (ref.)	3,030	N.A.	N.A.	N.A.	N.A.

Notes: AOR = adjusted odds ratio (adjusted for all predictors in the model); 95% CI = 95% confidential interval; ref. = reference category; N.A. = not applicable.

Discussion

We found that the highest rates of current drinking among adult rural men were in those 45-54 years of age in Hunan and those 35-44 years of age in Henan; this result is consistent with a prior survey in urban China (Ma et al., 2005; Yang et al., 2008; Zhang et al., 2008), which found the highest rates of drinking in middle-age individuals. However, the distribution of drinking behavior, heavy drinking, and frequent intoxication observed in this study across age groups is very different than what has been found in western

countries. For example, in a recent report from the U.S. Centers for Disease Control and Prevention (2009), the authors reported the highest prevalence of heavy episodic drinking among persons age 18-24 and 25-34. Alcohol is available to everyone at any store throughout China without age restrictions (Hao et al., 2005). However, youths are still at lower risk for drinking. Zhang et al. (2008) claimed that this could be explained by different cultural norms about drinking in younger and older individuals as well as by limited independent money of Chinese youth. This cultural norm in China that is probably protective against youth drinking needs fur-

ther examination and might be helpful in the prevention and intervention of youth drinking in the West, where adolescent drinking constitutes an important public health problem.

Unweighted lifetime and 3-month prevalence of drinking were 75.3% and 62.2%, respectively, in Hunan and 80.7% and 67.2%, respectively, in Henan, which supports anecdotal reports about higher rates of alcohol use in northern China. This result is also consistent with our finding that the prevalence of alcohol use disorder in Henan province is higher than that in Hunan province (Zhou et al., 2009). These prevalence rates are similar to those seen in a 2001 survey in rural Chinese that used similar measures (Hao et al., 2004). A comparative study on alcohol use in urban and rural populations in the same district of Hunan province found that drinking was more prevalent in adult men living in urban communities (Zhou et al., 2006). Consumption of alcohol was not equally distributed in current drinkers. In both provinces, about half of pure alcohol was consumed by heaviest drinkers (average consumed pure alcohol per day ≥ 75 ml) who accounted for only 10.0%-14.7% of current drinkers. These results indicate that efforts in reducing alcohol consumption among those who drink the most are needed. However, little attention has been paid to alcohol use disorders in clinical services in China today (Cochrane et al., 2003; Hao et al., 2005). Therefore, prevention and intervention strategies—which may include health education, developing facilities focused on the treatment and prevention of alcoholism, harm reduction projects, and brief intervention such as motivational interviews (Nyamathi et al., 2010)—should be used to reduce alcohol consumption and related harm.

Homemade alcoholic beverages are not recorded in official alcohol production statistics in China. Therefore, our finding that homemade wine was frequently consumed in one of the two provinces studied—a finding also reported in Hao and colleagues' 2001 study (Hao et al., 2004)—highlights the fact that official statistics underestimate production in communities where homemade alcohol use is prevalent. This also underlines the importance of including homemade alcohol beverages in surveys of drinking, both in China and in other countries.

Heavy drinking and frequent acute intoxication are associated with various negative health outcomes; therefore, we focused our analysis on the factors associated with these maladaptive behaviors. After adjusting for beverage type and other sociodemographic variables, we found that higher education was protective for heavy drinking in Hunan, but higher income was a risk factor for both heavy drinking and frequent intoxication in Henan. We believe that this seemingly contradictory finding is related to the types of alcohol used in the two provinces. Homemade wines, consumed by more than 80% of current drinkers in Hunan, are almost all cheap rice wines produced by farmers themselves and are not subject to taxation. Accordingly, rural farmers, the lowest

income group in China, may nonetheless have high access to these inexpensive wines, facilitating higher alcohol use. In Henan, however, the most commonly consumed alcoholic beverages are beer and distilled spirits, which are comparatively more expensive, and therefore higher income levels may facilitate drinking in Henan. This difference—which needs to be explored in subsequent studies—highlights the crucial importance of identifying regional differences in epidemiological surveys of alcohol use in China.

In both provinces, consumption of high- or low-content distilled spirits is associated with a higher risk of heavy drinking and frequent acute intoxication. The higher ethanol content in distilled spirits than in other kinds of alcoholic beverages is probably related to this increased risk, but there could also be a selection factor—that is, drinkers seeking out distilled spirits for their intoxicating properties. Not currently married adult rural men were also at greater risk for frequent acute intoxication in Hunan; this is consistent with prior findings in China (Zhu et al., 2007) and also parallels the protective “marriage effect” commonly reported in Western surveys (Leonard and Rothbard, 1999).

Two limitations need to be considered when interpreting these results. First, the sample of this study is male subjects 18-60 years of age from rural communities in two provinces of China. Therefore, it is not a nationally representative sample and does not provide information on drinking behavior in urban subjects, women, or men younger than 18 or older than 60 years of age. Second, the identified sample under-represented young men, presumably because of rural-urban migrant worker transmigration (estimated as 130 million individuals in 2006); therefore, it was necessary to use age-standardization techniques to adjust the estimated prevalence. However, the alcohol use patterns among young men who stay in rural areas may not be representative of all young rural men (including those who go to cities to work).

Despite these limitations, our results have some important implications for future alcohol control programs. In China, middle-age men must be considered when developing any program aimed at decreasing alcohol consumption. Prevention efforts aimed at reducing intense drinking and related outcomes should focus on the consumption of distilled spirits. Before implementing national or regional prevention programs, community-specific situational analyses about the pattern of drinking and types of beverages consumed will be needed so that the programs can be optimally adapted to local conditions. For example, in Henan the cost of alcohol is a factor; therefore, taxation could curb alcohol consumption. But in Hunan, the frequently consumed homemade rice wines are untaxed, and, therefore, such a strategy would be ineffective. Similar issues may be relevant in other countries, such as Uganda, Russia, Latvia, and the Republic of Korea, where the consumption of homemade alcoholic beverages is common (WHO, 2004). Other strategies that have been proved to be effective

tive in reducing alcohol-related harm in other countries—minimum drinking age, regulating physical availability of alcohol, drinking-driving countermeasures, advertising restrictions, and so on—should be tested in the social and cultural background of China (Babor et al., 2010).

References

- Babor, T., Caetano, R., Casswell, S., Edwards, G., Giesbrecht, N., Graham, K., . . . Rossow, I. (2010). *Alcohol: No ordinary commodity. Research and public policy*. New York: Oxford University Press.
- Barglietto, L., English, D. R., Hopper, J. L., Powles, J., & Giles, G. G. (2006). Average volume of alcohol consumed, type of beverage, drinking pattern and the risk of death of all causes. *Alcohol and Alcoholism*, 41, 664-671.
- Britton, A., & McKee, M. (2000). The relationship between alcohol and cardiovascular diseases in Eastern Europe: Explaining the paradox. *Journal of Epidemiology and Community Health*, 54, 328-332.
- Centers for Disease Control and Prevention. (2009). Sociodemographic differences in binge drinking among adults—14 states, 2004. *Morbidity and Mortality Weekly Report*, 58(12), 310-304.
- Cochrane, J., Chen, H. H., Conigrave, K. M., & Hao, W. (2003). Alcohol use in China. *Alcohol and Alcoholism*, 38, 537-542.
- Gmel, G., & Rehm, J. (2003). Harmful alcohol use. *Alcohol Research and Health*, 27, 52-62.
- Hao, W., Chen, H. H., & Su, Z. H. (2005). China: Alcohol today. *Addiction*, 100, 737-741.
- Hao, W., Su, Z. H., Liu, B. L., Zhang, K., Yang, H. Q., & Chen, S. Z. (2004). Drinking and drinking patterns and health status in the general population of five areas of China. *Alcohol and Alcoholism*, 39, 43-52.
- Hao, W., Young, D. S., Xiao, S. Y., Li, L. J., & Zhang, Y. L. (1999). Alcohol consumption and alcohol-related problems: Chinese experience from six area samples, 1994. *Addiction*, 94, 1467-1476.
- Klatsky, A. L. (2007). Alcohol, cardiovascular diseases and diabetes mellitus. *Pharmacological Research*, 55, 237-247.
- Leonard, K. E., & Rothbard, J. C. (1999). Alcohol and the marriage effect. *Journal of Studies on Alcohol*, 13, 39-46.
- Ma, G., Zhu, D., Hu, X., Luan, D., Kong, L., & Yang, X. (2005). The drinking practice of people in China [Chinese]. *Acta Nutrimenta Sinica*, 27, 362-365.
- National Bureau of Statistics of China. (1979). *Yearbook of Chinese statistics* [Chinese]. Beijing, China: Statistic Press.
- National Bureau of Statistics of China. (2007). *Yearbook of Chinese statistics* [Chinese]. Beijing, China: Statistic Press.
- Nielsen, N. R., Schnohr, P., Jensen, G., & Grønbaek, M. (2004). Is the relationship between type of alcohol and mortality influenced by socio-economic status? *Journal of Internal Medicine*, 255, 280-288.
- Nyamathi, A., Shoptaw, S., Cohen, A., Greengold, B., Nyamathi, K., Marfisee, M., . . . Leake, B. (2010). Effect of motivational interviewing on reduction of alcohol use. *Drug and Alcohol Dependence*, 107, 23-30.
- Rehm, J., Room, R., Graham, K., Monteiro, M., Gmel, G., & Sempo, C. T. (2003). The relationship of average volume of alcohol consumption and patterns of drinking to burden of disease: An overview. *Addiction*, 98, 1209-1228.
- World Health Organization. (2002). *The world health report 2002: Reducing risks, promoting healthy life*. Geneva, Switzerland: Author. Retrieved from http://www.who.int/whr/2002/en/whr02_en.pdf
- World Health Organization. (2004). *Global status report on alcohol 2004*. Geneva, Switzerland: Author. Retrieved from http://www.who.int/substance_abuse/publications/global_status_report_2004_overview.pdf
- Yang, Y., Shi, S., & Shi, X. (2008). Investigation on drinking prevalence and influencing factors in adults of Henan Province [Chinese]. *Chinese Journal of Public Health*, 24, 515-516.
- Zhang, J. F., Casswell, S., & Cai, H. M. (2008). Increased drinking in a metropolitan city in China: A study of alcohol consumption patterns and changes. *Addiction*, 103, 416-423.
- Zhou, L., Conner, K. R., Phillips, M. R., Caine, E. D., Xiao, S., Zhang, R., & Gong, Y. (2009). Epidemiology of alcohol use disorders in rural Chinese men. *Alcoholism: Clinical and Experimental Research*, 33, 1770-1776.
- Zhou, X. H., Su, Z. H., Deng, H. Q., Xiang, X. J., Chen, H., & Hao, W. (2006). A comparative survey on alcohol and tobacco use in urban and rural populations in the Huaihua district of Hunan province, China. *Alcohol*, 39, 87-96.
- Zhu, Y., Wang, L., Zhang, X., Guan, X., Ding, D., Fu, H., . . . Wang, S. (2007). A survey on drinking behavior among residents above 15 years old in Jilin province, South China. *Journal of Preventive Medicine*, 33, 46-47.