What If Americans Drank Less? The Potential Effect on the Prevalence of Alcohol Abuse and Dependence

Loran Archer, Bridget F. Grant, PhD, PhD, and Deborah A. Dawson, PhD

ABSTRACT

Objectives. Several advisory committees have recently recommended that alcohol consumption be limited to moderate levels. Moderate drinking has been defined generally as not more than two drinks per day for healthy men and not more than one drink per day for healthy, nonpregnant women. The impact of reducing alcohol consumption to within the recommended guidelines on the prevalence of two serious alcohol-related problems was examined by modeling the relationship between average daily ethanol intake and alcohol abuse and dependence.

Methods. The recommended drinking guidelines, both in their existing form and modified by a measure of impairment, were applied to the observed distribution of consumption derived from a large representative survey of the US general population.

Results. The results demonstrated that restricting drinking to the maximum allowable levels under the existing and the modified guidelines would reduce the prevalence of alcohol abuse and dependence by 14.2% and 47.1%, respectively, in the adult US general population.

Conclusions. Implications of these findings are discussed in terms of the validity of the assumptions underlying the models and the nature and direction of future research that would form the basis of newly developed guidelines for safe drinking limits. (*Am J Public Health.* 1995;85:61–66)

Introduction

Alcohol abuse and dependence are major health problems in the United States. In 1988, more than 13 million alcohol users 21 years of age and older met the criteria for alcohol abuse and/or dependence[1] outlined in the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R).[2] The economic cost of alcohol abuse and dependence to the nation was estimated to exceed $98 billion in 1990.[3] Alcohol involvement was implicated in 41% to 50% of all traffic crash deaths in 1990[4,5]; in 1988, there were 107 800 alcohol-related deaths, or 5% of the total mortality in the United States.[6] One fifth of these deaths (e.g., those involving liver cirrhosis) were directly attributable to alcohol abuse and dependence. The remaining four fifths were alcohol related and represented 35% of all accidental fall fatalities, 28% of all suicides, 45% of all accidental fire fatalities, 38% of all accidental drownings, and 50% to 70% of all deaths due to cancers of the lip, oral cavity, pharynx, and esophagus.[7]

Many health authorities have advised Americans to limit their alcohol consumption to reduce their risk of alcohol-related diseases and problems. Recent guidelines for safe limits on alcohol use recommend that consumption be confined to moderate levels. Moderate drinking levels have generally been defined as not more than two drinks per day for healthy men and not more than one drink per day for healthy, nonpregnant women.[8–10]

The exact cutoff values for levels of consumption that define the recommended drinking guidelines were determined through a large and consistent set of epidemiologic studies that quantified the relationships between consumption levels and various diseases, including liver cirrhosis, hypertension, and breast cancer.[11–14] For most of these alcohol-related diseases, risk is doubled at levels of daily ethanol intake of approximately 30 g/day (2.5 drinks per day) or more. The current nationally recommended safe limits of daily consumption of 2 drinks per day for men and 1 drink per day for women represent somewhat conservative levels of intake at which the relative odds of these alcohol-related diseases is not greatly increased above 1.0. In contrast, other research has highlighted the health benefits of moderate drinking, particularly in relation to reducing susceptibility to coronary heart disease and stroke.[15–21]

To date, there have been no population-based randomized trials of the effect of reducing alcohol consumption levels on the occurrence of alcohol-related diseases and problems. The sheer number of adverse effects associated with consumption would necessitate numerous trials that would exceed funding realities and current knowledge of entirely successful intervention strategies. However, the impact of reducing alcohol consumption to within the recommended guidelines on the prevalence of alcohol-related problems in the United States can be estimated by modeling the relationship between consumption and specific alcohol-related conditions. In this study, we selected alcohol abuse and dependence as the principal focus of our model because the risk of these alcohol use disorders was identified in the recommended drinking

The authors are with the National Institute on Alcohol Abuse and Alcoholism, Rockville, Md.

Requests for reprints should be sent to Bridget F. Grant, PhD, National Institute on Alcohol Abuse and Alcoholism, 6000 Executive Blvd, Suite 514, Rockville, MD 20892.

This paper was accepted September 16, 1994.

guidelines as the basis for establishing the maximum allowable levels of consumption below those estimated from empirical studies. Moreover, our analyses were facilitated by the availability of current national data and justified by the sheer magnitude of the alcohol abuse and dependence problem in the United States.

The purpose of this study was to evaluate the potential impact of current recommendations about safe limits on drinking by building a model to estimate reductions in the prevalence of alcohol abuse and dependence in the US general population. We assumed that all Americans drinking at a level higher than that recommended in the guidelines could succeed in reducing their alcohol intake to the maximum allowable under the guidelines. Those drinking at a level at or below that recommended (i.e., at a "moderate" level) were not affected in this model.

Methods

Sample

This study was based on data from the alcohol supplement of the 1988 National Health Interview Survey (NHIS), a nationwide representative survey conducted by the National Center for Health Statistics and sponsored by the National Institute on Alcohol Abuse and Alcoholism.[22] The alcohol supplement was administered by direct interview to one randomly selected adult 18 years of age or older in each of 43 809 households. The response rate was 86.0%. The analyses presented in this report were restricted to those respondents defined as current drinkers: 22 102 respondents who had consumed at least 12 drinks of alcohol during the 12 months preceding the interview.

Because of the stratification and clustering of the NHIS sample, variance estimation procedures based on the assumption of simple random sampling will result in standard error estimates that are about 20% larger than those that would be obtained with a simple random sample of equal size. Therefore, all variance estimates and statistical computations reported here were generated with SUDAAN, a software package that uses Taylor series linearization techniques to adjust for sample design characteristics.[23]

Alcohol Consumption Measures

Two consumption measures were constructed in this study. The first, typical average daily ethanol intake, was derived from a set of three questions asked separately for beer, wine, and liquor; the 2 weeks prior to the last drink served as the reference period. For each type of alcohol, the respondent was asked the number of drinking occasions, the usual number of drinks per occasion, and the usual size of the drink consumed during the reference period. Ounces of alcohol were converted to ounces of ethanol by means of conversion factors of 0.045 for beer, 0.121 for wine, and 0.409 for liquor. Summing ounces of ethanol for each beverage type and dividing by 14 yielded a continuous measure of typical average daily ethanol intake. Because measures of typical average daily consumption underestimate episodes of atypical or heavier drinking and, thus, total consumption, our measure was adjusted to incorporate the frequency of atypical drinking days (i.e., typical average daily consumption was weighted by the number of days the respondent drank five or more and nine or more drinks).[24–26] This consumption measure was used in the analyses related to application of both the existing and the modified drinking guidelines.

The existing US moderate drinking guidelines are exclusively defined in terms of predetermined levels of average daily consumption. However, in a review of the literature on risks associated with moderate drinking, Babor et al. concluded that both levels of consumption and a measure of impairment should be considered in the determination of guidelines for nonhazardous drinking.[27] Results from studies on alcohol consumption and alcohol-related problems in both general population[28,29] and treatment samples[30] suggest that consuming five or more drinks on any one occasion is associated with an increased risk of alcohol-related problems. After consideration of these findings, our second consumption variable—the relative frequency of heavy drinking—was constructed. This measure was used in the analyses related to the modified drinking guidelines (in addition to our first consumption measure of average daily consumption). The relative frequency of heavy drinking was calculated by dividing the number of past-year occasions on which the respondent reported drinking five or more drinks by his or her total number of drinking occasions per year, resulting in a proportion that ranged in value from 0.0 to 1.0.

Thus, for the purposes of this study, two alternative measures of moderate drinking were modeled. The first was existing US drinking guidelines, according to which men's average consumption would not exceed two standard drinks (1.0 oz of ethanol) per day and women's average consumption would not exceed one standard drink (0.5 oz of ethanol) per day. The second measure was modified US drinking guidelines, which involved the same criteria as the first measure with the following addition: no occasions of consuming five or more drinks (a measure of the absence of impairment).

Alcohol Abuse and Dependence Diagnoses

Diagnoses of current alcohol dependence were derived by means of 27 symptom-item questions designed to operationalize the nine criteria for abuse and dependence appearing in the DSM-III-R.[15] A list of these criteria and their corresponding symptom items has been published elsewhere.[1] An individual was classified as dependent if he or she had experienced one or more symptoms of at least three of the following criteria during the preceding year: tolerance; characteristic withdrawal state; drinking to relieve or avoid withdrawal; persistent desire or unsuccessful efforts to stop or cut down on drinking; drinking larger amounts or for longer periods than intended; spending a great deal of time obtaining alcohol, drinking, or recovering from the effects of alcohol; frequent intoxication or withdrawal when expected to fulfill major role obligations; important social, occupational, or recreational activities given up or reduced in favor of drinking; and continuing to drink despite a persistent or recurrent social, psychological, or physical problem caused or exacerbated by drinking. Two or more positive symptoms were required to meet the withdrawal criterion, so as to satisfy the DSM-III-R definition of withdrawal as a syndrome or cluster of symptoms. In order to satisfy the DSM-III-R duration criterion—that some symptoms of disturbance occur persistently for a month or repeatedly over a longer period of time—one or more positive symptoms of at least two of the dependence criteria must have been experienced two or more times during the previous year.

In order to meet DSM-III-R criteria for abuse, respondents were required to meet at least one of the two abuse criteria on two or more occasions during the previous year. The abuse criteria were continued drinking despite a persistent or recurrent social, occupational, psychological, or physical problem caused or exacerbated by drinking and recurrent drinking

in physically hazardous situations. For the purpose of the present analyses, abuse and dependence diagnoses were combined. The internal consistency reliability associated with all abuse and dependence items was .94, indicating excellent reliability. This estimate is consistent with the results of a previous test–retest reliability study of dependence items conducted in 1991.[31] In that study, the reliability of each alcohol abuse and dependence item and diagnosis exceeded .65, which denotes moderate to good reliability given the nature of the diagnostic measure and the more rigorous test–retest design.

Sociodemographic Variables

On the basis of previous research, several sociodemographic variables were identified as putative confounders and/or modifiers of the association between average daily consumption and abuse and dependence. The sociodemographic variables included age (measured in single years) and gender. Race and marital status were dichotomized as Black vs non-Black and currently married vs all other. Family history of alcoholism was dichotomized as positive vs negative and was determined by the respondent mentioning any blood relative ever being a problem drinker or alcoholic. The family income variable was treated as continuous once it was determined that it satisfied the linearity assumption. As a result of the large proportion of respondents who refused to reveal their family incomes, the regression equation technique was used to impute missing values for the income variable on the basis of age, race, gender, education, and (if available) whether the respondent had at least indicated that his or her annual income was below or above $20 000. The education measure was dichotomous: college graduates vs all others. Age at first drink was dichotomized as under 15 years vs 15 years or older, and total body water was treated as a continuous measure in deciliter units estimated on the basis of age, gender, and weight.

Linear Logistic Model

A linear logistic regression model was constructed to estimate the prevalence of past-year abuse and/or dependence among drinkers 21 years of age and older under two hypothetical scenarios: (1) that consumption in excess of the maximum allowable under the existing guidelines was eliminated and (2) that consumption in excess of the maximum allowable under the modified guidelines was eliminated.

The model estimated the association between alcohol consumption and DSM-III-R past-year alcohol abuse and/or dependence, adjusting for the confounding or modifying effects of the sociodemographic variables discussed previously. The two measures of consumption—average daily ethanol intake and proportion of drinking occasions on which five or more drinks were consumed—were assigned the status of exposure variables. In order to satisfy the assumption of linearity with the log odds of abuse and/or dependence, a log transform was applied to average daily intake and a cube-root transform was applied to the proportion of heavy drinking occasions.

The modeling process consisted of two stages. In stage 1, a backward stepwise regression procedure was used to eliminate all nonsignificant ($P < .05$) interactions between the consumption and sociodemographic variables. Stage 2 entailed the identification of confounders or, alternatively, the deletion of nonconfounders from the reduced models resulting from stage 1 (i.e., the model containing all main-effects and those interactions that were statistically significant). The main-effect terms left in the model were those whose removal materially affected the parameters for the exposure variables.

In order for the model to yield unbiased estimates of the prevalence of alcohol abuse and/or dependence, any cases omitted from the estimation of model parameters (because of missing values for one or more of the variables) would have to be randomly distributed. Preliminary investigation revealed that the omitted cases involved a slightly higher prevalence of alcohol use disorders than did the cases with which the model was fit. To compensate for this bias, the case weights for individuals with a positive value for the outcome measure were adjusted by the ratio of the prevalence in the total population of drinkers 21 years of age and over to the prevalence among the cases used in estimating the model (i.e., by a factor of p_{total}/p_{model}). The weights for cases with a negative value for the outcome measure were adjusted by a factor of $(1 - p)_{total}/(1 - p)_{model}$.

Results

Observed Prevalence of Alcohol Use Disorders and Mean Consumption Levels

The 1-year prevalence of DSM-III-R alcohol abuse and/or dependence was 15.5% among current drinkers 21 years of age or older (i.e., those above the legal drinking age) (Table 1). The observed mean daily consumption level in this segment of the population was 0.63 oz. Fifty-nine percent of these drinkers reported no occasions of consuming five or more drinks in the preceding year. Nine percent reported having consumed five or more drinks on half or more of their drinking occasions. One fourth of all current drinkers reported levels of consumption that exceeded the maximum allowable under the existing responsible drinking guidelines. Almost twice as many (44%) exceeded the modified guidelines.

TABLE 1—Characteristics of Current Drinkers 21 Years of Age and Over, 1988 National Health Interview Survey, Alcohol Supplement

Characteristic	Estimate (SE)
Alcohol abuse and/or dependence, %	15.5 (0.3)
Average daily ethanol intake, oz	0.63 (0.01)
Drinking occasions (proportion) on which 5+ drinks were consumed, %	
No occasions	58.9 (0.5)
.01–.24	27.4 (0.4)
.25–.49	5.2 (0.2)
.50 or more	8.6 (0.2)
Consumption exceeding maximum allowable under existing guidelines,%	23.5 (0.3)
Consumption exceeding maximum allowable under modified guidelines, %	43.9 (0.5)

The associations between these consumption measures and alcohol use disorders are illustrated by the logistic regression model shown in Table 2. The positive beta parameters for the two exposure variables reflect the positive relationships between each of these consumption measures and the odds of alcohol use disorders. The negative interaction term between average daily intake and Black race indicates that the positive effect of average daily intake was lower for Black than for non-Black drinkers (i.e., at a given level of average intake, the odds of abuse and/or dependence were lower for Black than for non-Black drinkers).

TABLE 2—Reduced Logistic Regression Model Predicting DSM-III-R Past-Year Alcohol Abuse and/or Dependence: Current Drinkers 21 Years of Age and Over

	$\hat{\beta}$	SE	P
Intercept	0.318	0.246	.200
Main effect			
Age	− 0.035	0.002	<.001
Male	0.417	0.099	<.001
Black	−0.540	0.113	<.001
Married	−0.355	0.060	<.001
Positive family history	0.546	0.055	<.001
Family income[a]	−0.014	0.005	.006
Less than 15 years old at first drink	0.243	0.101	.018
Total body water	−0.015	0.006	.024
Average daily ethanol intake[b]	0.746	0.030	<.001
Relative frequency of heavy drinking[c]	1.389	0.091	<.001
Interaction			
Average daily ethanol intake[b] × Black	−0.324	0.079	<.001

Note. Model χ^2 (17) = 3674.0; concordance between predicted and observed probabilities = 84.5%; lack of fit statistic (chi-square approximation with 8 *df*) = 7.38, *P* = .50. DSM-III-R = *Diagnostic and Statistical Manual of Mental Disoders*, revised third edition.
[a]Range from 00 = < $1000 to 26 = $50 000 and over.
[b]Intake in ounces, on a log scale.
[c]Percentage of drinking occasions on which 5+ drinks were consumed, on a cube-root scale.

TABLE 3—The Impact of Existing and Modified US Drinking Guidelines on Reductions in the Prevalence of Alcohol Abuse and/or Dependence

	Estimate
No. of current drinkers 21 years of age or older, thousands	85 880.7
Prevalence of DSM-III-R abuse and/or dependence at:	
Observed consumption levels, % (95% confidence interval)	15.5 (14.9, 16.1)
Consumption not to exceed maximum allowable under the existing drinking guidelines, % (95% confidence interval)	13.3 (13.3, 13.4)
Consumption not to exceed maximum allowable under the modified drinking guidelines, % (95% confidence interval)	8.2 (8.1, 8.2)

Note. Prevalences are reported as weighted percentages. DSM-III-R = *Diagnostic and Statistical Manual of Mental Disorders*, revised third edition.

Impact of Existing Drinking Guidelines on the Prevalence of Alcohol Abuse and Dependence

The impact of imposing the existing responsible drinking guidelines on the prevalence of alcohol abuse and/or dependence was estimated in the following way. First, individual consumption values for all drinkers whose average daily intake lay beyond the limits of the existing guidelines were reduced to the maximum allowable under the guidelines (i.e., to the log transforms of 1.0 oz for men and 0.5 oz for women). Individual log odds of abuse and/or dependence were then calculated with the formula $\hat{\text{logit}}_i = x_i^T\hat{\beta}$. The variance of each individual's log odds of abuse and/or dependence was calculated with the formula $V(\hat{\text{logit}}_i) = x_i^T\text{COV}(\hat{\beta})x_i$.

Individuals' log odds were converted to probabilities, $\hat{p}_i = 1/[1 + \exp(-\hat{\text{logit}}_i)]$. The average value of these individual probabilities (i.e., $\Sigma\hat{p}_i/n$) yielded the estimated population prevalence (EPP) of abuse and/or dependence among drinkers 21 years of age and over. The variance of each individual's probability was calculated by means of the delta method[32]:

$$V(\hat{p}_i) = V(\hat{\text{logit}}_i)\left(\frac{\exp(-\text{logit})}{[1 + \exp(-\text{logit})]^2}\right)^2.$$

Since each case is independent of all others, there is no covariance among cases, and the formula for the total population variance is simply $V(\text{EPP}) = \Sigma V(\hat{p}_i)/n^2$.

The resulting values indicated that if alcohol consumption were reduced so that no individual's average daily ethanol intake exceeded the maximum allowable under the existing responsible drinking guidelines, the prevalence of alcohol abuse and/or dependence would be reduced to 13.33% (95% confidence interval [CI] = 13.29%, 13.37%) (Table 3). This represents a 14% decrease in alcohol use disorders with respect to the baseline prevalence of 15.47%.

Impact of Modified Drinking Guidelines on the Prevalence of Alcohol Abuse and Dependence

The procedure used to estimate the impact of the modified guidelines on the prevalence of alcohol use disorders was identical to that described above with one exception. In addition to reducing individuals' average daily consumption values as required to meet the drinking guidelines, the proportion of drinking occasions on which five or more drinks were consumed was reduced to zero for all individuals who reported any such occasions of heavy drinking. With this additional reduction in consumption, the prevalence of abuse and/or dependence yielded by the model was 8.15% (95% CI = 8.11%, 8.19%), a decrease of 47% with respect to the baseline prevalence.

Discussion

The purpose of this study was to determine the potential impact of two sets of recommendations to restrict drinking on the prevalence of alcohol abuse and/or dependence in the US population 21 years of age and older. The results showed that the observed current prevalence of abuse and/or dependence could be reduced from 15.5% (approximately 13 million Americans) to 13.3% (approximately 11 million Americans) based on the assumptions underlying the existing drinking guidelines. On the basis of the assumptions of the modified drinking guidelines used in this study, the current prevalence of abuse and/or dependence

could be reduced to 8.2% (approximately 7 million Americans). Although both of these estimates were derived from the segment of the general population exceeding the legal drinking age (i.e., 21 years old and older), similar reductions in abuse and/or dependence could be expected if the model included the adult US population 18 years of age and older. When 18- to 21-year-olds were included, the observed prevalence of abuse and/or dependence of 16.7% was reduced to 14.6% and 9.1% when the existing and modified drinking guidelines, respectively, were applied to the observed distribution of consumption (data not shown).

The reductions in abuse and/or dependence estimated to occur as a result of applying either the existing or the modified drinking guidelines to the observed distribution of consumption represented best-case scenarios. That is, the model assumed that the relatively large percentage of alcohol users whose consumption exceeded the guidelines could and would reduce their consumption to the maximum levels allowable. In the present study, 48.0% of those respondents classified as alcohol abusers and 53.7% of those classified as alcohol dependent exceeded the maximum allowable limits of drinking under the existing guidelines (Table 4). Corresponding percentages of abusers and dependent persons exceeding the maximum allowable consumption levels under the modified drinking guidelines were 76.7% and 81.5%. Interestingly, 18.2% and 37.3% of those respondents not classified as alcohol abusers or as alcohol dependent also exceeded the maximum allowable consumption levels associated with the existing and modified guidelines, respectively.

The actual impact of the recommended drinking guidelines on reducing the prevalence of alcohol abuse and/or dependence would critically depend on the percentage of alcohol users in excess of the guidelines who would reduce their consumption to the maximum allowable levels. In this study, the maximum reduction of 47% in the prevalence of alcohol abuse and dependence would result from application of the modified drinking guidelines. As can be seen in Table 4, this reduction in prevalence would require about 44% of current drinkers 21 years of age and older to decrease their consumption to the maximum allowable under the modified guidelines. Although our model assumed 100% compliance in such reductions in drinking levels, the extent to which this assumption is unrealistic will result in proportional overestimation of the impact of the recommended drinking guidelines.

Despite our assumption of 100% compliance, application of the existing and modified drinking guidelines resulted only in 14.2% and 47.1% reductions, respectively, in the current prevalence of alcohol abuse and dependence in the US population 21 years old and older. These results strongly suggest that the risk of abuse and/or dependence may be associated with rather small average amounts of alcohol consumed on a daily basis. It is evident from these estimates, derived within the context of our models, that average daily ethanol intake would need to be reduced well below those levels recommended by the existing and modified drinking guidelines if we are to expect reductions in the current prevalence of abuse and/or dependence much below 50%.

Differential bias in reporting consumption levels and alcohol-related problems could also account, in part, for the disappointing reduction in the prevalence of alcohol abuse and dependence observed under the best-case scenarios presented in this study. That is, respondents in the 1988 NHIS survey may have consistently underestimated their consumption levels while more accurately reporting problems related to their drinking that would add up to a diagnosis of alcohol abuse and/or dependence. Although this differential reporting phenomenon has been observed in similar general population surveys on drinking and alcohol-related problems, it has not, to date, been adequately studied or documented.

Alternatively, the role of underestimation of self-reported consumption in producing less than anticipated reductions in the prevalence of abuse and dependence was supported by the finding that approximately 50% and 20% of the diagnosed respondents were not drinking in excess of the existing and modified guidelines, respectively. The implications of underreporting of self-report measures of consumption on this study's analysis would have little impact since the drinking guidelines were themselves established from a large and consistent set of epidemiological research that was also based on self-report measures of consumption.

This study's analysis estimated the extent of reduction in the prevalence of alcohol abuse and dependence that would result from reducing consumption in accordance with a set of recommended drinking guidelines. This was done by using individuals' reduced drinking levels as predictor variables in a regression equation estimated on the basis of their current levels of self-reported alcohol consumption and self-reported alcohol-related problems. The implicit assumption of this technique is that the association between consumption and dependence/abuse would not be affected by a change in the overall consumption profile of the population (i.e., that the consumption/problem curve would remain invariant before and after the changes in drinking behavior). This assumption may be questioned in light of findings from alcohol surveys over the past few years that have shown a general decrease in reported consumption levels with no concomitant reduction in the prevalence of self-reported alcohol problems. Moreover, the finding of this study that an aggregate decrease in abuse and dependence could be achieved by reducing consumption to a level not to exceed two drinks per day for men and one drink per day for women may be unrealistic on an individual level. Few clinicians would agree that alcoholics could successfully become controlled drinkers, and most would probably recommend total abstention in achieving the transition out of the abuse or dependence category.

Specification of the precise level of average daily ethanol intake that would more significantly reduce the prevalence of alcohol abuse and/or dependence must await empirical studies designed to directly quantify the risk of these alcohol use disorders at various levels of consumption. Optimally, such studies would focus on deriving a precise estimate of the relationship between the incidence (as opposed to the prevalence) of alcohol abuse and dependence and various levels of average daily ethanol intake within a prospective epidemiologic study design.

TABLE 4—Percentage of Current Drinkers 21 Years of Age or Older Whose Ethanol Consumption Exceeded the US Drinking Guidelines

Status	Existing, % (SE)	Modified, % (SE)
Abuse only	48.0 (2.0)	76.7 (1.5)
Dependence	53.7 (1.2)	81.5 (0.9)
Neither abuse nor dependence	18.2 (0.3)	37.3 (0.5)
Total	23.5 (0.3)	43.9 (0.5)

Within this design, due consideration must be given to the accurate measurement of the numerous dimensions of the complex variable of consumption (e.g., binge and daily drinking) and the inclusion of extraneous variables that modify or confound the association between consumption and abuse and dependence. Given more and more precise estimates of risk, recommendations for safe drinking guidelines can be reformulated incrementally with advancing knowledge. In turn, mathematical models incorporating the assumptions of the evolving guidelines can be applied to the observed distribution of consumption to determine expected reductions in the occurrence of alcohol abuse and dependence.

In summary, the application of the existing and modified guidelines to the observed distribution of consumption in the US general population 21 years of age and older resulted in 14.2% and 47.1% reductions in the current prevalence of alcohol abuse and/or dependence. These results should be considered in light of the reported protective effects of moderate drinking in reducing susceptibility to coronary heart disease. Our models also represented best-case scenarios involving the assumption of 100% compliance in reducing consumption levels to the maximum allowable under the existing or modified guidelines. Nonetheless, the estimates of the impact of the existing and modified drinking guidelines on the prevalence of alcohol abuse and dependence, and the statistical models from which the estimates were derived, have been useful in identifying the nature and direction of future research that will more validly form the basis of newly developed guidelines for safe drinking limits. □

Acknowledgment

The authors gratefully acknowledge the contributions of Dr Bengt Muthen, UCLA Graduate School of Education, toward the statistical techniques used in this paper.

References

1. Grant BF, Harford TC, Chou P, et al. Prevalence of DSM-III-R alcohol abuse and dependence: United States, 1988. *Alcohol Health Res World.* 1991;15:91–96.
2. *Diagnostic and Statistical Manual of Mental Disorders.* Rev. 3rd ed. Washington, DC: American Psychiatric Association; 1987.
3. Rice DP. The economic cost of alcohol abuse and dependence: 1990. *Alcohol Health Res World.* 1993;17:10–11.
4. Hingson R. Prevention of alcohol-impaired driving. *Alcohol Health Res World.* 1993;17: 16–18.
5. Zobeck TS, Stinson FS, Bertolucci D. *Trends in Alcohol-Related Fatal Traffic Crashes, United States: 1979–1990.* Rockville, Md: National Institute on Alcohol Abuse and Alcoholism; 1992.
6. Stinson FS, DeBakey SF. Alcohol-related mortality in the United States. *Addiction.* In press.
7. Shultz JM, Rice DP, Parker DL. Alcohol-related mortality and years of potential life lost—United States, 1987. *MMWR.* 1990;39: 173–178.
8. *The Surgeon General's Report on Nutrition and Health.* Washington, DC: US Dept of Health and Human Services; 1988. DHHS publication PHS 88-50215.
9. *Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 1990.* Washington, DC: US Dept of Agriculture, US Dept of Health and Human Services; 1990.
10. Darby S, Heinz A. *The Responsible Use of Alcohol: Defining the Parameters of Moderation.* New York, NY: American Council on Science and Health; 1991.
11. Criqui MH. Alcohol consumption, blood pressure, lipids, and cardiovascular mortality. *Alcoholism (NY).* 1986;10:564–569.
12. Pequignot G, Chabert C, Eudoux H, Courcoul MA. Augmentation de risque de cirrhose en function de la ration d'alcool. *Rev Alcohol.* 1974;20:191–202.
13. Pequignot G, Tuyns AJ, Berta JL. Ascitic cirrhosis in relation to alcohol consumption. *Int J Epidemiol.* 1979;7:113–120.
14. Longnecker MP, Berlin JA, Orza MJ, Chalmers TC. A meta-analysis of alcohol consumption in relation to risk of breast cancer. *JAMA.* 1988;260:652–656.
15. Blackwelder WC, Yano K, Rhoads GG, Kagan A, Gordon T, Palesch Y. Alcohol and mortality: the Honolulu heart study. *Am J Med.* 1980;68:164–169.
16. Cohen S, Tyrrell DAJ, Russell MAH, Jarvis MJ, Smith AP. Smoking, alcohol consumption, and susceptibility to the common cold. *Am J Public Health.* 1993;83: 1277–1283.
17. Dyer AR, Stamler J, Paul O, et al. Alcohol consumption, cardiovascular risk factors, and mortality in two Chicago epidemiologic studies. *Circulation.* 1977;56:1067–1074.
18. Manson JE, Tosteson H, Saherfield S, et al. The primary prevention of myocardial infarction. *N Engl J Med.* 1992;326:1406–1416.
19. Marmot MG, Rose G, Shipley MJ, Thomas BJ. Alcohol and mortality: a U-shaped curve. *Lancet.* 1981;1:580–583.
20. Rimm EB, Giovannucci EL, Willett WC, et al. Prospective study of alcohol consumption and risk of coronary disease in men. *Lancet.* 1991;338(8675):464–468.
21. Stampfer MF, Colditz GA, Willett WC, Speizer FE, Hennekens CH. A prospective study of moderate alcohol consumption and the risk of coronary heart disease and stroke in women. *N Engl J Med.* 1988;319: 267–273.
22. Massey JT, Moore TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985–1994. *Vital Health Stat* [2]. 1989; no. 110:1–33. DHHS publication PHS 89–1384.
23. *Software for Survey Data Analysis, Version 5.5.* Research Triangle Park, NC: Research Triangle Institute; 1993.
24. Knupfer G. The risk of drunkenness (or ebrieties resurrecta). *Br J Addict.* 1984;79: 185–196.
25. Polich JM, Armour DJ, Braiker HB. *The Course of Alcoholism: Four Years after Treatment.* Santa Monica, Calif: Rand Corp; 1980.
26. Sobell LC, Cellucei T, Nirenberg TD, Sobell MB. Does quantity-frequency data underestimate drinking-related health risks? *Am J Public Health.* 1982;72:823–828.
27. Babor TF, Kranzler HR, Laverman RJ. Social drinking as a health and psychosocial risk. In: Galanter M, ed. *Recent Developments in Alcoholism.* New York, NY: Plenum Press; 1987.
28. Anda RF, Williamson DF, Remington PL. Alcohol and fatal injuries among US adults. *JAMA.* 1988;260:2529–2562.
29. Hilton M. Drinking patterns and drinking problems in 1984: results from a general population survey. *Alcohol Clin Exp Res.* 1987;11:167–175.
30. Caetano R. Correlates of DSM-III-R alcohol dependence in treatment and general population surveys. *Drug Alcohol Dependence.* 1991;28:225–239.
31. Grant BF. *Test-Retest of Alcohol and Drug Abuse and Dependence Symptoms and DSM-III-R Diagnoses.* Rockville, Md: National Institute on Alcohol Abuse and Alcoholism; 1991.
32. Stuart A, Ord JK. *Kendall's Advanced Theory of Statistics—Distribution Theory.* New York, NY: Oxford University Press; 1987.