

The Dietary Guidelines: Surveillance Issues and Research Needs

If You Drink Alcoholic Beverages Do So in Moderation: What Does This Mean?¹

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ABSTRACT The changes in content of the alcohol guideline of the various editions of the *Dietary Guidelines for Americans* from 1980 to 2000 are discussed. This is followed by a capsule summary of the history and evolution of the discipline of alcohol epidemiology compared with that of nutrition epidemiology. Methods of assessment are discussed, and issues surrounding the validity and reliability of self-report of alcohol consumption are then outlined. Relevant objectives from *Healthy People 2010* are discussed. Surveillance of the alcohol guideline discloses that, at present, very few American drinkers follow the recommendations of the alcohol guideline. Indications for future research needs to address this issue conclude the discussion. *J. Nutr.* 131: 552S–561S, 2001.

KEY WORDS: • alcohol • moderate drinking • alcohol epidemiology • alcohol consumption • self-report • survey measurement

THE EVOLUTION OF THE ALCOHOL GUIDELINE

The actual alcohol guideline has changed relatively little over time. In 1980, the guideline stated “If you drink alcohol, do so in moderation.” In all subsequent editions (1985, 1990, 1995 and 2000), the text of the guideline reads “If you drink alcoholic beverages, do so in moderation.”

The 1985 alcohol guidance

Although the phrasing of the alcohol guideline itself has changed only slightly over the years, the accompanying explanatory text has evolved substantially. The issue of drinking and driving appears for the first time in the 1985 edition of the *Dietary Guidelines* (1). Following the introductory material, the seven guidelines were listed with the alcohol guideline reading “If you drink alcoholic beverages, do so in moderation—and don’t drive.” On page 4 in the section on adequate diet, alcohol was added to a discussion of the dietary needs of elderly people. “Elderly people may eat relatively little food. Thus, they should pay special attention to minimizing foods high in calories and low in essential nutrients—for example, fats, oils, sugars, and alcohol. The latter is not usually regarded as a food, but is high in calories.” The narrative text elaborating on the alcohol guideline was quite short compared with those of the other guidelines and focused primarily on energy and nutritional aspects of alcohol consumption. The issue of

alcohol consumption during pregnancy was discussed in a cautionary tone. “Excessive consumption of alcoholic beverages by pregnant women may cause birth defects or other problems during pregnancy. It has not been established whether there are risks to the fetus from minimum consumption of alcohol. Until this is known, pregnant women should abstain or limit alcohol intake to an occasional standard-size drink of beer, wine or liquor (not more than one drink per day).” By today’s standards, this paragraph was vague and perhaps not very informative. “Excessive consumption” was not defined (unless the subsequent injunction to limit intake to an occasional standard-size drink is considered definitive). The types of birth defects and pregnancy problems were not specified. Nevertheless, the 1985 Dietary Guideline Committee took a bold public health step by acknowledging that although a safe threshold for alcohol consumption during pregnancy had not been established, pregnant women should either abstain from alcohol or limit their consumption to an occasional drink but no more than one drink a day. Although “moderate drinking” and a “standard-size drink” were not defined, the guideline did begin to quantitate moderate drinking by stating that “one or two standard-size drinks daily appear to cause no harm in normal healthy adults.” The guideline concluded by stating “If you drink, be moderate in your intake and DO NOT DRIVE!”

The 1990 alcohol guidance

The Report of the Dietary Guidelines Advisory Committee on the Dietary Guidelines for Americans, 1990 was considerably longer and more detailed than that of the 1985 Committee (2). One of the eight major text changes highlighted in the Executive Summary states: “Moderate drinking is defined and

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certain groups, including women who are pregnant or trying to conceive, are cautioned not to drink at all.” In the introductory text of the Guidelines, it was noted that “Other guidelines suggest moderation in the use of sugars, salt, and if used at all, alcoholic beverages.” Alcohol was mentioned as a source of empty calories for inactive individuals and those trying to lose weight. In the text box “To Decrease Calorie Intake” one of the tips listed was “Drink little or no alcoholic beverages.” The Committee expressed concern that more space was needed for new material for several guidelines including the alcohol guideline. Indeed, the text of the alcohol guideline is expanded and considerably more specific than previously. In terms of the narrative, the Committee specified that the new material must achieve the following: 1) make clear that alcohol has no net benefit to health; 2) define moderate drinking; 3) identify people who should not drink; 4) add inflammation of the pancreas and damage to heart and brain as complications of drinking; and 5) refer to studies that link alcohol to lower risk for heart attacks and offsetting higher risk for hypertension and hemorrhagic stroke. Moderate drinking was defined as no more than one drink a day for women and no more than two drinks a day for men. A drink was defined as 12 oz of regular beer, 5 oz of wine or 1.5 oz of distilled spirits (80 proof). The 1990 alcohol guideline clearly stated for the first time that “some people should not drink alcoholic beverages.” The statement about alcohol and pregnancy was strengthened, i.e., women who are pregnant or trying to conceive was the first group listed among those who should not drink. Others who should not drink included “Individuals who plan to drive or engage in other activities that require attention or skill; individuals using medicines, even over-the-counter kinds; individuals who cannot keep their drinking moderate; and children and adolescents.”

The wording of the alcohol guideline was discussed at great length by the Committee. Some members favored a stronger caution such as: “Alcoholic beverages are not recommended. If you drink at all, do so in moderation.” Reasons for this recommendation were that drinking alcoholic beverages had no net benefit to health and could be addictive. In addition, at the time, it was understood that alcohol was a significant contributor to three of the top 10 causes of death, i.e., cirrhosis of the liver, motor vehicle and other “accidents” and suicide. Although all committee members agreed that excess alcohol consumption had serious consequences, the majority of members felt that this stronger alternative might be interpreted as overly judgmental and restrictive. In addition, such a change in wording would have required considerable additional space on the cover of the bulletin, thus drawing undue attention to this single guideline. Limiting ones drinking to moderate levels, if one chooses to drink, was felt to be consistent with recommendations found in both *The Surgeon General's Report on Nutrition and Health* of 1988 and the 1989 National Research Council's report *Diet and Health: Implications for Chronic Disease Risk*.

The 1990 edition of the alcohol guideline set several precedents. Not only was moderate drinking defined for the first time, but gender differences in the distribution and effect of alcohol were also recognized. By 1990, a substantial body of scientific evidence had demonstrated that the risk of fetal abnormalities increased with an increase in alcohol consumption during pregnancy. Although a threshold level of safety for alcohol consumption had not yet been established, the Committee recommended that pregnant women or those trying to conceive should avoid drinking during pregnancy. Early research was beginning to suggest that alcohol consumption by mothers who were breast-feeding might have a negative effect

on their infants, but the Committee did not consider this evidence strong enough to warrant advice that mothers should abstain from drinking while breast-feeding. A caution about the slow elimination of alcohol from the blood even after moderate drinking was also added, including a concrete time frame (“Most people retain some alcohol in the blood 3 to 5 h after even moderate drinking.”) Alcohol was not recommended as a means of preventing coronary heart disease because the Committee felt that it had not been shown to be effective and because of the many potentially harmful effects of alcohol consumption, including higher risk for hypertension and hemorrhagic stroke.

The 1995 alcohol guidance

The introductory text of the 1995 edition of the *Dietary Guidelines* included the statement that “Alcohol, although not a nutrient, also supplies energy—about 7 calories per gram” (3). It also mentioned that “fat and alcohol are high in calories.” In the discussion of location of body fat, the following statement appeared: “Smoking and too much alcohol increase abdominal fat and the risk of diseases related to obesity.” The text box containing tips for decreasing energy intake included the item “Drink less or no alcohol.” The 1995 Committee spent considerable time discussing the fact that the alcohol guideline was unique among the Dietary Guidelines because the substance referred to was both a food that is an energy-rich beverage and a drug, which is subject to abuse and can cause dependence. The Committee considered whether alcohol-related consequences including abuse and dependence represented more of a public health issue than a dietary issue and thus whether alcohol would be better dealt with elsewhere than in the Dietary Guidelines. Nevertheless, they also agreed that alcoholic beverages were a part of the diet as well and, when used in moderation, were safe and pleasurable. The Committee was also reluctant to remove the alcohol guideline because members were concerned that the absence of an alcohol guideline after its presence in the three previous editions of the Guidelines would send a confusing message to the public. Therefore the Committee ultimately decided to retain the alcohol guideline with the same heading as in the 1990 version. Changes in the body of the text of the alcohol guideline were not substantial.

The introductory paragraph of the guideline referred specifically to the physiologic or drug effects of alcohol, including the capacity to alter judgment. A statement that “Alcoholic beverages have been used to enhance the enjoyment of meals by many societies throughout human history” was also added to the opening paragraph. The definition of moderation was identical to that of 1990, but the box defining moderation appeared earlier in the text. In the same box, a statement was also added referring to the calories in alcoholic beverages (also included in the discussion of the weight guideline) and their possible contribution to weight gain. The list of problems associated with heavy drinking was expanded to include high blood pressure, stroke, heart disease, certain cancers, accidents and violence. The 1990 Committee had been concerned that the beneficial effects of moderate alcohol consumption on heart attack were offset by higher risk for hypertension and hemorrhagic stroke. The 1995 Committee concluded that on the strength of further studies on moderate drinkers in which neutral or beneficial effects on risk of stroke or cerebrovascular disease had been recorded, such concerns were no longer warranted.

The list of those who should not drink was similar to that in the 1990 edition but was rearranged to place children and

adolescents at the top of the list. In addition, the Committee intended the term *adolescents* to include all individuals younger than the legal drinking age of 21 y, although this was not specifically stated. Despite the publication of some studies showing no apparent detrimental effects of low or moderate alcohol consumption during pregnancy, because an absolutely safe level of alcohol intake during early pregnancy had not been established, the Committee decided to continue the prudent advice of the 1990 alcohol guideline that women who are pregnant or trying to conceive should not drink. The Committee also acknowledged that including women trying to conceive was done primarily to ensure that women who might already be in the first few weeks after conception and not yet realize that they are pregnant would also be included; however, this was not explicitly stated in the guideline. The 1995 Committee, like that of 1990, felt that evidence was still insufficient to make a recommendation on alcohol consumption during lactation. In the advice for today section, the text was expanded to stress the food use of alcoholic beverages. The Committee felt that including the mention of drinking with meals recognized that consumption of alcohol with food slows consumption and absorption of alcohol, although this is not explicitly stated. It was also noted in this section that alcohol should not be consumed in situations in which others might be put at risk.

The 2000 alcohol guidance

The 2000 Committee endorsed maintaining the wording that appeared in the 1995 alcohol guideline (4). Revisions in the text of the guideline were primarily to place more emphasis on adverse effects of excess consumption and to update statements based on more current scientific evidence. The committee proposed that the introductory text begin with a paragraph that documents adverse effects of excess alcohol intake and mentions no beneficial effects. The second paragraph specifies the age groups for whom moderate drinking may reduce risk of coronary heart disease (“mainly men over age 45 and women over age 55”). This greater specificity stemmed from age- and gender-specific rates of coronary heart disease as well as age-specific relative risks related to moderate alcohol consumption obtained from extensive prospective data based on three very large cohorts of men and women in the U.S. (5–7). In the third paragraph, it is clearly stated that moderate consumption provides little, if any, health benefit for younger people. The Committee also suggested adding the caution that among young people, risk of alcohol abuse increases with decreasing age of initiation of drinking.

In the 1995 guideline, the list of health risks associated with alcohol consumption included reference to “certain cancers” without specifying the types of cancer. Based on intervening scientific evidence, for the 2000 guideline, the Committee recommended adding breast cancer (“Even one drink per day can slightly raise the risk of breast cancer”) because members felt that although the reported level of risk was quite small, the issue was of serious concern to some women.

As mentioned earlier, the opening paragraph of the 1995 guideline included the statement “Alcoholic beverages have been used to enhance the enjoyment of meals by many societies throughout human history.” The Committee recommended that this sentence be deleted because, although the statement was factually correct, a similar statement could have been made for many other foods and nutrients such as sugar or salt. Although the Committee recognized the intent of the earlier Committee to place moderate alcohol consumption in the context of a healthy diet, they felt that such a statement

was inconsistent with the text in the other guidelines and, therefore, best omitted.

A sentence was added to the “What is Drinking in Moderation?” text box to make it clear that the different limits for men and women are based on both metabolism and body size/body water. The text of the section on “Who Should Not Drink?” was expanded to be more explicit about the categories of individuals who should not drink.

In particular, the bullet pertaining to pregnancy was strengthened. The phrase “women who are trying to conceive” was changed to “women who may become pregnant” in recognition of the many completed pregnancies in the U.S. that are unplanned. Acknowledging that fetal alcohol syndrome is a well-recognized clinical entity, the text for the 2000 edition states “Major birth defects, including fetal alcohol syndrome, can be caused by heavy drinking by the pregnant mother. Other fetal alcohol effects may occur at lower levels.” This replaced the weaker text of the 1995 edition which stated that “birth defects have been attributed to heavy drinking.” The statement “While there is no conclusive evidence that an occasional drink is harmful to the fetus or the pregnant woman” was also dropped. Although the text is scientifically accurate, it was felt to weaken the message, especially because, according to survey data, young women tend to underestimate the adverse effects of drinking during pregnancy. The phrase “including the first few weeks” was added to the statement “A safe level of alcohol intake has not been established for women at any time during pregnancy, *including the first few weeks*” to make it clearer that adverse effects may begin before the woman knows she is pregnant.

The phrase “operate machinery” was added as a second example of activities requiring attention or skill. In discussing the issue of alcohol-medication interactions, the committee felt that the text of the 1995 guideline was too broad-ranging and not supported by scientific evidence; they therefore recommended that the bullet covering medications be changed to be less restrictive. The bullet was modified to suggest that many medications can interact with alcohol and to advise that individuals taking medications should ask their health care professional for guidance. Finally, in the advice for today section, the text was expanded to further specify the meaning of moderation and to reinforce the importance of not drinking before or when driving.

With regard to the text of the 2000 *Dietary Guidelines* outside the alcohol guideline, alcohol appeared far less often than in the 1995 edition. Except for the first page of text where all the guidelines were outlined, alcohol appeared once in “Box 22: Steps That May Help Keep Blood Pressure In A Healthy Range” where it was stated “If you drink alcoholic beverages, do so in moderation. Excessive alcohol consumption has been associated with high blood pressure.”

METHODS OF ASSESSMENT

Definitions of “moderate drinking” and “a drink” were first spelled out explicitly in the 1990 edition of the *Dietary Guidelines* and are unchanged in the 1995 and 2000 editions. Since 1990, how have the drinking patterns of the American public compared with those suggested in the alcohol guideline? This question and related issues will be answered in the subsequent section on surveillance. For the reader to best appreciate the strengths and weaknesses of existing data and to be able to put such data in context, it is first necessary to discuss issues related to methods of assessment of alcohol consumption. As a part of the diet, measurement of consumption of alcoholic beverages logically falls within the scope of nutritional epide-

miology. Because alcohol is also a drug with potential for abuse and dependence, the measurement of alcohol use, abuse, dependence and consequences clearly also lies within the domain of alcohol epidemiology, a discipline quite separate and distinct from nutritional epidemiology. As subdisciplines of epidemiology, both indeed share many common underlying principles and methods. Nevertheless, there are critical differences of which the reader should be aware. Therefore, this section will begin with a brief historical description of the evolution and focus of alcohol epidemiology compared with that of nutritional epidemiology.

Epidemiology has its roots in the study of infectious diseases. Such research first used the public health model, which involves defining a disease agent, host and environment, to study and control epidemics. During the early and mid-20th century, medical advances and improvements in sanitation led to the mastery of many infectious diseases, such as tuberculosis. Soon thereafter, cancer and heart disease gained recognition as common killers. Thus a new discipline emerged—chronic disease epidemiology. In addition the focus of epidemiology shifted to assessing the general health of communities under normal conditions rather than only under specific epidemic circumstances. Alcohol epidemiology as a unique discipline is a relative newcomer to the field, and it marks a logical progression in the evolution of the science of epidemiology (8). Classic infectious disease epidemiology is relatively straightforward, having a specific, well-defined, easily identifiable etiologic agent (e.g., a bacterium or virus), a clear-cut case identification, generally a short clinical course and a quickly effective prevention (vaccination) or treatment (antibiotics). The epidemiology of chronic diseases such as cancer and heart disease is more complex. Alcohol epidemiology, however, is even more intricate and challenging because of the multiplicity of contributing factors. In addition, it encompasses a broad domain, i.e., alcohol use, abuse and dependence as well as countless medical, psychological, social, legal and economic consequences. One of the basic tenets in epidemiology is that in order to count something accurately, one must first be able to define it. The large number of varying definitions of terms such as “abstainer,” “a drink,” “moderate drinking” or “heavy drinking” in alcohol research further adds to the complexity of interpreting its epidemiologic findings. This lack of uniform, standard definitions stems in large part from the diverse origins of the discipline, the range of alcohol-related conditions and consequences, and the necessary diversity of purposes and methods required (9).

Alcohol epidemiology has developed as a conglomeration of four major epidemiological perspectives, i.e., psychosocial epidemiology, psychiatric epidemiology, chronic disease epidemiology and epidemiologic sociology (10). Research conducted using each perspective seeks slightly different information from study participants and defines measures and concepts differently. Although this diversity is an advantage in that the four disciplines complement each other in revealing drinking patterns and problems among the U.S. population, it is also a serious handicap in that information collected about alcohol consumption often is not comparable across studies. For example, one survey may ask questions in a way that permits the derivation of a diagnosis of alcohol dependence. Another study, however, may ask questions about alcohol consumption and alcohol problems without including specific diagnostic criteria, and thus a diagnosis cannot be made. A study's proposed research goals dictate the particular measurement approach. Furthermore, techniques that are ideally suited for one population subgroup may not work equally well for other subgroups (e.g., teenagers vs. senior citizens). Consequently,

scientists conducting large and expensive population-based surveys to answer multiple research questions and elucidate drinking behavior in diverse population subgroups must weigh many factors in deciding which alcohol consumption measures will best meet their needs.

Over the years, the focus of alcohol epidemiology also has changed. When alcohol-use surveys of the general population were first begun in the United States, they focused mainly on the distinction between drinkers and nondrinkers (11). For example, in 1939, the Gallup surveys, which probably were the first surveys to measure drinking on a national level in the United States, included the following question about alcohol consumption: “Do you have occasion to use alcoholic beverages such as liquor, wine, or beer or are you a total abstainer?” (11). As alcohol survey research progressed and investigators became interested in assessing the consequences of various levels and patterns of alcohol consumption, they found it necessary to develop methods to quantify consumption more accurately. Early on, volume of consumption was often the sole measure of alcohol intake. In recent years, with greater interest in better assessment of such alcohol-related consequences as motor vehicle crashes, there has been a corresponding increase in interest in assessing drinking patterns as well. This obviously has bearing on our examination of how American drinking compares with the alcohol dietary guideline. Two men may both report having 14 drinks a week. If we average this volume over a week it appears that both men consume an average of two drinks a day, in keeping with the recommendation of the guideline. If drinking pattern is assessed as well and one man reports having two drinks every evening and others reports 14 drinks on Friday night or two occasions of seven drinks or four occasions of three or four drinks, for example, we now see that only one of these individuals is actually following the guideline recommendation. Over the 50 years that alcohol researchers in the U.S. and abroad have conducted surveys of alcohol consumption and alcohol-related problems in representative population samples, investigators have made great progress in survey research methodology, including the quantification of drinking levels, despite the previously mentioned definitional differences. To address the issues surrounding how best to measure and model alcohol consumption, the National Institute on Alcohol Abuse and Alcoholism convened the International Workshop on Consumption Measures and Models for Use in Policy Development and Evaluation which was held in May, 1997 (12). This meeting provided a valuable overview of the state-of-the-science as well as identifying future research opportunities. Two additional such efforts include the International Guidelines for Monitoring Alcohol Consumption: Report to the World Health Organization Program on Substance Abuse (13) and the recent consensus conference “Measuring Drinking Patterns, Problems, and Their Connection: An International Research Conference” held recently in Sweden (14).

Extensive research is also currently underway to identify a biochemical marker or develop a laboratory test that will provide an accurate, reliable and objective chemical indicator of quantity and duration of alcohol consumption, but no single test meets these criteria to date. Thus, in the vast majority of epidemiologic surveys, information about alcohol consumption has been based on self-report. Why is self-report of alcohol consumption any more of a concern than that of carrot or rye bread consumption? Just how accurately and reliably is alcohol consumption reported?

One reason why self-report of alcohol consumption is sometimes considered suspect is that one of the hallmarks of alcohol dependence is denial. Alcoholic individuals often deny that

they are having problems or that these problems stem from alcohol; therefore, they may lie or grossly underestimate the reported quantity and frequency of their alcohol consumption. A second reason why self-report of alcohol consumption may be called into question is the discrepancy between alcoholic beverage sales data and survey reports of alcohol consumption. In general, comparison studies in the alcohol literature (15) have shown that self-reported alcohol consumption accounts for only 40–60% of alcoholic beverages sold as measured by sales and tax data. Several factors, when taken into consideration, account for part of this discrepancy. For example, alcohol used in cooking and losses of alcohol due to bottle breakage are not deducted from sales totals. An assumption is also made that alcoholic beverages purchased in a given year will be consumed in that same year, which may or may not be the case.

Furthermore most general population surveys that measure alcohol consumption use household sampling frames and thus do not include many of the heaviest drinking segments of the population. For example, in a large county study, Weisner and colleagues (16) estimated the prevalence of problem drinking in samples drawn from the nonhousehold population (individuals reporting that they were homeless or were living in rooming houses, hotels or prisons, for example) to be 49% compared with 11% in the general population of the county as defined by households. It should be noted, however, that because these groups are relatively small compared with the general population, the bias introduced into general population estimates by excluding such individuals is also relatively small.

On the other hand, sales data also do not include untaxed alcohol such as alcohol purchased in duty-free shops and homemade alcohol whether produced legally or otherwise. Legal home production of wine and beer is potentially a significant source of alcoholic beverages that will not be captured by sales and taxation data. Cider is thought to be another source of unregistered alcohol consumption in some parts of the United States. In addition, the increasingly popular home beer-brewing kits provide a further source of beer that will not be represented in alcohol sales data (17).

Nevertheless, taking all of these factors into account, some degree of undercoverage of survey data on alcohol consumption with respect to sales data remains, suggesting downward recall bias and perhaps other response and measurement biases as well. Do some groups of drinkers, defined either by demographics or drinking level, bias their reports differently? Do heavy drinkers deny, forget or otherwise underreport drinking amounts and/or occasions more than do lighter drinkers?

There is mixed empirical evidence regarding differential under- or overreporting. Despite the previously mentioned phenomenon of denial, Polich and colleagues (18) reported that alcoholics in clinical services research seldom have been found to diminish their self-reported drinking greatly compared with measurements of blood alcohol concentrations. Alcoholics in treatment, however, may be more likely to report drinking accurately compared with heavy drinkers in general. Compared with diary-based reporting, using summary measures based on graduated frequencies, Hilton (19) reported some underreporting of the number of occasions on which larger numbers of drinks were consumed and a compensatory overreporting of occasions on which only 1 or 2 drinks were consumed. Underrepresentation of heavier amounts also was reported by Perrine and colleagues (20), comparing daily telephone report of consumption with retrospective quantity-frequency self-report. Thus it appears that heavier drinkers do, in fact, underreport their drinking more than light drinkers. In

addition, some questions ask only about usual and not atypical heavy drinking, or gather frequency of consuming at some level such as “5 or more drinks on an occasion.” The latter may result in imputational problems because the threshold represents a lower number than actually consumed. In other words, an individual who drinks 8 drinks on these days will select the “5 or more” category. Researchers may then elect to count this as “5 drinks” when they are calculating index measures because they do not know where in the spectrum of “or more” the drinker falls.

Just exactly what is the magnitude of underreporting by heavier drinkers? What is the distribution of alcohol consumption across the American population? Greenfield and Rogers (21) recently investigated this issue. Using a dataset consisting of four large pooled surveys having a common design and using the graduated frequencies approach (explained in greater detail below), they found that 67.3% of the U.S. population were current drinkers (defined as respondents who reported at least one drink in the 12 mo before survey). Among these current drinkers, the top 2.5% of drinkers accounted for over one fourth (27%) of adult drinkers’ total reported alcohol consumption. The top 15% of drinkers accounted for nearly three-fourths (72.6%) of the reported alcohol consumption, whereas the top 20% of drinkers accounted for ~80% (80.6%). These results were confirmed using a separate national survey conducted the same year. Thus relatively small biases by heavy drinkers may have a large effect on population consumption estimates.

Alcohol abuse, dependence and alcohol-related consequences such as alcohol-related motor vehicle crashes are major public health problems. To better address these problems as well as to address the issue of accurate reporting of alcohol consumption, survey researchers have made major advances in alcohol epidemiology. It is now possible to classify individuals as alcohol abusers and/or alcohol dependent according to strict established criteria in general population surveys employing lay interviewers. Because researchers believed early on that most alcohol abuse, dependence and other consequences generally occurred at high levels of consumption, because of the highly skewed distribution of alcohol consumption and the above-mentioned issues about underreporting of heavy drinking, it makes sense that more attention has been given to fine-tuning quantification on the high end of the drinking spectrum. As research has progressed, it has been established that lower risk drinkers, because of their sheer numbers, actually account for a significant number of alcohol-related consequences (22,23). Clearly, patterns of drinking are as important as volume of consumption. Analyses from the 1992 National Longitudinal Alcohol Epidemiologic Survey (NLAES;² described in detail in the Surveillance section) disclose that just over half of all individuals in this sample who are alcohol dependent had *average* daily volumes of ethanol intake <1 oz of ethanol (two drinks), that is, within the alcohol guideline for male drinkers (23). On the other hand, only 6% of dependent drinkers never drank 5+ drinks. The effects of drinking pattern have even been found to affect all-cause mortality rates (24).

The effectiveness of a survey questionnaire in accurately measuring alcoholic beverage consumption is influenced by the way in which questions are phrased, the order in which the questions are asked and the way in which the answers to the

² Abbreviations: NAS, National Alcohol Survey; NESARC, National Epidemiologic Survey of Alcohol-Related Conditions; NHANES, National Health and Nutrition Examination Survey series; NLAES, National Longitudinal Alcohol Epidemiologic Survey; QF, quantity-frequency; TLFB, time line followback.

questions are compiled into a summary measure. The types of survey questionnaires most commonly used fall into the following five categories: frequency measures; quantity-frequency (QF) measures; graduated frequency measures; short-term recall methods; and diary methods (25). All of these measures are best suited to measuring consumption over the past year or some more recent period. When the focus is on consumption over a longer period, another technique for assessing alcohol consumption is the time line followback (TLFB) method (26). The TLFB is a structured interview in which participants receive calendar-based memory cues to assist them in constructing a chronological report of their alcohol consumption. Although the procedure is widely employed in research on the efficacy of alcohol treatment, the required interviews are highly individualized and thus extremely impractical for large-scale population-based surveys. Other more efficient lifetime measures suitable for use in surveys are now becoming available (27).

As the term implies, the most basic frequency measure captures only frequency of drinking. Because the amount of alcohol consumed on each drinking occasion is not assessed, it is not possible to calculate total volume of consumption. The semiquantitative food-frequency measure, frequently used in diet and nutrition studies, often employs a single-frequency item including ordinal number of times drinking in a day at the high end of the scale (25). This method of measurement also has limitations including inability to assess drinking patterns. QF measures ascertain both quantity and frequency of consumption. At present, QF measures are probably the most widely used instruments with which to measure drinking in most countries, including the United States. In some QF surveys, respondents are asked how often and how much they usually consumed different types of alcoholic beverages over the past year. Although overall quite effective, one disadvantage of this method is that respondents, especially those having irregular drinking habits, may have trouble providing accurate answers because they must mentally average their alcohol consumption over the entire year (25).

To overcome this mental averaging problem for people having varying quantities of intake, researchers have developed graduated frequency measures, which begin with a question eliciting the largest number of drinks consumed by the respondent on any one drinking occasion in the past year. Subsequent questions then ask about the number of occasions on which progressively lower quantities of alcohol were consumed. The benefit of this approach is that the reports of alcohol consumption are highly accurate because, according to some researchers, not as much recall and mental arithmetic are required. A degree of mental calculation is still required, nevertheless, because respondents must convert their usual size drink into a "standard-size" drink. In addition, this approach captures volume due to hazardous drinking better than QF and short-term measures discussed next (28). Other researchers feel that it is cognitively very demanding to figure out how often one has consumed a given number of standard drinks exclusive of other amounts, but that the demand characteristics of the graduated QF favor the reporting of larger quantities of alcohol in a way that may overcome the tendency for people to underestimate heavier drinking. This tendency plus the opportunity to report intake in more detail would improve accuracy. The main disadvantage, however, is that the greatly increased length of the questionnaire requires more time for respondents to answer which, in turn, not only increases research costs but decreases time available to ask about other items of interest (25).

Short-term recall methods ask about actual alcohol con-

sumption over a short period of time, such as 1 or 2 wk. This approach is based on the assumption that respondents are more likely to remember the actual amounts they drank over a short time period more accurately than over a longer period such as a year. One drawback of this methodology is that many infrequent or occasional drinkers may report no alcohol consumption during the time studied. Consequently, short-term recall measures may overestimate the number of abstainers relative to other survey methods (25). In addition, such short-term methods may well entirely miss intermittent heavy drinking (28).

In diary methods, participants record each drink consumed over a given time frame (e.g., 1 wk), ideally shortly after consumption. Researchers have recently introduced an automated variation of the diary method. In this approach, participants report their daily alcohol intake by calling a dedicated toll-free number and activating, through a touch-tone telephone, an automated, interactive voice-simulation system (29).

Why are the differences among assessment instruments relevant to our discussion of the alcohol guideline? One reason is that, for a given drinker, different questions may elicit different responses and therefore lead to varying estimates of alcohol consumption for that person. Furthermore, even if a respondent provides identical answers, differences in the scientific assumptions and calculations associated with the particular survey method may produce variations in reported results.

For example, questionnaires using the graduated frequency approach consistently produce higher estimates of volume of drinking than do basic QF measures, especially among heavier drinkers. Survey researchers have discovered that more questions (and consequently, more answers) may lead to higher consumption estimates, which are generally considered to be more accurate (28,30). Whether this assumption actually holds, however, is open to question, and further research in this area is clearly warranted (14).

Diary methods produce higher estimates than do either QF or short-term recall methods for frequent drinkers. For example, in the previously mentioned study using an automated interactive telephone reporting system (29), 50 volunteers reported their daily alcohol intake for 112 consecutive days. Other data collected by traditional means immediately after study completion demonstrated that drinkers, particularly heavier drinkers, retrospectively underreported their alcohol consumption.

More detailed and specific questions also elicit higher estimates of alcohol consumption. For example, QF questions for different periods within a given time frame produce higher estimates when summed than do global QF questions. Similarly, beverage-specific questions or questions asking about consumption in different contexts (e.g., at home, in bars, or at parties and celebrations) produce higher estimates than do global questions asking about total alcohol consumption (25).

With the increasing focus on research on moderate drinking has come greater interest in refining measurement of alcohol consumption across the range of consumption levels and patterns. Studies in the alcohol epidemiology literature examining the reliability and validity of survey measures of alcohol consumption indicate high levels of reliability. Validity estimates, although not uniformly as high, were generally within the upper range of validity coefficients found in much of psychometric research (31). Therefore, research suggests that carefully crafted questions elicit reliable and valid self-reported estimates of alcohol consumption (32).

In epidemiologic research on the role of alcohol intake as a

risk factor for chronic disease, however, information about alcohol intake may be derived from data on dietary intake (i.e., nutritional epidemiology) rather than from a method designed specifically for the purpose of measuring alcohol intake (alcohol epidemiology). As mentioned earlier, as a part of the diet, alcoholic beverages also fall into the domain of nutritional epidemiology, a discipline that has evolved quite apart from that of alcohol epidemiology. The field of nutritional epidemiology has developed from interest in the concept that aspects of the diet may influence the occurrence of human disease. Early on, investigations focused primarily on deficiency states. More recently the focus has switched to conditions such as cancer and heart disease in which a whole host of factors including genetics, occupational factors, psychological factors, infectious factors and behavioral factors (smoking, drinking, level of physical activity) play a role in addition to that of diet. In addition to multiple potential determinants, alone or in combination, for most diseases, the relevant period of exposure is often not known. Long latent periods may separate exposure from manifestation of disease. The critical exposure may be a short exposure many years before diagnosis or the cumulative exposure over many years. In addition, these conditions may arise from excessive as well as insufficient intake of dietary factors.

Diet represents an unusually complex set of exposures that are strongly intercorrelated. Such exposures are not usually present or absent, but rather are continuous variables. Individuals rarely make clear changes in diet at identifiable points in time; rather, these changes happen gradually over many years. In addition, people are not generally aware of the precise content of the foods they eat, making it necessary to ascertain the composition of nutrients indirectly on the basis of the reported use of foods or on the level of biochemical measures. Another serious issue in nutritional epidemiology has been the lack of practical methods to measure diet. Because these studies are large, involving hundreds or thousands of participants, methods of dietary assessment must not only be reasonably accurate but also inexpensive and not extremely time consuming. Fortunately, estimates of total alcohol intake from dietary interviews agree with estimates derived from recorded or measured dietary intake better than do estimates of most other nutrients (33). In multiple studies of the reliability and validity of self-report of food intake in a wide variety of populations ranging from highly educated health professionals to ordinary subjects not selected on the basis of their education or interest in diet, alcohol intake was found to be particularly reproducible compared with other nutrients (34–36).

Measures available to monitor progress

The following large national surveys collect some basic information on alcohol consumption (37): the State Behavioral Risk Factor Surveillance System, the National Health and Nutrition Examination Survey series (NHANES), The National Health Interview Survey series and the National Household Survey of Drug Abuse. Two additional national survey series that focus exclusively on youth are the Youth Behavior Surveillance System and the Monitoring the Future Study (38). The National Household Survey of Drug Abuse collects alcohol information on children beginning at age 12 y as well as adults. With the exception of NHANES, these surveys are conducted annually. Information from these data sets could be used to calculate *average* daily alcohol consumption. The proportion of individuals whose average daily consumption exceeds levels recommended in the alcohol guideline would provide a very crude estimate of compliance

because the measure derived would reflect average rather than actual measures of daily consumption. For example, a woman with an average daily consumption of one drink could drink one each day and thus be within the recommendations of the alcohol guideline or she could have three drinks on Tuesday, two on Wednesday and two on Saturday. The latter pattern clearly does not follow the guideline but still adds up to seven drinks a week with an average of 1 per day.

The National Alcohol Survey (NAS) includes consumption, pattern and problem variables as well as attitudes, cognitive and drinking context variables. The NAS is conducted approximately every 5 y by the Alcohol Research Group and collects extensive data, which include graduated quantity/frequency measures of total alcohol consumption as well as individual beverage type, including beer, wine and spirits, binge drinking, attempts to reduce drinking, attitudes/opinions on drinking levels in different drinking situations, treatment status and drinking consequences. Consumption and problem trend studies have been a major contribution of the NAS series (39–41).

Although the NAS surveys have contributed significantly to alcohol epidemiology over the years, it is not possible to use this information to track compliance with the alcohol guideline in all cases. For respondents who are drinkers, the lowest category of drinks per occasion that can be selected is “1–2.” Men who drink at this level clearly would be within the recommendations of the guideline. Thus we could track compliance among men with this data set. Because one drink per occasion is not offered as a choice, compliance among women cannot be tracked.

The National Longitudinal Alcohol Epidemiologic Survey (NLAES), which was conducted in 1992, was designed and sponsored by the National Institute on Alcohol Abuse and Alcoholism. This survey gathered information on alcohol consumption and alcohol-related problems from 42,862 U.S. adults ≥ 18 y old, one of whom was selected at random from each household in a sample that was representative of the noninstitutionalized population of the conterminous United States. Variables in this data set include use of alcohol and other drugs (illicit drugs as well as illicit use of prescription medications), specific abuse and dependence, family history of alcoholism, alcohol-related medical conditions and alcohol treatment utilization. As discussed in the surveillance section, these survey data can be used to estimate the degree with which drinking patterns are congruent with the guidelines for both men and women. The measures in NLAES do not permit calculation of exact frequency of drinking in excess of the dietary guideline and may miss some cases in which there is beverage overlap (people consuming more than one beverage type on a drinking occasion) that leads to exceeding the guideline. The National Epidemiologic Survey of Alcohol-Related Conditions (NESARC), the successor of NLAES, is scheduled to be fielded in 2001 with a longitudinal follow-up in 2003. Thus, although it is currently not possible to track long-term trends in adherence, data on short-term trends from 2001 to 2003 will be available in time to inform the development of the 2005 Dietary Guidelines.

The 2000 alcohol guideline contains a section entitled “Who should not drink?” which states that some people *should not drink alcoholic beverages at all*. These include the following: children and adolescents; people who cannot keep their drinking moderate; women who may become pregnant or who are pregnant; individuals who plan to drive, operate heavy machinery or take part in other activities that require attention or skill; and individuals taking certain prescription or over-the-counter medications that interact with alcohol. Taken to-

gether, the individuals in each of these five groups probably add up to a substantial proportion of the population. Tracking these individuals is just as important as following those who have no contraindications to drinking and stay within or exceed the drinking levels recommended in the guideline. Measuring "no drinking" on a population basis is difficult. In alcohol surveys, the lowest category of drinking is often called "abstainer." This term, however, is not always defined as no drinking. For example, in NLAES, people who respond that they have not had ≥ 12 drinks in the past year are labeled past-year abstainers. Further, assuming that the definitional issue is addressed, at present, identification and delineation of the five above-mentioned groups in one survey do not occur. As mentioned earlier, under-age drinking is currently tracked through the Monitoring the Future, the Youth Risk Behavior Surveillance System and the National Household Survey of Drug Abuse. The NLAES provides information on individuals ≥ 18 y old. Special surveys examining alcohol use among pregnant women are conducted periodically. Obviously women who are very early in their pregnancies and do not yet realize that they are pregnant, would not be included in such studies. Clearly, extensive work remains to be done before we are in a position to provide national surveillance related to the "no drinking" aspects of the alcohol guideline.

Healthy People 2010

Chapter 26: Substance Abuse of *Healthy People 2010* (42) contains the following three objectives related to levels of alcohol consumption.

26–11. Reduce the proportion of persons engaging in binge drinking of alcoholic beverages.

26–12. Reduce average annual alcohol consumption.

26–13. Reduce the proportion of adults who exceed guidelines for low-risk drinking.

The first two objectives are not new. Although the wording differs slightly, both objectives appeared in *Healthy People 2000*. Because Objective 26–11 deals with binge drinking, it is not directly relevant to tracking how drinking levels correlate with the recommendations in the *Dietary Guidelines*, although clearly binge drinking exceeds the recommendations of no more than one or two drinks a day. Objective 26–12 on average annual alcohol consumption is also not directly related to the *Dietary Guidelines*. It is worth noting at this juncture, however, that annual estimated per capita alcohol consumption is a crude but robust and valuable means for monitoring trends in U.S. alcohol consumption. These estimates are based on population figures as they relate to information on beverage sales, tax receipt data or both. The data come primarily from States with some data provided by beverage industry sources. Because, as mentioned earlier, alcoholic beverage sales and tax data represent the *gold standard* against which self-reported alcohol consumption is compared, this objective relates indirectly to the alcohol guideline. Obviously, however, because per capita consumption is calculated by dividing total sales data by the population ≥ 14 y old, this measure cannot be interpreted on a per drinker basis without an independent estimate of the proportion of drinkers within the denominator.

Objective 26–13 is new and was developed specifically to track lower level drinking in a range similar to that found in the *Dietary Guidelines*. In Objective 26–13, low risk drinking is defined as no > 14 drinks a week or no > 4 drinks per occasion for men and no > 7 drinks per week or no > 3 drinks per occasion for women (43). The definition of a drink is identical to that found in the *Dietary Guidelines*. The baseline

data for tracking this objective are derived from the 1992 NLAES. The analyses reported here were restricted to the 18,352 individuals identified as past-year drinkers, i.e., those who in response to screening questions reported having consumed at least 12 alcoholic drinks in the year preceding interview. In 1992, among current drinkers ≥ 21 y old, 72% of women and 74% of men exceeded the above-mentioned recommended levels of alcohol consumption (42). Most persons who exceeded these recommendations did so by drinking more than the specified maximum number of drinks per occasion at least once a year. The target for the year 2010 is to reduce to 50% the proportion of adults, both men and women, who exceed the *Healthy People 2010* guidelines for low risk drinking (42). This objective also lists several categories of people who should not drink at all; these are basically the same as those appearing in the *Dietary Guidelines* alcohol guideline: children and adolescents; women who are pregnant or considering pregnancy; persons who are alcohol dependent; people taking prescription or over-the-counter drugs that interact with alcohol; and people who plan to drive or engage in other activities requiring attention or skill. A sixth category not listed in the alcohol guideline also appears, i.e., persons with health problems that may be made worse by drinking alcohol.

Surveillance

Parallel analyses of the 1992 NLAES disclosed that among women, 98.7% of current drinkers (as defined above) exceeded the alcohol dietary guideline recommendation of no more than one standard drink on any day. Among men, 91.2% exceeded the level of no more than two standard drinks on any day (44). The majority of drinkers who exceeded the dietary guideline limits exceeded the daily limit as opposed to an overall volume of intake that exceeded the weekly limits. In other words, most women who exceeded the guidelines did so because they had > 1 drink on any day but not > 7 drinks in a given week. Similarly, most men who exceeded the guidelines reported consuming > 2 drinks on a given day but no > 14 drinks a week. Among individuals who exceeded the daily limits, 21.1% did so less than once a month and 54.7% did so less than once a week (44). Thus, in 1992, the vast majority of drinkers, both men and women, drank more than recommended in the alcohol guideline on at least one occasion in the year before interview with about a fifth of these individuals exceeding the guidelines less than once a month and slightly more than half doing so less than once a week.

As mentioned earlier, the successor to NLAES, the National Epidemiologic Survey of Alcohol-Related Conditions (NESARC) will be fielded in 2001 with a longitudinal follow-up in 2003. Because this follow-up survey data will not be available for a few years, we are currently unable to track trends over time but will be able to do so in the future. In the interim, trends in estimated per capita alcohol consumption suggest that behavior probably has not changed dramatically in the intervening years. In 1992, estimated per capita alcohol consumption for the U.S. was 2.31 gal of ethanol per person ≥ 14 y old (45). Over the years since 1992, per capita consumption has decreased gradually, reaching a low of 2.17 gallons in 1995, and then increased to 2.19 gallons in 1996. In 1997, the most recent year for which per capita consumption data are available, the level was similar at 2.18 gal ethanol (45).

STRATEGIES FOR IMPROVEMENT

Striking discrepancies clearly exist between the behavior of the American public and the alcohol recommendations in the

Dietary Guideline; these must be addressed on multiple levels. A critical first step is to ascertain the degree of public awareness of the recommendations in the alcohol guideline. Several studies are currently underway investigating public perceptions about what constitutes "moderate drinking." If people lack knowledge, then obviously additional educational efforts are necessary. Increased knowledge and awareness alone, however, do not guarantee changes in behavior. Clearly, additional research is also necessary on how best to measure and assess not only alcohol consumption but also the attendant risks and benefits at the levels addressed by the *Dietary Guidelines*. To date, the majority of such research has been subject to all of the strengths and shortcomings discussed earlier in the section on methods of assessment.

The fact that *Healthy People 2010* offers alcohol recommendations slightly different from those in the *Dietary Guidelines* serves to highlight the need for further research. The current guideline states "Limit intake to one drink/d for women or two/d for men . . ." How do readers interpret this statement? Do women conclude that they should *never* have more than one drink on any day or do they do mental arithmetic to average consumption, i.e., three drinks today and none for the next two is O.K.? Public health guidelines are designed to be "short and sweet" and protect as many people as possible. Yet clearly "one size" may not fit all. A 6-ft tall 300-lb woman may well be able to safely drink more than 1 drink/d, whereas for a small man, 2 drinks/d may be too much. How can this information be conveyed most effectively? The various Dietary Guideline committees over the years have all been composed of nationally known figures with extremely strong subject matter expertise. These committees have invested a great deal of time and effort in functioning as "wordsmiths" for the language in the alcohol guideline. What is the evidentiary basis for specific wording recommendations? Clearly, this is an important research agenda item for the future. Similarly, we know little of a scientific nature about the possible (mis)interpretations of guidelines and the potential for social movement backlash if a guideline is perceived as overly restrictive.

Identification of definitive biomarkers and the development of highly specific and sensitive laboratory tests to track alcohol consumption over time would also advance the field. Finally, creation of some type of miniaturized "wearer friendly" alcohol sensor or other telemetry device that would objectively quantify and record drinking patterns over time would revolutionize research in this area. Such developments would enable researchers to collect the data necessary to advance the science and best inform the American people.

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