Evaluating the effects of the Dietary Guidelines for Americans on consumer behavior and health: Methodological challenges

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ABSTRACT

The Dietary Guidelines for Americans is the official nutrition policy statement for the United States. Government involvement in providing information on private behavior, such as food choice, is justified by the high cost of poor diets, as measured in medical expenses and lost productivity. The Guidelines are intended to provide an up-to-date, consistent information base for federal nutrition education and information efforts and food assistance program regulations. Through these policy mechanisms, the Guidelines are assumed to improve dietary behavior, and, ultimately, health. By law, the Dietary Guidelines for Americans must be updated every five years; however, there is no mandate for evaluation. Evaluation could provide useful information to assess the extent to which the Guidelines positively influence health and provide insights into reasons for their successes and limitations. However, evaluation would also present considerable challenges. This paper discusses the critical data and methodological needs for improving evaluation of the Dietary Guidelines for Americans. *J Am Diet Assoc. 2003;103:S42-S49.*

In the United States, the federal government's involvement in provision of dietary advice to the general public has a long history, with the US Department of Agriculture (USDA) publishing its first food guide in 1916 (1). Nevertheless, some may question why government should involve itself in giving advice on private behavior, such as food choice. A rationale is provided by the potential improvement in public health and productivity from improved nutritional status of the population. Frazao (2) has estimated that in 1994, poor diets cost society $71 billion in medical costs and lost productivity from four nutrition-related health problems alone. Given that other health conditions also are affected by poor diet, this figure likely underestimates total costs. For example, costs of osteoporosis-related hip fractures—another health condition affected by poor diet—have been estimated at $13 to $18 billion yearly (3).

Creators of public policy therefore have an interest in promoting more healthful diets. Accurate, consistent information is a first step in crafting policy. The Dietary Guidelines for Americans, developed with input from an expert advisory committee, provide advice intended to promote health and reduce

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risk of chronic diseases such as heart disease, certain types of cancer, diabetes, stroke, and osteoporosis (4). Their review every five years, as mandated by law, is intended to ensure that nutrition policy is based on the most up-to-date scientific information. (See articles elsewhere in this supplement for description of the process for developing and updating the Guidelines.) There is no legal requirement for evaluation of the Guidelines's effects. Evaluation could provide useful information to assess the extent to which the Guidelines positively influence health and provide insights into reasons for their successes and limitations. However, evaluation would also present considerable challenges. This paper discusses the critical data and methodological needs for improving evaluation of the Dietary Guidelines for Americans.

POLICY EFFECTS OF DIETARY GUIDELINES

The Dietary Guidelines for Americans exert policy influence through two mechanisms: (a) their effects on information policy, such as federal nutrition education and food labeling efforts; and (b) their effects on regulations governing federal food assistance and nutrition programs. Current law requires that all nutrition education materials developed by the federal government for the general public be consistent with the Dietary Guidelines for Americans. This ensures that the federal government "speaks with one voice" on the subject of diet and health, minimizing consumer confusion. The Food Guide Pyramid, which was developed as a consumer education tool for following a diet that meets the Dietary Guidelines for Americans, is probably the most well-known federal nutrition education material; however, many others have also been developed to disseminate the Guidelines-based information (for examples, see references 5-7). In addition, the Dietary Guidelines for Americans have influenced nutrition education messages and materials produced by non-federal entities such as the Dietary Guidelines Alliance, which describes itself as "a partnership among leading health organizations, the government and the food industry, to provide consumers with concrete, practical advice on how to apply the Dietary Guidelines to their lives" (8). This amplifies their potential impacts.

Nutrition labeling is a second information policy influenced by Dietary Guidelines for Americans. Since the implementation of the Nutrition Labeling and Education Act in 1994, nutrition labeling has been required on virtually all packaged food sold at retail in the United States. (Nutrition labeling is not required on prepared foods sold in restaurants and other foodservice outlets.) The US Food and Drug Administration (FDA) and USDA's Food Safety and Inspection Service regulate nutrition labeling. In developing and updating regulations for nutrition labeling, these agencies consult major scientific consensus statements, including the Dietary Guidelines for Americans.

DIETARY GUIDELINES'S INFLUENCE ON FOOD ASSISTANCE PROGRAM POLICIES

USDA administers 15 food assistance programs, serving an estimated one in five people in the United States at a cost of $37.8 billion in fiscal 2002 (9). The Dietary Guidelines for Americans provide a basis for the nutrition standards underlying these programs and for nutrition education efforts supporting achievement of program goals. Two major examples of the Guidelines's influence on food assistance programs are the 1995 change in school meal nutrition standards and the 1999 update of the Thrifty Food Plan, the nutrition policy base of the Food Stamp Program.

In June 1995, USDA published the School Meals Initiative for Healthy Children final rule, which updated the nutrition standards for USDA school lunch and breakfast programs to conform to the 1995 Dietary Guidelines for Americans for fat and saturated fat. These new requirements have been described as the most substantial change to the USDA National School Lunch Program in more than 50 years (10).

In 1999, USDA's Center for Nutrition Policy and Promotion revised the Thrifty Food Plan to meet recommendations of the Dietary Guidelines for Americans and Food Guide Pyramid (11). The Thrifty Food Plan is a suggested market basket for purchasing a diet that meets recommendations at low cost using foods that match as closely as possible existing consumer preferences. As the basis of food stamp allotments, it plays an important policy role in the Food Stamp Program; it also is one of the bases for nutrition education of Food Stamp Program recipients. To further the educational role of Thrifty Food Plan, the Center for Nutrition Policy and Promotion developed menu and recipe guides based on the Thrifty Food Plan market basket (12). In addition, the Thrifty Food Plan, along with Dietary Guidelines for Americans and Food Guide Pyramid, is used in the Food Stamp Nutrition Education Program, which, in fiscal 2002, provided nutrition education to Food Stamp Program recipients in 48 states at an estimated federal cost of $177 million, which is matched equally by participating states for a total public expenditure of $354 million (13).

ROLE OF EVALUATION

Currently there is no requirement that the Dietary Guidelines for Americans be evaluated. Evaluation would likely be complex and would not be without costs; therefore, it is important to consider the potential benefits of periodically evaluating the Guidelines. Evaluation could establish the extent to which the Dietary Guidelines for Americans are or are not accomplishing their intended goals—that is, promoting health and reducing risk of certain chronic diseases (4), and provide insights into reasons for their successes and limitations. Potential explanations could be limitations of the Dietary Guidelines for Americans themselves—that is, when individuals follow them, do they receive the desired benefits? Such findings would shed light on the question of whether current diet-health guidance is optimal and provide insights into further diet-health research to improve information and guidance.

Alternatively, success or a lack thereof could be attributable to implementation of the Dietary Guidelines for Americans—that is, are Guidelines-based information and program policies having the desired effects on knowledge, attitudes, and behavior? If not, this information could be used to improve information and program strategies for changing dietary behavior.

Data, Measures, Analytical Methods: Necessary Tools for Evaluation

Evaluating the Dietary Guidelines for Americans would present considerable challenges. Important factors to consider include adequacy and quality of data, measures, and analytical methods. Although considerable progress has been made in improving these basic tools for evaluation of diet and health, problems and limitations remain.

Data—The Heart of Nutrition Monitoring

The most fundamental necessity for evaluation is adequate data. The key data components for national nutrition assessment have been identified as (a) the national food supply se-

ries, (b) food and nutrient consumption of individuals, (c) nutrition-related physiological and health measures, and (d) knowledge and attitudes concerning diet and health. Between 1986 and 1995, the federal government produced reports summarizing current knowledge of the diet and health status of people in the United States, drawing upon all these data sources (14-16). The legal requirement to produce these reports, established under the National Nutrition Monitoring and Related Research Act of 1990, has since lapsed.

Maintaining and improving the national data collection system is fundamental to our ability to assess the impacts of the Dietary Guidelines for Americans and the Federal nutrition policy initiatives derived from them. Nevertheless, continued collection of adequate data for evaluation cannot be taken for granted. With the exception of the food supply data system, other components of nutrition monitoring rely on national surveys for data collection. These survey administrators face increasing difficulties in obtaining representative samples, with fewer individuals being willing to participate in surveys. The complexities of survey design and collecting and processing data also raise problems of timeliness—that is, being able to provide information within a timeframe that is useful to policymakers and key advisors, such as the members of the Dietary Guidelines Advisory Committee.

The most fundamental necessity for evaluation is adequate data

Beyond the problem of collecting representative data, ensuring that those data are of adequate quality is also a challenge. In particular, for dietary data, there is the ongoing problem of underreporting of dietary data. Relying on self-reported data is clearly problematic: to accurately self-report food consumption requires perfect memory of type and amount of food consumed, perfect knowledge of its composition (eg, what type of oil used in cooking), and perfect willingness to report behavior accurately. All are daunting propositions; however, whereas researchers at USDA and elsewhere have developed improved interviewing methods to prod memory (17), the other limitations of self-report are probably more intractable. With more food being bought pre-prepared, individuals' knowledge of the composition of the food they eat is probably declining. Self-consciousness concerning body weight has become normative in US society and is reflected in the systematic relationship of underreporting to overweight (18). This systematic underreporting is a serious barrier to understanding the eating habits of overweight individuals, one of the groups of most public health interest.

Further improvements in interviewing techniques may improve self-report. It is also important to investigate dietary assessment methods that do not rely on self-reported intake, either for use in place of self-report or as an outside check on the quality of self-reported data. The US Food Supply Series has been used in national nutrition monitoring as a means of assessing trends and provides outside information that can confirm self-reported dietary intakes or point out areas where self-report may not be adequate (19). Kantor and colleagues, for example, have highlighted the difference in grain consumption as assessed by self-reporting in the Continuing Survey of Food Intakes by Individuals (CSFII) and the higher estimates obtained from food supply data (20). Clearly reasons for this discrepancy demand investigation.

Other approaches to supplementing or verifying self-reported dietary intake also need to be further explored. Among these might be more exploration of biomarkers of intake or perhaps use of other types of behavioral data, such as food purchase data. For example, USDA's Economic Research Service (ERS) has funded research to investigate assessment of the effects of the Special Supplemental Program for Women, Infants, and Children (WIC) on diet quality by examining the types of milk (low-fat, regular) redeemed by WIC participants with their vouchers (21).

Diet-Health Knowledge and Attitudes

Evaluation of the Dietary Guidelines for Americans requires not just monitoring of changes in diet and nutrition status but also exploration of the relationship of those changes to Guidelines recommendations and the policies used to advance them. Therefore, it is important to collect information on such Guidelines-related factors as diet-health knowledge and attitudes, nutrition labeling use, and food assistance program participation. Unfortunately, although their importance is generally agreed upon, these factors are not always collected in a way that can be linked to diet and health. Concerns about creating undue respondent burden, which adds to survey costs and to problems in getting a representative sample, may result in omitting these variables from surveys such as the new integrated national nutrition survey, which will contain diet and health data to which they could be analytically linked (22).

Even more difficult is the collection of longitudinal data. The major federal nutrition surveys—such as the Continuing Survey of Food Intakes by Individuals (CSFII) and the National Health and Nutrition Examination Survey (NHANES)—are cross-sectional. Yet, assessment of the long-term health effects of following the Dietary Guidelines for Americans requires longitudinal data. The Dietary Guidelines Advisory Committee 2000 recommended longitudinal research to evaluate short- and long-term benefits of adherence to Dietary Guidelines for Americans (23). With rare exceptions, such as the NHANES I Epidemiologic Follow-Up Survey (24), longitudinal data collection has not been a large part of Federal nutrition monitoring efforts. Because cost has typically been a major barrier to longitudinal data collection, it might be useful to explore adding nutrition-related variables to other longitudinal data sets, as USDA–ERS has done with the Early Childhood Longitudinal Study being conducted by the US Department of Education (25).

Measurement

Assuming we have data on dietary intakes from a representative sample, assessment requires translation into measures that are meaningful, valid, and reliable. For measures of nutrient intakes, the first prerequisite is adequate nutrient composition databases. As the diversity of food items consumed by people in the United States increases and our knowledge of dietary constituents broadens, the demands of maintaining a comprehensive, up-to-date nutrient database increase. Nevertheless, database inadequacies can impair the ability of expert groups to assess dietary intakes and their relationship to health. In particular, the Dietary Guidelines Advisory Committee 2000 cited inadequacy of existing carbohydrate databases as a barrier to decision-making regarding appropriate recom-

mendations on intake of different levels, types, and sources of dietary carbohydrates (23). It is to be expected that as scientific knowledge of food constituents expands and as intake sources change (eg, the growth in dietary supplements as important nutrient sources), those who maintain compositional databases will face increasing challenges.

In addition, appropriate standards for interpretation of intake data are needed. Federal evaluations of national nutrition status have historically been hampered by the inability to assess prevalence of inadequate nutrient intakes, with arbitrary standards such as a cutoff percentage of a nutrient's Recommended Dietary Allowance (RDA) being used as a substitute. The recent establishment of the Dietary Reference Intakes (DRI), a more comprehensive system of assessing intakes, and the establishment of analytical methods necessary to use the DRIs to assess population intakes has been major step forward (26). Nevertheless, knowledge gaps remain; in particular, adequate information is needed to establish an estimated average requirement for calcium, a nutrient of broad public health concern.

Moderation—How Should It Be Assessed?

A measure for assessing appropriate intake of dietary constituents for which the Dietary Guidelines for Americans counsel moderation—such as fat, saturated fat, sodium, and cholesterol—remains a challenge. A recommended intake of 30% or less of energy from total fat has been a part of the Dietary Guidelines for Americans since 1990. Data from national food consumption surveys initially seemed to indicate that during the 1990s, progress had occurred in meeting this recommendation, with fat intake as a percentage of energy dropping among both adults and children (27-29). For both adults and children, however, these changes in percent energy from fat are more attributable to increases in the denominator (reported energy intake) than to reductions in the numerator (reported grams of fat consumed). In fact, for both youth and adults, average grams of fat consumed increased slightly in the 1990s. However, this was masked by larger increases in carbohydrate and the energy they contributed (27-29).

Given the current problem of obesity in our society, decreasing the fat density of the US diet by increasing energy from other sources is probably not the strategy dietary guidance experts had in mind. This suggests that a measure that is less ambiguous in assessing improvement in fat intakes is needed. An absolute standard, such as grams of fat, might seem the alternative. But absolute standards are not without problems. Absolute standards are generally used for measuring compliance with advice to moderate sodium and cholesterol, for example, with sodium generally recommended to be limited to 2,400 mg/day and cholesterol 300 mg/day. With these absolute standards, individuals of differing energy needs may have to consume diets of dramatically different sodium and cholesterol densities to meet the standards. For example, a young boy six to 11 years of age eating the average number of kilocalories reported for his age group in 1994-1996 can consume 1,251 mg of sodium per 1,000 kcal and meet the guidelines, but if he eats the same way as a teenager, he won't. With their higher energy intakes, teen boys aged 12 to 17 years can consume no more than 877 mg of sodium per 1,000 kcal and meet the sodium guideline (30). Has this boy's diet really become lower in quality or is a criterion that doesn't address differences in energy intakes appropriate?

These examples illustrate the pitfalls of assessing moderation in dietary intakes without consideration of appropriate energy intake. Unfortunately, current nutrition-monitoring surveys do not collect sufficient information to assess energy needs of individuals. Nevertheless, because problems of excess consumption of such dietary components as fat, saturated fat, and sodium receive such emphasis in the Dietary Guidelines for Americans, investigation of more appropriate measures for their assessment is needed.

	Pyramid-based serving per capita per day	
	1999 food supply[a]	Recommended
■ Dark green, leafy	0.15	0.6
■ Deep yellow	.23	.8
■ Legumes	.24	.6
■ Other starchy	1.38	.8
■ Other vegetables	2.00	1.3
■ Total vegetables[b]	4.00	4.0

FIG 1. Food supply data show that while total vegetable availability follows Pyramid guidance, availability by subgroups does not. [a]Excludes inedible portions and adjusts for spoilage and waste. [b]May not add due to rounding. (US Department of Agriculture.)

Assessing Food Group Consumption

The Dietary Guidelines for Americans emphasize food-based guidance, and therefore assessment of food consumption is also an important part of evaluating their effects. Superficially, assessing food consumption may seem easier than nutrient assessment—the problem of adequate nutrient composition databases is avoided, for example. However, food-based dietary assessment presents its own set of challenges.

The first question is how to group foods for assessment, as examining individual foods would be impractical. Grouping influences assessment and interpretation, but how groups are organized is subjective, generally reflecting not only nutrient content but also culturally based ideas of appropriate usage. In USDA food guides, for example, fruits and vegetables at different times have been in three different groups ("Basic 7"), one group ("Basic 4"), and now in two groups in the Food Guide Pyramid (some Pyramid groups, such as vegetables, also have subgroups) (1,4).

Vegetable consumption provides a good example of the effect of grouping on assessment. When the group is considered as a whole, intake appears to meet Food Guide Pyramid recommendations. However, breaking it into subgroups reveals that most of this group is potato, with very little contribution of the more nutrient-dense, deeply colored vegetables (Figure 1). Yet, Food Guide Pyramid guidance recommends more servings of dark-green and deep-yellow vegetables and legumes (31).

Even when meaningful food groups have been identified and agreed upon, assessing the adequacy of food group consumption presents unanswered challenges. As with nutrients, usual intake is a concern; however, methodology to assess usual food group intake is still under development (32). Interpretation of food group consumption information is limited by the lack of meaningful cutoffs. Whereas with nutrients, the DRI process has led to development of a procedure for determining prevalence of inadequate intake, nothing similar exists for food

groups. As a result, assessment is arbitrary—if two servings of fruit are recommended, is an average of 1.9 servings deficient? Development of cutoffs for food group intake may be more difficult and subjective than for nutrients, as food groups are mixtures of many nutrients, the reasons for their health effects may be imperfectly understood, and the optimal range of food group intakes may depend on overall dietary composition and level of energy intakes. Nevertheless, given the current public health emphasis on meeting food-based goals (eg, consumption of recommended amounts of fruits and vegetables), these issues require more investigation.

The preceding discussion has focused on single measures of nutrients or food groups. Because the Dietary Guidelines recommend an overall pattern of diet, a multifaceted measure of diet quality that encompasses all-important aspects of the pattern would be more appropriate for assessing their effects. In addition, a summary measure is a useful communication tool, providing a simple answer to the question: "How well do diets compare with recommendations?"

As the diversity of food items consumed by people in the United States increases and our knowledge of dietary constituents broadens, the demands of maintaining a comprehensive, up-to-date nutrient database increase

The USDA developed the Healthy Eating Index (HEI) as a summary measure of dietary quality based on 1995 Dietary Guidelines for Americans and Food Guide Pyramid (33). The HEI is composed of 10 measures, each representing one aspect of dietary guidance. Diets of individuals are rated on each measure on a scale of one to 10; results are summed for a total dietary quality score ranging from zero to 100. The HEI, applied to USDA national consumption survey data, has been used by USDA to evaluate how well US diets compare to recommendations and to track progress in meeting recommendations.

McCullough and colleagues used the HEI-f, a modified version of the HEI, to examine how well adherence to the DGA recommendations influenced risk of development of diet-related chronic diseases in men and women. They found higher HEI-f scores to be associated with lower risk of cardiovascular disease risk in both men and for women (34,35). The association was, however, not very strong.

Their results offer only limited support for the value of Dietary Guidelines-based advice, as assessed in this data set, and as measured using the HEI-f. Several explanations for this limited relationship are possible. Among them are limitations of the data set, which, although longitudinal, is not population-representative, and limitations of the method of collecting dietary information, a self-reported food frequency questionnaire. Therefore, replication of the findings in other data sets would be important.

Nevertheless, the potential implications demand consideration. The results may indicate that the HEI needs improvement as a summary measure of a Dietary Guidelines-style diet. Certainly it does not perfectly capture the guidance in the 1995 Dietary Guidelines for Americans, as it lacks measures to capture the guidelines on sugar, alcohol, and healthy weight. Results may also suggest that the Dietary Guidelines for Americans themselves imperfectly captured dietary patterns that would promote health and reduce risk of disease.

The Dietary Guidelines for Americans were updated in 2000; some of the changes made—such as deletion of the recommendation for "variety" of food choices—have implications for HEI redesign. Researchers have developed new summary measures of diet quality, such as the Diet Quality Index-Revised (DQI-R) (36) and the Alternate Healthy Eating Index (AHEI) (37). The success of the HEI as a communication tool and a means of summarizing Dietary Guidelines advice should spur continuing improvement in summary assessment measures. In turn, more use of such measures and improvement in those measures should enhance evaluation of the merits of current dietary guidance and potential areas of improvement.

Analysis Methods

To answer questions on the effectiveness of Dietary Guidelines for Americans, it is crucial that analysts be able to distinguish diet or health changes attributable to Dietary Guidelines-based policies from those attributable to other social and environmental influences. Yet, causality is difficult to establish within a changing environment—for example, do individuals start eating more poultry because they perceive it to be healthful or because its price has dropped? A second problem is selection bias—that is, individuals choose or "self-select" to read labels, study the Food Guide Pyramid, or enroll in food assistance programs rather than being randomly assigned to these behaviors in classic experimental fashion. Their reasons for selecting those behaviors may influence effects—for example, individuals who read nutrition labels may be more health-concerned, more generally knowledgeable about nutrition, or have some other characteristics that not only led them to read labels but also would have influenced their food choices even if nutrition labels did not exist. Statistical methods for controlling for selection bias have been extensively studied and have been applied to studies of the effects of nutrition-related behaviors such as food label use (38). Because such methods may be sensitive to changes in specification; however, they are neither easy to implement, nor guaranteed to completely correct selection bias.

The Subcommittee on Interpretation and Uses of the DRIs has developed a methodology for assessing differences in usual nutrient intakes of population subgroups, such as those distinguished by food program participation (26). This methodology may be useful for assessment of Guidelines-based policy effects. In addition, increasing attention has been directed to methods of evaluation design that can distinguish program effects from other factors (39).

CURRENT UNDERSTANDING OF EFFECTS OF DIETARY GUIDELINES FOR AMERICANS

Because there have been no formal evaluations of the effects of the Dietary Guidelines for Americans, it is beyond the scope of this paper to draw conclusions about the extent to which they have achieved their intended goals of promoting health and reducing chronic disease risk (4). Nevertheless, policymakers will wish to know what can be said about the Dietary Guide-

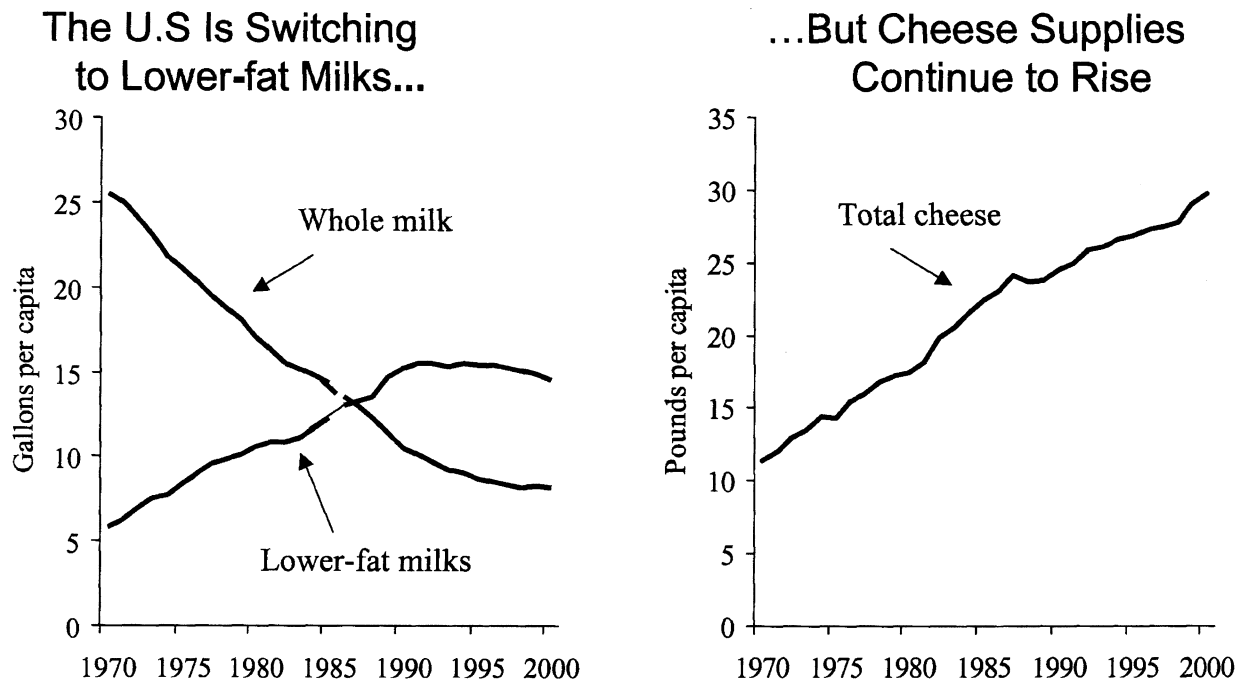

FIG 2. Food supply data show contradictions in consumer behavior (source: US Food Supply Series, US Department of Agriculture Economic Research Service).

lines's effects on diet and health. Certainly there is evidence for information effects. In the more than 20 years since the federal government first published the Dietary Guidelines for Americans, consumer information derived from them has become more widespread and familiar. Surveys indicate large numbers of people in the United States recognize the Food Guide Pyramid, read food labels, and say they act on the information provided (40). Research confirms consumer reports of information effects on behavior. Variyam and Golan (41) reviewed research on the role of information in shaping food choices and found consistent effects on consumption of specific food products such as eggs, lowfat versus whole milk, and so forth. Despite these findings, the most recent data on nutrition-related health status are not encouraging. Obesity is climbing at rapid rates. Although cardiovascular disease mortality has declined, the prevalence of diabetes is rising at a rate that is creating broad social concern.

How can we explain this seeming paradox—increased information, observable information effects, yet disappointing public health outcomes? One problem is that dietary quality depends on overall patterns of behavior, and therefore, dietary improvement requires multiple, consistent changes in a positive direction. Yet nutrition-monitoring data indicate that behavior is inconsistent. For example, food supply data confirm the shift to lower-fat milks, but at the same time, per capita usage of cheese, a higher-fat food, is increasing (Figure 2). These contradictory changes may reflect consumer difficulty in assimilating and using information in the more complex ways necessary to create an overall healthy eating pattern. Data from the FDA, for example, indicate that more people use food labels to compare products—for example, one box of crackers vs another—than to plan meals, a more complex task (40).

It may also indicate consumers' willingness to change their food choices is inconsistent across products. Teisl and colleagues examined the effect of label information on sales of several "more healthful" products compared with their standard counterpart (42). They found that information increased sales of some, but not all, more healthful products. Individuals evaluate foods on the basis of multiple attributes—taste, convenience, price, and so forth. Nutrition information can help individuals evaluate a product more accurately, but if the nutrition improvement in a modified product is perceived as less important than the loss of preferred taste, the less healthful product may still be chosen.

Not all individuals are equally able to assimilate and make use of information (41,43). More educated consumers, in particular, are more effective users of nutrition information. Other demographic characteristics—such as age, gender, and income—also play a role as do attitudes and preferences. Bhargava and colleagues (43) found that preexisting preferences for less healthful foods limit the effects of nutrition education, an argument for early intervention to help develop healthier preferences earlier in life.

EFFECTS RELATED TO FOOD ASSISTANCE PROGRAM POLICIES

Similarly, the Dietary Guidelines for Americans have affected food assistance program policies, but results are mixed. School meal reform sparked several changes—improvements in commodities, changes in menu planning approaches—intended to

result in meals meeting Dietary Guidelines-based standards for fat and saturated fat. Nevertheless, the most recent study of school meals offered to children indicates that average fat and saturated fat content of school lunches has decreased but still exceeds standards (44). Moreover, healthful foods such as fruits and green vegetables may be more likely to go uneaten by students (45). School foodservice directors report difficulty in improving the nutritional quality of school meals while still appealing to their student customers, who may opt for food from home or, in many schools, ala carte and vended items, if USDA school meals do not meet their preferences (46). Lin and colleagues (30) found that, as children got older, the meals they ate at school were increasingly less likely to be rich in calcium and dietary fiber, perhaps because children were substituting less nutritious beverages and foods for those obtainable from USDA-sponsored meals.

Similarly, although the Thrifty Food Plan provides Food Stamp Program participants with a suggested market basket for purchasing an affordable diet that meets the Dietary Guidelines for Americans, what participants actually purchase and consume is their personal choice. Using data from the CSFII 1994-96, Wilde and colleagues (47) found participation in the Food Stamp Program tended to increase intake of meats, added sugars, and total fats, but not of fruits, vegetables, grains, or dairy products. As with higher-income consumers, Food Stamp Program participants have preferences that compete with nutrition for importance when choosing foods. Since 1994-1996, USDA's Food Stamp Nutrition Education Program has expanded considerably; its impacts on knowledge and behavior of program participants demand more investigation.

CONCLUSION

The Dietary Guidelines for Americans are mandated by law to be reviewed every five years. This requirement ensures that they remain up-to-date, responding to new information on the relationship between diet and health. The need for periodic review is highlighted by the publication of new DRIs for macronutrients and for several micronutrients (48,49) since the last Dietary Guidelines review in 2000. In particular, the Executive Office of the President's Office of Management and Budget has urged revision of the Dietary Guidelines for Americans to incorporate the DRI Macronutrient Committee recommendations for n-3 fatty acid consumption and limitation of *trans*-fatty acid consumption (50).

There is no comparable mandate to evaluate the effectiveness of the Dietary Guidelines for Americans at periodic intervals. As outlined in this paper, evaluation would pose considerable methodological challenges. Nevertheless, evaluation research could be highly useful as part of the ongoing process of providing up-to-date dietary guidance to the US public and developing and implementing policies that will turn guidance from "recommendation into reality," thus improving public health. To conduct evaluation research, we need to maintain and improve national nutrition monitoring data. Besides the cross-sectional data sets that provide national estimates of diet and health, more longitudinal data sets are needed so that diet-health relationships can be better understood. Also important are development of new measures that can better assess Dietary Guidelines-related outcomes and analytical methods that improve our ability to assess Guidelines-related effects independent of other social changes. To the extent that we are able to make progress in this area, it will improve development and implementation of future Dietary Guidelines for Americans. Given the current prevalence of nutrition-related health problems and their social costs, these improvements are urgently needed.

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