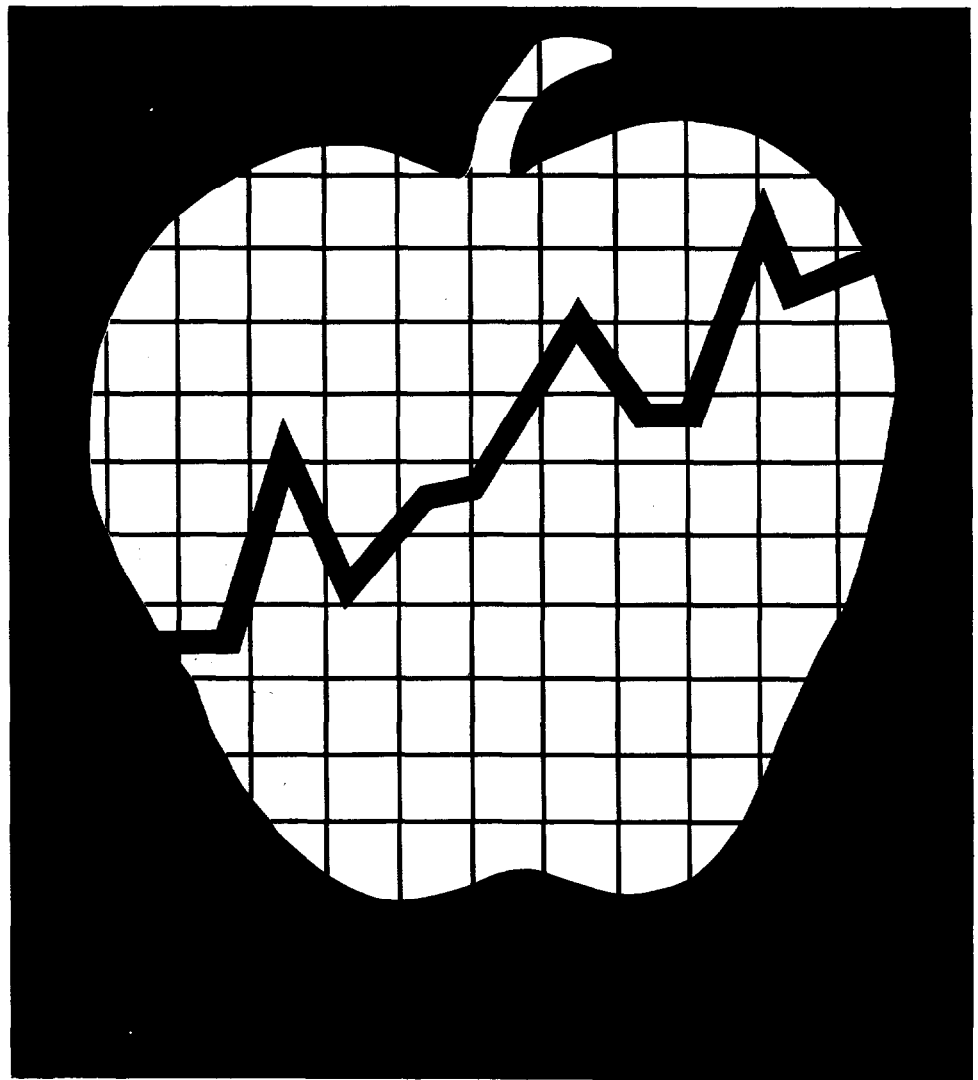


The Surgeon General's Report on

NUTRITION AND HEALTH



The Surgeon General's
Report on
NUTRITION
AND HEALTH

Summary and Recommendations

1988

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
DHHS (PHS) Publication No. 88-50211

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, DC 20402



DEPARTMENT OF HEALTH & HUMAN SERVICES

The Surgeon General of the
Public Health Service
Washington DC 20201

MESSAGE FROM THE SURGEON GENERAL

I am pleased to transmit to the Secretary of the Department of Health and Human Services this first Surgeon General's Report on Nutrition and Health. It was prepared under the auspices of the Department's Nutrition Policy Board, and its main conclusion is that overconsumption of certain dietary components is now a major concern for Americans. While many food factors are involved, chief among them is the disproportionate consumption of foods high in fats, often at the expense of foods high in complex carbohydrates and fiber--such as vegetables, fruits, and whole grain products--that may be more conducive to health.

I offer this Report in the context of the obligation of the Surgeon General to inform the American public of developments in the science base that have widespread implications for human health. Perhaps the classic example of such reports is the one issued in 1964 during the tenure of one of my predecessors, Dr. Luther Terry, which summarized the epidemiologic evidence available at the time on the relationship of tobacco to health. This report called attention to the inescapable conclusion that cigarettes were a major source of illness and death for those who smoked--at that time a majority of adult men.

This Surgeon General's Report on Nutrition and Health follows the tradition of the original report on smoking and health. It addresses an area of some controversy and substantial misunderstanding. And the relative magnitude of the associated health concerns is comparable, with dietary factors playing a prominent role in five of the ten leading causes of death for Americans. In addition, the depth of the science base underlying its findings is even more impressive than that for tobacco and health in 1964, with animal and clinical evidence adding to the epidemiologic studies.

On the other hand there are some fundamental differences. Most obvious is the fact that food is necessary for good health. Foods contain nutrients essential for normal metabolic function, and when problems arise, they result from imbalance in nutrient intake or from harmful interaction with other factors. Moreover, we know today much more about individual variation in response to nutrients than we know about possible variations in

response to tobacco. Some people are clearly more susceptible than others to problems from diets that are, for example, higher in fat or salt.

Also, unlike the experience for tobacco in 1964, people are already making dietary changes, as witnessed by the shift to products lower in saturated fats. Nonetheless, the important effects of the dietary factors underlying problems like coronary heart disease, high blood pressure, stroke, some types of cancer, diabetes, obesity--problems that represent the leading health threats for Americans--indicate the potential for substantial gains to be accrued by the recommendations contained in this Report

It is important to emphasize that the focus of this Report is primarily on the relationship of diet to the occurrence of chronic diseases. The Report is not intended to address the problems of hunger or undernutrition that may occur in the United States among certain subgroups of the population. All Americans should have access to an appropriate diet, but they do not. And even though the size and numbers of problems related to inadequate access to food are proportionately much smaller than those related to dietary excesses and imbalances, the problems of access to food are of considerable concern to me, personally, wherever they may occur.

The apparently sizable numbers of people resorting to the use of soup kitchens and related food facilities, as well as the possible role of poor diet as a contributor to the higher infant mortality rates associated with inadequate income, suggest the need for better monitoring of the nature and extent of the problem and for sustained efforts to correct the underlying causes of diminished health due to inadequate or inappropriate diets.

This report was prepared primarily for nutritional policy makers, although the eventual beneficiaries of better nutritional policy will be the American people. I am convinced that with a concerted effort on the part of policy makers throughout the Nation, and eventually by the public, our daily diets can bring a substantial measure of better health to all Americans. I commend to them the recommendations of this Report.



C. Everett Koop, M.D., Sc.D.
Surgeon General
U.S. Public Health Service

Foreword

This first *Surgeon General's Report on Nutrition and Health* marks a key event in the history of public health in the United States. While the Report has been developed for use by policymakers, it offers lessons that can be directly applied to the public. It responds to the increasing interest of scientists, health professionals, and the American people in the role of diet in health promotion. Within recent years, concerns about nutrition and health have expanded beyond the need to prevent deficiencies to encompass the effects of typical American dietary patterns on the incidence of chronic diseases that are leading causes of death and disability in this country. Although scientific research has provided substantial insight into the ways specific dietary factors influence specific diseases, there are still many uncertainties about diet-disease relationships. The Department of Health and Human Services, through the Public Health Service and the Surgeon General, welcomes the responsibility to evaluate the current state of knowledge and to advise the public accordingly.

This Report reviews the scientific evidence that relates dietary excesses and imbalances to chronic diseases. On the basis of the evidence, it recommends dietary changes that can improve the health prospects of many Americans. Of highest priority among these changes is to reduce intake of foods high in fats and to increase intake of foods high in complex carbohydrates and fiber.

The evidence presented here indicates the convergence of similar dietary recommendations that apply to prevention of multiple chronic diseases. The recommendation to reduce dietary fat, for example, aims to reduce the risk for coronary heart disease, diabetes, obesity, and some types of cancer. This advice is not new. But it is now substantiated by a large body of evidence derived from many different kinds of research—a research base that is now even more comprehensive than was the case for the pioneering 1964 *Surgeon General's Report on Smoking and Health*.

The weight of this evidence and the magnitude of the problems at hand indicate that it is now time to take action. In the cause of good health for all our citizens, I urge support for this Report's recommendations by every sector of American society.

Otis R. Bowen, M.D.
Secretary

Preface

The Public Health Service of the Department of Health and Human Services has long maintained an interest in the relationship between food and health. In the 1970's, this interest began to focus on the ways in which dietary excesses and imbalances increase the risk for chronic diseases. With the publication in 1979 of *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*, attention turned toward environmental and behavioral changes that Americans might make to reduce their risks for morbidity and mortality. Nutrition was one such priority area. The 1980 report *Promoting Health/Preventing Disease: Objectives for the Nation* included 17 specific, quantifiable objectives in nutrition designed to reduce risks and to prevent illness and death. Also in 1980, the Department published, jointly with the U.S. Department of Agriculture, the first edition of *Dietary Guidelines for Americans*. This report, revised in 1985, includes seven recommendations that, taken together, address the relationship between diet and chronic diseases.

Diseases such as coronary heart disease, stroke, cancer, and diabetes remain leading causes of death and disability in the United States. Substantial scientific research over the past few decades indicates that diet can play an important role in prevention of such conditions. The Public Health Service has now reviewed this research and has produced a comprehensive analysis of the relationship between dietary factors and chronic disease risk. This *Surgeon General's Report on Nutrition and Health* summarizes research on the role of diet in health promotion and disease prevention. Its findings indicate the great importance of diet to health. They demonstrate that changes in present dietary practices of Americans could produce substantial gains in the health of the population. The Public Health Service is committed to improving the health of Americans through its programs in education, services, and research.

One mechanism for improving the health of Americans is through the 1990 Health Objectives for the Nation. The role of nutrition in health will continue to be a focus of national health priorities as we develop new objectives for the year 2000. Federal, State, and local governments, the American public, the food industry, and scientists and health professionals can work together to encourage Americans to make healthy food choices and to achieve national health goals.

I am pleased to commend to the American people this review of the scientific evidence that links diet to chronic disease, and I urge that the findings of this important Report be given your careful consideration.

Robert E. Windom, M.D.
Assistant Secretary for Health

Contents

Foreword	v
Preface	vii
Nutrition Policy Board	x
Acknowledgments	xi
Summary and Recommendations	1
Appendix A: Selected Events in the History of Nutritional Science to 1950	21
Appendix B: Selected Federal Domestic Nutrition Policy Milestones, 1862–1988	25
Appendix C: Federal Dietary Recommendations for the General Public, 1917–88	29
Appendix D: Implications for Public Health Policy	33

Full Report Contents

- | | |
|--------------------------------|----------------------------------|
| 1. Introduction and Background | 11. Infections and Immunity |
| 2. Coronary Heart Disease | 12. Anemia |
| 3. High Blood Pressure | 13. Neurologic Disorders |
| 4. Cancer | 14. Behavior |
| 5. Diabetes | 15. Maternal and Child Nutrition |
| 6. Obesity | 16. Aging |
| 7. Skeletal Diseases | 17. Alcohol |
| 8. Dental Diseases | 18. Drug-Nutrient Interactions |
| 9. Kidney Diseases | 19. Dietary Fads and Frauds |
| 10. Gastrointestinal Diseases | |

Nutrition Policy Board
U.S. Department of Health and Human Services

J. Michael McGinnis, M.D. (*Chairman*), Deputy Assistant Secretary for Health (Disease Prevention and Health Promotion), Public Health Service

Faye G. Abdellah, R.N., Ed.D., Sc.D., Deputy Surgeon General, Public Health Service

W. Douglas Badger, M.Div., Deputy Assistant Secretary, Office of Human Development Services

Mary M. Evert, M.B.A., Director, Office of Community Services, Family Support Administration

Manning Feinleib, M.D., M.P.H., Dr.P.H., Director, National Center for Health Statistics, Centers for Disease Control, Public Health Service

Allan L. Forbes, M.D., Director, Office of Nutrition and Food Sciences, Center for Food Safety and Applied Nutrition, Food and Drug Administration, Public Health Service

William T. Friedewald, M.D., Associate Director for Disease Prevention, National Institutes of Health, Public Health Service

Bernard I. Grosser, M.D., Director, Office of Science, Alcohol, Drug Abuse, and Mental Health Administration, Public Health Service

John Porvaznik, M.D., F.A.C.S., Associate Director, Office of Health Programs, Indian Health Service, Public Health Service

William A. Robinson, M.D., M.P.H., Chief Medical Officer, Health Resources and Services Administration, Public Health Service

Acknowledgments

The *Surgeon General's Report on Nutrition and Health* was prepared under the general editorship of the Department of Health and Human Services' Nutrition Policy Board, whose members are listed on the previous page. Managing Editor was Marion Nestle, Ph.D., M.P.H., Office of Disease Prevention and Health Promotion. Special editorial assistance was contributed by John Bailar III, M.D., Ph.D., Science Advisor, Office of Disease Prevention and Health Promotion, and by Darla E. Danford, M.P.H., D.Sc., R.D., National Institutes of Health. Project Officer during early stages of preparation of the Report was Ann Sorenson, Ph.D., now with the National Institutes of Health.

In addition to the guidance of the Nutrition Policy Board's Senior Editorial Advisors and Staff Working Group, important editorial contributions were made by Karen Donato, M.S., R.D., Nancy D. Ernst, M.S., R.D., Marilyn E. Farrand, M.S., R.D., and Van S. Hubbard, M.D., Ph.D., of the National Institutes of Health's Nutrition Education Subcommittee; and by Walter H. Glinsmann, M.D., Marilyn G. Stephenson, M.S., R.D., John E. Vanderveen, Ph.D., and Elizabeth Yetley, Ph.D., R.D., of the Food and Drug Administration's Center for Food Safety and Applied Nutrition.

Senior Editorial Advisors to the Nutrition Policy Board were:

C. Wayne Callaway, M.D., Director, Center for Clinical Nutrition, George Washington University Medical Center, Washington, D.C.

Johanna T. Dwyer, D.Sc., Director, Frances Stern Nutrition Center, New England Medical Center Hospitals, and Professor of Medicine, Tufts University Medical School, Boston, Massachusetts

Samuel Fomon, M.D., Professor of Pediatrics, University of Iowa, Iowa City, Iowa

Richard L. Hall, Ph.D., Vice President, Science and Technology, McCormick & Co., Inc., Hunt Valley, Maryland

Robert I. Levy, M.D., President, Sandoz Research Institute, East Hanover, New Jersey

Walter Mertz, M.D., Director, Beltsville Human Nutrition Research Center, U.S. Department of Agriculture, Beltsville, Maryland

Malden C. Nesheim, Ph.D., Vice President for Planning and Budget, Cornell University, Ithaca, New York

Sushma Palmer, D.Sc., Executive Director, Food and Nutrition Board, National Academy of Sciences, Washington, D.C.

Irwin H. Rosenberg, M.D., Director, USDA Human Nutrition Research Center on Aging, Tufts University, Boston, Massachusetts

Theodore Van Itallie, M.D., Professor of Medicine, Columbia University College of Physicians and Surgeons, New York, New York

Nutrition Policy Board Staff Working Group members were:

Elizabeth Brannon, M.S., R.D., Clinical Nutrition Specialist, Bureau of Maternal and Child Health and Resources Development, Health Resources and Services Administration, Rockville, Maryland

Darla E. Danford, M.P.H., D.Sc., R.D., Nutritionist, Nutrition Coordinating Committee, National Institutes of Health, Bethesda, Maryland

Willie M. Etheridge, M.S., Policy Analyst, Policy Planning and Legislation Division, Office of Human Development Services, Washington, D.C.

James J. Hearn, L.L.B., Chief, Community Food and Nutrition Program, Office of Community Services, Family Support Administration, Washington, D.C.

M. Yvonne Jackson, Ph.D., R.D., Chief, Nutrition and Dietetics Section, Indian Health Service, Rockville, Maryland

Linda D. Meyers, Ph.D., Nutrition Advisor, Office of Disease Prevention and Health Promotion, Washington, D.C.

Marion Nestle, Ph.D., M.P.H., Director, Nutrition Policy Staff, Office of Disease Prevention and Health Promotion, Washington, D.C.

Lana Skirboll, Ph.D., Special Assistant to the Director, Office of Science, Alcohol, Drug Abuse, and Mental Health Administration, Rockville, Maryland

Frederick Trowbridge, M.D., M.S., Director, Nutrition Division, Center for Health Promotion and Education, Centers for Disease Control, Atlanta, Georgia

Catherine E. Woteki, Ph.D., R.D., Deputy Director, Division of Health Examination Statistics, National Center for Health Statistics, Centers for Disease Control, Hyattsville, Maryland

During preparation of the Report, chapters were subjected to six stages of critical review, three by experts within the Public Health Service (internal reviews) and three by scientists and professionals recommended as experts by national scientific and nutrition professional organizations in the private sector (external reviews). In addition, the senior editorial advisors and staff to the Nutrition Policy Board listed above provided expert technical evaluation throughout the review process. A full list of the many individuals who contributed to the writing or to the review of chapters or sections of the Report can be found in the Acknowledgments section of the complete *Surgeon General's Report on Nutrition and Health*.

The editors gratefully acknowledge the contributions of Joanna Fringer, Program Manager, and Margaret Leahy, Editor, Technical Resources Inc., Rockville, Maryland, David Schardt, Nutrition Consultant, Washington, D.C., and Nancy Chapman, N. Chapman Associates, Washington, D.C., to the preparation of this Report. A complete list of staff members and others who contributed to the Report's preparation is also given in its Acknowledgments.



Summary and Recommendations

This Report addresses the substantial impact of daily dietary patterns on the health of Americans. Good health does not always come easily. It is the product of complex interactions among environmental, behavioral, social, and genetic factors. Some of these are, for practical purposes, beyond personal control. But there are many ways in which each of us can influence our chances for good health through the daily choices we make.

In recent years, scientific investigations have produced abundant information on the ways personal behavior affects health. This information can help us decide whether to smoke, when and how much to drink, how far to walk or climb stairs, whether to wear seat belts, and how or whether to engage in any other activity that might alter the risk of incurring disease or disability. For the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other: what we eat.

Food sustains us, it can be a source of considerable pleasure, it is a reflection of our rich social fabric and cultural heritage, it adds valued dimensions to our lives. Yet what we eat may affect our risk for several of the leading causes of death for Americans, notably, coronary heart disease, stroke, atherosclerosis, diabetes, and some types of cancer. These disorders together now account for more than two-thirds of all deaths in the United States.

Undernutrition remains a problem in several parts of the world, as well as for certain Americans. But for most of us the more likely problem has become one of overeating—too many calories for our activity levels and an imbalance in the nutrients consumed along with them. Although much is still uncertain about how dietary patterns protect or injure human health, enough has been learned about the overall health impact of the dietary patterns now prevalent in our society to recommend significant changes in those patterns.

This first *Surgeon General's Report on Nutrition and Health* offers comprehensive documentation of the scientific basis for the recommended dietary changes. Through the extensive review contained in its chapters, the Report examines in detail current knowledge about the relationships among specific dietary practices and specific disease conditions and sum-

marizes the implications of this information for individual food choices, public health policy initiatives, and further research. **The Report's main conclusion is that overconsumption of certain dietary components is now a major concern for Americans. While many food factors are involved, chief among them is the disproportionate consumption of foods high in fats, often at the expense of foods high in complex carbohydrates and fiber that may be more conducive to health.** A list of the key recommendations based on the evidence presented in the Report is provided in Table 1.

Magnitude of the Problem

Diet has always had a vital influence on health. Until as recently as the 1940's, diseases such as rickets, pellagra, scurvy, beriberi, xerophthalmia, and goiter (caused by lack of adequate dietary vitamin D, niacin, vitamin C, thiamin, vitamin A, and iodine, respectively) were prevalent in this country and throughout the world. Today, thanks to an abundant food supply, fortification of some foods with critical trace nutrients, and better methods for determining and improving the nutrient content of foods, such "deficiency" diseases have been virtually eliminated in developed countries. For example, the introduction of iodized salt in the 1920's contributed greatly to eliminating iodine-deficiency goiter as a public health problem in the United States. Similarly, pellagra disappeared subsequent to the discovery of the dietary causes of this disease. Nutrient deficiencies are reported rarely in the United States, and the few cases of protein-energy malnutrition that are listed annually as causes of death generally occur as a secondary result of severe illness or injury, child neglect, the problems of the house-bound aged, premature birth, alcoholism, or some combination of these factors.

As the diseases of nutritional deficiency have diminished, they have been replaced by diseases of dietary excess and imbalance—problems that now rank among the leading causes of illness and death in the United States, touch the lives of most Americans, and generate substantial health care costs. Table 2, for example, lists the 10 leading causes of death in the United States in 1987.

In addition to the five of these causes that scientific studies have associated with diet (coronary heart disease, some types of cancer, stroke, diabetes mellitus, and atherosclerosis), another three—cirrhosis of the liver, accidents, and suicides—have been associated with excessive alcohol intake.

Table 1
Recommendations

Issues for Most People:

- *Fats and cholesterol:* Reduce consumption of fat (especially saturated fat) and cholesterol. Choose foods relatively low in these substances, such as vegetables, fruits, whole grain foods, fish, poultry, lean meats, and low-fat dairy products. Use food preparation methods that add little or no fat.
- *Energy and weight control:* Achieve and maintain a desirable body weight. To do so, choose a dietary pattern in which energy (caloric) intake is consistent with energy expenditure. To reduce energy intake, limit consumption of foods relatively high in calories, fats, and sugars, and minimize alcohol consumption. Increase energy expenditure through regular and sustained physical activity.
- *Complex carbohydrates and fiber:* Increase consumption of whole grain foods and cereal products, vegetables (including dried beans and peas), and fruits.
- *Sodium:* Reduce intake of sodium by choosing foods relatively low in sodium and limiting the amount of salt added in food preparation and at the table.
- *Alcohol:* To reduce the risk for chronic disease, take alcohol only in moderation (no more than two drinks a day), if at all. Avoid drinking any alcohol before or while driving, operating machinery, taking medications, or engaging in any other activity requiring judgment. Avoid drinking alcohol while pregnant.

Other Issues for Some People:

- *Fluoride:* Community water systems should contain fluoride at optimal levels for prevention of tooth decay. If such water is not available, use other appropriate sources of fluoride.
 - *Sugars:* Those who are particularly vulnerable to dental caries (cavities), especially children, should limit their consumption and frequency of use of foods high in sugars.
 - *Calcium:* Adolescent girls and adult women should increase consumption of foods high in calcium, including low-fat dairy products.
 - *Iron:* Children, adolescents, and women of childbearing age should be sure to consume foods that are good sources of iron, such as lean meats, fish, certain beans, and iron-enriched cereals and whole grain products. This issue is of special concern for low-income families.
-

Table 2
Estimated Total Deaths and Percent of Total Deaths for the
10 Leading Causes of Death: United States, 1987

Rank	Cause of Death	Number	Percent of Total Deaths
1 ^a	Heart diseases (Coronary heart disease) (Other heart disease)	759,400 (511,700) (247,700)	35.7 (24.1) (11.6)
2 ^a	Cancers	476,700	22.4
3 ^a	Strokes	148,700	7.0
4 ^b	Unintentional injuries (Motor vehicle) (All others)	92,500 (46,800) (45,700)	4.4 (2.2) (2.2)
5	Chronic obstructive lung diseases	78,000	3.7
6	Pneumonia and influenza	68,600	3.2
7 ^a	Diabetes mellitus	37,800	1.8
8 ^b	Suicide	29,600	1.4
9 ^b	Chronic liver disease and cirrhosis	26,000	1.2
10 ^a	Atherosclerosis	23,100	1.1
...	All causes	2,125,100	100.0

^aCauses of death in which diet plays a part.

^bCauses of death in which excessive alcohol consumption plays a part.

Source: National Center for Health Statistics, *Monthly Vital Statistics Report*, vol. 37, no. 1, April 25, 1988.

Although the precise proportion attributable to diet is uncertain, these eight conditions accounted for nearly 1.5 million of the 2.1 million total deaths in 1987. Dietary excesses or imbalances also contribute to other problems such as high blood pressure, obesity, dental diseases, osteoporosis, and gastrointestinal diseases. Together, these diet-related conditions inflict a substantial burden of illness on Americans. For example:

- **Coronary Heart Disease.** Despite the recent sharp decline in the death rate from this condition, coronary heart disease still accounts for the largest number of deaths in the United States. More than 1.25 million heart attacks occur each year (two-thirds of them in men), and more than 500,000 people die as a result. In 1985, illness and deaths from coronary heart disease cost Americans an estimated \$49 billion in direct health care expenditures and lost productivity.
- **Stroke.** Strokes occur in about 500,000 persons per year in the United States, resulting in nearly 150,000 deaths in 1987 and long-term disability for many individuals. Approximately 2 million living Americans suffer from stroke-related disabilities, at an estimated annual cost of more than \$11 billion.

- *High Blood Pressure.* High blood pressure (hypertension) is a major risk factor for both heart disease and stroke. Almost 58 million people in the United States have hypertension, including 39 million who are under age 65. The occurrence of hypertension increases with age and is higher for black Americans (of which 38 percent are hypertensive) than for white Americans (29 percent).
- *Cancer.* More than 475,000 persons died of cancer in the United States in 1987, making it the second leading cause of death in this country. During the same period, more than 900,000 new cases of cancer occurred. The costs of cancer for 1985 have been estimated to be \$22 billion for direct health care, \$9 billion in lost productivity due to treatment or disability, and \$41 billion in lost productivity due to premature mortality, for a total cost of \$72 billion.
- *Diabetes Mellitus.* Approximately 11 million Americans have diabetes, but almost half of them have not been diagnosed. In addition to the nearly 38,000 deaths in 1987 attributed directly to this condition, diabetes also contributes to an estimated 95,000 deaths per year from associated cardiovascular and kidney complications. In 1985, diabetes was estimated to cost \$13.8 billion per year, or about 3.6 percent of total health care expenses.
- *Obesity.* Obesity affects approximately 34 million adults ages 20 to 74 years in the United States, with the highest rates observed among the poor and minority groups. Obesity is a risk factor for coronary heart disease, high blood pressure, diabetes, and possibly some types of cancer as well as other chronic diseases.
- *Osteoporosis.* Approximately 15 to 20 million Americans are affected by osteoporosis, which contributes to some 1.3 million bone fractures per year in persons 45 years and older. One-third of women 65 years and older have vertebral fractures. On the basis of x-ray evidence, by age 90 one-third of women and one-sixth of men will have suffered hip fractures, leading to death in 12 to 20 percent of those cases and to long-term nursing care for many who survive. The total costs of osteoporosis to the U.S. economy were estimated to be \$7 to \$10 billion in 1983.
- *Dental Diseases.* Dental caries and periodontal disease continue to affect a large proportion of Americans and cause substantial pain, restriction of activity, and work loss. Although dental caries among children, as well as some forms of adult periodontal disease, appear to be declining, the overall prevalence of these conditions imposes a substantial burden on Americans. The costs of dental care were estimated at \$21.3 billion in 1985.

- *Diverticular Disease.* Because most persons with diverticular disease do not have symptoms, the true prevalence of this condition is unknown. Frequency increases with age, and up to 70 percent of people between the ages of 40 and 70 may be affected. In 1980, diverticulosis was accountable for some 200,000 hospitalizations.

In assessing the role that diet might play in prevention of these conditions, it must be understood that they are caused by a combination (and interaction) of multiple environmental, behavioral, social, and genetic factors. The exact proportion that can be attributed directly to diet is uncertain. Although some experts have suggested that dietary factors overall are responsible for perhaps a third or more of all cases of cancer, and similar estimates have been made for coronary heart disease, such suggestions are based on interpretations of research studies that cannot completely distinguish dietary from genetic, behavioral, or environmental causes.

We know, for example, that cigarette smoking exerts a powerful influence on the occurrence of both coronary heart disease and some types of cancer. We also know that some people are genetically predisposed to coronary heart disease, stroke, and diabetes and that the interaction of genetic predisposition with dietary patterns is an important determinant of individual risk. For these reasons, it is not yet possible to determine the proportion of chronic diseases that could be reduced by dietary changes. Nonetheless, it is now clear that diet contributes in substantial ways to the development of these diseases and that modification of diet can contribute to their prevention. The magnitude of the health and economic cost of diet-related disease suggests the importance of the dietary changes suggested. This Report reviews these issues in detail.

Nature of the Evidence

Whereas centuries of clinical observations and decades of basic and clinical research prove that dietary deficiencies of single, identifiable nutrients can cause disease, research on the relationship of dietary excesses and imbalances to chronic disease yields results that rarely provide such direct proof of causality. Instead, investigators must piece together various kinds of information from several kinds of sources. Nevertheless, the quantity of current animal, laboratory, clinical, and epidemiologic evidence that associates dietary excesses and imbalances with chronic disease is substantial and, when evaluated according to established principles, compelling.

Scientists must often draw inferences about the relationships between dietary factors and disease from laboratory animal studies or human meta-

bolic and population studies that approach the issues indirectly. Data sources for such human studies include clinical and laboratory measurements of physiologic indicators of nutritional status or risk factors, as well as dietary intake data estimated for populations or individuals. Epidemiologic studies using these data compare dietary intake and disease rates in different countries or in defined groups within the same country.

Interpretations of animal studies are limited by uncertainties about their applicability to people. Clinical, laboratory, and dietary intake studies can provide useful information, but each has limitations. Currently available clinical and laboratory measurements reveal only a small part of the complex physiological responses to diet, and they may reflect past rather than current nutritional status. Dietary surveys depend on accurate recall of the types and portion sizes of consumed foods as well as on the assumption that the food intake during any one period represents typical intake. Reported intake, however, is not always accurate, and intake reported for a given period may differ significantly from that typical of longer time periods. Dietary intake data provide useful indicators for populations, but even when an association or correlation between a dietary factor and a disease is observed, it is often difficult to prove that the dietary factor is an actual or sole cause of that disease.

This difference between association and causation is basic to understanding the scientific evidence that links diet to chronic disease. Uncertainties in the ability to determine causation have sometimes made it difficult to achieve consensus on appropriate public health nutrition policies. Established principles require evaluation of the supporting evidence for a given association between a dietary factor and a disease on the basis of its consistency, strength, specificity, and biological plausibility. The evidence showing that dietary intake of saturated fat raises blood cholesterol, which in turn increases the chance of coronary heart disease, illustrates this point. The similarity in results from laboratory, clinical, and epidemiologic research, the apparent relationship between dose and effect in these studies, the observations that the increase in blood cholesterol level is specific to saturated fatty acids but not to other types, and the biological plausibility of explanations for the observations, when taken together, provide considerable support for concluding that the association is causal, at least for some individuals.

For some of the other diseases reviewed in this Report, the available evidence is less complete and less consistent. Nevertheless, much evidence supports credible associations between a dietary pattern of excesses

and imbalances and several important chronic diseases. These associations, in turn, suggest that the overall health of Americans could be improved by a few specific but fundamental dietary changes.

Key Findings and Recommendations

Even though the results of various individual studies may be inconclusive, the preponderance of the evidence presented in the Report's comprehensive scientific review substantiates an association between dietary factors and rates of chronic diseases. In particular, the evidence suggests strongly that a dietary pattern that contains excessive intake of foods high in calories, fat (especially saturated fat), cholesterol, and sodium, but that is low in complex carbohydrates and fiber, is one that contributes significantly to the high rates of major chronic diseases among Americans. It also suggests that reversing such dietary patterns should lead to a reduced incidence of these chronic diseases.

This *Surgeon General's Report on Nutrition and Health* provides a comprehensive review of the most important scientific evidence in support of current Federal nutrition policy as stated in the *Dietary Guidelines for Americans*. These *Guidelines*, issued jointly by the Department of Agriculture and the Department of Health and Human Services, recommend:

- Eat a variety of foods.
- Maintain desirable weight.
- Avoid too much fat, saturated fat, and cholesterol.
- Eat foods with adequate starch and fiber.
- Avoid too much sugar.
- Avoid too much sodium.
- If you drink alcoholic beverages, do so in moderation.

Evidence presented in this Report expands the focus of these seven guidelines and provides considerable insight into priorities. Clearly emerging as the primary priority for dietary change is the recommendation to reduce intake of total fats, especially saturated fat, because of their relationship to development of several important chronic disease conditions. Because excess body weight is a risk factor for several chronic diseases, maintenance of desirable weight is also an important public health priority. Evidence further supports the recommendation to consume a dietary pattern that contains a variety of foods, provided that these foods are generally low in calories, fat, saturated fat, cholesterol, and sodium.

Taken together, the recommendations in this Report promote a dietary pattern that emphasizes consumption of vegetables, fruits, and whole grain products—foods that are rich in complex carbohydrates and fiber and relatively low in calories—and of fish, poultry prepared without skin, lean meats, and low-fat dairy products selected to minimize consumption of total fat, saturated fat, and cholesterol.

The evidence presented in this Report suggests that such overall dietary changes will lead to substantial improvements in the nutritional quality of the American diet. Consuming a higher proportion of calories from fruits, vegetables, and grains may lead to a modest reduction in protein intake for some people, but this reduction is unlikely to impair nutritional status. Average levels of protein consumption in the United States, 60 grams per day for women and 90 grams per day for men, are well above the National Research Council's recommendations of 44 and 56 grams per day, respectively.

The evidence also suggests that most Americans generally need not consume nutrient supplements. An estimated 40 percent of Americans consume supplemental vitamins, minerals, or other dietary components at an annual cost of more than \$2.7 billion. Although nutrient supplements are usually safe in amounts corresponding to the Recommended Dietary Allowances (and such Allowances are set to ensure that the nutrient needs of practically all the population are met), there are no known advantages to healthy people consuming excess amounts of any nutrient, and amounts greatly exceeding recommended levels can be harmful. For example, some nutrients such as selenium have a narrow range of safe level of intake. Toxicity has been reported for most minerals and trace elements, as well as some vitamins, indicating that excessive supplementation with these substances can be hazardous.

Finally, some recommendations for dietary change apply broadly to the general public whereas others apply only to specific population groups. These major findings and recommendations of *The Surgeon General's Report on Nutrition and Health* are noted below.

Issues for Most People

- ***Fats and cholesterol:* Reduce consumption of fat (especially saturated fat) and cholesterol. Choose foods relatively low in these substances, such as vegetables, fruits, whole grain foods, fish, poultry, lean meats, and low-fat dairy products. Use food preparation methods that add little or no fat.**

High intake of total dietary fat is associated with increased risk for obesity, some types of cancer, and possibly gallbladder disease. Epidemiologic, clinical, and animal studies provide strong and consistent evidence for the relationship between saturated fat intake, high blood cholesterol, and increased risk for coronary heart disease. Conversely, reducing blood cholesterol levels reduces the risk for death from coronary heart disease. Excessive saturated fat consumption is the major dietary contributor to total blood cholesterol levels. Dietary cholesterol raises blood cholesterol levels, but the effect is less pronounced than that of saturated fat. While polyunsaturated fatty acid consumption, and probably monounsaturated fatty acid consumption, lowers total blood cholesterol, the precise effects of specific fatty acids are not well defined.

Dietary fat contributes more than twice as many calories as equal quantities (by weight) of either protein or carbohydrate, and some studies indicate that diets high in total fat are associated with higher obesity rates. In addition, there is substantial, although not yet conclusive, epidemiologic and animal evidence in support of an association between dietary fat intake and increased risk for cancer, especially breast and colon cancer. Similarly, epidemiologic studies suggest an association between gallbladder disease, excess caloric intake, high dietary fat, and obesity. More precise conclusions about the role of dietary fat await the development of improved methods to distinguish among the contributions of the high-calorie, high-fat, and low-fiber components of current American dietary patterns.

At present, dietary fat accounts for about 37 percent of the total energy intake of Americans—well above the upper limit of 30 percent recommended by the American Heart Association and the American Cancer Society, and above the percent consumed by many societies, such as Mediterranean countries, Japan, and China, for example, where coronary heart disease rates are much lower than those observed in the United States. Consumption of saturated fat and cholesterol is also substantially higher among many Americans than levels recommended by several expert groups.

The major dietary sources of fat in the American diet are meat, poultry, fish, dairy products, and fats and oils. Animal products tend to be higher in both total and saturated fats than most plant sources. Although some plant fats such as coconut and palm kernel oils also contain high proportions of saturated fatty acids, these make minor contributions to total intake of saturated fats in the United States. Dietary cholesterol is found only in foods of animal origin, such as eggs, meat, poultry, fish, and dairy prod-

ucts. To help reduce consumption of total fat, especially saturated fat and cholesterol, food choices should emphasize intake of fruits, vegetables, and whole grain products and cereals. They should also emphasize consumption of fish, poultry prepared without skin, lean meats, and low-fat dairy products. Among vegetable fats, those that are more unsaturated are better choices.

- ***Energy and weight control:* Achieve and maintain a desirable body weight. To do so, choose a dietary pattern in which energy (caloric) intake is consistent with energy expenditure. To reduce energy intake, limit consumption of foods relatively high in calories, fats, and sugars and minimize alcohol consumption. Increase energy expenditure through regular and sustained physical activity.**

People are considered overweight if their body mass index, or BMI (a ratio of weight to height described in the Report), exceeds the 85th percentile for young American adults (approximately 120 percent of desirable body weight); they are considered severely overweight if their BMI exceeds the 95th percentile (approximately 140 percent of desirable body weight). Overweight individuals are at increased risk for diabetes mellitus, high blood pressure and stroke, coronary heart disease, some types of cancer, and gallbladder disease. Epidemiologic and animal studies have shown consistently that overall risk for death is increased with excess weight, with risk increasing as severity of obesity increases.

Type II (noninsulin-dependent) diabetes mellitus accounts for approximately 90 percent of all cases of diabetes and is strongly associated with obesity. Clinical studies indicate that weight loss can improve control of Type II diabetes.

Obesity increases the risk for high blood pressure, and consequently for stroke; it also increases blood cholesterol levels associated with coronary heart disease. In addition, it appears to be an independent risk factor for coronary heart disease. Weight reduction has been shown to reduce high blood pressure and high blood cholesterol. Most obese individuals who achieve a more desirable body weight improve their cholesterol profile, achieving a decrease in both total blood cholesterol and LDL (low density lipoprotein) cholesterol.

Some studies have found an association between overweight and increased risk for several cancers, especially cancer of the uterus and breast. In addition, overweight increases the risk for gallbladder disease.

More than a quarter of American adults are overweight. Black women age 45 and above have the highest prevalence, about 60 percent. Although evidence suggests a genetic component to the tendency of many people to become overweight, patterns of dietary caloric intake and energy expenditure play a key role. Sustained and long-term efforts to reduce body weight can best be achieved as a result of improving energy balance by reducing energy consumption and raising energy expenditure through physical activity and exercise.

Maintenance of desirable body weight throughout the lifespan requires a balance between energy (calorie) intake and expenditure. Weight control may be facilitated by decreasing energy intake, especially by choosing foods relatively low in calories, fats, and sugars, and by minimizing alcohol consumption. Energy expenditure can be enhanced through regular physical activities such as daily walks or by jogging, bicycling, or swimming at least three times a week for at least 20 minutes.

- ***Complex carbohydrates and fiber:*** Increase consumption of whole grain foods and cereal products, vegetables (including dried beans and peas), and fruits.

Dietary patterns emphasizing foods high in complex carbohydrates and fiber are associated with lower rates of diverticulosis and some types of cancer. The association shown in epidemiologic and animal studies between diets high in complex carbohydrates and reduced risk for coronary heart disease and diabetes mellitus is, however, difficult to interpret. The fact that such diets tend also to be lower in energy and fats, especially saturated fat and cholesterol, clearly contributes to this difficulty. Some evidence from clinical studies also suggests that water-soluble fibers from foods such as oat bran, beans, or certain fruits are associated with lower blood glucose and blood lipid levels. Consuming foods with dietary fiber is usually beneficial in the management of constipation and diverticular disease.

While inconclusive, some evidence also suggests that an overall increase in intake of foods high in fiber might decrease the risk for colon cancer. Among several unresolved issues is the role of the various types of fiber, which differ in their effects on water-holding capacity, viscosity, bacterial fermentation, and intestinal transit time.

Other food components associated with decreased cancer risk are commonly found in diets high in whole grain cereal products containing complex carbohydrates and fiber. In addition, some epidemiologic evidence

suggests that frequent consumption of vegetables and fruits, particularly dark green and deep yellow vegetables and cruciferous vegetables (such as cabbage and broccoli), may lower risk for cancers of the lung and bladder as well as some cancers of the alimentary tract. However, the specific components in these foods that may have protective effects have not yet been established. Current evidence suggests the prudence of increasing consumption of whole grain foods and cereals, vegetables (including dried beans and peas), and fruits.

- **Sodium: Reduce intake of sodium by choosing foods relatively low in sodium and limiting the amount of salt added in food preparation and at the table.**

Studies indicate a relationship between a high sodium intake and the occurrence of high blood pressure and stroke. Salt contains about 40 percent sodium by weight and is used widely in the preservation, processing, and preparation of foods. Although sodium is necessary for normal metabolic function, it is consumed in the United States at levels far beyond the 1.1 to 3.3 grams per day found to be as safe and adequate for adults by the National Research Council. Average current sodium intake for adults in the United States is in the range of 4 to 6 grams per day.

Blacks and persons with a family history of high blood pressure are at greater risk for this condition. While some people maintain normal blood pressure levels over a wide range of sodium intake, others appear to be "salt sensitive" and display increased blood pressure in response to high sodium intakes.

Although not all individuals are equally susceptible to the effects of sodium, several observations suggest that it would be prudent for most Americans to reduce sodium intake. These include the lack of a practical biological marker for individual sodium sensitivity, the benefit to persons whose blood pressures do rise with sodium intake, and the lack of harm from moderate sodium restriction.

Processed foods provide about a third or more of dietary sodium. Because about another third of the sodium consumed by Americans is added by the consumer, much can be done to reduce sodium consumption by using less salt at the table and substituting alternative flavoring such as herbs, spices, and lemon juice in the preparation of foods. In addition, choices can be made of foods modified to lower sodium content and less frequent choices could be made of foods to which sodium is added in processing and preservation.

- **Alcohol:** To reduce the risk for chronic disease, take alcohol only in moderation (no more than two drinks a day), if at all. Avoid drinking any alcohol before or while driving, operating machinery, taking medications, or engaging in any other activity requiring judgment. Avoid drinking alcohol while pregnant.

Alcohol is a drug that can produce addiction in susceptible individuals, birth defects in some children born to mothers who drink alcohol during pregnancy, impaired judgment, impaired ability to drive automobiles or operate machinery, and adverse reactions in people taking certain medications. In addition, alcohol abuse has been associated with disrupted family functioning, suicides, and homicides.

Excessive use of alcohol is also associated with liver disease, some types of cancer, high blood pressure, stroke, and disorders of the heart muscle. Extensive epidemiologic and clinical evidence has identified alcohol consumption as the principal cause of liver cirrhosis in the United States, at least in part as a result of the direct toxic effects of alcohol on the liver. Smoking and alcohol appear to act synergistically to increase the risk for cancers of the mouth, larynx, and esophagus. Less conclusive and somewhat conflicting evidence suggests a role of alcohol in other types of cancers such as those of the liver, rectum, breast, and pancreas.

Studies indicate a direct association between increased blood pressure and the consumption of alcohol at levels beyond about two drinks^a daily. Extremely excessive alcohol consumption is associated with cardiomyopathy. Alcohol consumption by the mother during pregnancy has also been associated with fetal malformations.

Although consumption of up to two drinks per day has not been associated with disease among healthy men and nonpregnant women, surveys suggest that at least 9 percent of the total population consumes two or more drinks per day and those in this group need to reduce their alcohol consumption. A threshold level of safety for alcohol intake during pregnancy has not been established. Thus, pregnant women and women who may become pregnant should avoid drinking alcohol.

^aOne drink is defined as a 12 ounce beer, a 5 ounce glass of wine, or 1½ fluid ounces (one jigger) of distilled spirits, each of which contains about 1 ounce of alcohol.



Other Issues for Some People

- **Fluoride:** Community water systems should contain fluoride at optimal levels for prevention of tooth decay. If such water is not available, use other appropriate sources of fluoride.

The most efficient means of making fluoride available to the general public to reduce dental disease is through drinking water. Numerous epidemiologic and clinical studies have attested to the efficacy, safety and cost-effectiveness of systemic fluoride in the prevention of tooth decay. Lifetime use of water containing an optimal fluoride concentration of approximately 1 part per million has been shown to reduce the prevalence of dental caries by more than 50 percent. Water fluoridation is considered one of the most successful public health efforts introduced in the United States.

For children living in areas with inadequate concentrations of fluoride in the water, supplementary fluoride sources should be used at dosages that depend on the fluoride content of the local water supply and the age of the child. The effectiveness of prenatal fluoride administration, however, is uncertain because clinical studies of its effects on subsequent caries incidence have been equivocal. Excessive fluoride should be avoided because it may cause mottling of developing teeth.

- **Sugars:** Those who are particularly vulnerable to dental caries (cavities), especially children, should limit their consumption and frequency of use of foods high in sugars.

Although genetic, behavioral, and other dietary factors also influence dental health, the major role of sugars in promotion of tooth decay is well established from animal, epidemiologic, clinical, and biochemical studies. Newly erupting teeth are generally more vulnerable to decay than mature teeth.

Research has shown that three conditions must exist for the formation of dental caries: the presence of fermentable carbohydrate, acid-producing bacteria, and a susceptible tooth. Caries-producing bacteria metabolize a range of sugars (glucose, fructose, maltose, lactose, and sucrose) to acids that demineralize teeth. The unique role of sucrose (common table sugar) in dental caries is related to its special ability to be converted by these bacteria into long, complex molecules that adhere firmly to teeth and form plaque.

The most important diet-related interventions are fluoridation of drinking water, or the use of other means of fluoride administration, and control of intake of sugars. While fluoride is the most important factor overall in dental caries prevention, reduction in the frequency of consumption and in the quantity of sugar-rich foods in the diet will also help reduce decay. Sticky sweet foods that adhere to the teeth are more cariogenic than those that wash off quickly. The longer cariogenic foods remain in the mouth, the more they are likely to increase the initiation and progression of tooth decay.

- **Calcium:** Adolescent girls and adult women should increase consumption of foods high in calcium, including low-fat dairy products.

Inadequate dietary calcium consumption in the first three to four decades of life may be associated with increased risk for osteoporosis in later life. Osteoporosis, a chronic disease characterized by progressive loss of bone mass with aging, occurs in both women and men, although postmenopausal women are twice as likely as men to have severe osteoporosis with consequent bone fractures. Evidence shows that chronically low calcium intake, especially during adolescence and early adulthood, may compromise development of peak bone mass. In postmenopausal women, the group at highest risk for osteoporosis, estrogen replacement therapy under medical supervision is the most effective means to reduce the rate of bone loss and risk for fractures. Maintenance of adequate levels of physical activity and cessation of cigarette smoking have also been associated with reduced osteoporosis risk.

Although the precise relationship of dietary calcium to osteoporosis has not been elucidated, it appears that higher intakes of dietary calcium could increase peak bone mass during adolescence and delay the onset of bone fractures later in life. Thus, increased consumption of foods rich in calcium may be especially beneficial for adolescents and young women. Food sources of calcium consistent with other dietary recommendations in this Report include low-fat dairy products, some canned fish, certain vegetables, and some calcium-enriched grain products.

- **Iron:** Children, adolescents, and women of childbearing age should be sure to consume foods that are good sources of iron, such as lean meats, fish, certain beans, and iron-enriched cereals and whole grain products. This issue is of special concern for low-income families.

Dietary iron deficiency is responsible for the most prevalent form of anemia in the United States. Iron deficiency hampers the body's ability to produce hemoglobin, a substance needed to carry oxygen in the blood. A

principal consequence of iron deficiency is reduced work capacity, although depressed immune function, changes in behavior, and impaired intellectual performance may also result. Because of the serious consequences of iron deficiency, continual monitoring of the iron status of individuals at high risk—particularly children from low-income families, adolescents, and women of childbearing age—is vital, as is treatment of those identified to be iron deficient.

Proper infant feeding—preferably breastfeeding, otherwise use of iron-fortified formula—is the most important safeguard against iron deficiency in infants. Among adolescents and adults, iron intake can be improved by increasing consumption of iron-rich foods such as lean meats, fish, certain kinds of beans, and iron-enriched cereals and whole grain products. Also, consuming foods that contain vitamin C increases the likelihood that iron will be absorbed efficiently.

Policy Implications

Dietary Guidance

General Public

Educating the public about the dietary choices most conducive to prevention and control of certain chronic diseases is essential. Educational efforts should begin in primary school and continue throughout the secondary grades, and should focus on the dietary principles outlined in this Report—the potential health benefits of eating a diet that is lower in fat (especially saturated fat) and rich in complex carbohydrates and fiber. The importance of adequate physical activity should also be stressed. Efforts should continue throughout each stage of life to promote the principles outlined in the *Dietary Guidelines for Americans*.

Special Populations

A disproportionate burden of diet-related disease is borne by subgroups in our population. Black Americans, for example, have higher rates of high blood pressure, strokes, diabetes, and other diseases associated with obesity (but lower rates of osteoporosis) than the general population. Some groups of Native Americans exhibit the highest rates of diabetes in the world. Pregnant and lactating women also have special nutritional needs. Particular effort should be made to identify and remove the barriers to optimal health and nutritional status in such high-risk groups, using methods that take into consideration their diverse cultural backgrounds.

Many older persons suffer from chronic diseases that can reduce functional independence; many take multiple medications that may adversely interact with nutrients. Sound public education directed toward this group—and professional education directed toward individuals who care for older Americans—should focus on dietary means to reduce risk factors for chronic disease, to promote functional independence, and to prevent adverse consequences of use of medications.

Health Professionals

Improved nutrition training of physicians and other health professionals is needed. Training should emphasize basic principles of nutrition, the role of diet in health promotion and disease prevention, nutrition assessment methodologies and their interpretation, therapeutic aspects of dietary intervention, behavioral aspects of dietary counseling, and the role of dietitians and nutritionists in dietary counseling of patients.

Programs and Services

Food Labels

Food labeling offers opportunities to inform people about the nutrient content of foods so as to facilitate dietary choices most conducive to health. Food manufacturers should be encouraged to make full use of nutrition labels. Labels of processed foods should state the content of calories, protein, carbohydrate, fats, cholesterol, sodium, and vitamins and minerals. To the extent permitted by analytical methods, manufacturers should disclose information where appropriate on the content of saturated and unsaturated fatty acids and total fiber in foods that normally contain them. Descriptive terms such as “low calorie” and “sodium reduced” in compliance with the Food and Drug Administration’s regulations for food labeling may also be helpful, and the expanded use of these terms should be encouraged.

Nutrition Services

Health care programs for individuals of all ages should include nutrition services such as, when appropriate, nutrition counseling for individuals or groups, interpretation and implementation of prescribed therapeutic diets tailored to individual food preferences and lifestyle, referral to appropriate community services and food assistance programs, monitoring of progress, and appropriate followup. These services should routinely incorporate assessment of nutritional status and needs based on established criteria

to identify individuals with nutritional risk factors who would profit from preventive measures and those with nutritional disorders who need remedial care.

Food Services

Lack of access to an appropriate diet should not be a health problem for any American. Wherever food is served to people or provided through food assistance programs, it should reflect the principles of good nutrition stated in this Report. Whether served in hospitals, schools, military installations, soup kitchens, day care centers, or nursing homes, or whether delivered to homes, food service programs offer important opportunities for improving health and providing dietary education. Such programs should pay special attention to the nutritional needs of older people, pregnant women, and children, especially those of low income or other special dietary needs. Because a large proportion of the population takes meals in restaurants and convenience food facilities, improvements in the overall nutritional balance of the meals served in such places can be expected to contribute to health benefits.

Food service programs should also take particular care to ensure that special diets lower in fat, especially saturated fat, are provided to people with elevated blood cholesterol, heart disease, or diabetes; that diets low in sodium are provided to individuals with high blood pressure; and that protein-restricted diets are made available to people with end-stage kidney disease.

Food Products

The public would benefit from increased availability of foods and food products low in calories, total fat, saturated fat, cholesterol, sodium, and sugars, but high in a variety of natural forms of fiber and, perhaps, certain minerals and vitamins. Food manufacturers can contribute to improving the quality of the American diet by increasing the availability of palatable, easily prepared food products that will help people to follow the dietary principles outlined here. Because the public is becoming increasingly conscious of the role of nutrition in health, development of such products should also benefit the food industry.

Research and Surveillance

Impressive evidence already links nutrition to chronic disease. However, much more information is needed to continue to identify changes in the

national diet that will lead to better health for the Nation. Gaps in our knowledge of nutrition suggest future research and surveillance needs. Examples are:

- The role of specific dietary factors in the etiology and prevention of chronic diseases.
- The childhood dietary pattern that will best prevent later development of chronic diseases.
- The effects of maternal nutrition on the health of the developing fetus.
- The nutrient and energy requirements of older adults.
- How nutrient requirements translate into healthful dietary patterns.
- The development of biochemical markers of dietary intake to monitor better the effects of dietary intervention.
- The identification of effective educational methods to translate dietary recommendations into appropriate food choices.
- The establishment of a nutrition surveillance system that will enhance the monitoring of population-specific and State-specific trends in the occurrence of nutrition-related risk factors and conditions.

Specific research recommendations are listed at the end of each chapter of the full Report and in Appendix D of this volume.



Appendix A

Selected Events in the History of Nutritional Science to 1950

- c. 1500 B.C. *Papyrus Ebers* contains prescription believed to refer to diabetes.
- c. 400 B.C. Hippocrates wrote of relationship of diet to health.
- c. 300 B.C. Beriberi described in ancient Chinese texts.
- c. 200 A.D. Arataeus gave the name diabetes to the condition of "too much passing of urine."
- 1250 Joinville described scurvy among troops of Louis IX at the siege of Cairo.
- 1614 Sanctorius published studies relating body weight to food intake.
- 1650 Glisson described rickets in *De Rachitide*.
- 1730 Casal described pellagra, calling it "mal de la rosa."
- 1747 Lind proved that citrus fruits cure scurvy in first controlled human dietary experiment. Menghini established presence of iron in blood.
- 1752 Reaumur published experiments on digestion in birds.
- 1780 Spallanzani produced evidence that digestion was the chemical action of gastric juices.
- 1789 Lavoisier and Seguin make first measurements relating oxygen consumption to human energy metabolism. Cod liver oil used as treatment for rickets.
- 1796 Lemon juice officially introduced in British Navy to prevent scurvy.
- 1807 Davy isolated sodium, potassium, calcium, magnesium, sulphur, and boron.
- 1810-23 Chevreul studied chemistry of animal fats.
- 1810 Wollaston isolated cystic oxide (later named cystine) from urine—first amino acid discovered.
- 1816 Magendie identified dietary nitrogen requirements in dogs.
- 1827 Prout classified food constituents as saccharine, oily, and albuminous (sugar, fat, and protein).
- 1833 Beaumont reported observations and experiments on digestion in his patient St. Martin.
- 1838 Mulder introduced the term "protein."

- 1839 Boussingault conducts first nitrogen balance studies in animals.
- 1840 Liebig published *Animal Chemistry*, stating basic principles of metabolism.
- 1843 Chossat studied the effect of starvation on the body using pigeons.
- 1848 Addison described pernicious anemia.
- 1849–57 Bernard elucidated digestive action of pancreatic juices and glycogenic function of liver.
- 1850 Livingstone described xerophthalmia (due to vitamin A deficiency) in Africa.
- 1850–52 Chatin in France used iodine to prevent goiter.
- 1866–81 Voit and Pettenkofer explained protein metabolism.
- 1867 Boussingault recognized iron as essential nutrient.
- 1877 Pavlov began classic studies on digestion in dogs.
- 1885 Takaki demonstrated in controlled dietary experiments with Japanese Navy sailors that beriberi could be prevented.
- 1896 Atwater and Bryant introduced their basic reference, *Chemical Composition of American Food Materials*.
- 1897 Eijkman published his work on causes of beriberi.
- 1902 Rubner showed that food components increased metabolism by different amounts.
- 1909–28 Osborne and Mendel studied the nutritive value of protein.
- 1912 Funk coined the term “vitamine.”
- 1914 Goldberger established dietary cause of pellagra.
- 1916 McCollum and Davis and Osborne and Mendel discovered accessory dietary factors “fat-soluble A” and “water-soluble B.”
- 1918 Mellanby showed that experimental rickets in dogs is due to lack of fat-soluble vitamin.
- 1919–22 Water-soluble B factor shown to be more than one factor.
- 1921–24 Blindness in children shown to be result of lack of vitamin A.
- 1922 McCollum identified vitamin D in cod liver oil.
- 1928 Goldberger identified pellagra-preventing factor in yeast.
- 1929 Role of intrinsic and extrinsic factors in pernicious anemia discovered.
- 1931–37 Fluoride content of drinking water identified as cause of mottled enamel of teeth and prevention of tooth decay.
- 1932 Vitamin C isolated from lemon juice. Warburg and Christian identified riboflavin and defined its molecular function.


- 1933 Williams identified kwashiorkor as a nutritional disease.
- 1938 Rose classified amino acids as essential and nonessential.
- 1941 Evidence provided for the influence of prenatal diet on the health of the newborn infant.
- 1944–46 Keys and coworkers studied effects on young men of experimentally induced semistarvation and methods of dietary rehabilitation.
- 1945 Grand Rapids, Michigan, becomes the first city in the world to fluoridate its drinking water to prevent tooth decay.
- 1948–49 Crystalline vitamin B₁₂ isolated from liver extract and shown to contain cobalt.
- 1949 Framingham Study of coronary heart disease risk factors begins.



Appendix B


Selected Federal Domestic Nutrition Policy Initiatives, 1862–1988

1862	U.S. Department of Agriculture (USDA) created. Morrill Act establishes land grant colleges.
1867	Office of Education established with responsibilities for nutrition education within public schools.
1887	Hatch Act establishes agricultural experiment stations. Federal research laboratory established at Staten Island. Name is changed to the National Institute of Health in 1930.
1889	U.S. Public Health Service Commissioned Corps authorized for duty on communicable, nutritional, and other diseases.
1893	USDA authorized by Congress to conduct research on agriculture and human nutrition.
1906	The Pure Food and Drug (Wiley) Act prohibits interstate commerce and misbranded and adulterated foods, drinks, and drugs. Federal Meat Inspection Act passed.
1914	Cooperative Extension Service created as part of USDA.
1916	USDA publishes <i>Food for Young Children</i> , first dietary guidance pamphlet.
1917	U.S. Food Administration established to supervise World War I food supply. First dietary recommendations issued by USDA— <i>Five Food Groups</i> .
1921–29	Maternity and Infancy Act enabled State health departments to employ nutritionists.
1924	Addition of iodine to salt to prevent goiter is first U.S. food fortification program.
1927	Food, Drug, and Insecticide Administration established. Name is changed to Food and Drug Administration (FDA) in 1932.
1930	USDA and Federal Emergency Relief Administration buy and distribute surplus agricultural commodities as food relief. Public Health Service Hygienic Laboratory designated as National Institute of Health (later changes to National Institutes of Health).
1933	Agricultural Act amendments permit purchase of surplus commodities for donation to child nutrition and school lunch programs.

 Nutrition and Health

- 1935 Food Distribution Program established. Social Security Act authorizes grants to States for nutrition services to mothers and children.
- 1936–37 USDA conducts first Nationwide Food Consumption Survey (NFCS).
- 1938 The Food, Drug and Cosmetic (FD&C) Act includes provisions for food standards. FDA nutrition research program established. Social Security Act provides support for role of nutrition in health.
- 1939 Federal Surplus Commodities Corporation initiates experimental Food Stamp Program.
- 1940 National Defense Advisory Commission draws attention to malnutrition in the United States.
- 1941 President Roosevelt calls National Nutrition Conference, with announcement of the first Recommended Dietary Allowances by the Food and Nutrition Board. FDA promulgates standards for enrichment of flour and bread with B-complex vitamins and iron.
- 1946 National School Lunch Program established.
- 1947 Laboratories of Nutrition, Chemistry, and Pathology of the National Institutes of Health incorporated into Experimental Biology and Medicine Institute.
- 1954 Special Milk Program established.
- 1955 Interdepartmental Committee on Nutrition for National Defense established (discontinued 1967).
- 1956 Title VII of the Public Health Service Act authorizes funds to support graduate training in public health nutrition.
- 1958 Food Additives Amendment to FD&C Act prohibits use of a food additive until safety established by manufacturer. Delaney Clause prohibits carcinogenic additives. GRAS (Generally Recognized As Safe) list established.
- 1961 President Kennedy expands the use of surplus food for needy people at home and abroad and announces a new pilot Food Stamp Program.
- 1963 and 1965 Maternal and Child Health and Mental Retardation Planning Amendments to the Social Security Act allow for an expanded number of nutritionists in health care programs.
- 1965 Food Stamp Act passed by Congress. Nationwide Food Consumption Survey collects first data on dietary intake of individuals.

- 1966 Child Nutrition Act passed. School Breakfast Program established. President Johnson outlines Food for Freedom Program, the "war on hunger." Allied Health Professions Personnel Training Act includes support for training of dietitians.
- 1966–70 The Department of Health, Education, and Welfare (DHEW), which later becomes the Department of Health and Human Services (DHHS), sponsors a National Academy of Sciences study, Maternal Nutrition and the Course of Pregnancy, which makes major recommendations related to the role of nutrition in human reproduction.
- 1968 U.S. Senate Select Committee on Nutrition and Human Needs established.
- 1968–70 DHEW sponsors Preschool and Ten-State Nutrition Surveys that report evidence of hunger and malnutrition in poverty groups in the United States.
- 1969 President Nixon calls White House Conference on Food, Nutrition, and Health. Secretary of Agriculture establishes the Food and Nutrition Service to administer Federal food assistance programs.
- 1971–74 The National Center for Health Statistics conducts the first National Health and Nutrition Examination Survey (NHANES) to measure the nutritional status of the U.S. population. This is followed by NHANES II in 1976–80, Hispanic HANES in 1982–84, and NHANES III in 1988.
- 1972 USDA establishes Special Supplementary Food Program for Women, Infants, and Children (WIC). Agriculture and Consumer Protection Act provides price supports to farmers. Amendments to the Older Americans Act of 1965 establish a congregate and home-delivered meals program for older Americans.
- 1974 U.S. Senate Select Committee on Nutrition and Human Needs issues *Guidelines for a National Nutrition Policy*, prepared by the National Nutrition Consortium. Safe Drinking Water Act passed.
- 1975 National Institutes of Health establishes Nutrition Coordinating Committee.
- 1977 U.S. Senate Select Committee on Nutrition and Human Needs issues two editions of *Dietary Goals for the United States*. Food and Agricultural Act and Child Nutrition and National School Lunch Amendments passed.
- 1978 Joint Subcommittee on Human Nutrition Research established in Office of Science and Technology Policy (in 1983 becomes Interagency Committee on Human Nutrition Research under joint direction of USDA and DHHS). DHEW and USDA submit proposal to Congress for National Nutrition Monitoring System.

 Nutrition and Health

- 1979 DHEW establishes Department-wide Nutrition Policy Board and issues *Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention*.
- 1980 USDA and DHHS jointly issue *Nutrition and Your Health: Dietary Guidelines for Americans*. A second edition follows in 1985. DHHS issues *Promoting Health/Preventing Disease: Objectives for the Nation*, which contains 17 nutrition objectives to be achieved by the year 1990. The Surgeon General's Workshop on Maternal and Infant Health makes recommendations about improving nutrition for these vulnerable groups.
- 1981 DHHS and USDA issue *Joint Implementation Plan for a Comprehensive National Nutrition Monitoring System*, revised in 1987 as the *Operational Plan for the National Nutrition Monitoring System*. The Select Panel for the Promotion of Child Health, created by Public Law 95-626, submits to Congress and the Secretary of DHHS its report, which includes recommendations on nutrition.
- 1984 The Surgeon General's Workshop on Breastfeeding and Human Lactation develops strategies for promoting breastfeeding.
- 1985 USDA initiates Continuing Survey of Food Intakes by Individuals, repeated in 1986.
- 1986 DHHS and USDA issue *Nutrition Monitoring in the United States*, the report of the Joint Nutrition Monitoring Evaluation Committee.
- 1988 DHHS publishes *The Surgeon General's Report on Nutrition and Health*.
-

Appendix C

Appendix C
Federal Dietary Recommendations for the General Public, 1917–1988

Year	Agency ^b	Publication	Recommendation ^a							
			Variety	Maintain Ideal Body Weight	Include Starch and Fiber	Limit Sugar	Limit Fat	Limit Choles- terol	Limit Salt	Limit Alcohol
1917	USDA	What the Body Needs— Five Food Groups	+		+	*	*			
1942	USDA	Food for Freedom— Daily Eight	+		+			*		
1943	USDA	National Wartime Nutrition Guide—Basic Seven	+		+			*		
1946	USDA	National Food Guide— Basic Seven	+		+			*		
1946	USDA	Food for Growth— Four Food Groups	+		+					
1958	USDA	Food for Fitness— Four Food Groups	+		+					
1977	U.S. Senate	Dietary Goals for the U.S.		+	+	+	+	+	+	
1979	USDA	Building a Better Diet— Five Food Groups	+	+	+	+	+	+	+	+
1979	DHEW	Healthy People: The Surgeon General's Report on Health Promotion and Disease Prevention	+	+	+	+	+	+	+	+

1979	DHEW/NCI	Statement on Diet, Nutrition, and Cancer—Prudent Interim Principles	+	+	+	+			+
1980	USDA/DHHS	Dietary Guidelines for Americans	+	+	+	+	+	+	+
1980	DHHS	National 1990 Nutrition Objectives	+	+	+	+	+	+	+
1984	DHHS/NHLBI	Recommendations for Control of High Blood Pressure		+			+		+
1985	USDA/DHHS	Dietary Guidelines for Americans, 2nd edition	+	+	+	+	+	+	+
1986	DHHS/NCI	Cancer Control Nutrition Objectives for the Nation: 1985–2000		+	+		+		+
1987	DHHS/NHLBI	National Cholesterol Education Program Guidelines	+	+	+		+	+	+
1988	DHHS/NCI	Dietary Guidelines for Cancer Prevention	+	+	+		+		+

*Recommended for *inclusion* in the daily diet, as opposed to subsequent recommendations to *limit* intake.

^aOther recommendations include: increased consumption of foods containing vitamins and minerals (USDA 1917–1958; NCI 1986), increased physical activity (USDA/DHHS 1980, 1985; DHHS 1980), and reduced intake of salt-cured or smoked foods (NCI 1988).

^bUSDA = U.S. Department of Agriculture, U.S. Senate = U.S. Senate Select Committee on Nutrition and Human Needs, DHEW = Department of Health, Education, and Welfare, DHHS = Department of Health and Human Services, NCI = National Cancer Institute, NHLBI = National Heart, Lung, and Blood Institute.



Appendix D

Implications for Public Health Policy^a

Coronary Heart Disease

Dietary Guidance

General Public

High blood cholesterol is one of the three major modifiable risk factors for coronary heart disease (CHD). The principal nutritional factors identified with high blood cholesterol and the development of CHD are dietary fat, particularly saturated fatty acids and cholesterol, and energy imbalance leading to obesity. Other dietary constituents, such as fiber or alcohol, may interact with these factors in ways that are not clearly understood.

The relationship of dietary fat and cholesterol to CHD is supported by extensive and consistent clinical, epidemiologic, metabolic, and animal evidence. These studies strongly indicate that the formation of atherosclerotic lesions in coronary arteries—contributing to the risk for CHD—is increased in proportion to levels of total and LDL (low density lipoprotein) cholesterol in blood, which, in turn, are increased by diets high in total and saturated fat but decreased by diets containing polyunsaturated and/or monounsaturated fat. International epidemiologic comparisons and migration studies have revealed strong associations of fat, especially saturated fat, intake to development of elevated blood cholesterol levels, atherosclerosis, and CHD. Evidence from studies within a given population has been less consistent but points in a similar direction. Dietary intervention trials in men with elevated blood cholesterol levels have demonstrated small but significant proportionate improvements such that each 1 percent reduction in total blood cholesterol is accompanied by about a 1.5 percent reduction in heart disease risk. Intervention to lower elevated blood cholesterol levels has been shown in both human and animal studies to reduce CHD risk and to slow lesion progression. Animal studies have shown lesion regression,

^aThe material in Appendix D is taken from the concluding sections of each of chapters 2 through 19 of the full Report.

and there is suggestive evidence from some clinical studies that this also occurs in humans.

Taken together, these studies provide strong support for recommendations for an overall considerable decrease in dietary fat intake by the general public from the present level of 37 percent of total caloric intake and decrease in saturated fat from the present level of about 13 percent of total caloric intake.

Although the effect of dietary cholesterol on blood cholesterol is somewhat weaker and more variable among individuals than that for dietary saturated fatty acids, a reduction in the amount of cholesterol consumed by the general public from present average levels of approximately 305 mg/day for women and 440 mg/day for men seems appropriate.

Obesity is associated with such CHD risk factors as elevated LDL and total blood cholesterol, lower HDL (high density lipoprotein) cholesterol, high blood pressure, and diabetes mellitus. It is also a significant independent predictor of CHD, especially in women and in persons under age 50. Thus, current evidence suggests that an overall decrease in the prevalence and severity of overweight in the population, through both a decrease in caloric intake and an increase in caloric expenditure, is advisable on the basis of the relationship of obesity to heart disease risk.

Studies of animal protein, coffee, and sugar have shown variable associations with increased blood lipid levels, but present evidence of their relationship to CHD, if any, is too weak and insufficient to draw implications for changes in the consumption of these substances. Likewise, evidence from some studies that certain components of dietary fiber and omega-3 fatty acids from fish oils reduce blood cholesterol levels and heart disease risk is too preliminary to recommend changes in average intake of these substances. In addition, advice concerning vitamin and mineral supplements on the basis of their relationship to CHD is unwarranted.

Special Populations

There is a need to identify those individuals with high cholesterol levels, who are therefore at greatest risk. For individuals whose high total and LDL cholesterol levels warrant treatment, the first line of intervention is diet therapy. The recently released National Cholesterol Education Program guidelines on the treatment of high blood cholesterol in adults recommend that intensive dietary treatment should generally be carried out for at least 6 months. As indicated in this Report, only after that period of time,

and if the cholesterol level remains significantly high, should the addition of drugs to the dietary regimen be considered. Even then, continuation of diet therapy can reduce the need for drugs and thus their risk of side effects and cost. Furthermore, studies in persons with CHD suggest that diets low in fat, saturated fat, and cholesterol can retard the progression of the disease, including recurrent heart attacks, and perhaps induce regression of atherosclerotic lesions. Persons with such high blood cholesterol levels should receive dietary guidance by qualified health professionals.

Adults with total cholesterol levels of 240 mg/dl or above (whose LDL cholesterol levels are also significantly elevated), and those with total cholesterol levels of 200 to 239 mg/dl with CHD or two or more CHD risk factors should begin a program of supervised dietary treatment. The NCEP guidelines recommend starting dietary therapy with a step-one diet, in which the intake of total fat is less than 30 percent of calories, saturated fat is less than 10 percent of calories, and cholesterol is less than 300 mg/day. If after 3 months on this diet cholesterol lowering is insufficient, the person should progress to a step-two diet, in which saturated fat is further reduced to less than 7 percent of total calories and cholesterol intake is further reduced to less than 200 mg/day.

Although in epidemiologic studies light to moderate alcohol consumption is associated with reduced heart disease risk, a cause-and-effect relationship has not been proved. Since heavy drinking has numerous adverse health consequences (see chapters on maternal and child nutrition and on alcohol), including several on the cardiovascular system, the use, even in moderate quantities, of alcohol for its possible beneficial effects on CHD is not recommended.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in CHD supports the need for manufacturers to increase the number of food labels with their total fat, fatty acids, and cholesterol content.

Food Services

Evidence related to the role of dietary factors in CHD suggests that the public would benefit from increased availability of foods low in fat, saturated fat, and cholesterol in food service programs. The need is critical for the one in four persons with cholesterol levels that put them at appreciably high risk for CHD.

Food Products

Evidence related to the role of dietary factors in CHD suggests that food manufacturers should increase availability of foods and food products that are low in fat, saturated fat, and cholesterol.

Special Populations

Persons with high blood cholesterol and their food preparers should be given access to counseling by qualified health professionals and assistance in the development of diets low in fat, saturated fat, and cholesterol as well as in the appropriate balance of caloric intake and expenditure. Education and training opportunities for health professionals should be expanded to meet this need.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in CHD should include investigations into:

- The identification and management of individuals with high blood cholesterol in the general population.
- The most effective educational and dietary intervention strategies to reduce blood lipid levels and heart disease risk.
- Improved methods for assessing American dietary patterns in relation to CHD risk.
- Refinement of current dietary recommendations, including evaluation of other potentially efficacious dietary regimens, evaluation of dietary fiber, and optimal intakes of omega-3 and omega-6 fatty acids to prevent CHD.
- The mechanisms by which alterations in dietary fatty acids affect atherogenesis and the risk for CHD, including degree of saturation, chain length, and fatty acid series.
- Clarification of the role of dietary cholesterol in atherogenesis, including variability in response, effects on cholesterol metabolism in both fasting and postprandial states, and interactions of postprandial lipoproteins and lipoprotein remnants with cells of the arterial wall.

High Blood Pressure

Dietary Guidance

General Public

Dietary factors that clearly contribute to high blood pressure include obesity and excessive intake of sodium and alcohol. The average daily sodium consumption of 4 to 6 g by adult Americans is substantially above the National Research Council's recommended range of 1.1 to 3.3 g for safe and adequate intake and is 5 to 10 times higher than the amount required. Many individuals are able to maintain normal blood pressure levels over a large range of sodium intake; the lack of known harm from moderate sodium restriction, however, and the potential benefit to people whose blood pressures rise with increased sodium intake suggest that those who ingest excess sodium—most Americans—should consider reducing their dietary sodium intake.

The strong association between obesity and hypertension and the demonstrated reduction in blood pressure that occurs with weight loss suggest that maintenance of desirable body weight should be a goal for the population.

Similarly, there is a direct association between blood pressure and alcohol consumption beyond about two standard-sized drinks daily. (One standard-sized drink is defined as 12 oz of regular beer, 5 oz of wine, or 1½ oz of distilled spirits.)

Some evidence indicates that a reduction in blood pressure is associated with increased dietary intake of potassium, calcium, magnesium, and fiber. This evidence is, as yet, too preliminary to recommend increased intake of these factors for the general population for the purpose of hypertension control. Likewise, although increased intake of certain lipids (e.g., omega-6 or omega-3 polyunsaturated fatty acids) may decrease blood pressure, additional research is needed before any recommendations can be made.

Special Populations

Achieving and maintaining desirable body weight and moderating sodium and alcohol intake can lower blood pressure in patients with mild and moderate hypertension and reduce the need for antihypertensive medications. Such patients should be informed of the likely benefit of these dietary practices, along with the importance of adequate caloric expenditure

through exercise, and the moderation of fat intake, especially saturated fatty acids, to reduce high blood cholesterol levels and the risk for heart attack.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in hypertension supports the need for nutrition labeling on a wide selection of foods so that the consumer has the option of choosing foods with known amounts of calories and sodium.

Food Services

Evidence related to the role of dietary factors in hypertension suggests that food service programs should provide adequate choices of foods that provide essential nutrients and energy to maintain desirable body weight and should include foods that are low in sodium.

Food Products

Evidence related to the role of dietary factors in hypertension suggests that food manufacturers should continue to reduce sodium in products and continue the research and development of products low in calories and sodium.

Special Populations

Counseling and assistance in the selection and preparation of foods low in sodium and calories and assistance with the development of dietary patterns that control energy, sodium, and alcohol should be available to individuals whose blood pressure places them in the mild-to-moderate as well as high range of hypertension.

Research and Surveillance

Special priority is attached to the following research and surveillance tasks related to the role of diet in hypertension:

- Development of practical methods for the rapid and reliable identification of individuals at high risk for hypertension because they are salt sensitive.
- Investigation of the interactions of sodium with other nutrients—such as potassium, calcium, chloride, magnesium, fatty acids, and fiber—in influencing blood pressure.

- Investigation of the role of specific dietary factors, including potassium, calcium, fatty acids, fiber, amino acids, trace elements, and alcohol, in the cause and potential prevention of hypertension and the mechanisms for these effects.
- Investigation of the mechanism of obesity-associated hypertension and determination of the ratio of fat to lean body mass that might prevent development of hypertension.

Cancer

Dietary Guidance

General Public

The dietary factors evaluated for the possible relationship to cancer risk are fat, calories, fiber, foods high in vitamin A and carotenoids, and alcohol. Roles for vitamin C, vitamin E, selenium, protein, and salt-cured, salt-pickled, and smoked foods have been proposed.

Studies of carcinogen-induced tumorigenesis in experimental animals and international epidemiologic comparisons have provided substantial but not conclusive evidence that dietary fat increases the risk for cancers of the breast, colon, rectum, endometrium, and prostate. The results of epidemiologic investigations within more homogeneous population groups, however, are inconsistent. Because fat contains more than twice the calories per given quantity of protein or carbohydrate, high-fat diets are generally high in calories. Despite such complications, the animal and international epidemiologic data suggest that a decrease in fat consumption by the general public from the current 37 percent of total caloric intake might reduce the risk for certain cancers.

Results from animal and human studies of obesity and cancer are not wholly consistent, perhaps because of the difficulty of separating the effects of calories, fat, and body weight. Furthermore, the level of caloric restriction that seems effective in preventing cancer in most animal studies is at a food intake level not advisable for most humans. Consistent with other health recommendations, maintenance of desirable weight is recommended and may potentially decrease the risk of breast, colon, prostate, and endometrial cancers.

Correlational epidemiologic studies suggest an association between diets low in fiber and increased risk for colon cancer, while results from case-control studies are mixed. Studies in experimental animals indicate that

further research is needed on the effects of different types of fiber. While inconclusive, evidence suggests that an overall increase in intake of foods high in fiber might decrease the risk for colorectal cancer. Despite the need for additional evidence, this recommendation is consistent with guidance for reducing gastrointestinal disease.

Likewise, epidemiologic studies provide suggestive evidence that consumption of foods containing carotenoids, including the beta-carotene precursor of vitamin A, protects against development of epithelial cell cancers such as those of the oral cavity, bladder, or lung. These studies have generally shown lower rates of cancer among individuals consuming the highest overall levels of vitamin A, carotenoids, or fruits and vegetables. These studies have not distinguished the specific form of vitamin A associated with protection, nor have they ruled out the possibility of protection from as yet unidentified components of fruits and vegetables. Until the results of clinical trials examining these relationships become available, an increase in consumption of fruits and vegetables might benefit persons who now consume below-average amounts of these foods. There is no evidence that vitamin A in amounts greater than the RDA is beneficial.

Despite some difficulties in distinguishing the cancer-producing effects of excessive alcohol intake from those of cigarette smoking, evidence suggests that a reduction in alcohol intake among the portion of a population that drinks most heavily would help to reduce the prevalence of cancers of the mouth, esophagus, pharynx, and perhaps other sites.

Excessive selenium intake is toxic. This fact and limitations in information about selenium intake in the general population suggest that selenium intake should not be increased above levels now in the average diet.

Although some epidemiologic studies suggest an association between dietary protein and cancer incidence, these studies are limited and not consistently supported by animal evidence. Thus, the evidence does not justify a recommendation to the general public to decrease protein on the basis of its relationship to cancer.

There is some suggestive but not conclusive evidence that correlates consumption of salt-pickled, salt-cured, and smoked foods with stomach and esophageal cancers, indicating that the public should continue to limit its intake of these foods to the current low levels of consumption.

Special Populations

Persons at high risk for diet-related cancers because of family history, obesity, or excessive alcohol intake should receive counseling from qualified health professionals to design approaches that could reduce their elevated risk for cancer.

Patients with cancer should receive appropriate nutritional support and dietary advice to maintain optimal nutritional status throughout medical, surgical, or radiological therapy. There is no credible evidence that nutritional changes specifically help in the cure of cancer patients.

Children and older persons are not currently targeted by the dietary guidelines relative to cancer risk due to limited data for these groups.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in cancer suggests that food manufacturers should include on package labels information about nutritional content of the food, especially for fat and carbohydrate components (and including fiber components to the extent permitted by analytical methods).

Food Services

Evidence related to the possible role of dietary factors in cancer suggests that the public might benefit from increased availability of foods low in fat and high in fiber.

Food Products

Evidence related to the role of dietary factors in cancer suggests that foods low or reduced in calories and fat and high in fiber should be made increasingly available by food manufacturers.

Special Populations

Persons with cancer should be provided with counseling and assistance in the development of diets appropriate to their condition.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in cancer should include investigations into:

- Molecular mechanisms of carcinogenesis and the ways in which initiating or promoting events may be affected by specific components of dietary fat, fiber, protein, alcohol, vitamin A, carotenoids, and other vitamins or minerals.
- Quantitative relationships between food and nutrient intake and cancer incidence through chemoprevention and dietary clinical trials.
- The effect of specific components of dietary fat, fiber, vitamin A, and carotenoids on cancer etiology.
- Interactions between dietary factors such as fat, fiber, calories, protein, and specific vitamins and minerals in cancer prevention and causation.
- Development of biochemical markers of dietary intake to better monitor effects of dietary intervention on cancer risk.
- Patterns of food intake best associated with cancer prevention.
- Development of national population data on food and nutrient consumption patterns and specific cancer rates, including more accurate assessment of intake of specific dietary factors within relatively homogeneous population groups.
- Levels of carcinogenic and mutagenic substances in the food supply.
- Dietary guidance methods that are most effective in helping people improve patterns of food intake.
- The causes of wasting and malnutrition in cancer patients and the effects of nutritional support on response to therapy and survival in these patients.

Diabetes

Dietary Guidance

General Public

Obesity greatly increases the risk for developing Type II diabetes, and obesity is in turn related to caloric imbalance: excessive intake of energy and/or insufficient energy expenditure. Because dietary fat contains more than twice the calories of either protein or carbohydrate, a reduction in fat

intake should lead to a more favorable caloric balance, especially when this dietary change is accompanied by appropriate levels of physical activity. Controlling obesity by reducing dietary fat intake should help reduce the prevalence of Type II diabetes and is also consistent with dietary recommendations for the prevention of coronary heart disease, hypertension, and some types of cancer.

Special Populations

Overweight persons with Type II diabetes benefit substantially from weight loss and may accrue benefits when fat, salt, alcohol, and simple sugars are reduced in combination with an appropriate increase in foods containing complex carbohydrates and soluble fiber. Even moderate weight loss, accomplished by reducing caloric intake and increasing energy expenditure, reduces blood glucose and insulin toward normal levels.

Current research suggests that diets relatively low in fat and cholesterol, salt, and protein can reduce the risk of the long-term cardiovascular, hypertensive, and renal complications of diabetes, respectively. Persons with diabetes and concurrent insulin-induced hypoglycemia, neuropathy, or poor metabolic control should avoid alcohol. Although research has not unequivocally established that complex carbohydrates and fiber improve blood glucose and insulin levels in individuals with diabetes, diets higher in these substances are generally lower in fat, cholesterol, and calories, and they are associated with lower blood lipid levels and, therefore, lower risk for coronary heart disease. Such diets can help reduce high blood cholesterol levels and the risk for coronary heart disease. Until similar uncertainties about the metabolic effects of sugar in persons with diabetes are resolved, prudence dictates caution in the amount of its use. Research on dietary management of Type I diabetes emphasizes the importance of weight maintenance, avoidance of hypoglycemia, and metabolic control by coordinating caloric intake and expenditure with the schedule of insulin administration. Information, counseling, and followup on the appropriate application of these dietary principles and guidance for dietary management should be provided to persons with diabetes by qualified health professionals.

Nutrition Programs and Services

Food Labels

The food industry should be encouraged to provide nutrition information on the labels of most food products. The information on calories, fat (especially saturated fat), and other nutrient content will help the public to

control caloric intake and will help persons with diabetes to make the necessary dietary modifications their physicians recommend.

Food Services

Evidence related to the role of dietary factors in diabetes currently holds no special implications for policy changes in food service programs.

Special Populations

Persons with diabetes of either type should be provided with counseling and assistance with dietary changes to control their disease. This should be coordinated with other aspects of their health care needs, such as insulin administration and levels of physical activity.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in diabetes should include investigations into:

- The role of calorie intake and physical activity, and subsequent weight control, in the prevention of Type II diabetes.
- The metabolic consequences of obesity.
- The metabolic mechanisms of intestinal and hepatic processing of dietary carbohydrate, and the effects of other nutrients and of fiber on carbohydrate metabolism.
- The influence of dietary carbohydrates on glycemic responses in persons with diabetes, and the effects of such responses on development of the cardiovascular, renal, retinal, and neurologic complications of this condition.
- The influence of specific dietary factors—fat, cholesterol, sugar, protein, fiber—on development of the cardiovascular, renal, retinal, and neurologic complications of diabetes.
- The long-term risks and benefits of non-nutritive sweeteners as aids to adherence to dietary regimens.
- The behavioral and environmental factors that influence adherence to weight loss and dietary regimens in persons with diabetes.
- The specific educational techniques that will improve acceptance of and adherence to therapeutic regimens.

Obesity

Dietary Guidance

General Public

Excess weight or overweight occurs when too few calories are expended and too many consumed for individual metabolic requirements. The extraordinarily high prevalence of obesity in the United States—one-fourth of American adults are overweight and nearly one-tenth are severely overweight—coupled with its role as a risk factor for diabetes, hypertension, coronary artery disease and stroke, gallbladder disease, and some types of cancer, suggests that a reduction in the average weight of the general population would improve the Nation's health. Americans, in general, would benefit from a lifestyle that includes more physical activity and a diet containing fewer calories.

Because fat contains more than twice the caloric value per gram of either protein or carbohydrate, the general public would benefit from reduced fat intake. In addition, it may be difficult to meet essential vitamin and mineral requirements on low-calorie diets. Because sugar and alcohol provide calories from carbohydrate but no other nutrients, individuals seeking to attain and maintain desirable body weight should use these substances sparingly.

Evidence indicates that exercise burns calories, increases the proportion of lean to fat body mass, and, therefore, raises the metabolic rate. Therefore, increased levels of physical activity are important for attaining desirable body weights among the general population.

Special Populations

Qualified health professionals should evaluate overweight persons for the presence of chronic disease risk factors—especially elevated blood cholesterol, blood glucose, or blood pressure. Such evaluation is important for individuals whose excess body fat is distributed mainly on the abdomen. This pattern is more typical for men than for women, and it increases risks for diabetes, high blood pressure, hyperlipidemia, and heart attacks.

Health professionals should work with obese persons to restrict caloric intake and to increase caloric expenditure. Such advice should also be provided to overweight persons, with or without other significant risk factors, to help reduce their risk for heart disease, stroke, some kinds of cancers, and many other diseases and to prevent or reduce psychosocial

complications of obesity. Professional guidance is recommended because many popular means to reduce weight may themselves pose risks to health and because unsupervised efforts to control obesity usually fail over the long term. Although excess body fat is difficult to lose, current research suggests that long-term individual or group programs that facilitate behavioral changes in diet and exercise are most likely to be effective. The intensity of these programs and the precise goal for weight loss should depend on the patient's degree and distribution of overweight, weight history, chronic disease risk factors, health status, and personal choices.

Current evidence is insufficient to recommend similar programs for overweight children. Obesity in infancy and childhood increases the risk for adult obesity, but most overweight children will not become obese. Because no method now exists to predict which children will develop obesity as adults, because research has not yet identified effective methods to prevent adult obesity, and because children require adequate energy and nutrients to develop and grow normally, low-calorie diets should not be generally recommended for this group. Instead, they should be reserved for children with elevated risk factors for chronic disease. For most overweight children and their families, qualified health professionals should provide counseling and assistance in developing diets that contain adequate, but not excessive, calories and social and physical activities in which the child enjoys participating.

Nutrition Programs and Services

Food Labels

Evidence related to the role of diet in obesity indicates that calorie information should be provided on most food product labels.

Food Services

Evidence related to the role of diet in obesity suggests that service programs should include a variety of foods low in calories in their menus.

Food Products

Evidence related to the role of diet in obesity suggests that the food industry should continue to develop food products low in calories and with adequate nutrient content.

Special Populations

Overweight patients should be provided with counseling and assistance in the development of diets low in calories and high in essential nutrients, as

well as lifestyle modifications that include high levels of physical activity to achieve appropriate weight goals.

Research and Surveillance

Research and surveillance issues of special priority related to the role of nutrition and exercise in obesity and weight management should include investigations into:

- Determination of ideal or desirable body weights for individuals or for the population of various ages.
- Determination of the health risks associated with various degrees of overweight in children and adults.
- Identification of an effective means to measure total body fat and its regional distribution in individuals and in the population.
- Identification of the types of obesity most associated with increased chronic disease risk.
- The contribution of genetic and metabolic factors to obesity, including the molecular and genetic basis of energy metabolism and the nature of genetic aberrations in human obesity.
- The effects of diet, exercise, and weight loss on metabolism and thermogenesis.
- The effects of physical activity on maintenance of desirable body weight.
- The identification of dietary, behavioral, environmental, or genetic factors that predict development of obesity or the ability to lose weight successfully.
- Identification of the dietary, behavioral, environmental, social, or genetic factors that increase the risk of overweight in high-risk population groups.
- The health consequences of repeated cycles of weight gain and loss.
- The most effective individual, group, and community intervention strategies for weight management.
- The most effective intervention strategies for use with high-risk groups.
- The most effective means by which to educate individuals and the public about the factors predisposing to weight gain and loss.
- The most effective ways in which to promote increased physical activity in the population.
- The long-term effectiveness of existing weight control programs.

Skeletal Diseases

Dietary Guidance

General Public

The prevalence, health consequences, and expense of osteoporosis among Americans make it a compelling public health priority. Dietary factors of particular concern are calcium, phosphate, vitamin D (and its hormonally active form calcitriol), protein, sodium, calories, and alcohol. How these factors affect peak bone mass development is important and requires further investigation. Other lifestyle factors that may decrease the risk for osteoporosis include increased exercise and decreased cigarette smoking. In postmenopausal women, estrogen-replacement therapy has been the best documented method of preventing osteoporosis.

The dietary factors associated with bone mass, the universality of bone loss with age, the interaction of diet and lifestyle with genetic factors, and the difficulties in measuring bone loss in populations make defining the relationship between diet and osteoporosis difficult. However, evidence suggests that, particularly during the first three to four decades of life, ingesting adequate calcium, maintaining appropriate body weight, exercising, restricting alcohol, and avoiding cigarette smoking are appropriate public health strategies for prevention of osteoporosis.

Most interest in the dietary control of osteoporosis focuses on calcium. Although current epidemiologic and clinical evidence is uncertain, chronic low calcium intake may decrease peak bone mass, especially during adolescence. Surveys indicate that dietary calcium intake of adolescent girls is one-third or more below the 1,200 mg/day recommended for this population and that adult women of reproductive ages also consume less than the recommended 800 mg/day. Although the ideal level of calcium intake for development of peak bone mass is unknown, and although it has not yet been established whether increased calcium intake will prevent osteoporosis, females, particularly adolescents and young adults, in the United States should increase food sources of calcium. The public should also be educated about the calcium content of various foods, particularly low-fat dairy products, and should maintain adequate calcium intake at all ages.

Additional study of the epidemiologic association between diets high in protein and increased prevalence of osteoporosis is required to make further conclusions.

Special Populations

Children, pregnant and lactating women, and older people have special needs for calcium based on, respectively, the extra skeletal demands of growth, milk production, or the age-related decrease in absorption of calcium. Older Americans consume amounts of calcium that average as much as 40 percent below current recommendations of 800 mg/day. Postmenopausal women should receive counseling on supplemental use of estrogen, and all groups should receive information about calcium-rich foods. People who take calcium supplements also need education on appropriate use, side effects, the forms in which they are best absorbed, and interactions with other medications.

Nutrition Programs and Services

Food Labels

Present evidence on the role of dietary factors in skeletal disease has no special implications for change in policy related to food labeling. However, nutrition labeling, which lists calcium and other nutrient content, should be encouraged on most food products.

Food Services

Aside from the special populations noted below, evidence related to the role of dietary factors in skeletal diseases currently holds no special implications for change in policy related to food service programs.

Food Products

Foods abundant in calcium are widely available in the United States. However, the diversity of U.S. dietary patterns suggests the possibility of calcium fortification of a limited number of foods. These additions should be carefully selected to avoid excessive calcium in the food supply. Fortification should be chosen based on the frequency of consumption of a food by the targeted populations, and the calcium should be in a physiologically available form. It is important to continue fortification of suitable foods with vitamin D because this has been instrumental in reducing the prevalence of rickets and osteomalacia in the United States.

Special Populations

Food services offered to children, adolescents, and young adults should provide diets with sufficient calcium to enhance achievement of peak bone

mass. Persons who are unable to convert vitamin D to its active form may require supplementation with calcitriol. Those with chronic malabsorption syndromes may require supplementation with calcium or calcitriol.

Whether calcium, vitamin D, or calcitriol should be provided to older women to prevent or delay postmenopausal bone loss is as yet uncertain. Although evidence for the precise role of physical activity in prevention of osteoporosis is still emerging, it seems reasonable to include exercise as a component of any program to enhance the skeletal integrity of older Americans. Older persons should be encouraged to maintain regular activities such as walking and other weight-bearing exercise.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in skeletal diseases should include investigations into:

- Changes in calcium and phosphate requirements throughout life.
- The effects of altering proportions of phosphate and protein on calcium requirements and bone mineralization.
- The effects of increased calcium intake on peak bone mass and on prevention of postmenopausal bone loss.
- Potential toxicities of high-dose supplements of calcium.
- The development of calcium sources with improved bioavailability.
- Safe and adequate levels of vitamin D added to the food supply.
- The relationship of vitamin D and its metabolites to calcium in the development of peak bone mass and prevention of bone loss.
- The levels of vitamin D and its metabolites, fluoride, and calcium that are safe and adequate for the treatment of osteoporosis.
- The effects of moderate and excessive alcohol intake on bone mineral metabolism.
- The effects of various levels of physical activity on loss of bone mass.
- The relationship of other vitamins and minerals to peak bone mass and to prevention of bone loss.

Dental Diseases

Dietary Guidance

General Public

Dietary factors of principal interest in dental diseases are sugars and fluoride. Frequent consumption of sugars, especially sucrose, promotes formation of dental plaque, the key predisposing cause of both caries and periodontal disease. In the United States, the daily intake of sugars ranges on average from 62 to 143 g, or 18 to 32 percent of total caloric intake. Evidence exists that sugars as they are consumed in the average American diet contribute to the development of dental caries, suggesting that the general public should reduce its sugar consumption.

The role of fluoride in prevention of tooth decay is also well established from animal studies and from human epidemiology and clinical trials. Although fluoride is present in foods, the most efficient source of this nutrient for the general public is community drinking water that naturally contains fluoride at an optimal level or to which fluoride is added to achieve the optimal level. Most, but not all, water supplies can be fluoridated, and current recommendations for optimum fluoride concentrations vary from 0.7 to 1.2 ppm depending on regional variation according to prevailing air temperature. Conclusive evidence shows that such levels of fluoride are safe.

Although other nutrients such as vitamin A, vitamin C, calcium, and phosphate may also be associated with prevention of dental diseases, evidence is insufficient at this time to recommend changes in dietary patterns on the basis of their relationship to these conditions for the general public.

Special Populations

Persons with diminished salivary flow are at special risk for caries and periodontal disease. They also may be unable to wear removable dental prostheses due to the lack of lubrication by saliva. Artificial saliva preparations containing fluoride and topical fluoride gels help to prevent tooth decay in such persons and can be recommended as an adjunct to sugar-restricted diets and appropriate dietary counseling. Children over the age of 6 months are at risk for nursing bottle caries, and their parents and caregivers should receive guidance in dietary and behavioral approaches to prevent this condition. Evidence related to the benefits of fluoride con-

sumption by pregnant women on subsequent tooth development of the fetus is insufficient to recommend fluoride supplementation during pregnancy. Individuals with diabetes are especially prone to periodontal infections and should take special care to use available dietary and therapeutic means to control disease.

Nutrition Programs and Services

Food Labels

The presence and relative amount of added sugars, especially sucrose, contained in processed foods, as indicated by ingredient lists on food labels, should continue to play an important role in identifying dietary factors associated with dental disease.

Food Services

Evidence related to the role of dietary factors in dental disease suggests that food service programs should provide optimally fluoridated drinking water and promote noncariogenic foods, especially in programs for populations at high risk for dental diseases.

Special Populations

Persons with an active history of dental caries or with reduced salivary flow and parents of young children should be provided with counseling and assistance in developing diets low in cariogenic foods and in accessing appropriate sources of fluoride. Persons with diabetes are especially prone to periodontal infections and should take special care to use available dietary and therapeutic means to control their disease (see chapter on diabetes).

Research and Surveillance

Research and surveillance issues of priority related to the role of diet in dental diseases should include investigations into:

- The definition of critical periods of development of dental tissues that may be sensitive to nutrient intake.
- The role of nutritional factors in the maintenance and repair of the periodontium and oral tissues.
- The relationship between nutritional imbalances during tooth development and the formation of tooth lesions or defects that may increase caries susceptibility in children.



- The role of nutrition and nutritional status in the etiology and pathogenesis of dental diseases in older persons and other high-risk populations.
- The relationship between nutrition and both the immune and the nonspecific defense mechanisms of oral tissues and fluids.
- The most effective means to educate the public on the role of water fluoridation, diet, and dental care in preventing dental diseases.
- The mechanisms of fluoride action in the prevention of dental disease or osteoporosis.
- The effect of dietary factors such as vitamin A, vitamin E, and alcohol on the initiation and progression of oral cancers.
- Epidemiologic methods to determine the correlation between malnutrition and dental caries and/or periodontal disease.
- The role of calcium in the etiology and/or prevention of residual ridge resorption and periodontal disease.
- Estimation of the levels of fluoride from all sources in the diets of children.
- Estimation of the extent of dental fluorosis in the population.

Kidney Diseases

Dietary Guidance

General Public

Nutrients of particular interest in the occurrence of renal disease are protein, phosphate, and certain fatty acids. Although there is evidence in animals and humans that protein restriction can retard the progression of end-stage renal disease, there is no evidence that current protein intakes by the American population adversely affect the prevalence of renal disease.

Dietary phosphate restrictions have been noted to retard the progression of renal disease, but there is not sufficient evidence to indicate a role in the prevention of this condition. Nor may any implications be drawn for the general public on the relationship of dietary fatty acids intake to renal disease. Suggestions that certain lipids may increase the progression of renal disease have yielded conflicting research results.

Special Populations

Protein restriction is a therapeutic measure prescribed for patients with advanced renal disease, and end-stage renal disease patients on dialysis must follow a protein-, potassium-, and phosphate-restricted maintenance diet. A qualified health professional should provide information to such patients on using these diets appropriately.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in renal disease currently holds no special implications for change in policy related to food labeling.

Food Services

Evidence related to the role of dietary factors in renal disease currently holds no special implications for policy changes in food service programs.

Special Populations

Patients with renal disease should receive counseling and assistance in developing diets low in protein and low in phosphate. Those with renal stones should receive advice on diets that reduce excretion of stone-promoting factors (purines and excessive calcium) and should receive recommendations for a high daily fluid intake in excess of two liters.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in renal disease should include investigations into:

- The ability of low-protein diets to retard the decline of renal function in normal aging.
- The mechanisms by which dietary protein affects renal function.
- The relationship of the role of dietary protein to that of phosphate in its effect on kidney function.
- The mechanisms by which other nutrients such as fatty acids or amino acids might affect renal function.
- The use of various diets—such as those low in protein or phosphate—to retard the rate of progression of renal failure.

- The relative merits of specialized formula diets, pharmacologic therapy, and traditional low-protein diets in treating progressive renal failure.
- The causes of wasting, malnutrition, and other nutritional disorders that occur in renal failure.
- The treatment—with calories, amino acids, or drugs—of wasting, malnutrition, and other nutritional disorders that occur in renal failure.
- The interplay of dietary factors (such as calcium, vitamin D, phosphate, protein, and oxalate) in the etiology of renal stones.
- The effect of omega-3 fatty acids in preventing the immune inflammatory response in chronic renal disease.
- The regulatory mechanisms in the utilization and metabolism of keto-acids in humans.
- The impact of reduced protein/amino acid intake on the quantitative dynamic status of protein and specific amino acid metabolism in organs and the entire body.
- Lipid metabolism as affected by reduced protein and amino acid intake.
- The role of lipids in the progression of chronic renal disease: lipid turnover by renal cells, effect on tubular growth and function, relationship of hyperlipidemia to renal injury, and effect of drugs in the treatment of hyperlipidemia.
- Control of renal growth and impact of nutrition on renal mass.
- Mechanisms that produce toxicity of uremia and consequences of uremic symptoms.
- Effect of protein restriction, as opposed to total calorie restriction, on renal injury.

Gastrointestinal Diseases

Dietary Guidance

General Public

Dietary fat, fiber, and alcohol are significant factors associated with gastrointestinal diseases, although the great variety of these conditions makes generalizations difficult. Because diets that contain a large proportion of calories from fat may be low in fiber, it is often difficult to separate the effects of these substances on gastrointestinal disease. Thus, current evidence on whether dietary fiber helps prevent diverticulosis is not con-

clusive. Similarly, whether dietary fiber helps prevent inflammatory or irritable bowel disease is uncertain. Nevertheless, evidence that dietary fiber helps treat and prevent constipation and manage chronic diverticular disease suggests the prudence of consuming diets higher in fiber and lower in fat.

The strong cause-and-effect association between excessive alcohol consumption and the development of chronic liver disease and cirrhosis (as reviewed in the chapter on alcohol) emphasizes that persons who consume alcoholic beverages should do so in moderation. Epidemiologic associations between diet and some types of gastrointestinal cancer (as reviewed in the chapter on cancer) suggest—but do not yet prove—that consuming less fat and alcohol and more fiber would help reduce the risk for these cancers.

Evidence on the role of dietary factors in the development of gastric or duodenal ulcers or reflux esophagitis is insufficient to make recommendations at this time.

Special Populations

Higher intakes of dietary fiber can prevent or relieve symptoms of constipation and chronic diverticular disease. Qualified health professionals should inform persons with these conditions about foods with relatively high fiber contents. Individuals with celiac disease should be provided with information on foods free of wheat gluten. Those with inflammatory bowel disease, irritable bowel syndrome, lactose intolerance, gallbladder disease, heartburn, and ulcers should be provided with guidance on diets appropriate to their conditions.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in gastrointestinal disease suggests that food manufacturers should include on package labels information about nutritional content of the food, especially for fat and carbohydrate components (and including fiber components to the extent permitted by analytical methods).

Food Services

Evidence related to the role of dietary factors in gastrointestinal diseases suggests that food services should include provisions for adequate intake of high-fiber and low-fat foods.

Food Products

Evidence related to the role of dietary factors in gastrointestinal diseases suggests that the public would benefit from additional products that are low in fat and calories and higher in fiber.

Special Populations

Persons with gastrointestinal diseases should receive counseling and assistance in developing appropriate diets for their particular condition. Qualified health professionals should provide appropriate training and enteral or parenteral nutritional support to persons with conditions that prevent food ingestion, cause malabsorption, or impair bowel function.

Research and Surveillance

Research and surveillance issues of special priority related to dietary factors affecting gastrointestinal function and diseases of the gastrointestinal tract should include investigations into:

- The prevalence of gastrointestinal diseases among the population.
- The influence of dietary factors such as specific dietary fibers, fat, and calories on development and function of the digestive tract.
- The influence of dietary factors on the development and release of enzymes and hormones that affect gastrointestinal function.
- The role of intestinal flora on nutrient bioavailability.
- The most effective nutrient-related interventions to improve the recovery of intestinal function following episodes of malnutrition or disease.
- The mechanisms by which dietary fiber may work in the prevention and treatment of bowel cancer, appendicitis, diverticular disease, gallbladder disease, and other gastrointestinal conditions.
- The identification of specific dietary factors that might influence the causation, prevention, and treatment of celiac disease, inflammatory and irritable bowel syndromes, ulcers, and other gastrointestinal disorders.
- The most effective means to achieve dietary counseling to help alleviate gastrointestinal disorders.

Infections and Immunity

Dietary Guidance

General Public

Adequate nutrient and energy intake is critical to the maintenance of optimal immune function. However, evidence related to the role of specific dietary factors such as fatty acids, vitamin C, or zinc is insufficient to recommend changes in dietary guidance policy for the general public. Evidence related to the role of microbial and chemical contamination of food and water in human health suggests that the general public should receive information on appropriate food handling and storage methods to prevent outbreaks of food-borne disease.

Although the overall public health significance of breastfeeding in the United States is uncertain, studies in developing countries have shown the importance of breastfeeding in preventing diarrheal diseases and in reducing their severity. The immune protection conferred by breastfeeding also helps reduce the severity of certain infectious diseases among infants. Breastfeeding should continue to be recommended to pregnant women and to new mothers as the optimal method of infant feeding.

Although the relationship between malnutrition and changes in immune function observed with aging is not well understood, it is clear that adequate intake of nutrients is basic to the adequate immune protection in older Americans.

Special Populations

Infections produce well-documented adverse effects on nutritional status, and nutritional rehabilitation restores immune function and reduces the severity of infectious disease complications. Thus, the nutritional status of persons with infectious illnesses should be assessed regularly, and appropriate nutritional support measures should be instituted whenever necessary. Qualified health professionals should advise persons with food allergies and intolerances on the diagnosis of these conditions and on diets that exclude foods and food substances that induce symptoms.

Nutrition Programs and Services

Food Labels

Evidence related to diet-immune function interactions reinforces the need for food manufacturers to include explicit and complete ingredient state-

ments to protect individuals who may have severe adverse reactions to foods.

Food Services

Current evidence about the role of dietary factors in the maintenance of optimal immune function currently has no special implications for change in policy related to food service programs. Evidence related to the spread of infections suggests that food service personnel should receive adequate training in sanitary food handling and storage procedures.

Food Products

Evidence related to diet-immune function interactions suggests that food product manufacturers should take special precautions to use good manufacturing practices to avoid contamination with ingredients that may produce severe reactions and to reduce microbial and chemical contamination during production and storage. Manufacturers should continue to develop new products that are free of substances likely to induce allergic symptoms in susceptible individuals.

Special Populations

Patients with infectious diseases should be treated as rapidly and effectively as possible to minimize the depletion of body nutrients. Convalescing patients should be counseled and assisted in the development of diets that provide adequate intake of nutrients to regain an appropriate nutritional status. Patients with food intolerances should be counseled and assisted in the development of diets that omit foods and food factors that induce symptoms.

Research and Surveillance

Research and surveillance issues of special priority related to interactions between diet, infection, and immunity should include investigations into:

- The mechanisms by which generalized malnutrition depresses the function of specific components of the immune system.
- The effects of deficient or excess intake of single nutrients such as vitamin A, zinc, iron, or dietary fat on specific elements of the immune system and on immune function.
- The mechanisms by which deficient or excess intake of single nutrients might depress or improve immune system function.
- The factors in breast milk that protect infants from infectious disease.

Nutrition and Health

- The role of breast milk in transmitting allergens, infectious agents, or toxicants such as drugs.
- The role of nutrition in maintaining adequate immune function in older persons.
- The mechanisms by which infectious diseases alter nutrient metabolism and impair nutritional status.
- The most effective means of restoring nutritional status to malnourished individuals recovering from infectious illnesses.
- The identification of natural food products and chemical additives that induce adverse physiologic responses and the mechanisms by which they do so.
- The basic biochemistry of food antigens and biologically active components.
- The effects of processing and digestion of food substances with conversion to or inactivation of allergenic fractions.
- The value of therapeutic procedures designed to induce tolerance to food antigens.
- The prevalence of food-borne infections and intolerances and immunologic reactions to food in the population.
- The identification of behavioral determinants of unsanitary food handling and storage procedures and the development of effective educational methods to prevent transmission of food-borne illnesses.
- The effect of nutritional status on susceptibility to infectious diseases, including HIV infection, and on the complications of AIDS.

Anemia

Dietary Guidance

General Public

Prevention of nutrition-related anemia depends on adequate dietary intake of iron, vitamin B₁₂, and folate as well as the full complement of other essential nutrients. Except for younger children and women of reproductive age, who are at greater risk for iron deficiency, it appears that current iron consumption levels are sufficient for most of the population.

Special Populations

Routine health care for infants and pregnant women, the groups at highest risk for anemia, should include laboratory evaluation for anemia and

nutritional advice on methods to ensure adequate iron intake. Nonpregnant women in their childbearing years and adolescents are also at greater risk for iron deficiency anemia; these individuals should be monitored and should receive special counsel on preventing iron deficiency. Frequent blood donors, another high-risk group, should be advised by blood bank personnel about dietary methods to enhance iron intake and absorption. Groups who may need iron supplements, such as premature infants, pregnant women, women with excessive menstrual bleeding, frequent blood donors, strict vegetarians, and regular aspirin users, should also receive advice from health professionals on enhancing iron bioavailability from the diet. Specific education efforts directed toward these special groups, even though difficult, are needed.

Folate deficiency anemia usually occurs among women late in the course of pregnancy, among small and premature infants, and among alcoholics. These groups, especially from low-income families, should receive advice about dietary and supplemental sources of this vitamin.

Strict vegetarians who consume no foods of animal origin, especially women who are pregnant or nursing, should be advised to consume supplemental sources of vitamin B₁₂.

Nutrition Programs and Services

Food Programs

Because groups that benefit from food programs are those at highest risk for anemia, such programs should continue to be made available to high-risk groups and should encourage consumption of foods rich in iron and folate. Evidence suggests that current levels of iron fortification are safe and adequate, and no changes should be recommended at this time.

Food Labels

Evidence related to the role of iron and folate in anemia suggests that food labels should indicate the content of these nutrients.

Special Populations

Patients with anemia should receive counseling and assistance to develop diets that have adequate amounts of bioavailable iron, folate, or vitamin B₁₂ from dietary or supplemental sources.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in anemia should include investigations into:

- Screening for earlier stages of iron deficiency using tests that identify iron depletion (e.g., erythrocyte protoporphyrin).
- Elucidation of the health consequences of conditions of iron depletion prior to development of anemia.
- Validation of methodologies for identification of the extent of deficiencies of iron, folate, and vitamin B₁₂ in the general population and in high-risk groups.
- Interactions between iron, folate, vitamin B₁₂, and other nutrients consumed in the diet.
- Improved methods for analysis of the folate content of food.
- Determination of iron requirements at various stages of the life cycle and under various physiologic conditions.
- Identification of appropriate levels and types of iron in the food supply for individuals with hereditary conditions of excess iron absorption.
- Identification of the level of iron intake that confers maximum protection against major infections.
- Determination of trends in iron fortification in the U.S. food supply.
- Development of effective methods to educate the general public and high-risk groups about consuming diets adequate in iron and folate.

Neurologic Disorders

Dietary Guidance

General Public

Nutrients of concern in stroke are those associated with its major diet-related risk factors—hypertension, diabetes, and obesity. Evidence suggests that diets low in sodium and alcohol, as well as caloric intake and physical activity to achieve and maintain desirable body weight, should be recommended as public health measures to prevent stroke and its related conditions. Excessive drinking has been associated with stroke; hence, this practice should be avoided. Although some evidence links very large exposures of major dietary components (e.g., amino acids, choline) to nervous system disorders other than stroke, this evidence is, for the most part, preliminary and remains to be confirmed by additional clinical evidence before implications can be drawn.



Over- or underconsumption of certain vitamins and minerals can damage the nervous system as in the occurrence in alcoholics of thiamin deficiency-related Wernicke-Korsakoff's syndrome.

Special Populations

Studies in patients with major diet-related risk factors for stroke indicate that similar dietary changes can reduce the level of the risk factor and help prevent cardiovascular disease (see chapters on high blood pressure, diabetes, and obesity). Qualified health professionals should provide patients with information on the means to achieve these changes. In addition to a focus on weight reduction and sodium restriction, this information should emphasize the importance of alcohol restriction in patients with high blood pressure and/or high glucose levels.

Suggestions that certain foods or food components might influence headache or epilepsy have yielded conflicting research results and are too preliminary to draw conclusions.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in stroke and other neurologic diseases supports the need for sodium labeling of packaged food products.

Food Services

Food service programs should emphasize diets low in sodium and calories to maintain ideal body weight and to control obesity and diabetes.

Special Populations

Patients at high risk for stroke and other neurologic conditions should be provided with counseling and assistance in the development of diets appropriate to their conditions.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in neurologic disease should include investigations into:

- The role of specific dietary factors in the etiology and prevention of stroke.

Nutrition and Health

- The relationship, if any, between specific dietary factors and specific brain functions such as memory, alertness, and response time.
- The mechanisms by which food components, such as dietary precursors of neurotransmitters and certain additives and toxins, might affect nervous system function.
- The role, if any, of specific dietary factors in the etiology and prevention of Alzheimer's disease.
- The nutritional needs of the brain and nervous system in health and throughout life.
- The effects of excessive intake of nutrients and supplements (vitamins A, B₆, etc.) on nervous system function.
- The mechanism or mechanisms by which excessive alcohol intake increases the risk for stroke.
- The ability of diets low in calories, sodium, alcohol, and, perhaps, other dietary factors to prevent stroke.
- The most effective methods to educate the public about diet-related risk factors for stroke, and to assist the public in making recommended dietary changes.
- The comparative effects of dietary insufficiency on cognitive function and neurologic disease.
- The understanding of the blood-brain barrier nutrient transport processes and the mechanisms by which diet may influence brain function and health.
- The role of preexisting nutritional disease and nutritional status on the impact of neurotoxins.

Behavior

Dietary Guidance

General Public

Behavioral factors clearly influence food selection, dietary change, and chronic disease risk, but research in this area is still too preliminary to draw more than a few implications for the general public; exceptions generally apply to specific chronic disease conditions. Similarly, beyond the dietary guidance implications presented in the chapter on obesity, current evidence is insufficient to recommend specific dietary changes to prevent or treat the eating disorders—*anorexia nervosa*, *bulimia*, and *pica*. Sugar, certain food additives, and caffeine have been suggested as predisposing

dietary factors to the development of behavioral disorders in children and adults, but evidence is weak and contradictory, and there is no reason to expect that a reduced intake of these substances would affect the incidence or severity of behavioral disorders. In addition, current evidence does not support any implications at present about the effects of amino acid precursors of neurotransmitters on behavior.

Special Populations

Studies in patients with eating disorders and other chronic disease conditions (reviewed in other chapters of this Report) emphasize the importance of modification of diet-related behavior in these conditions. Such patients should receive advice from qualified health professionals on the application of dietary principles appropriate for their conditions. Although evidence linking dietary caffeine, refined sugars, and food additives to behavioral disorders is uncertain, their elimination from the diet will not impair nutritional status and can be recommended to patients on an individual trial basis.

Nutrition Programs and Services

Food Labels

Evidence related to the role of dietary factors in behavioral disorders holds no special implications for food labeling policies.

Food Services

Evidence related to the role of dietary factors in behavioral disorders currently holds no special implications for change in policies related to food programs beyond those suggested by the *Dietary Guidelines for Americans*.

Food Products

Evidence related to the role of dietary factors in behavioral disorders holds no special implications for change in policies related to food products at this time.

Special Populations

Patients with eating disorders should be provided with ready access to counseling and assistance in the development of diets that provide safe and adequate levels of energy and nutrients.

Research and Surveillance

Research and surveillance issues of special priority related to the role of behavior in the prevention of diet-related chronic disease and to the role of diet in behavioral disorders include investigations into:

- Behavioral factors that influence food selection patterns and dietary change.
- The most effective behavioral methods to encourage appropriate dietary changes.
- Behavioral factors that increase the risk for diet-related chronic disease.
- Behavioral factors that increase the risk for obesity, anorexia nervosa, bulimia, and pica.
- The prevalence of these eating disorders among different groups.
- Behavioral techniques effective in treatment of these disorders.
- Effects of foods and nutrients on etiology and treatment of behavioral disorders.
- Behavioral interventions that increase the long-term effectiveness of health promotion and chronic disease treatment programs.

Maternal and Child Nutrition

Dietary Guidance

General Public (Including Children and Pregnant Women)

Assessment of nutritional status is an integral part of maternity care at the beginning of pregnancy and periodically throughout pregnancy and lactation to provide continuing monitoring and recommend appropriate intervention.

Evidence related to the role of diet in maternal and child health indicates that well-nourished mothers produce healthier children. Intake of sufficient energy and nutrients to attain optimal nutritional status, including appropriate weight before pregnancy and adequate weight gain during pregnancy, improves infant birth weight and reduces infant mortality and morbidity. Avoiding potentially toxic substances such as alcohol or drugs during pregnancy seems to improve infant birth weight and health, but the evidence regarding low exposures to these agents is not conclusive. Information on appropriate dietary intake, with consideration of ethnic and

cultural food habits, should be provided as early as possible to pregnant women and to women expecting to become pregnant.

Evidence related to the role of diet in infancy indicates that breast milk is the optimal food for infants. Whenever possible and as early as possible, health professionals should provide guidance and support to pregnant women and new mothers on the importance of breastfeeding and on methods for its initiation and maintenance. Mothers who cannot or choose not to breastfeed should receive information about appropriate formulas.

Consuming the appropriate amount and form of energy and nutrients for developmental age is important for good health, as is early education about lifelong dietary patterns that help prevent disease. Parents should guide their children in developing positive eating behaviors and on age-appropriate food patterns that meet nutritional requirements but avoid excessive intake of fat, sodium, and sugar. Parents should also help adolescents develop healthy eating habits and should emphasize the importance of including sufficient quantities of low-fat, nutritious foods in meals and snacks.

Special Populations

Some factors present at the onset of pregnancy place women at increased nutritional risk. These include: adolescence, short interconceptional period, poor reproductive performance, economic deprivation, food faddism, substance use, chronic systemic disease, and inadequate or excessive prepregnant weight (below 85 percent or above 120 percent of standard weight for height). Other nutritional risk factors such as anemia and inadequate or excessive weight gain may develop during pregnancy.

Attaining appropriate prepregnancy body weight and nutritional status, gaining adequate body weight, and avoiding alcohol during pregnancy are important for all women. Qualified health professionals should provide close nutritional monitoring and individualized counseling to women appropriate to their educational level and cultural food habits before and throughout pregnancy.

Specialized professional counseling on feeding should be provided to parents of low birth weight (LBW) infants, other infants at high risk, and infants who require special formulas. Parents of children who are at high risk because of developmental disorders, inborn errors of metabolism, physical disabilities, or chronic disease should also receive ongoing professional advice on appropriate diets and feeding methods. Because children

from families with a history of diet-related chronic disease have a high risk for such conditions, they should be evaluated for these conditions. Children of families whose blood cholesterol, blood sugar, or blood pressure exceed appropriate levels should be advised on dietary and other means to reduce these risk factors.

Physicians, nurses, and other health professionals caring for children and women of childbearing age should receive education and training in nutrition assessment, nutrition intervention for prevention of disease, and promotion of maternal and child health.

Nutrition Programs and Services

Nutrition Services

Evidence related to the role of nutrition in maternal, infant, and child health suggests that all health care programs for these groups should provide nutrition services, especially to those people at special health or economic risk. Such services include nutrition assessment, dietary counseling, nutrition education, and referral.

Food Products

Evidence related to the role of dietary factors in maternal and child health suggests that food manufacturers should develop nutritious, low-fat, low-salt, low-sugar snack food products for children and adolescents. Quality and safety of infant formulas and other infant foods require continued monitoring to prevent untoward health consequences.

Special Populations

Pregnant women, infants, and children with diet-related disease conditions and physical disabilities that impair food intake should receive counseling and assistance in dietary management. Low-income families should have access to an adequate diet. Those with poor education, limited understanding of English, and different cultural patterns require nutrition education approaches appropriate to their needs.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in maternal, infant, and child health should include investigations into:

- The amounts of energy and essential nutrients pregnant women must consume to achieve optimal birth outcome and promote long-term maternal health.

- The optimal weight gain during pregnancy.
- The diet during pregnancy that best prevents complications of chronic disease conditions in the mother.
- The effects of potentially toxic dietary factors such as alcohol on fetal health.
- The optimal feeding methods and diet for improving growth and development of LBW infants.
- The diet in childhood that will best prevent later development of chronic disease conditions.
- The influence of nutritional status on teratogenic outcomes, particularly neural tube defects.
- Nutritional care for optimal development of infants and children with special health care needs due to chronic illness or developmental disorders.
- Effective educational methods to teach parents how to develop good dietary practices for themselves and their children.
- Effective educational methods for teaching good nutritional practices to children and adolescents.
- Effective strategies to integrate nutrition screening, education, and intervention services into health care programs.
- The impact of social changes on nutritional status, including those related to meal sources and eating patterns.

Aging

Dietary Guidance

General Public

Aging is accompanied by a variety of physiologic, psychologic, economic, and social changes that may compromise nutritional status. However, ways in which the aging process affects energy balance, specific nutrient requirements, and nutrient status remain to be fully elucidated. Older adults may not necessarily have the same nutritional requirements as younger adults, yet current estimates of the nutrient requirements of older persons are based almost entirely on values extrapolated from data from studies of younger adults. The ways in which nutritional status might influence changes in tissue and organ function change with age and may influence the relationships between dietary components and the occurrence of chronic diseases of old age. Until more appropriate age-specific RDA's are estab-

lished, the current RDA's should continue to be used as standards for nutrient intake of healthy older persons.

Until more is known, older Americans should consume sufficient nutrients and energy and maintain levels of physical activity that maintain desirable body weight and may prevent or delay the onset of chronic disease. Because it is often difficult to maintain adequate nutrient intake on low-calorie diets, older people should be advised to maintain at least moderate levels of physical activity so as to increase caloric needs. Recommendations to the general population about calcium intake (see chapter on skeletal diseases) are true for older Americans. Because many of the chronic diseases common to older persons may originate earlier in life (see chapter on maternal and child nutrition), dietary guidance to prevent them should be provided throughout life (as discussed in other chapters).

Health promotion messages from the public and private sectors should utilize advanced communication techniques, recognizing different lifestyles, decrements in vision and hearing, different cultural experiences, and different learning styles that may be common to older people. Federal and State agencies should provide information about successful public-private sector models for nutrition, health promotion, and education for older adults—for example, Healthy Older People, Age Well, and OASIS (Older Adult Service Information System).

Special Populations

Sedentary older individuals should be counseled on appropriate methods to increase caloric expenditure. Older persons who do not (or cannot) consume adequate levels of nutrients from food sources and those with dietary, biochemical, or clinical evidence of inadequate intake should receive advice on the proper type and dosage of nutrient supplements. Such supplements may be appropriate for some older persons, but self-prescribed supplementation, especially in large doses, may be harmful and should be discouraged. Older people who suffer from diet-related chronic diseases should receive dietary counseling from credentialed health professionals, and those who take medications should be given professional advice on diets that minimize food-drug interactions.

Nutrition Programs and Services

Food Labels

Evidence related to the role of diet in the aged currently holds no special implications for change in policy related to food labeling, although the size

of the type on the label is a factor for most older consumers. Information provided on food labels should be scientifically sound, understandable, and nonmisleading.

Food Services

Food services, especially those receiving Government funds, should be required to pay special attention to meeting the caloric and nutrient needs of older clients. Nutritional assessment and guidance should be done at hospital admission or enrollment in or discharge from institutional or community-based services for older adults (e.g., acute and long-term care inpatient services, hospital-based outpatient services, alcohol and drug treatment programs, community health services, and home-delivered meals programs).

Food Products

Evidence suggests that older people would benefit from food products that provide a high proportion of available nutrients to calories, that have taste appeal, and that are easy to prepare.

Special Populations

Older people who are homebound, who live in isolation, or who suffer from chronic disease have special needs for nutrition services that are tailored to their particular conditions. Considerable evidence supports the nutritional and health benefits of dietary, economic, and social support programs for the older population.

Research and Surveillance

Research on nutrition and aging currently focuses on two general areas—the nutritional requirements and status of aging people and the influence of diet on aging processes and related pathologies. Psychosocial interactions with nutrition cut across both areas.

Research and surveillance issues of special priority related to the role of nutrition in the aged should include investigations into:

- The nutrient and energy requirements of older adults, currently extrapolated from younger age groups.
- The effects of dietary restriction and overconsumption on longevity and age-related pathology.
- The interactions among nutritional status, lifestyle and behavior, and the environment in older Americans.

Nutrition and Health

- The effects of nutrition on age-related impairment of the cardiovascular, gastrointestinal/oral, immune, musculoskeletal, and nervous system functions and on prevention and treatment of disorders of those systems.
- The effects of marginal nutrient and energy deficiencies on the mental and physical health of older persons.
- Interactions among nutrients and between nutrients and drugs in older adults.
- Development of data bases for use by pharmacists and dietitians in counseling older persons on drug-nutrient interactions.
- Age-specific methods and standards to assess the nutritional status and body composition of older adults.
- The educational methods and program strategies that best promote adequate food consumption by older persons.
- Improved methods to monitor the nutritional status of older populations and individuals, including institutionalized older adults, over time.
- The educational and public health strategies that can be used to eliminate nutrition-related health fraud directed toward older citizens.

Alcohol

Dietary Guidance

General Public

Alcohol has been identified as a dietary factor that increases the risk for diseases of the liver, nervous system, and heart. It also contributes to the development of certain cancers. Although consumption of up to one to two drinks per day has not been associated with disease among healthy male and nonpregnant female adults, evidence that 9 percent of the total population consumes two or more alcoholic drinks per day suggests that the risk for alcohol-related conditions could be reduced by an overall decrease in alcohol consumption among some segments of the general public.

Special Populations

Because studies in pregnant women have been unable to identify a threshold level of safety for alcohol intake during pregnancy, and because the risk for fetal abnormalities increases with increased alcohol intake during pregnancy, pregnant women—and women planning to become pregnant—should be advised to avoid drinking alcohol.

Persons with alcohol-related liver, nervous system, and cardiovascular conditions (e.g., elevated blood cholesterol and blood pressure levels) should receive advice from health professionals to reduce or eliminate alcohol intake to reverse or to prevent progression of these conditions. Persons with diabetes should also receive counseling on the effects of alcohol on caloric intake and blood glucose control.

Adolescents and young adults should be counseled in schools and through the media on the relationship between alcohol intake and motor vehicle and other accidents, suicides, and homicides. Older individuals should be counseled on the relationship between alcohol intake, nutritional deficiencies, and drug interactions.

Nutrition Programs and Services

Food Labels

Evidence related to the role of alcohol in health suggests that if alcoholic beverage containers are required to bear health warning labels, these labels should carry information warning of hazards to the developing fetus as well as of other health hazards associated with alcohol consumption abuse.

Food Services

Aside from the special populations noted below, evidence related to the role of alcohol currently holds no special implications for change in policies related to food service programs.

Food Products

There are no special implications for change in policy related to formulation of food products.

Special Populations

Pregnant women, including those served by the Special Supplemental Food Program for Women, Infants, and Children (WIC) and other maternal and child health programs, should be provided with counseling on avoidance of alcoholic beverages. Persons with alcohol-related conditions should be provided with counseling and referrals on the benefits of abstinence.

Research and Surveillance

Research and surveillance issues of special priority related to the role of alcohol and health include investigations into:

- The levels at which alcohol intake increases risk for chronic diseases and birth defects.
- The mechanisms by which alcohol induces fatty changes in the liver.
- The mechanisms by which alcohol increases blood pressure, blood cholesterol, blood glucose levels, and other risk factors for chronic disease.
- The mechanisms by which low levels of alcohol may reduce risk for coronary heart disease.
- The mechanisms by which alcohol increases cancer risk.
- The mechanisms by which alcohol damages the nervous system.
- The mechanisms by which alcohol intake interferes with nutritional status.
- Definition of the physiologic energy value of alcoholic beverages.
- The interaction of alcohol intake, nutritional status, socioeconomic status, and health.

Drug-Nutrient Interactions

Dietary Guidance

General Public

Although drugs interact with dietary factors in many ways that impair nutrient availability, evidence about the public health significance of such interactions is insufficient to recommend general shifts in the pattern of use of any particular drug on the basis of its adverse effects on nutritional status. Nor may any implications be drawn at this time for the general public on intake of specific nutrients with relation to nonprescription drug interactions.

Special Populations

Studies of patients consuming multiple drugs for prolonged time periods, especially those patients who are older, suggest that dietary intakes may need to be adjusted to compensate for adverse interactions of specific nutrients with medications and that information should be provided to such patients by qualified health professionals on appropriate use of such diets.

Patients taking drugs that induce acute reactions in the presence of dietary factors such as tyramines or alcohol should be instructed on appropriate means to avoid those factors.

Persons with inborn metabolic errors that respond to pharmacologic doses of nutrients or to special products designed to minimize toxic symptoms should be advised on the safe and effective use of such therapies. Health professionals should receive instruction about drug-nutrient interactions to understand how best to maximize drug efficacy and minimize adverse reactions.

Nutrition Programs and Services

Food Labels

Evidence related to the role of diet in drug interactions currently holds no special implications for change in policy related to food labeling.

Drug Labels

Evidence related to the role of diet in drug interactions suggests that drug manufacturers should provide information in the package insert on the potential effects of the medication on nutritional status, and vice versa.

Food Services

Evidence related to the role of diet in drug interactions currently holds no special implications for change in policy related to food service programs.

Food Products

Evidence related to the role of diet in drug interactions currently holds no special implications for change in policy related to packaged food products. Preliminary evidence relating human infections to antibiotic-resistant micro-organisms derived from animals treated with subtherapeutic doses of antibiotics suggests the need for close scrutiny of this practice.

Special Populations

Persons—especially older persons—who consume drugs should be provided with counseling and assistance on dietary methods to avoid adverse drug-nutrient interactions. Persons with inborn metabolic errors requiring therapy with pharmacologic doses of nutrients should be provided with counseling and assistance on appropriate and safe use of such supplements.

Research and Surveillance

Research and surveillance issues of special priority related to the role of diet in drug interactions should include investigations into:

- The extent of drug taking (prescription, over the counter, and illegal) among the population.
- The extent of adverse drug-nutrient interactions in the population.
- Age-related changes in nutrient metabolism with special implications for pharmaceutical use.
- Effects of medications on the nutritional status of older persons.
- Drug effects on nutrient intake, absorption, metabolism, and excretion.
- Effects of diet, including alcohol, on drug absorption, metabolism, and excretion.
- The effects of antibiotics, hormones, or other drugs in animal feeds on human health.
- The levels of intake of essential nutrients that induce toxic symptoms.
- The most effective means to educate health professionals and the general public about drug-nutrient interactions.

Dietary Fads and Frauds

Dietary Guidance

General Public

Running counter to—and sometimes capitalizing on—legitimate gains in scientific understanding of the relationships between diet and health, food faddism and nutrition fraud are increasingly prevalent in the United States. Although most of the adverse consequences of this trend are economic, fraud can cause significant health consequences to individuals as a result of direct toxicity and as a result of failure to seek appropriate medical care or to engage in genuinely healthful dietary practices. Cooperative educational efforts by Government, health professionals, and the private sector, including the news media, are needed to expose emerging fads and frauds before they are widely accepted. One approach to this end is general public education to reinforce the basic principles of sound nutrition as stated in the *Dietary Guidelines for Americans*. Another approach is to direct the public to responsible sources of nutrition information.

Special Populations

Special efforts should be directed toward older persons, who are the target of much nutrition fraud. Cooperative educational efforts by Government and the private sector, such as current collaborations of the FDA with the Pharmaceutical Advertising Council and the Council of Better Business Bureaus, can provide effective support for Government enforcement programs. People with chronic debilitating illnesses—such as cancer, coronary heart disease, arthritis, or Alzheimer's disease—may be especially susceptible to fads and frauds, and health providers should be informed about the most common schemes in each area and should be involved in the effort to forewarn patients.

Nutrition Programs and Services

Food Labels

Food labels should contain information about nutrient content that is provided in a straightforward, effective, and efficient way. Should a health-claims-approved program be implemented, claims for a particular product should be presented in a manner that is most informative, scientifically sound, and not misleading to consumers.

Food Services

Education provided in the context of food services should emphasize general principles of sound nutrition for the general public and inform people about the nature of and problems associated with common nutritional frauds and fads.

Food Products

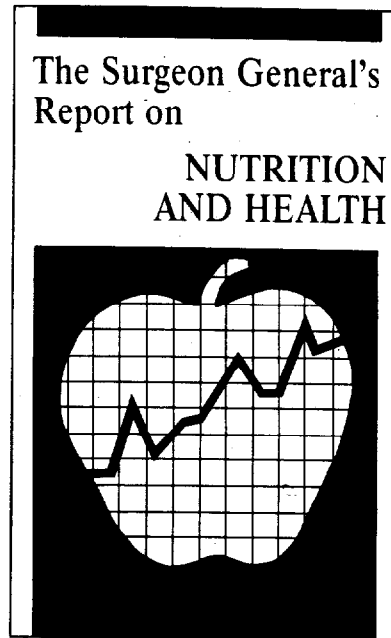
The FDA is charged with ensuring that misleading claims about foods are not presented to the public and that specific foods are not promoted as therapeutic or preventive agents unless there is adequate documentation to support such claims. Continued support for, and vigilance by, the FDA is important in this regard. A cornerstone of this effort is close coordination of regulation and enforcement activities of the various agencies at the Federal, State, and local levels through coalitions developed against nutrition fraud.

Research and Surveillance

Research and surveillance issues of special priority related to the issue of food fads and frauds should include investigations into:

- Frequency and type of fraudulent claims and harmful effects.
- Establishment of safe levels of essential nutrients as well as other components in food.
- The personal and behavioral factors that enhance response to certain unscientific claims and ways to counter them.
- The level of use of vitamin, mineral, and food components that may induce nutrient toxicities or deficiencies by the general public.

The Surgeon General's Report on NUTRITION AND HEALTH



This authoritative 750 page report from the Surgeon General on the relationship between nutrition and health presents:

- Nineteen chapters that document the scientific evidence for associations between diet and disease;
- The historical context in which these associations are examined;
- The public health impact of the diseases covered;
- The public policy implications of the evidence;
- Tables and charts that support these associations; and
- Extensive reference lists for each chapter.

The 78 page *Summary and Recommendations* presents highlights of the full report, including the sections on policy implications and tables that illustrate key issues.

Take this opportunity to obtain copies of these landmark publications on how diet affects health. Use the order form on the reverse side of this page to order *The Surgeon General's Report on Nutrition and Health* (available October 1988) and/or the report's *Summary and Recommendations* (available now). Reproduction of the order form is encouraged.

→