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January 23, 2009

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Kathryn McMurry
Co-Executive Secretary for DGAC 2010
Department of Health and Human Services
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Rockville, MD 20852

Re: 2010 Dietary Guidelines for Americans

Dear Ms. Davis and Ms. McMurry:

On behalf of the American Heart Association (AHA), including the American Stroke Association (ASA) and over 22.5 million AHA and ASA volunteers and supporters, we appreciate the opportunity to provide comments concerning the review and revision of the *Dietary Guidelines for Americans*.

Since 1924, the American Heart Association has dedicated itself to building healthier lives free of cardiovascular disease and stroke – the #1 and #3 leading causes of death in the United States – through research, education, community-based programs, and advocacy. Since 1999 when AHA and ASA committed to achieving a 25% reduction in cardiovascular disease, stroke, and associated risk by 2010, the Association's efforts have contributed to a 30.7% reduction in deaths from coronary heart disease and a 29.2% reduction from stroke – an early achievement of our goal.

AHA applauds the U.S. Department of Agriculture (USDA) and the U.S. Department of Health and Human Services (HHS) for soliciting public comment as part of the development of the 2010 Dietary Guidelines for Americans. The Dietary Guidelines are a valuable source of nutrition information for the public and the Guidelines serve as the basis for a number of important federal food and nutrition education initiatives. It is therefore important that the Dietary Guidelines reflect current science and provide the public with the best available information about reducing the risk for chronic disease through diet and physical activity. AHA strongly believes that proper nutrition, along with adequate physical activity

and appropriate weight management, is key to a healthy lifestyle and is essential to cardiovascular – and overall – health.

AHA offers the following comments for consideration by the Dietary Guidelines Advisory Committee as it prepares its recommendations. AHA's comments are largely based on the Association's scientific statement Diet and Lifestyle Recommendations: Revisions 2006 (See Attachment A).

Carbohydrates

Added Sugars

The Dietary Guidelines should set a limit on intake of added sugars. Added sugars are a significant source of empty calories and may be associated with greater overall calorie intake, higher body weights, and lower intakes of essential nutrients. Excess sugar consumption has also been linked to several metabolic abnormalities and adverse health conditions.

No more than one-half of discretionary calories should come from added sugars. The limit for most women would be no more than 100 calories per day and no more than 150 calories for men.

Fiber

The Dietary Guidelines should emphasize food-based sources of fiber. Consumption of high fiber foods such as legumes, whole-grain products, and fruits and vegetables will help individuals meet the Guidelines in their entirety. Dietary fiber may also promote satiety, leading to an overall decrease in calorie intake.

Whole Grains

The Committee should make a point to recommend a decrease in consumption of refined grains such as white bread and white rice and continue with previous advice to keep at least half of all grains whole. The Guidelines should encourage individuals to replace refined carbohydrates with whole grains with specific examples of foods to consume.

The Dietary Guidelines Advisory Committee should also recommend in its report to the federal agencies that they develop a single definition for whole grains that is easily understood by consumers and can be adopted for use by the food industry.

Protein

The current Dietary Guidelines address the consumption of meat, poultry, and fish as a combined food group. AHA strongly urges the Advisory Committee to place an increased emphasis on the consumption of fish; fish should be featured as a major source of protein. AHA recommends the consumption of fish, especially oily fish, at least twice a week. Oily fish is rich in long-chain omega-3 polyunsaturated fatty acids and the consumption of two servings per week has been associated with a reduced risk of both sudden death and death from coronary artery disease.

The recommendations should also emphasize non-animal-based sources of protein such as legumes and beans. Consumption of plant-based sources of protein may facilitate the displacement of other foods from the diet such as fatty meats.

In addition, the Advisory Committee should be explicit in its recommendations and any guidance pertaining to "lean" meats should be clarified so that it's clear whether the term "lean" refers to the regulatory definition of lean (less than 10g total fat, 4.5g or less saturated fat, and less than 95mg of cholesterol) or simply the leanest cut of meat available.

The Advisory Committee should recommend the consumption of "extra lean" meats. Extra lean should be defined using the regulatory definition of seafood or game meat products that contain less than 5g total fat, less than 2g saturated fat, and less than 95mg cholesterol per RACC.

It is important that the policy document which follows the DGAC report translates recommendations to eat "lean" or "extra lean" servings of meat in a useful manner for consumers. For example, it is not clear that the discretionary calorie allowance is calculated based on the assumption that an individual is consuming "lean" meats or the most nutrient-dense forms of foods throughout the day. The recommendations should address the health and caloric benefits of eating "lean" or "extra lean" meats rather than full fat versions.

Fats

Saturated Fatty Acids

The current Guidelines recommend that individuals should consume less than 10% of calories from saturated fatty acids. Based on scientific evidence, 10% is too high for heart health. AHA urges the Committee to consider revising the current recommendation to less than 7% of energy from saturated fats.

Trans Fatty Acids

The current Guidelines recommend that *trans* fatty acid consumption be kept "as low as possible". While AHA supports keeping *trans* fat consumption as low as possible, we are concerned that this recommendation is too vague. In order to help consumers incorporate this recommendation into their diet, we suggest revising the language to include a specific amount of *trans* fats that should not be exceeded. AHA recommends that *trans* fat consumption be as low as possible, but no more than 1% of energy; this equates to a maximum of 3 grams per day based on a 2,000 calorie diet.

Omega-3 Fatty Acids

As described above, scientific evidence supports recommending two servings per week of fish high in eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Intake of these omega-3 fatty acids has been associated with a decreased risk of cardiovascular disease. We urge the Committee to make this recommendation.

In addition, AHA urges the Committee to make specific recommendations for consumption of 250 to 500mg of EPA and DHA per day. Two servings of fish per week would make an average intake of 250mg to 500mg of EPA and DHA per day.

Although we acknowledge that this goes beyond current dietary reference intakes established by the Institute of Medicine (IOM), it has been over six years since the IOM updated its reports examining these essential fatty acids. An updated report examining current science would be extremely useful in establishing recommended levels for omega-3 fatty acids, but available data already shows that consumption of food-based sources of EPA and DHA has a cardiovascular benefit. Therefore, the Committee should recommend weekly consumption of EPA and DHA, especially through consumption of oily fish. The recommendation would keep EPA and DHA combined, since scientific evidence on how the fatty acids function separately is lacking.

The Committee should also address alpha-linolenic acid (ALA). ALA serves as a precursor for synthesis of EPA and DHA so it is required by the body; however, the body cannot synthesize ALA, so a dietary source is required. The Guidelines should provide examples of major sources of ALA such as flaxseed, canola, and soybean oil.

Unsaturated Fatty Acids

The AHA is currently in the process of publishing a science advisory on omega-6 fatty acids and the risk for cardiovascular disease. We believe this paper may be of interest to the Committee. The paper will be available online after January 26th at http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.108.191627.

Fluid and Electrolytes

Sodium

The current Dietary Guidelines recommendation that individuals consume less than 2,300mg of sodium per day is too high. The amount should be changed to the amount recommended in the 2005 Guidelines for salt sensitive populations, or no more than 1,500mg of sodium per day. According to the Centers for Disease Control and Prevention, the special populations described above – individuals with hypertension, African-Americans, middle-age, and older adults – now account for 68% of the American population.[1] Because these specific population groups now constitute a majority of the total population, the 1,500mg should apply to all populations.

A reduced sodium intake can have significant health benefits. Studies have shown that a reduced sodium intake can lower blood pressure, prevent hypertension, can help control hypertension, and can prevent cardiovascular disease. And although sodium is an essential nutrient, there is no biologic requirement for 2,300mg a day. Very little sodium is needed. Under conditions of maximal adaptation and without sweating, the minimum amount of sodium required to replace losses is estimated to be no more than 180 mg per day. However, it is unlikely that a diet providing this level of sodium intake is sufficient to meet dietary requirements for other

[1] Darwin Labarthe, Division for Heart Disease and Stroke Prevention, Centers for Disease Control and Prevention. Presentation at the Institute of Medicine Committee on Strategies to Reduce Sodium Intake. January 13, 2009.

nutrients. Therefore, to ensure nutrient adequacy and replace sweat losses, healthy adults generally need about 1,500 mg a day.[2]

To accommodate a more realistic approach for reducing the sodium intake to 1,500mg in the 2010 Dietary Guidelines, the Committee may want to consider making a recommendation for reducing sodium in two phases. In recent comments to the Food and Drug Administration and the Institute of Medicine, AHA recommended that the daily value for sodium be lowered to 1,500mg by 2020 with an intermediate goal of 2,000mg by 2013. This two-step phase down should provide manufacturers with time to reformulate products and identify acceptable salt substitutes, as well as allow consumers to adapt their taste sensitivities to the lower sodium content in foods.

To meet a science-based recommendation of 1,500mg per day, the scientific report and the policy document must strongly encourage consumers to reduce sodium intake by choosing foods with little or no salt and limiting the amount of salt added to food. However, we acknowledge that it will be difficult for consumers to lower their sodium intake to 1,500mg on their own. With processed foods accounting for 77% of all sodium consumed, it will require the cooperation of food manufacturers and restaurants to reduce the sodium content of the foods they make available to the public. AHA would like to see food manufacturers and restaurants reduce the salt added to foods by 50% over the next 10 years.

Beverages

The current Guidelines recommend that consumers select beverages with little added sugars or caloric sweeteners. AHA agrees with this recommendation; the 2006 AHA Diet and Lifestyle Recommendations suggest limiting beverages that are high in added sugars.

In recent years the consumption of beverages with added sugars has risen markedly. High calorie energy drinks and caffeinated beverages have become the leading source of added sugar in the diet. This is concerning because high consumption of beverages with added sugars has been associated with consumption of greater calories and weight gain. Consumers tend not to compensate as well for calories consumed in liquid form when compared to calories consumed as solid foods. Because calories consumed as beverages may not be as satiating, we tend to overconsume beverages and other foods.

The Committee should address and emphasize high calorie energy drinks and caffeinated beverages in the updated Guidelines.

Vitamins

The Dietary Guidelines recommend consumption of a number of vitamins including vitamins A, C, D, E, and B_{12}. Individuals are instructed to obtain these vitamins through vitamin-rich sources of food, fortified foods, and/or supplements.

[2] Institute of Medicine. *Dietary Reference Intakes: Water, Potassium, Sodium Chloride, and Sulfate.* 1st ed. Washington, DC: National Academy Press; 2004.

AHA recommends that the 2010 Guidelines emphasize food-based sources as much as possible. In general, individuals can obtain nutrient adequacy through the consumption of a wide variety of foods.

Energy Balance/Physical Activity

Physical Activity

AHA strongly supports the Guidelines' emphasis on the importance of physical activity in promoting health and maintaining a healthy body weight. Regular physical activity is essential for maintaining physical and cardiovascular fitness, maintaining healthy weight, and sustaining weight loss once achieved. Regular physical activity improves cardiovascular risk factors and lowers the risk of developing chronic diseases such as diabetes, osteoporosis, obesity, depression, and some forms of cancer.

To address physical activity in the 2010 Dietary Guidelines, AHA recommends that the Committee incorporate the 2008 Physical Activity Guidelines for Americans which were recently released by the Department of Health and Human Services (HHS). In order to be of use to the public, it is of utmost importance that the messaging between the Dietary Guidelines and the Physical Activity Guidelines is consistent. Implementation efforts for the physical activity recommendations in both policy documents should also be coordinated. AHA urges that the Physical Activity Guidelines, like the Dietary Guidelines, be updated and revised every five years.

Weight Management

Maintenance of a healthy weight is a critical area that must be heavily emphasized in the updated Guidelines. Obesity is a major public health problem in the United States. Obesity is a major risk factor for cardiovascular disease, diabetes, many forms of cancer, and a number of additional chronic conditions; and the prevalence continues to steadily rise.

To combat the obesity epidemic, the Committee must address obesity prevention and weight control for individuals in the normal weight range, as well as weight loss for those for are overweight or obese. The Guidelines should recommend specific steps individuals can take to decrease calories in order to achieve and maintain a healthy weight such as limiting sugar-sweetened beverages, limiting added sugars, determining correct portion sizes, increasing consumption of whole grains, fruits and vegetables, and focusing on consumption of nutrient-dense calories.

The Guidelines should also educate consumers about their calorie needs. Consumers do not understand the number of calories they should consume. An underlying message of the entire Guidelines policy document should be the need for consumers to "know their number" (how many calories they should consume based on their age, gender, and level of physical activity).

We must note however, that addressing individual behavior alone is unlikely to solve the problem of obesity and overweight. Environment and policy also play a significant role. As the Committee considers weight management as it develops its recommendations, we urge the

Committee to also pursue a policy and environmental approach to addressing obesity. Last year, AHA released a scientific statement entitled Population-Based Prevention of Obesity: The Need for Comprehensive Promotion of Healthful Eating, Physical Activity, and Energy Balance (See Attachment B). We believe this statement may be of use to the Committee.

Nutrient Density/Discretionary Calories

Nutrient Density

Consumers should focus on the consumption of nutrient-dense calories that meet the Dietary Guidelines. To do this, individuals should consume a variety of fruits, vegetables, and whole grain products; choose fat-free and low-fat dairy products, legumes, poultry, and lean meats; and eat fish, preferably oily fish, twice a week. The recommendations should be specific for the types of nutrient-dense foods that should be consumed, and emphasize the need to limit consumption of high calorie foods with low nutritional value such as sugars and saturated and *trans* fats.

Discretionary Calories

The concept of discretionary calories is difficult to understand. While discretionary calories provide beneficial flexibility in the diet, people do not understand discretionary calories limits. In order for individuals to have discretionary calories available, they must limit foods of low nutritional value and caloric intake must be in balance with caloric expenditure.

Unfortunately the majority of the American population is too sedentary and they do not have discretionary calories to burn. The recommendations should continue to emphasize this point and the Committee should explore new ways to make the discretionary calories concept more consumer-friendly.

Evidence-Based Review Process

AHA applauds the use of the new Nutrition Evidence Library in the development in the 2010 Dietary Guidelines. The Nutrition Evidence Library will be a valuable resource to the Advisory Committee and will ensure that the dietary recommendations are based on a comprehensive scientific review. We commend the USDA and HHS for bringing the process to this level of scientific rigor.

Other

Development Process

The development of the Dietary Guidelines occurs in three stages: first, the Advisory Committee prepares a report of recommendations; second, USDA and HHS jointly develop a Policy Document of key recommendations based on the Advisory Committee's report and outside comments; and third, USDA and HHS develop messages to communicate the Dietary Guidelines to the public.

AHA understands that once the first stage is completed – the Advisory Committee submits its scientific recommendations to USDA and HHS – the Committee is disbanded. It is our further

understanding that once the Committee is disbanded, there is no mechanism to allow the USDA and HHS staff charged with developing the Policy Document and Consumer Brochure to communicate with Committee members. AHA recommends that this process be revised and a mechanism be established to allow for communication between the Committee and USDA and HHS staff. A communication mechanism will allow USDA and HHS staff to ask questions and seek clarification from Committee members to ensure that they are correctly translating the science-based recommendations into policy. The Canadian model of forming a communications committee at the same time as the science committee may be a useful model for USDA and HHS to consider.

Communication with the Public

As previously mentioned, AHA is very pleased with the opportunity to provide comments on the 2010 Dietary Guidelines and we are confident that the Committee will develop a set of strong, science-based recommendations designed to help consumers form healthy eating patterns, increase their physical activity, and reduce the risk of chronic disease. However, in order for the Dietary Guidelines to be of use, they must be communicated to the public properly. We cannot overemphasize that communication with the public is key.

The Committee and USDA and HHS staff must give significant thought on how to communicate the recommendations to the public. The messaging must focus on helping consumers translate the Dietary Guidelines into their normal, everyday lives. Implementation of the Guidelines should encourage consumers to look broadly at their whole diet and dietary patterns. In addition, all messaging should tie-in to the broader message around weight control and energy balance.

Closing

In closing, we reiterate our appreciation for the opportunity to provide comments on the 2010 Dietary Guidelines. The Dietary Guidelines are a valuable source of nutrition information for policy makers, health care providers, nutritionists, and the public, and we support the efforts of the Committee, USDA, and HHS to develop updated recommendations that will promote the health of Americans. Raising the public's awareness of the benefits of a healthy diet and active lifestyle is an important strategy for reducing the incidence and risk of cardiovascular disease, stroke, and other chronic diseases. We hope that as the public learns more about the relationship between diet and disease, consumers will try to adopt a healthier lifestyle and make better food choices.

If you have any questions or need any additional information, please do not hesitate to contact Susan Bishop, MA, Regulatory Affairs Manager, at 202-785-7908 or susan.k.bishop@heart.org.

Sincerely,

Timothy J. Gardner, MD
President, AHA

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Diet and Lifestyle Recommendations Revision 2006: A Scientific Statement From the American Heart Association Nutrition Committee

Alice H. Lichtenstein, Lawrence J. Appel, Michael Brands, Mercedes Carnethon, Stephen Daniels, Harold A. Franch, Barry Franklin, Penny Kris-Etherton, William S. Harris, Barbara Howard, Njeri Karanja, Michael Lefevre, Lawrence Rudel, Frank Sacks, Linda Van Horn, Mary Winston and Judith Wylie-Rosett

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AHA Scientific Statement

Diet and Lifestyle Recommendations Revision 2006

A Scientific Statement From the American Heart Association Nutrition Committee

Alice H. Lichtenstein, DSc, FAHA, Chair; Lawrence J. Appel, MD, FAHA, Vice-Chair; Michael Brands, PhD, FAHA; Mercedes Carnethon, PhD; Stephen Daniels, MD, PhD, FAHA; Harold A. Franch, MD, FAHA; Barry Franklin, PhD, FAHA; Penny Kris-Etherton, RD, PhD, FAHA; William S. Harris, PhD, FAHA; Barbara Howard, PhD, FAHA; Njeri Karanja, PhD; Michael Lefevre, PhD, FAHA; Lawrence Rudel, MD, PhD, FAHA; Frank Sacks, MD, FAHA; Linda Van Horn, PhD, RD, FAHA; Mary Winston, EdD; Judith Wylie-Rosett, EdD, RD

***Abstract*—**Improving diet and lifestyle is a critical component of the American Heart Association's strategy for cardiovascular disease risk reduction in the general population. This document presents recommendations designed to meet this objective. Specific goals are to consume an overall healthy diet; aim for a healthy body weight; aim for recommended levels of low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and triglycerides; aim for normal blood pressure; aim for a normal blood glucose level; be physically active; and avoid use of and exposure to tobacco products. The recommendations are to balance caloric intake and physical activity to achieve and maintain a healthy body weight; consume a diet rich in vegetables and fruits; choose whole-grain, high-fiber foods; consume fish, especially oily fish, at least twice a week; limit intake of saturated fat to <7% of energy, *trans* fat to <1% of energy, and cholesterol to <300 mg/day by choosing lean meats and vegetable alternatives, fat-free (skim) or low-fat (1% fat) dairy products and minimize intake of partially hydrogenated fats; minimize intake of beverages and foods with added sugars; choose and prepare foods with little or no salt; if you consume alcohol, do so in moderation; and when you eat food prepared outside of the home, follow these Diet and Lifestyle Recommendations. By adhering to these diet and lifestyle recommendations, Americans can substantially reduce their risk of developing cardiovascular disease, which remains the leading cause of morbidity and mortality in the United States. **(*Circulation*. 2006;114:82-96.)**

Key Words: AHA Scientific Statements ■ nutrition ■ cardiovascular diseases

Improving diet and lifestyle is a critical component of the American Heart Association's (AHA's) strategy to prevent cardiovascular disease (CVD), the leading cause of morbidity and mortality in Americans. This document presents diet and lifestyle recommendations designed to meet this objective. Several features distinguish this set of recommendations from previous AHA Dietary Guideline versions: (1) Recognizing that diet is part of an overall healthy lifestyle, *Lifestyle* has been added to the title. (2) The 2006 recommendations incorporate new scientific evidence that has emerged after publication of the last set of guidelines in 2000.[1] (3) The 2006 recommendations have been reformatted so that they are more easily understood. (4) A section raising awareness about environmental influences on CVD health behaviors has been included. (5) Practical guidance on how to achieve diet and lifestyle changes is provided. (6) The importance of following the recommendations when eating at home and away from home is emphasized. (7) The vital roles of healthcare professionals, restaurants, the food industry, schools, and local policies are highlighted, along with specific recommendations to these groups. This last feature and the focus on CVD prevention are the principal differences between these recommendations and those from the US Departments of Agriculture and Health and Human Services.[2]

Consistent with the strategic plan of the AHA, the 2006 AHA Diet and Lifestyle Recommendations are one component of a comprehensive plan to achieve specific goals for

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on April 26, 2006. A single reprint is available by calling 800-242-8721 (US only) or writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0365. To purchase additional reprints: up to 999 copies, call 800-611-6083 (US only) or fax 413-665-2671; 1000 or more copies, call 410-528-4121, fax 410-528-4264, or e-mail kelle.ramsay@wolterskluwer.com. To make photocopies for personal or educational use, call the Copyright Clearance Center, 978-750-8400.

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TABLE 1. AHA 2006 Diet and Lifestyle Goals for Cardiovascular Disease Risk Reduction

- Consume an overall healthy diet.
- Aim for a healthy body weight.
- Aim for recommended levels of low-density lipoprotein (LDL) cholesterol, high-density lipoprotein (HDL) cholesterol, and triglycerides.
- Aim for a normal blood pressure.
- Aim for a normal blood glucose level.
- Be physically active.
- Avoid use of and exposure to tobacco products.

cardiovascular risk reduction (Table 1). The recommendations (Table 2) are appropriate for the general public, including adults and children over 2 years of age. Separate AHA dietary guidelines specifically addressing the special needs of growing children have recently been published.[3] The AHA 2006 Diet and Lifestyle Recommendations are intentionally flexible to meet the unique needs for growth, development, and aging.

Evidence cited in this report is drawn from many authoritative documents, including previous AHA scientific statements and other evidence-based reviews, as well as seminal studies and national surveys.

Public Health and Clinical Application of AHA Diet and Lifestyle Recommendations

Public Health Recommendations

The AHA has traditionally provided dietary recommendations and recommendations for an overall healthy lifestyle to the American public with the goal of reducing risk for CVD, the No. 1 killer of Americans. Maintaining a healthy diet and lifestyle offers the greatest potential of all known approaches for reducing the risk for CVD in the general public. This is still true in spite of major advances in clinical medicine. The recommendations contained in this document provide a foundation for a public health approach to CVD risk reduction through healthy eating habits and other lifestyle factors. In recent years, obesity has emerged as a major nutritional problem in the United States. For this reason, this document contains expanded information on nutrition and physical activity approaches to preventing or managing obesity and minimizing its complications.

Clinical Recommendations

The general recommendations contained in this document generally can be applied to the clinical management of patients with or at risk for CVD. For certain patients at higher risk, the recommendations may have to be intensified. Although great advances have been made in prevention and treatment of CVD through drug therapies and procedures, diet and lifestyle therapies remain the foundation of clinical intervention for prevention. Unfortunately, the latter commonly are neglected, to the detriment of patients. Rigorous application of the principles of diet and lifestyle intervention outlined in this document to patients at risk will contribute significantly to risk reduction and will augment the benefit that may be obtained by other approaches. The clinical approach is an extension of the public health approach, with some modifications depending on the type of patient.

Goals

The AHA Diet and Lifestyle Goals are intended to reduce CVD risk (Table 1). They provide guidance for adults and children over the age of 2 years.

Consume an Overall Healthy Diet

Although the vast majority of research studies have focused on individual nutrients and foods, it is well recognized that multiple dietary factors influence the risk of developing CVD and its major risk factors. To a much lesser extent, research has examined the health effects of the whole diet; both observational studies and clinical trials. These data have documented that healthy dietary patterns are associated with a substantially reduced risk of CVD,[4] CVD risk factors,[5,6] and noncardiovascular diseases.[7] An emphasis on whole diet is also appropriate to ensure nutrient adequacy and energy balance.[2] Hence, rather than focusing on a single nutrient or food, individuals should aim to improve their whole or overall diet. Consistent with this principle, the AHA recommends that individuals consume a variety of fruits, vegetables, and grain products, especially whole grains; choose fat-free and low-fat dairy products, legumes, poultry, and lean meats; and eat fish, preferably oily fish, at least twice a week (Table 2).

Aim for a Healthy Body Weight

A healthy body weight is currently defined as a body mass index (BMI) of 18.5 to 24.9 kg/m^2. Overweight is a BMI

TABLE 2. AHA 2006 Diet and Lifestyle Recommendations for Cardiovascular Disease Risk Reduction

- Balance calorie intake and physical activity to achieve or maintain a healthy body weight.
- Consume a diet rich in vegetables and fruits.
- Choose whole-grain, high-fiber foods.
- Consume fish, especially oily fish, at least twice a week.
- Limit your intake of saturated fat to <7% of energy, *trans* fat to <1% of energy, and cholesterol to <300 mg per day by
  - — choosing lean meats and vegetable alternatives;
  - — selecting fat-free (skim), 1%-fat, and low-fat dairy products; and
  - — minimizing intake of partially hydrogenated fats.
- Minimize your intake of beverages and foods with added sugars.
- Choose and prepare foods with little or no salt.
- If you consume alcohol, do so in moderation.
- When you eat food that is prepared outside of the home, follow the AHA Diet and Lifestyle Recommendations.

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between 25 and 29.9 kg/m^2, and obesity is a BMI ≥30 kg/m^2. In the United States, achieving and maintaining a healthy weight throughout life is particularly difficult. Currently, about one third of adults are overweight, and an additional one third are obese.[8,9] The prevalence of overweight and obesity has increased dramatically over the past 20 years, and the problem has now reached epidemic proportions.[9,10] Of particular concern is that this trend has shown no signs of abating.

Obesity is an independent risk factor for CVD.[11] Excess body weight adversely affects CVD risk factors (eg, increasing low-density lipoprotein [LDL] cholesterol levels, triglyceride levels, blood pressure [BP], and blood glucose levels, and reducing high-density lipoprotein [HDL] cholesterol levels) and increases the risk of developing coronary heart disease (CHD), heart failure, stroke, and cardiac arrhythmias.

The causes of this dramatic population-wide increase in overweight and obesity are multifactorial. Implicated factors include increased portion sizes; high–calorie-density foods; easy access to plentiful, inexpensive food; sedentary lifestyle; and commercial and cultural influences that, in aggregate, encourage calorie consumption in excess of calorie utilization. No one factor appears responsible for the epidemic. Hence, the optimal strategy to retard the epidemic must likewise be multifactorial.

Achieving and maintaining a healthy weight throughout the life cycle are critical factors in reducing CVD risk in the general population. Data indicate that body weight at 18 years tracks with subsequent risk of developing CVD and diabetes, as does weight gain after 18 years of age.[12] It is important to intensify efforts in the general population to help individuals avoid inappropriate weight gain during childhood and subsequent weight gain during adult years. Increased emphasis should be put on prevention of weight gain, because achievement and maintenance of weight loss, although certainly possible, require more difficult behavioral changes (ie, greater calorie reduction and more physical activity) than prevention of weight gain in the first place.[13,14]

Aim for a Desirable Lipid Profile

LDL, which is the major cholesterol-carrying lipoprotein particle in plasma, is primarily derived from lipoprotein particles made by the liver. As levels of LDL cholesterol increase, so does the risk of developing CVD.[15] LDL levels are classified as follows: optimal, <100 mg/dL; near or above optimal, 100 to 129 mg/dL; borderline high, 130 to 159 mg/dL; high, 160 to 189 mg/dL; and very high, ≥190 mg/dL.[15] Among non-Hispanic whites living in the United States, 17% of women and 20% of men have LDL cholesterol levels >160 mg/dL.[9] Corresponding estimates for non-Hispanic blacks are 19% of women and 19% of men, and for Mexican Americans, 14% of women and 17% of men.[9]

Current recommendations for LDL cholesterol goals depend on the estimated 10-year risk of developing CVD and the presence of CVD-related risk factors.[15] Although drug therapy is often prescribed for those at moderate or high risk, dietary changes are recommended for all individuals. The strongest dietary determinants of elevated LDL cholesterol concentrations are dietary saturated fatty acid and *trans* fatty acid intakes. *Trans* fatty acids tend to increase LDL cholesterol levels slightly less than saturated fatty acids, whereas saturated fatty acids increase HDL cholesterol concentrations but *trans* fatty acids do not.[16] To a lesser extent, dietary cholesterol and excess body weight are positively related to levels of LDL cholesterol.[15]

HDL cholesterol and triglycerides are other plasma lipid measures related to CVD risk that can be affected by diet and body weight.[17,18] The concentration of HDL cholesterol is inversely associated with the risk of developing CVD.[15] This association is thought to be mediated by a constellation of events collectively referred to as reverse cholesterol transport—the transport of cholesterol from peripheral tissues to the liver for subsequent metabolism or excretion. HDL directly protects against the development of atherosclerosis. The major nongenetic determinants of low HDL cholesterol levels are hyperglycemia, diabetes, hypertriglyceridemia, very low-fat diets (<15% energy as fat), and excess body weight.[17] Although at this time there are no HDL cholesterol goals as there are for LDL cholesterol, levels <50 mg/dL in women and <40 mg/dL in men are considered one of the criteria for the classification of metabolic syndrome.[15] Likewise, although at this time there are no triglyceride goals, levels >150 mg/dL are considered one of the criteria for the classification of metabolic syndrome.[15] In general, a moderate inverse relationship exists between triglyceride and HDL cholesterol concentrations, and determinants of high triglycerides are mainly the same as those of low HDL cholesterol.[17]

Aim for a Normal Blood Pressure

A normal BP is a systolic BP <120 mm Hg and a diastolic BP <80 mm Hg. BP is a strong, consistent, continuous, independent, and etiologically relevant risk factor for cardiovascular-renal disease. Notably, no evidence of a BP threshold exists—that is, the risk of CVD increases progressively throughout the range of BP, including the prehypertensive range (a systolic BP of 120 to 139 mm Hg or diastolic BP of 80 to 89 mm Hg).[19] Hence, efforts to reduce BP to normal levels are warranted, even among individuals with prehypertension.

According to the most recent National Health and Nutrition Examination Survey (NHANES) (1999–2000), 27% of adult Americans have hypertension (systolic BP ≥140 mm Hg, diastolic BP ≥90 mm Hg, or use of antihypertensive medication), and another 31% have prehypertension.[20] It has been estimated that among adults >50 years of age, the lifetime risk of developing hypertension approaches 90%. On average, blacks have higher BP than do nonblacks, as well as an increased risk of BP-related complications.

Elevated BP results from environmental factors, genetic factors, and interactions among these factors. Of the environmental factors that affect BP (ie, diet, physical inactivity, toxins, and psychosocial factors), dietary factors have a prominent, and likely predominant, role. A substantial body of evidence strongly supports the concept that multiple dietary factors affect BP.[21] Dietary modifications that lower BP are reduced salt intake, caloric deficit to induce weight loss, moderation of alcohol consumption (among those who drink), increased potassium intake, and consumption of an

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overall healthy diet, based on the DASH (Dietary Approaches to Stop Hypertension) diet.[5] The latter is a carbohydrate-rich diet that emphasizes fruits, vegetables, and low-fat dairy products; includes whole grains, poultry, fish, and nuts; and is reduced in fats, red meat, sweets, and sugar-containing beverages. Replacement of some carbohydrates with either protein from plant sources or with monounsaturated fat can further lower BP.[6]

Aim for a Normal Blood Glucose Level

A normal fasting glucose level is ≤100 mg/dL, whereas diabetes is defined by a fasting glucose level ≥126 mg/dL. Hyperglycemia and the often-associated insulin resistance are related to numerous cardiovascular complications, including CHD, stroke, peripheral vascular disease, cardiomyopathy, and heart failure. Type 2 diabetes is the most common form of diabetes. Reducing caloric intake and increasing physical activity to achieve even a modest weight loss can decrease insulin resistance and improve glucose control and the concomitant metabolic abnormalities. In nondiabetic individuals, weight loss and increased physical activity can delay the onset of and possibly prevent diabetes.[22,23]

Be Physically Active

Regular physical activity is essential for maintaining physical and cardiovascular fitness, maintaining healthy weight, and sustaining weight loss once achieved.[24] Current estimates indicate that 61% of US adults do not engage in any regular physical activity.[9] A sedentary lifestyle is associated with older age and is more common among Hispanic or Latino and black adults than among white adults. Regular physical activity improves cardiovascular risk factors (BP, lipid profiles, and blood sugar) and lowers the risk of developing other chronic diseases, including type 2 diabetes, osteoporosis, obesity, depression, and cancer of the breast and colon.[25]

Avoid Use of and Exposure to Tobacco Products

On the basis of the overwhelming evidence for the adverse effects of tobacco products and secondary exposure to tobacco smoke on CVD, as well as cancer and other serious illness, the AHA strongly and unequivocally endorses efforts to eliminate the use of tobacco products and minimize exposure to second-hand smoke.[26–28] Nearly 23% of US adults smoke, with the highest rates in American Indian/Alaskan Native women (37%) and the lowest rates in Asian women (7%).[9] Because cessation of smoking in habitual smokers can be associated with weight gain, particular attention should be given to preventing this outcome.[29] Concern about weight gain should not be a reason for continued use of tobacco products.

AHA Diet and Lifestyle Recommendations

The AHA 2006 Diet and Lifestyle Recommendations (Table 2) are intended to reduce CVD risk. These recommendations are intentionally presented in a manner that allows maximal flexibility in their implementation among a group of individuals with a wide range of dietary preferences and to meet the unique needs for growth, development, and aging. They are not presented as a "diet plan," per se, but rather a lifestyle prescription to promote cardiovascular health. Practical approaches for implementing these recommendations are presented in Table 3. Two examples of eating patterns at 2000 calories per day that meet the AHA 2006 Diet and Lifestyle Recommendations are presented in Table 4. The 2 examples provide a general framework to aid health practitioners in giving general, practical food-group–based guidance. The example of 2000 calories is provided for consistency with the Nutrition Facts Panel. For individuals who consume more or less than 2000 calories, appropriate adjustments in number of servings per day that are consistent with achieving and maintaining a healthy body weight should be made.

Although the recommendations present guidance about specific nutrients and types of foods, the importance of an overall healthy diet and lifestyle cannot be overemphasized. Multiple dietary factors influence CVD risk, and not all do so via changes in the risk factors described above. Hence, CVD benefit is likely to accrue by adherence to a healthy diet and lifestyle even if these risk factors are not markedly altered. Although the Food and Drug Administration (FDA) has sanctioned health claims for certain nutrients and foods, a focus on the overall diet is preferred over a specific focus on individual dietary components. This is, in part, due to the overarching goal of achieving energy balance and nutrient adequacy. If a specific food or category of foods is added to, rather than used to displace, other food from the diet (eg, as a result of an FDA claim or new research finding), then the additional calories can lead to weight gain.

Balance Calorie Intake and Physical Activity to Achieve or Maintain a Healthy Body Weight

To avoid weight gain after childhood, individuals must control calorie intake so that energy balance is achieved—that is, energy intake matches energy expenditure. To control calorie intake, individuals should increase their awareness of the calorie content of foods and beverages per portion consumed and should control portion size.[30] The macronutrient composition of a diet (ie, the amount of fat, carbohydrate, and protein) has little effect on energy balance unless macronutrient manipulation influences total energy intake or expenditure.[30] While reducing caloric intake, individuals should adopt and maintain a diet consistent with recommendations in this document (Table 2).

A physically active lifestyle is recommended to reduce risk for CVD in all individuals, regardless of body weight.[13] Regular physical activity also reduces symptoms in patients with established CVD. Among individuals who are overweight or obese, regular physical activity along with calorie restriction is recommended as a means to achieve weight loss. Regular daily physical activity has been shown to be particularly effective in maintaining weight loss once achieved.[14]

The AHA recommends that all adults accumulate ≥30 minutes of physical activity most days of the week. Additional benefits will likely be derived if activity levels exceed this minimum recommendation. At least 60 minutes of physical activity most days of the week is recommended for adults who are attempting to lose weight or maintain weight loss and for children. The physical activity can be accumu-

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TABLE 3. Practical Tips to Implement AHA 2006 Diet and Lifestyle Recommendations

Lifestyle

- Know your caloric needs to achieve and maintain a healthy weight.
- Know the calorie content of the foods and beverages you consume.
- Track your weight, physical activity, and calorie intake.
- Prepare and eat smaller portions.
- Track and, when possible, decrease screen time (eg, watching television, surfing the Web, playing computer games).
- Incorporate physical movement into habitual activities.
- Do not smoke or use tobacco products.
- If you consume alcohol, do so in moderation (equivalent of no more than 1 drink in women or 2 drinks in men per day).

Food choices and preparation

- Use the nutrition facts panel and ingredients list when choosing foods to buy.
- Eat fresh, frozen, and canned vegetables and fruits without high-calorie sauces and added salt and sugars.
- Replace high-calorie foods with fruits and vegetables.
- Increase fiber intake by eating beans (legumes), whole-grain products, fruits, and vegetables.
- Use liquid vegetable oils in place of solid fats.
- Limit beverages and foods high in added sugars. Common forms of added sugars are sucrose, glucose, fructose, maltose, dextrose, corn syrups, concentrated fruit juice, and honey.
- Choose foods made with whole grains. Common forms of whole grains are whole wheat, oats/oatmeal, rye, barley, corn, popcorn, brown rice, wild rice, buckwheat, triticale, bulgur (cracked wheat), millet, quinoa, and sorghum.
- Cut back on pastries and high-calorie bakery products (eg, muffins, doughnuts).
- Select milk and dairy products that are either fat free or low fat.
- Reduce salt intake by
  - —comparing the sodium content of similar products (eg, different brands of tomato sauce) and choosing products with less salt;
  - —choosing versions of processed foods, including cereals and baked goods, that are reduced in salt; and
  - —limiting condiments (eg, soy sauce, ketchup).
- Use lean cuts of meat and remove skin from poultry before eating.
- Limit processed meats that are high in saturated fat and sodium.
- Grill, bake, or broil fish, meat, and poultry.
- Incorporate vegetable-based meat substitutes into favorite recipes.
- Encourage the consumption of whole vegetables and fruits in place of juices.

lated throughout the day. It is not easy for individuals to achieve these goals. However, it is important to encourage behaviors that will facilitate achieving and maintaining these goals over time. Achieving a physically active lifestyle requires effective time management, with a particular focus on reducing sedentary activities such as screen time (eg, watching television, surfing the Web, playing computer games) and making daily choices to move rather than be moved (eg, taking the stairs instead of the elevator).

Consume a Diet Rich in Vegetables and Fruits

Most vegetables and fruits are rich in nutrients, low in calories, and high in fiber. Therefore, diets high in vegetables and fruits meet micronutrient, macronutrient, and fiber requirements without adding substantially to overall energy consumption. Whether it is the vegetables and fruits themselves or the absence of other foods displaced from the diet that is associated with CVD risk reduction has yet to be determined. Regardless, diets rich in vegetables and fruits have been shown to lower BP and improve other CVD risk factors in short-term randomized trials.[5,6,31] In longitudinal observation studies, persons who regularly consume such diets are at a lower risk of developing CVD, particularly stroke.[32,33]

A variety of vegetables and fruits are recommended. Vegetables and fruits that are deeply colored throughout (eg, spinach, carrots, peaches, berries) should be emphasized because they tend to be higher in micronutrient content than are other vegetables and fruits such as potatoes and corn. Fruit juice is not equivalent to the whole fruit in fiber content and perhaps satiety value and should not be emphasized. A diet rich in vegetables and fruits is a strategy for lowering the energy density of the diet to control energy intake. Equally important is the method of preparation. Techniques that preserve nutrient and fiber content without adding unnecessary calories, saturated or *trans* fat, sugar, and salt are recommended (Table 3).

Choose Whole-Grain, High-Fiber Foods

Dietary patterns that are high in whole-grain products and fiber have been associated with increased diet quality and decreased risk of CVD.[34] Soluble or viscous fibers (notably β-glucan and pectin) modestly reduce LDL cholesterol levels beyond those achieved by a diet low in saturated and *trans*

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TABLE 4. Two Examples of Daily Dietary Patterns That Are Consistent With AHA-Recommended Dietary Goals at 2000 Calories

Eating Pattern	DASH*	TLC†	Serving Sizes
Grains‡	6 to 8 servings per day	7 servings§ per day	1 slice bread; 1 oz dry cereal¶; ½ cup cooked rice, pasta, or cereal
Vegetables	4 to 5 servings per day	5 servings§ per day	1 cup raw leafy vegetable, ½ cup cut-up raw or cooked vegetable, ½ cup vegetable juice
Fruits	4 to 5 servings per day	4 servings§ per day	1 medium fruit; ¼ cup dried fruit; ½ cup fresh, frozen, or canned fruit; ½ cup fruit juice
Fat-free or low-fat milk and milk products	2 to 3 servings per day	2 to 3 servings per day	1 cup milk, 1 cup yogurt, 1½ oz cheese
Lean‖ meats, poultry, and fish	<6 oz per day	≤5 oz per day	
Nuts, seeds, and legumes	4 to 5 servings per week	Counted in vegetable servings.	⅓ cup (1½ oz), 2 Tbsp peanut butter, 2 Tbsp or ½ oz seeds, ½ cup dry beans or peas
Fats and oils	2 to 3 servings# per day	Amount depends on daily calorie level	1 tsp soft margarine, 1 Tbsp mayonnaise, 2 Tbsp salad dressing, 1 tsp vegetable oil
Sweets and added sugars	5 or fewer servings per week	No recommendation	1 Tbsp sugar, 1 Tbsp jelly or jam, ½ cup sorbet and ices, 1 cup lemonade

*Dietary Approaches to Stop Hypertension. For more information, please visit http://www.nhlbi.nih.gov/health/public/heart/hbp/dash.

†Therapeutic Lifestyle Changes. For more information, please visit http://www.nhlbi.nih.gov/cgi-bin/chd/step2intro.cgi. TLC includes 2 therapeutic diet options: Plant stanol/sterol (add 2 g per day) and soluble fiber (add 5 to 10 g per day).

‡Whole-grain foods are recommended for most grain servings to meet fiber recommendations.

§This number can be less or more depending on other food choices to meet 2000 calories.

¶Equals ½ to 1¼ cups, depending on cereal type. Check the product's Nutrition Facts Label.

‖Lean cuts include sirloin tip, round steak, and rump roast; extra lean hamburger; and cold cuts made with lean meat or soy protein. Lean cuts of pork are center-cut ham, loin chops, and pork tenderloin.

#Fat content changes serving counts for fats and oils: For example, 1 Tbsp of regular salad dressing equals 1 serving; 1 Tbsp of low-fat dressing equals ½ serving; 1 Tbsp of fat-free dressing equals 0 servings.

fatty acids and cholesterol alone.[35] Insoluble fiber has been associated with decreased CVD risk[36–38] and slower progression of CVD in high-risk individuals.[39] Dietary fiber may promote satiety by slowing gastric emptying, leading to an overall decrease in calorie intake.[40,41] Soluble fiber may increase short-chain fatty acid synthesis, thereby reducing endogenous cholesterol production.[41] The AHA recommends that at least half of grain intake come from whole grains.

Consume Fish, Especially Oily Fish, at Least Twice a Week

Fish, especially oily fish, is rich in very long-chain omega-3 polyunsaturated fatty acids: eicosapentaenoic acid, C20:5n-3 (EPA) and docosahexaenoic acid, C22:6n-3 (DHA). The consumption of 2 servings (≈8 ounces) per week of fish high in EPA and DHA is associated with a reduced risk of both sudden death and death from coronary artery disease in adults.[42,43] In addition to providing EPA and DHA, regular fish consumption may facilitate the displacement of other foods higher in saturated and *trans* fatty acids from the diet, such as fatty meats and full-fat dairy products. Methods used to prepare fish should minimize the addition of saturated and *trans* fatty acids, as occurs with the use of cream sauces or hydrogenated fat during frying.

Contamination of certain fish with methyl mercury, polychlorinated biphenyls, and other organic compounds is a potential concern.[44] Subgroups of the population, primarily children and pregnant women, are advised by the FDA to avoid eating those fish with the potential for the highest level of mercury contamination (eg, shark, swordfish, king mackerel, or tilefish), eat up to 12 ounces (2 average meals) per week of a variety of fish and shellfish that are lower in mercury (eg, canned light tuna, salmon, pollock, catfish), and check local advisories about the safety of fish caught by family and friends in local lakes, rivers, and coastal areas.[45] Potential exposure to some contaminants can be reduced by removing the skin and surface fat from these fish before cooking. For middle-aged and older men and postmenopausal women, the benefits of fish consumption far outweigh the potential risks when amounts of fish are eaten within the recommendations established by the FDA and Environmental Protection Agency. Consumers should also check with local and state authorities about types of fish and watersheds that may be contaminated and the FDA Web site for the most up-to-date information on recommendations for specific subgroups of the US populations (eg, children, pregnant women).

Limit Your Intake of Saturated and *Trans* Fat and Cholesterol

As a set of goals, the AHA recommends intakes of <7% of energy as saturated fat, <1% of energy as *trans* fat, and <300 mg cholesterol per day. These goals can be achieved by (1) choosing lean meats and vegetable alternatives; (2) selecting fat-free (skim), 1%-fat, and low-fat dairy products; and (3) minimizing intake of partially hydrogenated fats.

Diets low in saturated and *trans* fatty acids and cholesterol reduce the risk of CVD, in large part through their effects on LDL cholesterol levels. For all age groups of the US population, in 1999 to 2000, the daily mean percentage of calories from saturated fats was 11.2.[46] In those same years, average cholesterol intakes for men and women ages 20 to 74 years were 341 mg and 242 mg, respectively.[46] The mean

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trans fatty acid intake has been estimated to be ≈2.7% of energy.[47] This number should only be considered a crude estimate because it is likely current intakes are shifting, in part prompted by the new *trans* fatty acid labeling requirement. Subgroups within the population are likely to have higher or lower intakes based on their habitual dietary practices.

In the current US diet, the major sources of saturated fatty acids are animal fats (meat and dairy), and the primary sources of *trans* fatty acids are partially hydrogenated fats used to prepare commercially fried and baked products. Major sources of dietary cholesterol are foods of animal origin (eggs, dairy, and meat). Saturated and *trans* fatty acid intakes are directly related to LDL cholesterol levels.[48–50] Increased dietary cholesterol intake also raises LDL cholesterol concentrations.

Efforts to reduce saturated fat and cholesterol typically rely on replacement of animal fats with unsaturated fats (polyunsaturated and monounsaturated fats) and on selection of lower-fat versions of foods (eg, replacing full-fat dairy products with nonfat or low-fat versions). Replacing meats with vegetable alternatives (eg, beans) or fish is one strategy to replace saturated fats with unsaturated fats and reduce the cholesterol content. In view of the positive linear relationship among dietary saturated fat, LDL cholesterol, and CVD risk, and current US intakes, the AHA now recommends a population-wide goal of <7% of energy.

Efforts to reduce *trans* fatty acids typically rely on the substitution of partially hydrogenated fats with those made with liquid vegetable oils (with the exception of tropical fats). With the introduction of mandatory *trans* fat labeling on January 1, 2006, it is easier for consumers to identify and limit their *trans* fatty acid intake. However, even if partially hydrogenated fats were removed from the food supply, it is estimated that *trans* fats still would represent ≈1% of the calories because some *trans* fatty acids are produced from deodorization of vegetable oils and because meat and dairy products contain naturally occurring *trans* fatty acids.[50]

There are currently no numerical goals for *trans* fat. The Institute of Medicine recommends limiting *trans* fat intake as much as possible,[48] and both the 2005 Dietary Guidelines Advisory Committee and a recent FDA Food Advisory Committee, Nutrition Subcommittee, recommended that the intake of *trans* fat be ≤1% of energy.[50,51] (The FDA subcommittee voted [6 yes, 1 abstaining] in favor of the recommendation.) For this reason, the AHA recommends the goal of a diet containing <1% *trans* fatty acids.

The relative health effects of polyunsaturated and monounsaturated fats are actively debated. A few clinical outcome trials have documented that replacement of saturated fat with polyunsaturated fats reduces the risk of developing CHD, whereas prospective observational studies have documented that diets rich in monounsaturated fats are associated with a reduced risk of CHD. The AHA supports the recommendations of the Institute of Medicine and the National Cholesterol Education Program for total fat. A range of 25% to 35% for total fat is an appropriate level of intake in a healthy dietary pattern.

Minimize Your Intake of Beverages and Foods With Added Sugars

Over the past few decades, the consumption of beverages and foods with added sugars has risen markedly. The intake of added sugars (sucrose, corn syrup, and high-fructose corn syrup) increased from 13.1% of energy during the period 1977 to 1978 to 16.6% of energy during 1999 to 2002.[52,53]

The primary reasons for reducing the intake of beverages and foods with added sugars are to lower total calorie intake and promote nutrient adequacy.[54] Individuals who consume large amounts of beverages with added sugars tend to consume more calories and gain weight.[55–57] Some evidence suggests that calories consumed as liquid are not as satiating as calories consumed as solid food.[58] This factor may negatively affect attempts to achieve and maintain a healthy body weight.

Choose and Prepare Foods With Little or No Salt

On average, as salt (sodium chloride) intake increases, so does BP.[59,60] A reduced sodium intake can prevent hypertension in nonhypertensive individuals, can lower BP in the setting of antihypertensive medication, and can facilitate hypertension control. A reduced sodium intake is associated with a blunted age-related rise in systolic BP and a reduced risk of atherosclerotic cardiovascular events and congestive heart failure. In general, the effects of sodium reduction on BP tend to be greater in blacks; middle-aged and older-aged persons; and individuals with hypertension, diabetes, or chronic kidney disease (CKD). Diets rich in potassium lower BP and also blunt the BP-raising effects of an increased sodium intake.[59]

Because of the progressive dose-response relationship between sodium intake and BP, it is difficult to set a recommended upper level of sodium intake, which could be as low as 1.5 g/d (65 mmol/d). However, in view of the available high-sodium food supply and the currently high levels of sodium consumption, a reduction in sodium intake to 1.5 g/d (65 mmol/d) is not easily achievable at present. In the interim, an achievable recommendation is 2.3 g/d (100 mmol/d).

If You Consume Alcohol, Do So in Moderation

Moderate alcohol intake has been associated with reduced cardiovascular events in many populations.[2] This association is not only found with wine but also with other alcoholic beverages.[61,62] Unlike other potentially beneficial dietary components, the consumption of alcohol cannot be recommended solely for CVD risk reduction. Alcohol can be addictive, and high intake can be associated with serious adverse health and social consequences, including hypertriglyceridemia, hypertension, liver damage, physical abuse, vehicular and work accidents, and increased risk of breast cancer.[2]

For these reasons, and on the basis of available epidemiological data, the AHA recommends that if alcoholic beverages are consumed, they should be limited to no more than 2 drinks per day for men and 1 drink per day for women, and ideally should be consumed with meals.[63] In general, a 12-ounce bottle of beer, a 4-ounce glass of wine, and a 1½-ounce shot of 80-proof spirits all contain the same amount of alcohol (one half ounce). Each of these is considered a "drink equivalent."[63,64]

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Individuals who choose to consume alcoholic beverages should also be aware that alcohol has a higher caloric density than protein and carbohydrate and is a source of additional "empty" calories.

When You Eat Food That Is Prepared Outside of the Home, Follow the AHA 2006 Diet and Lifestyle Recommendations

Increasingly, Americans consume food that is prepared outside of the home. Such types of "away" food include food prepared at restaurants and grocery stores, quick-serve establishments, schools and daycare centers, and other non-home locations. Between 1977 to 1978 and 1994 to 1996, consumption of away food increased from 18% to 32% of calories.[65] Large portion sizes and high energy density are common features of away food.[66] Many types of away foods, particularly traditional quick-serve, are also high in saturated fat, *trans* fatty acids, cholesterol, added sugars, and sodium and low in fiber and micronutrients. Adverse health consequences have emerged. There is a positive association between frequency of meal consumption at quick-serve restaurants and total energy intake, weight gain, and insulin resistance.[67] Attainment of a healthy diet will require individuals to make wise choices when they eat food prepared outside of the home.

Dietary Factors With Unproven or Uncertain Effects on CVD Risk

Antioxidant Supplements

Antioxidant vitamin supplements or other supplements such as selenium to prevent CVD are not recommended.[68,69] Although observational studies have suggested that high intakes of antioxidant vitamins from food and supplements are associated with a lower risk of CVD, clinical trials of antioxidant vitamin supplements have not confirmed benefit. Some trials, in fact, have documented potential harm, including an increased risk of lung cancer from beta-carotene supplements in smokers and an increased risk of heart failure[70] and the possibility of increased total mortality[71] from high-dose vitamin E supplements. Although antioxidant supplements are not recommended, food sources of antioxidant nutrients, principally from a variety of plant-derived foods such as fruits, vegetables, whole grains, and vegetable oils are recommended.

Soy Protein

Evidence of a direct cardiovascular health benefit from consuming soy protein products instead of dairy or other proteins or of isoflavone supplements is minimal.[71,72] Although earlier research has suggested that soy protein has clinically important favorable effects on LDL cholesterol levels and other CVD risk factors, studies reported during the past 5 years have not confirmed those results.[72] A very large amount of soy protein, comprising more than half of daily protein intake, may lower LDL cholesterol levels by a few percentage points when it replaces dairy protein or a mixture of animal proteins, but data are mainly from hypercholesterolemic individuals. The evidence favors soy protein rather than soy isoflavones as the responsible nutrient.[76] No meaningful benefit of soy consumption is evident with regard to HDL cholesterol, triglycerides, or lipoprotein(a). Nevertheless, consumption of soy protein–rich foods may indirectly reduce CVD risk if they replace animal and dairy products that contain saturated fat and cholesterol.

Folate and Other B Vitamins

Available evidence is inadequate to recommend folate and other B vitamin supplements as a means to reduce CVD risk at this time. Folate intake and to a lesser extent intake of vitamins B6 and B12 are inversely associated with blood homocysteine levels. In observational studies, increased blood levels of homocysteine are associated with an increased risk of CVD.[77] Trials of homocysteine-reducing vitamin therapy have been disappointing, however.[78–82]

Phytochemicals

Flavonoids and sulfur-containing compounds are classes of compounds found in fruits and vegetables that may be important in reducing the risk of atherosclerosis. Within these categories are multiple possible compounds, most of which are not well characterized and whose modes of action are not established.[83] Until more of this information is gathered and fully understood, a diet consistent with AHA recommendations (Table 2) is the most prudent way to ensure optimum consumption of macronutrients, micronutrients, and associated bioactive compounds.[32]

Other Dietary Factors That Affect CVD Risk

Fish Oil Supplements

Fish intake has been associated with decreased risk of CVD.[83,84] On the basis of the available data, the AHA recommends that patients without documented CHD eat a variety of fish, preferably oily fish, at least twice a week.[42] Patients with documented CHD are advised to consume ≈1 g of EPA+DHA per day, preferably from oily fish, although EPA+DHA supplements could be considered in consultation with their physician. For individuals with hypertriglyceridemia, 2 to 4 g of EPA+DHA per day, provided as capsules under a physician's care, are recommended.[42]

Plant Stanols/Sterols

Plant stanols/sterols lower LDL cholesterol levels by up to 15%[85] and therefore are seen as a therapeutic option, in addition to diet and lifestyle modification, for individuals with elevated LDL cholesterol levels. Maximum effects are observed at plant stanol/sterol intakes of ≈2 g per day. Plant stanol/sterols are currently available in a wide variety of foods, drinks, and soft gel capsules. The choice of vehicle should be determined by availability and by other considerations, including caloric content. To sustain LDL cholesterol reductions from these products, individuals need to consume them daily, just as they would use lipid-lowering medication.

Special Groups

Children Over 2 Years of Age

Overweight and obesity are a particular concern for children as the prevalence of overweight is now ≈16% for children and adolescents. Achieving energy balance may be more complicated in children and adolescents because caloric and

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TABLE 5. High-Priority Recommendations to Facilitate Adoption of AHA 2006 Diet and Lifestyle Recommendations

Target Group	Recommendations
Practitioners	Advocate a healthy dietary pattern consistent with AHA recommendations.
	Encourage regular physical activity.
	Calculate BMI and discuss results with patients.
	Discourage smoking among nonsmokers and encourage smoking cessation among patients who do smoke.
	Encourage moderation of alcohol intake among those who do drink alcohol.
Restaurants	Display calorie content prominently on menus, or make calorie and other nutrition information easily accessible to consumers at point of decision and point of purchase.
	Reduce portion sizes and provide options for selecting smaller portions.
	Reformulate products to reduce calories, sodium, and saturated and *trans* fats.
	Use *trans* fat–free and low–saturated fat oils in food preparation to eliminate added *trans* fat without increasing saturated fat.
	Provide more vegetable options, and prepare them with minimal added calories and salt.
	Provide more fruit options, and serve them without added sugar.
	Develop creative approaches to including and marketing fruits and vegetables to make them more attractive to consumers.
	Allow substitution of nonfried and low-fat vegetables for usual side dishes (eg, French fries and potato salad).
	Provide whole-grain options for bread, crackers, pasta and rice.
Food industry	Reduce the salt and sugar content of processed foods.
	Replace saturated and *trans* fats in prepared foods and baked goods with low–saturated fat liquid vegetable oils.
	Increase the proportion of whole-grain foods available.
	Package foods in smaller individual portion sizes.
	Develop packaging that allows for greater stability, preservation, and palatability of fresh fruits and vegetables without added sodium and reduces refrigeration needs in grocery stores.
Schools	Adopt competitive food policies that limit foods high in added sugar, saturated and *trans* fat, sodium, and calories while encouraging consumption of fruits, vegetables, whole-grain foods, and low-fat or fat-free dairy. (Competitive food policies should address vending, a la carte, school stores, fundraising, and all food sold outside of the reimbursable school lunch.)
	Ensure the availability daily of heart-healthy lunches to students and staff by meeting USDA nutrition standards, offering nonfried fish as a regular menu item, and offering at least 1 meal/day low in saturated and *trans* fat.
	Offer and require daily physical education taught by qualified teachers at all grade levels.
	Expand physical activity opportunities by providing noncompetitive as well as competitive extracurricular physical activity options. Examples include intermural and intramural sports, dance classes, and walking clubs.
	Incorporate healthy nutrition and increased physical activity policy into after-school activities.
	Adopt 100% smoke-free policies on school campus, including parking lots and surrounding school grounds.
Local government	Develop and implement a Safe Routes to School plan.
	Implement land-use practices that promote nonmotorized transportation (walking and biking), such as complete streets and community parks.
	Promote policies that increase availability of healthy foods (eg, use of public land for farmers' markets and full-service grocery stores in low-income areas).

micronutrient intake must be adequate to support normal growth and development. However, many children are eating excess calories and experiencing unhealthy weight gain. Children can eat a diet consistent with the AHA 2006 Diet and Lifestyle Recommendations and maintain appropriate growth while lowering risk for future CVD. Furthermore, because diet in youth is associated with the occurrence of CVD outcomes later in life and because lifestyle habits in youth track into adulthood, adoption of a healthy diet and lifestyle at early ages is recommended. More specific guidance is provided in a separate AHA diet statement for children.[3]

Older Adults

Atherosclerosis is a chronic process beginning in youth. The risk of developing CVD increases dramatically with advancing age. Diet and lifestyle behaviors can decrease CVD risk.[86] Also, ample evidence from clinical trials indicates that older-aged persons can make and sustain lifestyle changes, perhaps more so than younger adults.[86,87] Because of the high incidence of CVD events in older-aged individuals, even relatively small improvements in risk factors (eg, small reductions in BP and LDL cholesterol through diet and lifestyle changes) should be of substantial benefit.[88,89] In general, the goals and recommendations described in this document are appropriate for older-aged individuals. Because they have decreased energy needs while their vitamin and mineral requirements remain constant or increase, however, older individuals should be counseled to select nutrient-dense choices within each food group.[90]

Persons With Metabolic Syndrome

Metabolic syndrome refers to a cluster of abnormalities that are related to insulin resistance and that commonly occur in

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the setting of overweight and obesity.[91] Characteristic features of the metabolic syndrome are abdominal obesity, atherogenic dyslipidemia (elevated triglycerides, low HDL cholesterol), increased BP, insulin resistance (with or without glucose intolerance), and prothrombotic and proinflammatory states.[17,91] The primary approach to reducing CVD risk in persons with the metabolic syndrome is to control the individual risk factors by diet and lifestyle intervention.[85] Physical activity and weight maintenance are recommended as a means to prevent the development of metabolic syndrome and lower the risk of developing type 2 diabetes or CHD.[91] Very low-fat diets should be avoided if elevated triglyceride or depressed HDL cholesterol levels are present.[92] Reducing caloric intake while maintaining a moderate-fat diet and increasing physical activity to achieve even a modest weight loss can improve insulin resistance and the concomitant metabolic abnormalities.

Persons With Chronic Kidney Disease

CKD, which precedes end-stage kidney disease, substantially increases the risk of CVD, at least in part through diet-related CVD risk factors.[93] CKD is associated with a high prevalence of diabetes, dyslipidemia (especially hypertriglyceridemia), and hypertension. Dietary therapies recommended for the general population are also recommended for persons with early stages of CKD, even though empiric evidence is sparse. In particular, a reduced salt intake is recommended as a means to reduce BP and prevent fluid overload, and dietary strategies to manage dyslipidemia are also recommended. Replacing meat with dairy and vegetable alternatives may also slow loss of kidney function.[94] At advanced stages of CKD, the dietary management of CKD diverges from general population recommendations; in particular, a reduced intake of protein, phosphorus, and potassium is recommended.

Socioeconomic Groups at High Risk of CVD

It is well recognized that individuals of lower socioeconomic status have a higher incidence of CVD than do individuals of higher socioeconomic status. Population subgroups of racial/ethnic minorities (eg, Mexican Americans, American Indians, and blacks), who are overrepresented in lower socioeconomic status groups, have a strikingly high prevalence of overweight and obesity—a condition that precedes the development of many other CVD risk factors.[95,96] Although the reasons for such disparities are complex and multifactorial, available research is sufficient to advocate diet and lifestyle changes as a means to reduce disparities. For example, blacks are especially sensitive to the BP-lowering effects of a reduced salt intake, increased potassium intake, and the DASH diet.[6]

Promotion of a desirable diet should be culturally sensitive and should encourage healthy preparation of traditional ethnic foods. Unfortunately, social and economic barriers make widespread adoption of current diet and lifestyle recommendations difficult for many segments of society. Targeted diet and lifestyle messages directed at ethnic minorities and policies that affect availability and affordability are critically needed to reduce CVD health disparities.

Environmental Influences on CVD Health Behaviors

Ultimately, people select the types and amount of food they eat and the amount of physical activity they perform. Still, the environment has a powerful influence on whether people consume excess calories, follow a healthy diet, and are physically active. By environment, we mean the constellation of cultural forces, societal norms, and commercial interests that influence the behavior of individuals.

The obesity epidemic, which has unfolded over the past 2 decades in genetically stable populations, illustrates the adverse impact of environment on diet and lifestyle behaviors. In brief, it is well recognized that the current environment encourages overconsumption of calories and discourages expenditure of energy. There is a growing agreement among experts that changes in the environment are a major driving force behind the obesity epidemic.[97] Environmental factors that contribute to excess calorie intake are increased portion sizes, high-calorie foods, and easy access to plentiful inexpensive food. Environmental factors that discourage physical activity include an environment that encourages automobile use rather than walking and that has few cues to promote activity and numerous cues that discourage activity (eg, poor pedestrian infrastructure, lack of sidewalks and other safety features, and poor street aesthetics). Other factors include reduced energy expenditures at school, work, and home, and increased time spent on sedentary activities such as watching television, using computers, and playing video games.

The effects of environmental factors and of individual nutrients and food groups on overweight and obesity (eg, role of fat, added sugars, alcohol, fruits and vegetables, dairy products, physical inactivity) have been explored. No one factor appears responsible for the epidemic. Such findings reinforce the belief that multiple factors are responsible for the obesity epidemic and that the optimal strategy to arrest the epidemic will be multifactorial. Because many of these factors are beyond the control of individuals (eg, size of portions served in restaurants, lack of information on calorie content at point of purchase, presence of sidewalks, adequate streetlights after dark), substantial changes to the environment will be required. Furthermore, the obesity epidemic highlights the importance of primary prevention efforts in children so that adverse diet and lifestyle behaviors do not become habits.

For individuals to adhere to a healthy diet and lifestyle, the AHA Nutrition Committee strongly believes that substantial changes to the environment must occur. In its deliberations, the Nutrition Committee identified several changes that it considers high priority and that should help achieve the AHA's strategic goals of reducing CVD risk in the general population. Not surprisingly, several target groups are involved. A list of the changes by target group is presented in Table 5.

Conclusions

A substantial and expanding body of evidence has implicated several aspects of diet in the pathogenesis of CVD and its risk factors. Importantly, lifestyle modifications can effectively

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control CVD risk factors and lower CVD risk. To realize these benefits, individuals should aim for a desirable body weight, be physically active, avoid tobacco exposure, and follow a diet and lifestyle consistent with AHA dietary recommendations as stated in this report. Accomplishing these objectives will require individuals to change their behavior and society to make substantial environmental changes. The current challenge to healthcare providers, researchers, and government officials is to develop and implement effective clinical and public health strategies that lead to sustained lifestyle changes among individuals and, more broadly, among populations.

Appendix

Resources

Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): http://www.nhlbi.nih.gov/guidelines/hypertension/jnc7full.htm

The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents: http://www.nhlbi.nih.gov/health/prof/heart/hbp/hbp_ped.htm

The DASH Eating Plan: http://www.nhlbi.nih.gov/health/public/heart/hbp/dash

Behavioral Intervention program from the PREMIER trial (designed to increase physical activity, lose weight, and accomplish the DASH diet): http://www.kpchr.org/public/premier/intervention

Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (describes panel's recommendations for Therapeutic Lifestyle Changes [TLC], a multifactorial lifestyle approach to reducing risk for CHD): http://www.nhlbi.nih.gov/guidelines/cholesterol/atp3_rpt.htm

Risk Assessment Tool for Estimating Your 10-Year Risk of Having a Heart Attack: http://hin.nhlbi.nih.gov/atpiii/calculator.asp?usertype=pub

Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.htm

The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: http://www.nhlbi.nih.gov/guidelines/obesity/practgde.htm

Calculate Your Body Mass Index: http://www.nhlbisupport.com/bmi/bmicalc.htm

Interactive Menu Planner: http://hin.nhlbi.nih.gov/menuplanner/menu.cgi

Portion Distortion: http://hin.nhlbi.nih.gov/portion

Palm and Download Tools

Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7): http://hin.nhlbi.nih.gov/jnc7/jnc7pda.htm

ATP III Cholesterol Management Implementation Tool for Palm: http://hin.nhlbi.nih.gov/atpiii/atp3palm.htm

Ten-Year Risk Assessment Tool: http://hin.nhlbi.nih.gov/atpiii/riskcalc.htm

BMI Calculator: http://hin.nhlbi.nih.gov/bmi_palm.htm

Obesity Education Initiative Guidelines Implementation Tool: http://hin.nhlbi.nih.gov/obgdpalm.htm

Dietary Guidelines for Americans 2005 (In addition to the guidelines, link contains several other links to tools and other resources on diet and physical activity.): http://www.healthierus.gov/dietaryguidelines

USDA National Nutrient Database (nutrient content of individual foods): http://www.nal.usda.gov/fnic/foodcomp/Data

What You Need to Know About Mercury in Fish and Shellfish: http://www.cfsan.fda.gov~dms/admehg3.html

Your Guide to Lowering Blood Pressure with DASH. http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/index.htm

American Heart Association Cookbooks

American Heart Association's No-Fad Diet Book
The New American Heart Association Cookbook, 7th Edition
American Heart Association One-Dish Meals
American Heart Association Low-Salt Cookbook
American Heart Association Meals in Minutes Cookbook
American Heart Association Quick & Easy Cookbook

AHA Web Sites

American Heart Association: www.americanheart.org

American Heart Association Council on Nutrition, Physical Activity, and Metabolism: http://www.americanheart.org/presenter.jhtml?identifier=650

Easy Food Tips for Heart-Healthy Eating: http://www.americanheart.org/presenter.jhtml?identifier=9033

Diet & Nutrition: http://www.americanheart.org/presenter.jhtml?identifier=1200010

Nutrition Facts: http://www.americanheart.org/presenter.jhtml?identifier=855

Council on Nutrition, Physical Activity and Metabolism Hot Links: http://www.americanheart.org/presenter.jhtml?identifier=1160

Nutrition and Cardiovascular Disease—Statistics: http://www.americanheart.org/presenter.jhtml?identifier=3020707

AHA Comment: FDA's new nutrition labeling requirement for *trans* fatty acids: http://www.americanheart.org/presenter.jhtml?identifier=3013636

AHA Scientific Statements on Diet/Nutrition: http://www.americanheart.org/presenter.jhtml?identifier=3004604

Physical Activity, Nutrition & School Health Policy (State-by-State Research): http://www.americanheart.org/presenter.jhtml?identifier=3019642

Nutrition materials in Spanish: http://www.americanheart.org/presenter.jhtml?identifier=3003430

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Disclosures

TABLE 6. Relationships With Industry—AHA Writing Group to Develop Diet and Lifestyle Recommendations

Writing Group Member	Employment	Research Grant	Other Research Support	Speakers' Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board	Other
Alice H. Lichtenstein	Tufts University	NIH	None	None	None	None	None
Lawrence J. Appel	Johns Hopkins University	None	None	None	None	None	None
Michael Brands	Medical College of Georgia	None	None	None	None	None	None
Mercedes Carnethon	Northwestern University	None	None	None	None	None	None
Stephen Daniels	University of Cincinnati	None	None	None	None	Abbott Laboratories; Able Laboratories	None
Harold A. Franch	Atlanta VA Medical Center, Emory University	NIH, Department of Veterans Affairs	None	None	None	None	None
Barry Franklin	William Beaumont Hospital, Royal Oak, Mich	None	None	None	None	None	American College of Sports Medicine; American Association of Cardiovascular and Pulmonary Rehabilitation
Penny Kris-Etherton	Penn State	Dairy Council; California Pistachio Board	None	Sunflower Association	None	McNeil	None
William S. Harris	St. Luke's Hospital	None	None	None	None	None	None
Barbara Howard	MedStar Research Institute	None	Donation of drugs: Pfizer, Merck, Schering-Plough	Lectures for Schering-Plough	None	Merck, Egg Nutrition Council, General Mills	None
Njeri Karanja	Kaiser Permanente	None	None	None	None	None	None
Michael Lefevre	Pennington Biomedical Research Center	General Mills, includes salary support (PI); Hershey Foods, includes salary support (Co-PI)	None	None	None	Kraft Foods; Member, Global Health and Wellness Advisory Board; International Life Sciences Institute: Scientific Advisor, Technical Committee on Fatty Acids	None
Lawrence Rudel	Wake Forest School of Medicine	None	Lipid Sciences contract research	Merck	None	TAP Pharmaceuticals	None
Frank M. Sacks	Harvard School of Public Health	None	None	None	None	None	None
Linda Van Horn	Northwestern University	None	None	None	None	None	None
Mary Winston	American Heart Association	None	None	None	None	None	None
Judith Wylie-Rosett	Albert Einstein College of Medicine at Yale University	Atkins Foundation	None	None	None	Frito-Lay (resigned)	None

This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit.

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TABLE 7. Relationships With Industry—External Peer Reviewers for the AHA 2006 Diet and Lifestyle Guidelines

Reviewer	Employment	Research Grant	Other Research Support	Speakers Bureau/Honoraria	Ownership Interest	Consultant/Advisory Board	Other
Benjamin Caballero	Johns Hopkins University Center for Human Nutrition	None	None	None	None	None	None
Robert M. Carey	University of Virginia	NIH	None	None	None	Novartis	None
Scott M. Grundy	University of Texas Southwestern Medical Center at Dallas	Merck, Abbott, Kos	None	Merck, Pfizer, Sankyo, Schering Plough, Kos, Abbott, Fournier, Bristol-Myers Squibb, AstraZeneca	None	None	None
Janet C. King	Children's Hospital Oakland Research Institute	National Dairy Council	None	None	None	None	None
Russell R. Pate	University of South Carolina	NIH and CDC	None	National Association of School Boards of Education, Kansas State University, Penn State University, Kansas University School of Medicine, Maine Center for Public Health, University of Georgia	None	NIH, CDC, Chartwells, Kraft Foods, and Porter Novelli (Bone Health)	None

This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit.

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Correction

In the article "Diet and Lifestyle Recommendations Revision 2006: A Scientific Statement From the American Heart Association Nutrition Committee," by Alice Lichtenstein et al, which published online before print on June 21, 2006, and appeared in the July 4, 2006, issue of *Circulation* (*Circulation*. 2006;114:82–96), the following relationships with industry should be added: Writing Group member William S. Harris reports ownership interest in OmegaMetrix, LLC, and has served as a consultant to and/or member of the advisory boards of Monsanto, Frito-Lay, Bayer Consumer Products, Cardiotabs, and TherRx Corporation.

Table 6 ("Relationships With Industry—AHA Writing Group to Develop Diet and Lifestyle Recommendations") has been updated in the current online version of the statement.

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Correction

The version of the AHA Scientific Statement, "Diet and Lifestyle Recommendations Revision 2006: A Scientific Statement From the American Heart Association Nutrition Committee," by Lichtenstein et al, that published online before print on June 19, 2006 (DOI: 10.1161/CIRCULATIONAHA.106.176158) required three corrections. These corrections were made in the version of the article printed in the July 4, 2006, issue of the journal (*Circulation*. 2006;114:82–96) and in the current online version of the article.

1. Harold A. Franch, MD, FAHA, should have been listed as an author. We regret this error. His relationship-with-industry information has been added to Table 6 (p 93).
2. Reference 43, originally listed as "in press," has been updated.
3. On page 88, in the last paragraph of the left column, the following sentences have been added: "The AHA supports the recommendations of the Institute of Medicine and the National Cholesterol Education Program for total fat. A range of 25% to 35% for total fat is an appropriate level of intake in a healthy dietary pattern."

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Population-Based Prevention of Obesity: The Need for Comprehensive Promotion of Healthful Eating, Physical Activity, and Energy Balance: A Scientific Statement From American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (Formerly the Expert Panel on Population and Prevention Science)

Shiriki K. Kumanyika, Eva Obarzanek, Nicolas Stettler, Ronny Bell, Alison E. Field, Stephen P. Fortmann, Barry A. Franklin, Matthew W. Gillman, Cora E. Lewis, Walker Carlos Poston, II, June Stevens and Yuling Hong

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AHA Scientific Statement

Population-Based Prevention of Obesity

The Need for Comprehensive Promotion of Healthful Eating, Physical Activity, and Energy Balance

A Scientific Statement From American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (Formerly the Expert Panel on Population and Prevention Science)

Shiriki K. Kumanyika, PhD, RD, MPH, FAHA; Eva Obarzanek, PhD, MPH, RD, FAHA*; Nicolas Stettler, MD, MSCE, FAHA; Ronny Bell, PhD; Alison E. Field, ScD; Stephen P. Fortmann, MD, FAHA; Barry A. Franklin, PhD, FAHA; Matthew W. Gillman, MD, SM; Cora E. Lewis, MD, MSPH, FAHA; Walker Carlos Poston II, PhD, MPH, FAHA; June Stevens, PhD; Yuling Hong, MD, PhD, FAHA

***Abstract*—**Obesity is a major influence on the development and course of cardiovascular diseases and affects physical and social functioning and quality of life. The importance of effective interventions to reduce obesity and related health risks has increased in recent decades because the number of adults and children who are obese has reached epidemic proportions. To prevent the development of overweight and obesity throughout the life course, population-based strategies that improve social and physical environmental contexts for healthful eating and physical activity are essential. Population-based approaches to obesity prevention are complementary to clinical preventive strategies and also to treatment programs for those who are already obese. This American Heart Association scientific statement aims: 1) to raise awareness of the importance of undertaking population-based initiatives specifically geared to the prevention of excess weight gain in adults and children; 2) to describe considerations for undertaking obesity prevention overall and in key risk subgroups; 3) to differentiate environmental and policy approaches to obesity prevention from those used in clinical prevention and obesity treatment; 4) to identify potential targets of environmental and policy change using an ecological model that includes multiple layers of influences on eating and physical activity across multiple societal sectors; and 5) to highlight the spectrum of potentially relevant interventions and the nature of evidence needed to inform population-based approaches. The evidence-based experience for population-wide approaches to obesity prevention is highlighted. **(*Circulation*. 2008;118:428-464.)**

Key Words: AHA Scientific Statement ■ obesity ■ overweight ■ prevention ■ population-based ■ policy strategies ■ environmental strategies

Obesity is a major influence on the development of cardiovascular disease (CVD) and affects physical and social functioning and quality of life.[1,2] The proportion of adults and children who are obese has reached epidemic proportions, moving steadily away from the Healthy People 2010 goals of 15% prevalence of obesity in adults and 5% prevalence in children.[3–5] These goals may be beyond our reach for several decades to come (Figures 1 and 2).

The obesity epidemic is a major concern for the health of populations in the United States and many other na-

*The findings and conclusions of this report are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute.

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

This statement was approved by the American Heart Association Science Advisory and Coordinating Committee on April 2, 2008. A single reprint is available by calling 800-242-8721 (US only) or by writing the American Heart Association, Public Information, 7272 Greenville Ave, Dallas, TX 75231-4596. Ask for reprint No. 71-0450. A copy of the statement is also available at http://www.americanheart.org/presenter.jhtml?identifier=3003999 by selecting either the "topic list" link or the "chronological list" link. To purchase additional reprints, call 843-216-2533 or e-mail kelle.ramsay@wolterskluwer.com.

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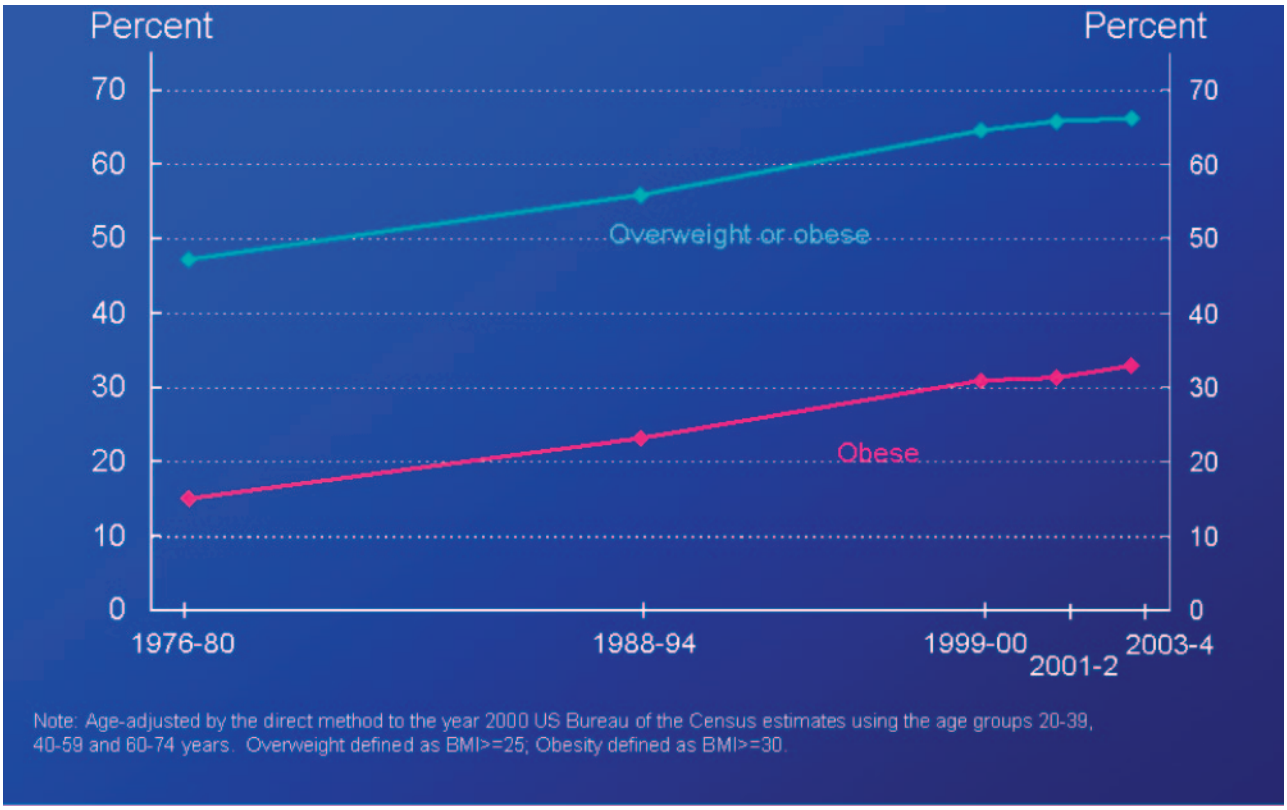

Figure 1. Trends in adult overweight and obesity ages 20 to 74 years. Source: National Center for Health Statistics.[4]

tions.[6–10] Based on data from the 2003–2004 US National Health and Nutrition Examination Survey (NHANES), approximately 66 million American adults (30 million men and 36 million women) are obese and an additional 74 million (42 million men and 32 million women) are overweight. Among American children 6 to 11 years of age, an estimated 4.2 million (2.3 million boys and 1.9 million girls) are overweight; among American adolescents 12 to 19 years of age, 5.7 million (3.1 million boys and 2.6 million girls) are overweight.[11] Assuming that the same trends continue, by 2015 2 in every 5 adults and 1 in every 4 children in the United States will be obese.[12] Obesity prevalence is also rising in countries throughout the world, reaching 20% to 30% in some European countries and 70% in Polynesia (International Obesity Task Force). According to the World Health Organization, the number of overweight and obese people worldwide will increase to 1.5 billion by 2015 if current trends continue.[13] Clearly, overweight and obesity place a large public health burden on society.

The prevalence of some obesity-related CVD risk factors (eg, elevated cholesterol and high blood pressure) decreased in the United States during the period from 1960 to 2000, despite increased obesity.[14] Nevertheless, the prevalence of these risk factors remained higher in overweight and obese than nonoverweight individuals, despite the concomitant trend of increased use of medications to treat these risk factors. Furthermore, the prevalence of diagnosed type 2 diabetes mellitus continued to increase concurrently with increases in obesity.[14] These trends underscore the importance of curbing the obesity epidemic. Control of type 2 diabetes requires a lifetime of medical care and usually drug therapy from the point of diagnosis, with the attendant financial costs and potential adverse effects on quality of life. Pharmacological control of high blood cholesterol and hypertension likewise requires lifelong medical therapy. Even with medical intervention, increased obesity may ultimately reverse gains made with respect to declines in related CVD risk factors. Thus, there is no room for complacency in dealing with this public health problem.

It is preferable to avoid, in the first place, the excess weight gain that leads to overweight and then obesity. Effective treatment of obese individuals can substantially reduce risk factors for CVD and improve disease management,[2,15] although some effects of long-standing obesity may not be reversible[16] or readily manageable. However, even those overweight people who are able to lose weight are often unable to maintain their weight at that level, and no clear guidance currently exists on definitive strategies to achieve long-term weight loss in the population at large.[15,17] The ability of weight loss to improve overall and CVD mortality has also not been clearly established, although a study to address this question is in progress.[18]

A major emphasis on obesity prevention is needed in the population at large[19,20] to prevent the development of obesity in those adults who are still in the normal weight range and in successive generations of children and adolescents during development. Treatment will continue to be of critical importance, but treatment alone cannot curb

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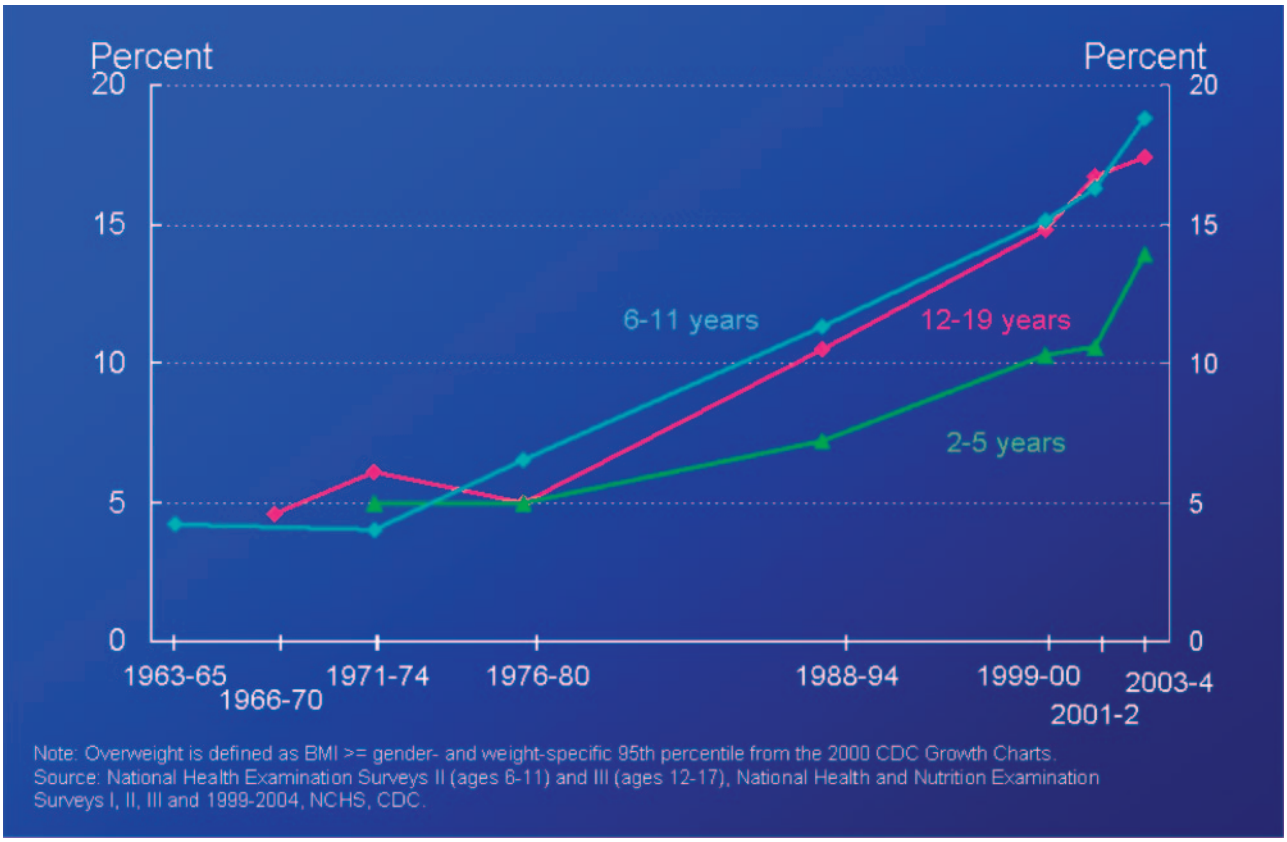

Figure 2. Trends in childhood overweight. Source: National Center for Health Statistics.[5]

the epidemic. Besides the limited long-term success of most obesity treatments, another factor is the limited ability to deliver enough treatment to enough people. We are already unable to deliver obesity treatment services to those who need such services, while the numbers needing treatment are rising. Health insurance seldom covers the cost of counseling for obesity, particularly the extended treatment of a year or more that is suggested to facilitate long-term weight loss.[17] The need for treatment is highest, relatively speaking, among low-income and ethnic minority populations,[21] who have a high burden of obesity, CVD, and stroke outcomes but less access to healthcare services.

This review provides a rationale for population-based obesity prevention efforts and research from a United States public health perspective. It is intended for a broad audience of health professionals, policy makers, and consumer advocates who may contribute to prevention efforts. As an overview of issues related to obesity prevention, this statement is complementary to published statements, workshop proceedings, and guidelines from the American Heart Association and other organizations that describe the effects of obesity and weight loss on CVD and its risk factors and provide guidance for obesity assessment and treatment and related lifestyle interventions[2,7,17,21–37] (Appendixes). This statement addresses the need to bring together, in one place, the various arguments for what needs to be done, and how, with respect to population-based initiatives to promote healthful eating, physical activity, and energy balance. A key goal is to motivate health professionals and others to contribute directly to broadly based obesity prevention efforts—"treating the community at large."[38] The relevance to clinicians is to describe population-based efforts needed to support and complement obesity prevention and treatment activities undertaken in day-to-day practice. Obesity prevention in the population at large is also highly relevant to obesity treatment in that it fosters social and environmental conditions that support healthful eating and active living. Such conditions are essential for all weight-control efforts.

The writing group objectives were as follows: 1) to raise awareness of the importance of undertaking population-based initiatives specifically geared to the prevention of excess weight gain in adults and children; 2) to describe considerations for undertaking obesity prevention overall and in key risk subgroups; 3) to differentiate environmental and policy approaches to obesity prevention from those used in clinical prevention and obesity treatment; 4) to identify potential targets of environmental and policy change using an ecological model that includes multiple layers of influences on eating and physical activity across multiple societal sectors; and 5) to highlight the spectrum of potentially relevant interventions and the nature of evidence needed to inform population-based approaches. The evidence reviewed includes primary sources, systematic reviews and expert reports, emphasizing articles published from June 1995 through May 2007. The population burden and health effects of obesity are described as background. Conceptual frameworks that can be used to describe and analyze prevention strategies are presented.

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Background: Scope of the Problem

The Burden of Overweight and Obesity in the US Population

Adults

Overweight and obesity are generally defined using body mass index (BMI), a measure of weight relative to height that is closely correlated with total body fat content. BMI is calculated as weight in kilograms divided by height in meters squared or by dividing weight in pounds by height in inches squared and multiplying by a conversion factor of 703.[15] According to the National Heart, Lung, and Blood Institute, for adults, overweight is defined as a BMI of 25 to 29.9 kg/m^2; obesity, ≥30 kg/m^2; and extreme obesity, ≥40 kg/m^2.[15] Measures of waist circumference or waist-hip ratio are indicative of visceral adipose tissue, or intraabdominal fat, which may be more deleterious than overall overweight or obesity in some cases. Accordingly, the National Heart, Lung, and Blood Institute Clinical Guidelines recommend the use of waist circumference in addition to BMI in clinical screening of adults. High waist circumference, defined by cutoffs of >35 inches (>88 cm) for women and >40 inches (>102 cm) for men,[15] increases the level of risk associated with a given BMI level.

Data based on measured heights and weights, which are more reliable and valid than self-report, are available from NHANES.[9] In NHANES data for 2003–2004, an estimated 66.3% of US adults ≥20 years of age were either overweight or obese,[9] a relative increase of 18% from the previous estimate of 56% in NHANES III (1988–1994). The estimated prevalence of obesity alone was 32.3% in the 2003–2004 NHANES, a relative increase of 40.6% from the estimated 22.9% prevalence reported in NHANES III. The prevalence of extreme obesity (BMI ≥40) in the 2003–2004 NHANES was 4.8%. The prevalence of obesity generally increases across adult age groups. Previously observed gender differences in obesity prevalence, at the level of BMI 30 or above, have disappeared, with men "catching up" to women between 1999–2000 and 2003–2004. However, the prevalence of extreme obesity continues to be higher in women.

Long-term trends in overweight and obesity show notable increases (from 47.4% to 66.0%, or a relative increase of 39.2%) in the percent of persons who were either overweight or obese in the last quarter of the 20th century[39] (Figure 1). Most of the increase was attributable to increases in the prevalence of BMI ≥30 (obesity), whereas only minor increases occurred in the prevalence of BMI of 25 to 29.9 (overweight). The prevalence of obesity increased from 15.1% to 32.1% (a relative increase of 112.6%) for those aged 20 to 74 between the 1976–1980 NHANES and the 2001–2004 NHANES.

Children and Adolescents

For children and adolescents up to age 20 years, the term "overweight" rather than "obesity" is currently used by the Centers for Disease Control and Prevention (CDC) and generally defined as a BMI at or above the 95th percentile of sex-specific BMI-for-age values from the 2000 CDC growth charts.[40] In children and adolescents, the term "at risk of overweight" is the counterpart of overweight in adults, which the CDC defined as a BMI between the 85th and 95th percentiles. If recommendations of an expert panel convened by the American Medical Association, Health Services and Resources Administration and CDC[41] are implemented, the terminology for children will change to align with that for adults, ie, overweight and obesity. An estimated 17% of children and adolescents 2 to 19 years of age are overweight according to the 2003–2004 NHANES.[9] Among children 6 to 11 years of age, the percentage of those considered overweight increased from 4.2% to 18.8% (a 348% relative increase) between 1963–1965 and 2003–2004. Among adolescents 12 to 19 years of age, the percentage of those considered overweight increased from 4.6% to 17.4% (a 278% relative increase) between 1966–1970 (for adolescents 12 to 17 years of age) and 2003–2004[39] (Figure 2 for recent trends).

Waist circumference percentiles based on national data are available for white, African American, and Mexican American children.[42] However, whereas clinical guidelines for obesity assessment in adults include waist circumference, the above-referenced expert committee on child and adolescent overweight[41] did not find sufficient evidence or guidance to warrant a recommendation for routine clinical use of waist circumference in children at present.

Ethnic Disparities

In adults, NHANES data indicate consistent trends of higher obesity prevalence for non-Hispanic blacks and Mexican Americans compared with non-Hispanic whites but do not provide estimates for other ethnic minority populations. Drawing on other data sources—of which some rely on self-reported weight and height and, therefore, underestimate prevalence overall or in specific demographic groups[43,44]—obesity prevalence is also higher for American Indians and Alaska Natives, other Hispanic/Latino populations, Native Hawaiians, and Pacific Islanders in comparison with non-Hispanic whites, across the adult age spectrum.[15,25,45] Depending on the ethnic group, the prevalence of obesity is higher in females only or in both males and females.[9,46–52]

In the NHANES data, extreme obesity (BMI ≥40), which is associated with particularly high levels of CVD risk and total mortality,[53] affects approximately 15% of non-Hispanic black women compared with 6% and 8% of non-Hispanic white and Mexican American women and 2% to 5% or fewer in men in these ethnic groups.[9] Among immigrants in ethnic minority populations (Hispanic/Latino, Asian American, Pacific Islander, and possibly non-Hispanic blacks), obesity prevalence typically increases with a longer duration of US residence and, in some cases, approaches rates observed among US-born residents.[54–56]

Ethnic disparities in obesity prevalence apply to both BMI and waist circumference and are accompanied by disparities in obesity-related diseases.[21] However, there are ethnic differences in the interpretation of obesity indexes.[57–60] For example, the clinical consequences of obesity are higher for people of Asian descent at lower BMI and waist circumference cut points than for whites.[60,61] A report from the World Health Organization, Western Pacific Region,[62] suggested that overweight should be defined as a BMI of 23 kg/m^2 or

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greater and obesity as a BMI of 25.0 kg/m^2 or greater in adults of Asian descent rather than using the respective cutoffs of BMIs of 25 and 30. A subsequent World Health Organization expert panel recognized that a range of plausible BMI cutoffs for overweight and obesity existed for these populations.[60] A more recent article[63] calls for revisions of BMI criteria for South Asians, Chinese, and Aboriginals.

Ethnic disparities in overweight prevalence are also observed in male or female children and adolescents, as in adults.[9,49,52,64–66] For example, in the NHANES data for 1999–2004, Mexican American male children and adolescents had a higher prevalence of overweight than non-Hispanic white male children and adolescents.[9] The prevalence of overweight among non-Hispanic black male children and adolescents was not materially different from that among non-Hispanic white male children and adolescents. The prevalence of overweight in Mexican American and non-Hispanic black female children and adolescents was higher than non-Hispanic while female children and adolescents. Rates of increase in overweight have been steepest in non-Hispanic black children compared with Mexican American and non-Hispanic white children and generally intermediate for Mexican American children.[67] Together with the higher prevalence of overweight in non-Hispanic black girls and Mexican American boys, these faster rates of increase indicate a particular need for preventive strategies addressed to these populations.

Socioeconomic Status and Geographic Variations

Population-based surveys show a higher prevalence of obesity in populations with lower socioeconomic status (SES), especially among white females,[68–71] although this relationship is less clear in more recent prevalence trends.[12] Patterns of SES differences in children and adolescents are complex and not consistent across age, gender, and ethnicity.[72–74] For example, in recent NHANES data, an inverse association of obesity prevalence with SES was observed in white girls, whereas higher SES was associated with higher obesity levels in African American girls.[74] Overall, SES differences in obesity are becoming less prominent in both adults and children.[12,74]

Geographic variation in obesity has been reported by state, as well as degree of urbanization. For example, interview data (ie, using self-reported height and weight data) from the 2005 Behavioral Risk Factor Surveillance System (BRFSS) survey indicate that the highest prevalence of obesity was seen in Louisiana, Mississippi, and West Virginia, whereas the lowest prevalence was seen in Colorado and Hawaii.[75] This may reflect socioeconomic differences among states.[76] Higher prevalence of obesity has been reported for rural populations compared with urban and suburban populations in the National Health Interview Survey.[77–79] For example, in 32 440 adult respondents to a 1998 National Health Interview Survey module,[78] obesity was more prevalent among adult residents of rural areas than residents of urban areas (20.4% versus 17.8%; $P=0.0002$) and this rural-urban difference was consistent across all ethnic groups. An analysis of 2000–2001 BRFSS data showed a similar pattern but with higher prevalence (23.0% and 20.5% in rural and urban areas, respectively). Rural-urban-suburban differences in obesity and health may also reflect socioeconomic differences, with rural areas being more characterized by local poverty and lack of resources,[77] at least in part.

Health Effects of Obesity

Adults

Obesity prevention in adults can potentially have a major impact in reducing morbidity and mortality that result from the chronic effects of excess body fatness.[8,80] The worldwide increase in obesity portends an increasing epidemic of diabetes and its serious consequences, including CVD. The American Heart Association (AHA) identified obesity as a major CVD risk factor in 1998.[81] As reviewed in a separate AHA scientific statement,[2] the impact of obesity in the pathophysiology of cardiovascular and pulmonary diseases and diabetes is well documented and has been recognized for decades.[2,82]

Weight gain after young adulthood is associated with an increased risk of CVD events and risk factors later in life independent of BMI levels. For example, in a cohort study of young adults, those who gained more than 5 lb over 15 years had unfavorable changes in CVD risk factors and higher incidence of metabolic syndrome and its components (waist, lipids, blood pressure), independent of initial BMI than those who had stable weight.[83,84] In a 20-year follow-up of middle-aged men, risks of major CVD events and type 2 diabetes mellitus were related to excess body weight at baseline (overweight and obesity) and to weight gain.[85] Also, in the Nurses Health Study, weight gain was associated with increased risk of all-cause, coronary heart disease, and CVD mortality at any level of initial BMI.[86] The association between obesity and several diseases begins when an individual is well within the "normal" weight range. For example, in a study of >7000 middle-aged men screened in British general practices and monitored for nearly 15 years, the lowest overall mortality rate was at a BMI of 22 to 27.9; however, for a combined end point of myocardial infarction, stroke, type 2 diabetes, and death, risk was lowest at a BMI of 20 to 23.9, and all major CVD risk factors increased progressively from a BMI of <20.[87]

As shown in Table 1, adverse health outcomes associated with obesity are not limited to CVD.[1,59,81–166] There is a large and growing body of evidence on the other myriad health effects of overweight and obesity, based on both animal and human studies, including mechanistic studies, epidemiological studies (eg, prospective cohort and case-control studies), and clinical trials. Of the adverse medical consequences of overweight in adults, diabetes is the most strongly linked with increasing BMI.[167] For example, insulin resistance, which is associated with obesity and is a risk factor for coronary heart disease, also appears to be related to liver disease and obstructive sleep apnea.[95] Obesity increases the risk for several types of cancer, including relatively common cancers, such as breast cancer in postmenopausal women[135] and prostate cancer.[96] As shown in Table 1, other relevant outcomes include osteoarthritis, gastroesophageal reflux disease, erectile dysfunction, and Alzheimer disease, as well as physical disability, employee absenteeism, impaired quality

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Table 1. Adverse Outcomes for Which Obesity Increases Risk or Complications In Adulthood

Cardiovascular diseases, diabetes, and related conditions
Coronary heart disease (CHD)
Type 2 diabetes
CHD risk factors
Type 2 diabetes
Hypertension
Dyslipidemia
Inflammation
Hypercoagulability
Autonomic nervous system dysfunction
Heart failure
Stroke
Deep venous thrombosis
Pulmonary disease (including obesity hypoventilation syndrome, obstructive sleep apnea)
Other outcomes*
Absenteeism from work
Alzheimer's disease
Asthma
Cancer (including breast [postmenopausal], endometrial, esophageal, colorectal, kidney, and prostate)
Disability, physical
Erectile dysfunction
Fertility and pregnancy complications
Gallstones/cholecystitis
Gastroesophageal reflux disease
Gout
Healthcare costs
Impaired quality of life
Kidney stones
Liver (spectrum of nonalcoholic fatty liver disease)
Mortality
Obesity-related glomerulopathy
Osteoarthritis
Psychological disorders (eg, depression, aggressive behaviors)
Surgical complications

*Listed alphabetically. See text for relevant references.

of life, and increased healthcare costs. In older adults, obesity is associated with protection against hip fracture,[168] but this protective effect on bone status does not offset the extensive array of potential adverse effects on conditions that are common in the older population.

The extensive data indicating that weight loss can reverse or arrest the harmful effects of obesity[26] are further evidence of the causal link between obesity and disease. Lifestyle intervention studies have shown the effectiveness of weight loss in improving cardiovascular risk factors, including blood pressure,[156,169] insulin resistance and type 2 diabetes,[100,159] lipid disorders, and the metabolic syndrome,[26,170] in some cases lowering the incidence of hypertension or diabetes in a population at high risk for such diagnoses. Data from surgically treated obese subjects with larger weight losses than those usually observed in lifestyle trials have further confirmed the marked improvements in systolic (2 years only) and diastolic blood pressure, pulse pressure, and glucose, insulin, uric acid, triglycerides, high-density lipoprotein cholesterol, and total cholesterol levels, associated with weight loss after up to 10 years of follow-up.[153]

With respect to mortality, although controversies continue, many studies show clear, statistically significant, positive associations of BMI with CVD mortality, suggesting that obesity prevention can improve longevity. Most studies show an association between BMI in the obese range (≥30) and mortality.[92,106,107,140] The Look AHEAD trial[18] was initiated to specifically clarify the potential benefits of intentional weight loss on mortality. However, mortality data—even if conclusive with respect to the presence or absence of an association of obesity or weight loss with longevity—do not reflect the full spectrum of obesity-related health or quality-of-life issues (Table 1).

Children and Adolescents

Events that occur at the earliest stages of human development—even before birth—may have a profound influence on risk for obesity, diabetes, CVD, and other common adult conditions and are, therefore, potentially important focal points for preventive efforts.[171] Excess weight during childhood is associated with chronic disease morbidity and adverse psychosocial effects from childhood onward and, therefore, the lifetime duration of these diseases. Obesity during childhood also increases the risk of being obese as an adult, with the attendant implications for the above-described morbidity during adulthood.

Prenatal Determinants of Obesity and Related Health Risks

Both higher and lower birth weight are correlated to later obesity-related consequences.[172] Higher birth weight is associated with larger amounts of gestational weight gain and with gestational diabetes, 2 factors also implicated in childhood obesity.[173,174] Lower birth weight is consistently associated with central fat distribution, insulin resistance, the metabolic syndrome, type 2 diabetes, and ischemic CVD.[172] Moreover, the phenotype of lower birth weight followed by higher BMI in childhood or adulthood appears to confer the highest risk of these outcomes. This pattern holds, for example, for insulin resistance among 8-year-olds in India,[175] blood pressure among Filipino adolescents,[176] the metabolic syndrome among white and Mexican American adults,[177] and coronary heart disease among Welsh men and American female nurses.[178,179] Recent studies have found that excess weight gain during childhood and adolescence appears to explain these observations.[180,181] Whether accelerated weight gain in infancy confers excess risk for these adult outcomes is controversial.[182]

Other prenatal determinants of obesity-related outcomes may span the entire "fetal supply line" from maternal dietary intake to alterations in uteroplacental blood flow, placental function, and fetal metabolism, and they may or may not have any influence on birth weight. Maternal smoking during

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Table 2. Adverse Outcomes for Which Obesity Increases Risk During Childhood

Metabolic
Type 2 diabetes mellitus
Metabolic syndrome
Orthopedic
Slipped capital femoral epiphysis
Blount's disease
Cardiovascular
Dyslipidemia
Hypertension
Left ventricular hypertrophy
Atherosclerosis
Psychological
Depression
Poor quality of life
Neurological
Pseudotumor cerebri
Hepatic
Nonalcoholic fatty liver disease
Nonalcoholic steatohepatitis
Pulmonary
Obstructive sleep apnea
Asthma (exacerbation)
Renal
Proteinuria

Source: Reference 27.

pregnancy is one potentially modifiable factor that appears to increase the risk for obesity and elevated blood pressure levels in offspring.[183] Smoking among women is rising in developing countries; reversal of this trend has the potential to help curb the emergence of obesity as a public health threat around the world.

Consequences of Overweight During Childhood

CVD effects of obesity during childhood are reviewed in detail in other AHA statements.[23,27] In addition to CVD morbidity, obesity can also lead to a number of other adverse health outcomes in childhood, including sleep apnea, gastroesophageal reflux, fatty liver, and orthopedic problems[27] (Table 2). Evidence relating to type 2 diabetes, asthma, and psychosocial problems associated with childhood overweight is highlighted below.

Given the strong relationship of obesity and diabetes in adults, the increase in childhood obesity is likely driving the concomitant increase in rates of type 2 diabetes among children. Once considered rare in children and adolescents, referrals for type 2 diabetes now rival those for type 1 diabetes in some centers.[184] In a multiethnic, population-based study of diabetes in youth, type 2 diabetes was more common than type 1 diabetes among 10- to 17-year-olds who were black, Asian, or American Indian and almost as common among Hispanics.[185] Among 12- to 19-year-olds in the 1999–2000 NHANES, 32.1% of overweight adolescents met national criteria for the metabolic syndrome.[186] In a referral group of >400 obese children and adolescents studied in detail, elevated BMI was associated with prevalence of the metabolic syndrome, which reached 50% in the most severely obese.[187] Also, in a prospective study of nearly 2400 9- and 10-year-old girls, increased waist circumference was a robust predictor of metabolic syndrome at age 18.[188]

Although the definition of metabolic syndrome itself is controversial, childhood overweight is also related to its individual components. For example, in the Bogalusa Heart Study,[189] overweight children were 12 times more likely than their leaner peers to have high levels of fasting insulin; the relative risk was greater for whites than blacks. The race difference may reflect that independent of body fatness, blacks appear to have lower insulin sensitivity than whites.[190] Higher BMI is also associated with higher blood pressure and abnormal lipid (including higher triglyceride) levels in children and adolescents.[189,191] Girls who were overweight at age 9 were 10 times more likely than normal-weight girls to have elevated systolic blood pressure, 6 times more likely to have low high-density lipoprotein levels, and 2 to 3 times more likely to have elevated diastolic blood pressure, triglycerides, and total and low-density lipoprotein cholesterol.[192]

The association of obesity with asthma is noteworthy because asthma is the most common chronic disease of childhood. In the late 20th century, the increase in asthma incidence paralleled that of obesity.[193–196] In addition to the observation that asthmatic children can become overweight because asthma limits their physical activity, prospective studies support the hypothesis that overweight children are more likely than their peers to develop asthma. Among 3792 children and adolescents 7 to 18 years of age who were assessed annually between 1993 and 1998, those who were overweight or obese were nearly twice as likely as their leaner peers to develop asthma.[197] Data are sparse on the relation of weight status in infancy and subsequent risk for asthma but would be of interest given the recent increase in overweight among the youngest children and because the peak age incidence of asthma occurs in the preschool and school years. The results of a preliminary study suggest that increased weight for length at 6 months predicts more wheezing by age 3 years.[198] The mechanisms by which excess weight can increase the risk for asthma include the presence of inflammatory cytokines produced by adipocytes and mechanical disruption of respiration.[199]

Psychosocial problems associated with overweight in children relate to self-concept, discrimination, and excessive weight concern and overeating disorders. Even in children as young as 5 years, a weight for height exceeding the 85th percentile has been associated with impaired self-concept (eg, higher-weight 5-year-old girls having a lower perception of their cognitive ability compared with girls with lower weight status).[200] Overweight children are more likely to be teased or bullied.[201,202] Overweight adolescents are more likely than their lean counterparts to be socially isolated.[203,204] Overweight children and youth are also more likely to suffer decreased self-esteem[205,206] and more likely to be extremely concerned with their weight and engage in bulimic behaviors.[207–210] It is possible that binge eating leads to, rather than

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results from, excess weight gain, however.[211,212] Overweight children appear to have lower physical functioning and overall psychosocial health,[213,214] and in 1 study,[215] their health-related quality of life was similar to that of children and adolescents diagnosed with cancer.

Consequences of Childhood Overweight for Later Morbidity and Mortality

Children and adolescents who are overweight tend to remain so over time, particularly for older compared with younger children and if 1 or both parents are overweight.[216–220] Overweight adolescents may be as much as 20 times more likely than their leaner peers to be obese in early adulthood.[220] In younger children, parental obesity is a more potent risk factor than the child's own weight status in predicting whether the child will become an obese adult, whereas the opposite is true for adolescents.[220] The elevated risk of adult obesity is not limited to children who are frankly overweight. Two studies have demonstrated that children with a BMI in the 50th to 74th percentiles are substantially more likely than children with a BMI below the 50th percentile to become overweight or obese adults.[221,222] Therefore, obesity prevention must not be limited to children in the highest weight status categories.

At least 4 studies[223–226] demonstrate that adolescent overweight is associated with higher overall mortality. In these studies, males who had a higher BMI had an approximately 1.5 to 2 times greater risk of overall mortality during follow-up periods of approximately 30 to 70 years. Curiously, in 2 studies that monitored both women and men, adolescent females with a higher BMI did not have a substantially elevated risk of dying.[223,224] However, the more recent study shows that adolescent obesity strongly predicts increased mortality among women at midlife.[226]

At least 1 study indicates that weight in late adolescence is strongly related to risk of developing type 2 diabetes in adulthood. After adjusting for subsequent weight gain, 18-year-old female adolescents with a BMI >30 kg/m^2 were about 10 times more likely to develop diabetes than those with a BMI <22 kg/m^2.[227] Both males and females with an elevated BMI in late adolescence appear more likely than their leaner peers to develop CVD. Morrison et al[228] report 25-year follow-up data that showed an association between the presence of metabolic syndrome in children, 77% of whom had BMI at or greater than the 90th percentile, and CVD during adulthood. In the Caerphilly Prospective Study, Yarnell et al[229] studied 2335 middle-aged men who provided recalled information on weight and height at age 18. Males who were obese at age 18 were >2 times more likely than their leaner peers to have a coronary event within 14 years of joining the prospective study. Among the 508 men and women in the Harvard Growth Study,[223] those who had been overweight as adolescents were more likely than their peers to have a coronary event in adulthood or to die from CVD. Greater weight in late childhood or adolescence is also associated with higher blood pressure in adulthood.[222,230,231] Excess weight in adolescence may also increase the adult risk of conditions such as polycystic ovarian syndrome[232] or its concomitant ovulatory infertility[233] and ovarian cancer.[234,235] It is unclear whether these long-term effects of obesity in childhood stem from its longer duration or from the presence of obesity at certain critical periods for risk development.

The Case for Prevention

Overall Goals and Objectives

The goals of obesity prevention, broadly defined, include avoidance of weight gain to levels defined as overweight or obese and stabilization of weight in those who may already be overweight or obese or after weight loss.[236] Obesity prevention in childhood also has the goal of preventing obesity during adolescence and adulthood. Treatment of obese children to promote weight loss and to avoid tracking of obesity into adulthood is also a goal of obesity prevention. A focus on obesity prevention in childhood may seem particularly intuitive, because, as noted in the previous section, the process of developing obesity may begin in early life,[27,171] and arresting development of obesity in childhood has the greatest long-term payoff in years of healthy life. Preventing or reducing obesity in adulthood may be cost effective, based on the potential immediate benefits of avoiding the otherwise high prevalence of obesity-related comorbidities that develop during adulthood,[80] although the best way to determine the overall cost-effectiveness of interventions in obesity is as yet unclear.[237]

Preventive strategies for adults may include the promotion of small changes in eating and physical activity[238] or small initial weight losses to counteract expected annual weight gains or both.[239] Implicit in all obesity prevention goals are the related objectives of promoting healthful eating and activity patterns, and for children, normal growth and development, avoidance of adverse psychosocial or quality-of-life effects, and improvement in obesity-related health risk factors and outcomes.[7,19]

Achieving Individual Energy Balance to Prevent Excess Weight Gain

Prevention of excess weight gain relies on the maintenance of energy balance, whereby energy intake equals energy expenditure (in growing children and adolescents, energy expenditure plus energy for healthy weight gain) over the long term. For children and youth, this means growth and development along an acceptable weight trajectory.[240] For adults, this means maintaining a relatively stable weight across life stages, including the reproductive years, in contrast to the average progressive gain of 0.5 to 1 kg per year commonly observed in US adults.[241] A positive imbalance will increase energy storage, deposited as body fat and observed as weight gain. Although the concept is beguilingly simple, the physiological systems that regulate body weight through energy intake and expenditure mechanisms are complex, interactive, homeostatic, and still poorly understood.[8,242] Furthermore, the components of energy balance are not measured easily or with sufficient precision to be practical as a guide to help individuals maintain energy balance. Theoretically, a small persistent energy imbalance of 50 kcal per day could result in a 5-lb weight gain in 1 year (18 250 kcal per year divided by 3500 kcal/lb weight gain), all other things being equal. This scenario is an oversimplification, however, because the en-

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ergy cost of 1 lb of weight gain depends on the fat composition of the added weight,[243] and all things do not remain equal,[244] because, for example, energy expenditure increases with higher caloric intake and weight gain. Nevertheless, the accumulation of a constant positive energy imbalance over the long term causes weight gain, and the great ease with which this accumulation occurs in people in the United States and many other countries causes the high prevalence of obesity.[8,19]

Although prevention and treatment of obesity both rely on the same principles of energy balance, the application of the principles is quite different. For treatment of obesity, a large reduction in caloric intake of about 500 to 1000 kcal per day, along with increased physical activity, can produce a loss of approximately 8% to 10% of body weight over the relatively short period of about 6 months.[15] Although the types of low-calorie diets that best promote weight loss are the subject of current investigations,[244,245] behaviors for weight loss are focused on caloric reduction: decreasing overall food intake, reducing portion sizes, substituting lower-calorie for higher-calorie foods, and increasing physical activity. Weight loss is best accomplished by participation in a behavioral program using self-monitoring, goal-setting, and problem-solving techniques.[15,246] Motivation levels may be high for appearance reasons or if adverse health consequences and quality-of-life impairments associated with obesity are readily perceived. Apparently, behaviors learned for weight loss are not sustained, however, because weight regain after weight loss is common.[247] Motivations and strategies to maintain weight after weight loss may differ substantially from those used to initiate weight loss.[248,249]

The application of energy balance principles toward prevention of weight gain and obesity is more subtle, and the results are less evident and less reinforcing than those for treatment of obesity.[250] The goal is to prevent a persistent small positive energy imbalance. To prevent obesity and weight gain, permanent lifestyle changes must be achieved and maintained over the long term and perhaps even intensified, because aging and environmental influences continue to create the conditions for positive energy imbalance. On the energy intake side of the equation, a healthy, low-energy–dense diet, along the lines of Dietary Guidelines for Americans[251] and the AHA Dietary Guidelines[30] is recommended: rich in fruits, vegetables, and whole grains and limited in high-fat and sweetened foods with high-energy density and low nutritional value. Important strategies are reading the calorie and serving-size information on nutrition labels, requesting simply prepared foods at food establishments, and preparing and consuming appropriate portion sizes (at restaurants, a strategy is to order or consume only half-portions). Because it is unknown directly whether caloric balance is being maintained, frequent weighing helps determine whether weight is stable.[252,253] Physical activity also plays a critical role in the prevention of weight gain and obesity.[254] Current physical activity guidelines to prevent weight gain are 60 minutes per day of at least moderate-intensity physical activity,[255] which is more than the amount recommended for general health and cardiovascular function.[256] Motivation is a particularly important issue to address. There are no dramatic improvements on an individual level, because the results are no change in weight or health outcomes in contrast to the weight loss and decrease in risk factors associated with weight loss.

Achieving Energy Balance in Populations

"Population-based" obesity prevention approaches are designed to produce large-scale changes in eating behaviors and levels of physical activity to stabilize the distribution of BMI levels around a mean level that minimizes the percent who become overweight and obese, without increasing prevalence at the underweight end of the continuum.[19] Population-level obesity prevention can and should be approached not as the promotion of widespread "dieting" but rather from the perspective of promoting healthful eating and physical activity patterns and a balance between the two. This approach requires modifications of factors that shape individual choices, as well as individual habits and preferences. There is ample evidence that individual eating and physical activity behaviors are responsive to the surrounding social and physical environmental contexts both for adults and children and, thus, amenable to public health prevention interventions.[7,19,257–263] Population-based approaches are also compatible with a broad range of public health goals. For example, improvement of eating and physical activity behaviors promotes healthy growth and development in childhood and adolescence, independently of weight, protects against certain types of respiratory, musculoskeletal, and liver diseases, as well as cancer, and improves cardiopulmonary fitness and overall health and wellness. Population-based prevention approaches reach populations through a variety of routes that extend beyond clinics and traditional health services and, when prevalence is high, at a lower cost per person compared with treatment approaches.[264]

Intake-related behaviors that have been linked to obesity include frequent consumption of meals at fast-food and other eating establishments,[265–267] consumption of large portions at home and at restaurants,[268,269] consumption of energy-dense foods, such as high-fat, low-fiber foods,[270–272] and intake of sweetened beverages.[273–276] These behaviors occur in an environment in which energy-dense food is abundant, relatively inexpensive, easy to obtain, and easy to eat with minimal preparation.

Low levels of physical activity are widespread in the United States[277] and have been associated with obesity and weight gain.[278–280] In some reports, television viewing and other sedentary activities have also been related to increased body weight,[281,282] although more of the evidence relates to children.[283,284] Deficient expenditure of energy could occur not only from sedentary lifestyles, but also from physiological changes that occur with aging. With increasing age, decreases in muscle mass, resting metabolic rate, and aerobic capacity occur.[285] Also, sedentary lifestyles may indirectly result in higher energy intakes because of less ability to regulate energy balance, for example,[286] and more time and opportunity to eat. Low levels of physical activity occur in the context of an automated and automobile-oriented environment that is conducive to a sedentary lifestyle.[287]

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Community design and infrastructure characteristics (sometimes referred to as the "built environment," as differentiated from naturally occurring environmental factors) have become increasingly prominent in efforts to identify population-level determinants of obesity.[288] Evidence related to several of the commonly used variables in this category is highlighted below.

Urban "sprawl" is a geographic concept that has recently been studied in relation to risk of obesity. There is some disagreement about how to define sprawl,[289] but regardless of how sprawl is defined, most agree that sprawl results in large areas of low-population density that encourage and usually require residents to drive from home to work, stores, school, and recreation facilities[290] rather than to walk or use public transportation. Several studies have examined the relation between urban sprawl and risk of obesity. For example, Ewing and associates[291] constructed a County Sprawl Index that included population density measures and block size; larger scores indicated less sprawl. Health status data, including BMI, were derived from the BRFSS and were self-reported. After adjusting for gender, age, race, education, and smoking status, residents of counties characterized by greater sprawl walked less, weighed more, were more likely to be obese, and were more likely to have hypertension. Similarly, Lopez[289] constructed a 100-point metropolitan sprawl index using the US Census and calculated it for 330 US metropolitan areas that could be linked with data from the 2000 BRFSS. After controlling for age, gender, race, individual income, and education, a significant relation was found between the sprawl index and risk for overweight and obesity. Sprawl at the state level also has been found to increase risk for obesity.[292]

Land use mix and street connectivity are other geographic concepts that also have been linked to obesity. Sprawl is characterized by less diverse land use mix and less street connectivity. Giles-Corti and colleagues[293] found that both overweight and obese adults were more likely to live in neighborhoods that lacked adequate sidewalks and proximal places for physical activity and that overweight people were more than 4 times more likely to live near a highway. Participants with poor access to recreational facilities were 1.68 times more likely to be obese.

Neighborhoods can also be described in terms of "walkability." Saelens et al[294] characterized residents as living in high-walkable (single- and multiple-family residences) and low-walkable (single-family residences) neighborhoods with comparable SES using census data. They collected data on physical activity using accelerometers, weight status, and self-reported neighborhood perceptions. Residents of highly walkable neighborhoods walked significantly more (eg, a difference of 63 minutes per week of moderate to vigorous physical activity) than residents of low-walkable neighborhoods. In addition, residents of low-walkable neighborhoods tended to report higher average BMIs and higher rates of overweight than residents living in highly walkable neighborhoods.[294]

Frank and associates[295] investigated the impact of community design and physical activity on obesity in the Atlanta metropolitan area, characterizing neighborhoods as connected or disconnected (ie, high- and low-walkable, respectively) by using land-use mix data from the county tax assessor and the 2000 census within a Geographic Information System framework. Participant data within each neighborhood were drawn from a transportation and air-quality survey, which measured individual-level factors. After adjusting for the effects of age, level of education, and individual income, a significant relation was found between land-use mix and the prevalence of obesity, although this relationship was mediated by physical activity (ie, distance walked during a 2-day period). For instance, for each single quartile increase in land-use mix, there was a concomitant 12.2% reduction (odds ratio, 0.878; 95% confidence interval, 0.839 to 0.919) in the probability of obesity.

As discussed in the next section, community characteristics that influence obesity risk in low-income and minority communities may differ from those just described. For example, communities in inner city urban areas may be very "walkable" in the sense of connectivity but offer limited opportunities for physical activity because of safety issues, a lack of affordable recreational facilities and programs, and limited access to healthy foods because of the types of food stores and restaurants that are available.

Considerations for Prevention in Key Risk Subgroups

Whereas clinical preventive services are often characterized in terms of the stage of disease when the intervention occurs (ie, primary, secondary, and tertiary prevention), comprehensive public health approaches can be characterized on the basis of the population segment of interest. In the World Health Organization's obesity prevention framework,[8] whole-population approaches that target the entire community without prior screening of risk (although those at high risk are included) are termed "universal prevention." As will be discussed, whole-population approaches that are "passive" (ie, have their effects through environmental and policy changes) improve opportunities for healthful eating and physical activity without requiring deliberate actions by individuals and can be particularly useful in addressing inequities. Universal prevention approaches that rely only on changing individual behaviors directly through social marketing campaigns or community education may actually worsen disparities if they are only feasible for or attractive to relatively advantaged individuals. A combination of these types of approaches is needed.

"High-risk" approaches focus specifically on groups or individuals who are identified as being at high risk. When the focus is on groups at high risk, defined by demographic, health characteristics, or life stage, the term "selective prevention" is used in the World Health Organization framework. Focusing on specific individuals at high risk, including individuals with existing weight problems, is termed "targeted prevention." As will be discussed in a subsequent section, population approaches draw on tools and strategies from health promotion and public health to reach whole communities with educational or motivational messages or to foster environmental and policy changes that render physical and social contexts more conducive to weight control,

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whereas high-risk approaches often resemble treatment programs because they involve screening and follow-up at the individual level and may occur in primary care or specialized treatment settings.

Obesity prevention is important throughout the life course and for both sexes, although prevention approaches and issues may differ according to gender. Body composition (higher percent body fat) and fat distribution (generally more gynoid and less abdominal fat distribution) among females may influence the health effects of a given BMI.[296,297] Men are an important population of interest because of their higher absolute risk for obesity-related diseases and lower likelihood of seeking treatment for obesity compared with women.[17] As discussed in this section, people with mental and physical disabilities are important subpopulations for focused efforts to prevent excess weight gain.

Childbearing-Age Women

Women of childbearing age in general and particularly women who are pregnant or postpartum are of particular interest for obesity prevention during adulthood. Excess pregnancy weight gain is particularly common among women who were overweight before pregnancy and having their first child.[298] Maternal prepregnancy BMI is a strong risk factor for gestational diabetes and is a reminder that the rise in rates of obesity among girls and women of childbearing age is producing a concomitant increase in rates of gestational diabetes, which in turn will likely lead to more obesity—and thus gestational diabetes—in the next generation. This vicious cycle may well fuel the obesity epidemic for decades to come, both in the developed and the developing worlds, particularly given that perpetuation of obesity in girls may ultimately affect the gestational environments of future generations. In addition, the potential for retention of excess weight gained during pregnancy greatly increases a woman's risk of later obesity-related diseases.

Gender-Related Differences in Obesity Prevention

Compared with men, women on average are more interested in food and nutrition, eat healthier diets than men, are more likely to do the household food shopping and preparation, and are more concerned about weight and familiar with dieting.[299–302] Nevertheless, obesity prevention may be more difficult for women than men. Women have lower caloric requirements than men on average and must, therefore, consume less food than men if they are to remain in energy balance.[255] This may be particularly disadvantageous for women when eating out, given that restaurant and take-home portion sizes have increased and are the same whether the customer is male or female or large or small. It appears that appetite controls in humans are more effective for avoiding hunger than preventing overeating. Experimental studies have demonstrated that the more food people are given, the more they are likely to eat.[271] Unwitting consumption of a few hundred extra calories is more detrimental to energy balance for women than men. Offsetting excess caloric intake by extra expenditure through physical activity is difficult because of the time it takes. For example, moderate activity, such as 15 minutes of walking, burns only 100 calories for an average size adult, whereas it is quite easy to consume an extra 200 or 300 calories in a much shorter time. In addition, the amount of calories expended is proportional to body size and the amount of lean tissue. A potential female advantage with respect to controlling food shopping and preparation may be offset by factors related to food preparation. Both women who work outside the home and busy homemakers may rely on convenience foods, prepared foods, or eating take out or restaurant foods, all of which are associated with higher calorie content. Depression, which is more common in women than in men,[303] has been associated with overeating and weight gain, both with respect to using food for comfort and because many antidepressants cause weight gain.[304,305] Also, stress has been associated with increased food intake, which could contribute to obesity.[306] In a recent survey, more women than men reported overeating under stress.[307]

In addition to the lower metabolism and energy expenditure associated with having higher percent body fat or a smaller body size, women are also at a disadvantage with respect to energy expenditure from a social and behavioral perspective. Leisure time or recreational activity levels are lower for females than males,[39] declining markedly in adolescence and particularly among African American girls.[308] Occupational activity levels are also lower for females.[309] Moreover, opportunities for physical activity in women are constrained by greater caregiving responsibilities and safety concerns that affect times and places available for physical activity.[310,311] Socially acceptable forms of physical activity may be fewer for women than men, particularly in some ethnic groups. Social concerns may include how exercise affects one's hairstyle or image of femininity,[312] as well as the possible displeasure of spouses or other household members, because exercise may be perceived as taking a woman away from family responsibilities.[311]

The greater concern about weight and dieting among women compared with men is well recognized and is apparently reflected in the tendency of women to participate in weight-loss programs.[17] The literature on treatment of obesity is dominated by studies in women to a much greater extent than can be explained by any gender differences in the prevalence of the problem. At any given time, nearly half of women, compared with about one third of men, are trying to lose weight, and women attempt weight loss at a lesser degree of overweight than men.[313] But dieting as such does not appear to be associated with success at preventing weight gain or obesity, perhaps because those who diet have the greatest difficulty controlling their weight or because dieting periods are interspersed with periods of overeating.

Social norms and attitudes about attractiveness differ for men and women. Slenderness has a much stronger importance for women, which appears to increase with upward mobility or high social position.[314] Social disapproval of obesity and excess weight in men is less strong, and the inverse gradient of obesity with SES, observed in women in many ethnic groups, is less predictable in men and is sometimes absent or reversed (eg, obesity may increase with increasing social position). Another reason for the higher

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weight concern in women is retention of weight gained during pregnancy. This may be a major contributor to lifetime weight gain among women, particularly in ethnic groups such as African American women, for whom pregnancy-associated weight gain is more marked.[315,316]

The advantages and disadvantages for men in relation to obesity prevention are the opposite of those in women. Men may be less knowledgeable about or interested in healthful diets or calorie counting, and men's lower participation in weight-control programs than women may reflect and reinforce social norms that weight-control issues are not relevant to men and not important or as important for men. Health risks for which men are more susceptible (eg, risk of heart attack) or an interest in physical fitness may attract men to weight control. Physical activity expenditure among men may also be facilitated by their greater participation in sports or higher level of occupational activity.[309] Nevertheless, sedentary pastimes, such as watching television, are popular among men, as well as among women.[317]

Adults With Mental and Physical Disabilities

People with disabilities are included in the Healthy People 2010 focus on elimination of health disparities,[3] and those with either mental or physical disabilities constitute an important audience for obesity prevention. This diverse population has higher rates of overweight, obesity, and extreme obesity than those found in the general population.[318,319] A wide variety of disabilities have an impact on diet and physical activity, with the result that many different issues must be considered when designing obesity prevention strategies. Issues affecting overweight and obesity in the disabled vary greatly with the type of disability, including effects on physical condition and appetite, physical limitations that affect the ability to participate in regular physical activity, issues regarding responsibility for food decisions, and effects of prescription drugs on intake and activity. Because the issues are different for each type of disability, only a few examples are included here.

Physical limitations have obvious effects on the ability to perform physical activity,[320] which is important in the prevention of weight gain. Physical limitations can be part of a vicious cycle in which obesity contributes to the physical limitation (eg, low-back pain, osteoarthritis of the knee, foot injuries in diabetics), which in turn affects the person's ability or willingness to perform physical activity. Depression can also be a factor.

Adults with Down syndrome have a higher prevalence of overweight and obesity than adults in the general population.[321–323] Adults with Down syndrome who live at home have higher rates of overweight and obesity than those who live in group homes.[321–323] Hypotonia (weak muscle tone) may lead to reduced physical activity and may thus contribute to the high prevalence of overweight. Overweight and obesity are also common in persons with schizophrenia and schizoaffective disorder.[324] There is some evidence that the disability itself may contribute to overweight and obesity, and it is well known that several antipsychotic drugs cause substantial weight gain.[304] Limited attempts have been made at achieving weight loss among persons with mental disabilities. When cognitive impairment is present, interventions to change behavior can raise ethical issues, such as in Prader-Willi syndrome, in which the appetite is increased and the ability to understand health consequences is decreased.[325]

Children and Adolescents

General Issues

Fetal life, infancy, childhood, and adolescence are periods of tremendous physiological changes, which may explain why some periods may be critical in the establishment of not only behaviors, but also physiological processes. As stated previously, the possibility of physiological imprinting or programming early in life suggests that there may be sensitive or critical periods in childhood when an intervention will affect lifelong physiological processes that would be more difficult to change at a later age. Reduced fetal growth is thought to be associated with central fat distribution,[326] whereas weight gain in early infancy[327] and excessive weight gain in adolescence are associated with obesity in adulthood.[216]

Eating and physical activity behaviors learned during childhood may persist into adulthood,[328–332] and food and taste preferences may be established early in life.[333,334] Thus, interventions aimed at changing behavior during this period have the potential of establishing healthy behaviors that will continue over the individual's life span. Addressing gestational determinants of childhood obesity requires prevention of obesity in women of childbearing age. Apart from associations of lower birth weight with adverse cardiovascular outcomes that have garnered much recent attention, the well-established association of higher birth weight with higher BMI in childhood and adulthood should be emphasized.[172,335] Gestational diabetes, which leads to fetal hyperinsulinemia and increased fetal growth, may cause obesity and impaired glucose tolerance as the child becomes an adult.[173] Excessive weight gain by the mother during pregnancy is also associated with a higher BMI in the child at age 3.[174] Because women are increasingly beginning pregnancy at greater weights and because excessive weight gain during pregnancy has also probably increased during the past 1 to 2 decades,[336] avoiding excess pregnancy weight gain is another potential strategy to reduce the burden of obesity-related consequences in the next generation.

Obesity prevention in the pediatric ages involves specific circumstances and considerations. Interventions aimed at this population should be adapted to the neurodevelopmental characteristics of the target age and will require expertise in child development. Because developmental changes are rapid, most behavioral interventions likely need to be targeted at relatively narrow target age groups. Because children and adolescents are generally more sensitive than adults to outside influences (parents, media, and peers), prevention interventions based on changes in the child/adolescent's environment are particularly attractive for changing behavior in this age group to achieve population-based prevention of obesity.[7]

Another aspect of obesity prevention in children and adolescents is the potential setting of the interventions. Most children attend school or go to daycare centers, where they spend a large part of their waking time, have opportunities for physical activity, and eat 1 or 2 meals. Schools and daycare

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centers are, therefore, ideal settings for interventions for obesity prevention in children. Schools have been used extensively[337–339] for such interventions, and there are some interventions in preschool, head start, or daycare settings.[340–343] Schools are also increasingly the setting for battles over politically charged decisions, such as exclusive contracts with beverage companies, regulation of advertising on school grounds, and community pressure on time and funding for physical education.[7] Child-specific settings, such as youth and recreational centers, have also been used for community-based interventions. Well-child visits to the primary care physician offer opportunities for pediatric obesity prevention. However, despite their dedication to preventive care, pediatric care providers are insufficiently trained to feel comfortable about implementing obesity prevention in the office[344] and are not appropriately compensated to implement obesity treatment.[345]

Children and Adolescents With Mental and Physical Disabilities

As in adults, children and adolescents with mental and physical disabilities are an important subpopulation of children who require special attention in relation to obesity prevention. Participation of children with disabilities in school and other social activities is lower than in the general population of children, and children with disabilities are more likely to be institutionalized. Such children are, therefore, less likely to be exposed to population-based obesity prevention strategies based in schools or community organizations.

Children with disabilities constitute a large but very heterogeneous population group with a variety of functional disabilities and medical impairments. In 1994, it was estimated that 12% of noninstitutionalized children and adolescents in the United States 5 to 17 years of age had some type of functional limitation, a percentage that corresponds to >6 million individuals.[346] These numbers have likely increased since 1994. Children with disabilities are overrepresented among US populations at increased risk for obesity, such as minorities and the poor.[3,346] Children with developmental disorders have a prevalence of overweight as high or higher than that of other children.[347] Many of these children with disabilities use medications that increase the risk of excessive weight gain, such as antiepileptics, antipsychotics, antidepressants, and steroids. However, although children with some types of disabilities and medical impairments are at increased risk for obesity (Down syndrome, brain cancer survivors), others are at decreased risk for obesity because of undernutrition (sickle cell anemia, cystic fibrosis). Even within the same medical impairment, for example, cerebral palsy, some patients can present with undernutrition, whereas others present with overnutrition.[348,349]

The disabilities affecting children and adolescents are heterogeneous in nature and severity, making it difficult to design a strategy that fits all children with disabilities. Because of limited mobility, communication, or learning abilities, many children and adolescents with disabilities will not be able to participate optimally in obesity prevention programs designed for the general population, and adapting obesity prevention strategies to a wide range of types and severity of disability will be a significant challenge. Existing initiatives, such as the Special Olympics, however, have been successful at increasing physical activity levels in children, adolescents, and adults with a wide range of disabilities and overcoming physical and societal barriers to sports. This could provide a model for prevention of obesity in this population.[350,351]

Ethnic Minority and Low-Income Populations

Several factors are thought to contribute to the ethnic disparities in obesity in ways that potentially influence the nature of preventive interventions that will be effective.[352–354] Historical and current exposure to social inequities may lead to adverse eating and physical activity patterns through various mechanisms,[355] including the possibility that overeating is used as a mechanism to cope with stress or that children are overfed as "insurance" against hunger.[356] Studies have indicated ethnic differences in consumption of calories and fat,[357–359] which to some extent is associated with high levels of consumption of fast foods[360–362] and in levels of sedentary behaviors.[358,362] A number of studies have shown that African American women are more likely to accept a larger ideal body image[357,363–367] than are women from other ethnic groups, although the ways in which body image influences weight control are uncertain. Also, the nature and impact of body image variables for ethnic groups other than African Americans are unclear. The diversity of ethnic subgroups within the major categories of Hispanics/Latinos, American Indians, and Pacific Islanders makes it inappropriate to state generalities for these groups as a whole. The issue of body image is relevant, at least theoretically, to motivation for weight control and prevention of obesity. Survey data suggest that African American women who are overweight are less likely than Hispanic or non-Hispanic white women to try to lose weight[313] and may not perceive themselves to be overweight.[368] Ethnic minority populations in general are underrepresented in the weight-control literature, although this may reflect the access (both location and eligibility requirements) of minority populations to the studies that have been conducted. Studies comparing weight loss in African Americans and whites in the same program indicate lower average weight loss among African Americans than whites, within sex.[369–371] This lesser level of success in weight-control programs could reflect social/environmental context issues, motivation, cultural appropriateness of the program, or other factors not yet identified. Again, whether this applies to other ethnic minority populations and also whether the results of treatment studies are informative for designing prevention strategies are unknown.

Recent attention has focused on aspects of the social contexts for obesity development that are less favorable for African Americans and other ethnic minority populations, including types of foods and retail food outlets available, range and accessibility of healthy food availability, opportunities for physical activity, and exposure to targeted marketing of less healthful foods.[352,372–375] Acculturation may play a significant role in the association of obesity with increased duration of US residence. In some studies conducted among Asian and Hispanic adolescents, acculturation to a US life-

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style was shown to be associated with adoption of unhealthy behaviors in those born outside of the United States, such as sedentary behavior and poor dietary habits.[376,377] However, culture of origin and circumstances after immigration are important variables to consider. There may also be instances in which less acculturation is associated with a higher occurrence of overweight, as suggested in a study of Chinese American children.[378]

Access to supermarkets, which increases access to healthy foods, has been associated with better dietary quality[379] (eg, greater consumption of fruits and vegetables). Supermarket access is relatively lower in census tracts with a high proportion of African American residents. For example, Morland and colleagues[380] reported that 4 times as many supermarkets were located in non-Hispanic white neighborhoods than in African American neighborhoods. In addition, the ratio of supermarkets:residents was substantially higher in predominantly non-Hispanic white neighborhoods (1:3816 residents) than in African American neighborhoods (1:23 582 residents). Zenk et al[381] found that the most impoverished neighborhoods in Detroit with high proportions of African Americans were farther away (1.1 miles on average) from the nearest supermarket than neighborhoods that were less impoverished and had low proportions of African American residents. In contrast, access to fast-food restaurants may be greater in black or low-SES neighborhoods. Block and colleagues[360] showed that the density of fast-food restaurants was greatest in neighborhoods in which residents were predominantly African American and low income. Neighborhoods in which 80% of the residents were African American had 2.4 fast-food restaurants per square mile, whereas neighborhoods in which 80% of the residents were non-Hispanic white had only 1.5 fast-food restaurants per square mile.

In addition to issues related to types of available food stores, the relative costs of low- versus high-calorie foods is another potentially critical influence on efforts to prevent obesity in low-SES communities. As reviewed by Drewnowski,[382] several lines of evidence converge to suggest that the likelihood of being able to consume a healthful diet with calories appropriate to energy needs decreases with decreasing income. Limited income means limited money to spend on food and less flexibility in food spending as a percentage of available funds. The current price structure of foods is such that products high in fat and sugar and low in other nutrients are the least expensive, whereas fruits, vegetables, and whole-grain products, which are both lower in calories per unit weight and higher in essential nutrients, are relatively more expensive. Therefore, even where supermarkets are available, people with low incomes may purchase a relatively higher-calorie diet of less expensive, higher-calorie foods. High-fat and high-sugar foods are "energy dense" (eg, have more calories per unit weight) and are often highly palatable, making them relatively easy to overconsume. The perception that people with low incomes can afford a healthful, calorically appropriate diet is perpetuated by federal policy—specifically the "Thrifty Food Plan" that is used to calculate the Food Stamp Program benefits—that assumes a base diet of raw foods that will be cooked "from scratch."[383] However, from a practical perspective, few people, including recipients of federal nutrition assistance or income support, are spending sufficient time in food preparation to consume such a diet.[383]

Studies that suggest that low-SES areas negatively influence physical activity include 1 study by Yen and Kaplan[384] based on data from the Alameda County Study, a population-based longitudinal cohort study that began in 1965. Overall physical activity decreased between 1965 and 1974 but decreased significantly more in areas of poverty than in nonpoverty areas. Even after adjustment for numerous potential confounds, including age, gender, baseline physical activity score, smoking, individual income, education, BMI, alcohol consumption, and perceived health status, living in an area of poverty was significantly associated with a greater decrease in physical activity. Observed interactions indicated differences in effects according to race/ethnicity and individual income. There were no racial/ethnic differences (comparing blacks with all others) in the pattern of changes within poverty areas but a greater decrease in physical activity among blacks versus others in the nonpoverty areas, adjusting for potential confounders. A similar interaction was seen with individual income (ie, similar patterns within poverty areas but greater decreases among those with inadequate incomes in nonpoverty areas). This reduction in physical activity in poorer areas may be owing to the possibility that physical activity–friendly environments (ie, safe, affordable, well maintained, and appealing) are less common in low-SES areas. For example, Powell et al[373] studied 409 communities and found high-poverty areas had significantly fewer sports areas, parks, greenways, and bike paths than areas characterized by higher median household income and lower poverty rates.

Considerations for Taking Action

The motivational and behavioral issues that people encounter in achieving and maintaining energy balance combined with the fact that the many environmental context factors that influence energy balance are beyond the individual's control provide a compelling rationale for taking a public health, or population-wide, approach to prevention of obesity. This type of approach is comprehensive, including educational and motivational messages aimed at the entire population, as well as societal, worksite, government, public health, and health-care organizations promoting health consciousness, providing opportunities for physical activity, and making healthy foods accessible.[19,20,236] Such efforts make healthy eating and physically active lifestyles easier to adopt and more socially acceptable and self-reinforcing. The pillar of the rationale for a public health approach to obesity prevention lies in the overall strategy for preventive medicine as outlined by the late Geoffrey Rose.[264]

Determining Where to Intervene: Targets for Action in an Ecological Framework

An Institute of Medicine[385] committee concluded that approaches informed by an ecological model are critical for effectively addressing major public health challenges gener-

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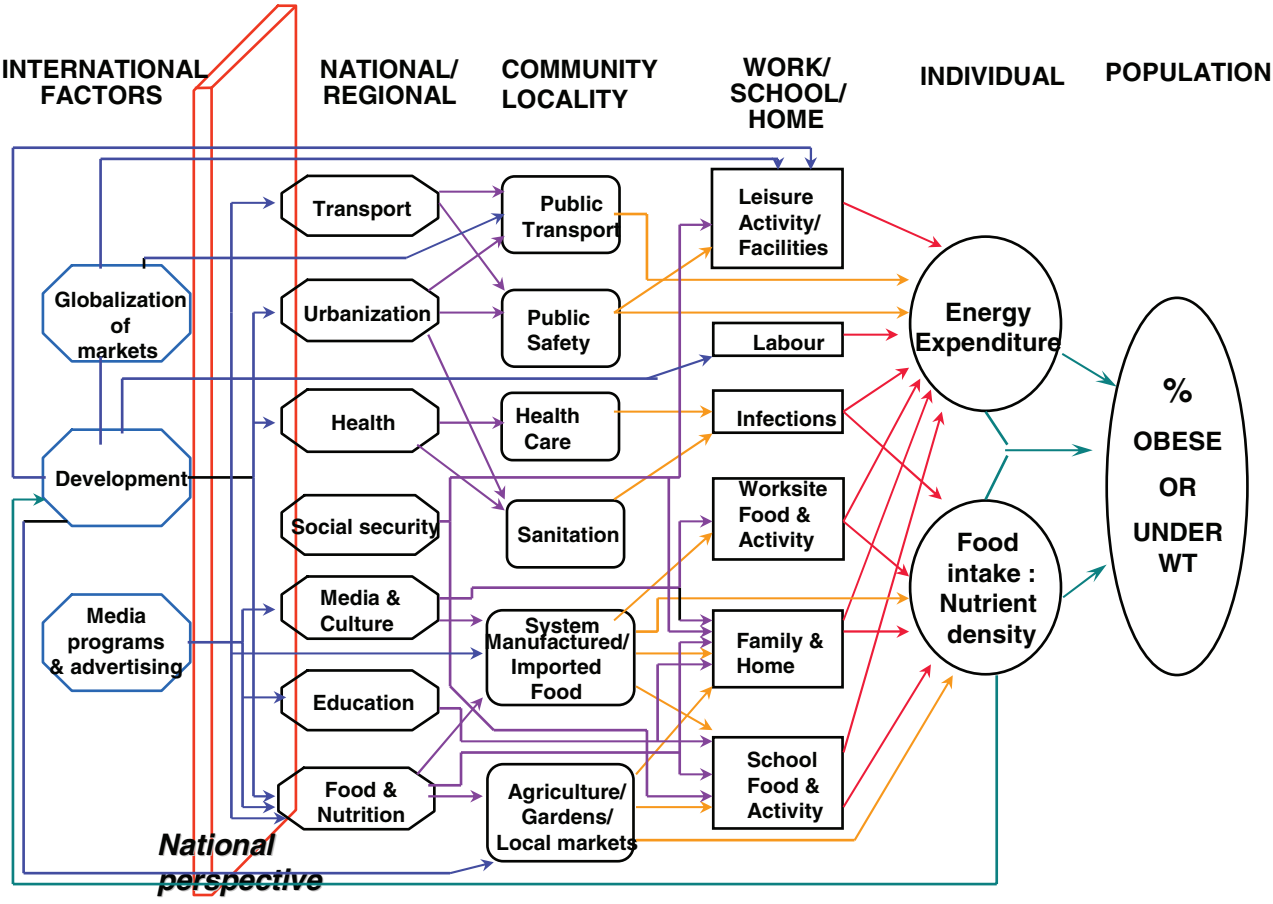

Figure 3. Societal policies and processes influencing the population prevalence of obesity.[19]

ally, and a subsequent Institute of Medicine committee used an ecological framework as the basis for a comprehensive national action plan to address the epidemic of obesity in children and youth.[7] Ecological frameworks emphasize the importance of social, environment, and policy contexts as influences on individual behavior and the interactions and interdependence of influences across different levels extending from the individual to the society at large.

The need for a multilevel, multisectoral approach to population-based obesity prevention has been emphasized[8,19] and is illustrated in Figure 3. This "causal web" of societal-level influences on obesity provides a framework for conceptualizing the different sectors or processes from which they arise and act (eg, transportation, urbanization, commerce, social welfare, media and marketing, education, agriculture, food and nutrition, and health) and the different levels at which these factors operate to influence the contexts for food choices and activity patterns in the population at large (global, national, regional, and local, as well as immediate environments such as work, school, and home).[19] The arrows in Figure 3 indicate the complexity and interrelationships among processes and pathways emanating from different sectors.

Table 3, which is complementary to Figure 3, was adapted from an ecological framework developed by the Partnership to Promote Healthy Eating and Active Living.[257] The listings in columns 1 to 3 give examples of specific categories of factors that might provide leverage points and settings for interventions in various sectors and settings with a goal of shifting influences in a direction less conducive to chronic positive energy imbalance. Together with Figure 3, these listings illustrate that some influences that relate to obesity may require action through national and international channels (eg, those related to the food industry), whereas others can be influenced by policies and practices that are controlled by state or regional authorities, at the city or neighborhood level, or in schools and workplaces. The other 4 columns in Table 3 reflect the societal and individual response variables that will affect the feasibility and effectiveness of obesity prevention initiatives. Many of these variables are reflected in the earlier described considerations for prevention in key risk subgroups. A longitudinal analysis of patterns of weight gain among members of social networks, including unrelated individuals and spouses, as well as family members who were genetically related, underscores the potentially powerful influence of social relationships in transmission of environmental risks of obesity.[386]

Figure 3 illustrates the complexity of the social and environmental contexts that produce the greatest challenge for obesity prevention. Implicit in the causal web (Figure 3) are processes and pathways that are fundamental to the social fabric and to day-to-day lifestyles. The number and types of potential stakeholders and vested interests potentially af-

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Table 3. Influences on Physical Activity and Eating Behavior in Sectors and Settings: Ecological Layers From Macrosocietal to Individual Level

Focal Points and Settings for Interventions			Practical, Social, and Personal Influences on Intervention Effectiveness			
Distal Leverage Points	Proximal Leverage Points	Behavioral Settings	Enablers of Choice	Social	Ethnic/ Cultural	Individual
Architecture and building codes	Community	Community activity providers	Accessibility	Educational attainment	Beliefs	Genetics
Education system	Developers	Day care	Convenience	Interpersonal relationships	Ethnic identities	Hierarchy of needs
Entertainment industry	Employer	Food stores	Cost	Life stage	Habits	Physiology
Exercise, physical activity, and sports industry	Family	Health club	Knowledge	Social roles	Life experience	Pleasure
Food industry	Food stores	Home	Safety	Socioeconomic status	Values	Self identities
Government	Healthcare providers	Local school	Seasonality			
Healthcare industry	Local government	Neighborhood	Situation or context physical and social			
Information industry	Nongovernmental organizations	Parks, recreation centers, senior centers	Social trends			
Labor-saving device industry	Nonprofit providers	Religious, community, and nongovernmental	Source of information			
Political advocacy/lobbying	Property owners	Restaurants	Time			
Recreation industry	Recreation facilities	Shopping malls				
Transportation system	Restaurants and food outlets	Vehicle of transport				
	School boards/ districts	Workplace				
	Shopping mall					

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fected by interventions in these sectors and channels are vast. Policy makers, industries, and consumers may not support making changes in these factors, even when they recognize the need for action on obesity, because of the structural nature of these factors and the perceived negative consequences for other outcomes, both commercial and personal. Also evident in this understanding of what is required for obesity prevention is that influences controlled by health professionals or health policy makers are only 1 type of influence and are not involved in many important pathways. Creating the multisectoral, multilevel, and interdisciplinary partnerships and initiatives that are needed to influence the many other sectors is one of the major challenges of obesity prevention.[20]

Increasing the emphasis on population approaches that go "upstream" to focus on environmental and policy change requires a shift in thinking for those trained in clinical or individually oriented interventions. It is difficult to know when one is being effective when taking action so far removed from the ultimate behavioral outcome of interest. Prevailing attitudes of health professionals and others may also argue against reducing the focus on individuals to change their behaviors. The "upstream-downstream" argument is often made by analogy to a situation in which a continuing number of people are struggling in the water downstream, about to drown. Going upstream to find out why people keep falling into the river (eg, a bridge might have collapsed) is as critical as working downstream to pull the people out of the river one at a time. This is not a dichotomy; the goal is both to save "those who are drowning" and to stop others from "falling in." The analogy is used to make the point that the clinical approaches in which we are so well trained and perhaps confident can never be sufficient to solve widespread population health problems unless broad-based population strategies are also applied. Moreover, upstream approaches are the most cost effective when problems are widespread because individualized screening and counseling are, by comparison, much more costly on a per capita basis. As noted previously, upstream approaches are also the most likely to level the playing field for socially disadvantaged populations whose options for healthy eating and physical activity patterns are the most limited, for a variety of reasons,[352,372] and who, because of limited resources and limited social capital or power, are more constrained by the available options than those with more advantages, who may be able to find ways to

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work around constraints and create new options for themselves.[387,388]

How to Intervene: Determining What to Do and Whether It Works

Figure 3 and Table 3 describe potential targets for action—covering many different sectors, levels, and specific potential focal points. How to actually have an impact on these targets requires a more process-oriented perspective related to the design of specific intervention programs or community action initiatives. Useful insights for how to take action can be drawn from general public health and prevention models. For example, the "Spectrum of Prevention"[389] is useful for characterizing and differentiating interventions at all of the levels that may be needed to address obesity at the population level and how these levels interrelate. This framework, described in Table 4 and discussed below in relation to obesity, has 7 bands or levels that indicate different types of strategies for environmental and policy changes, as well as community mobilization and individual education directed to selected combinations of the intervention targets outlined above. Consistent with an ecological model, the complementarity of these different strategies should be emphasized. In particular, the more upstream strategies at the upper levels of the spectrum (influencing policy and legislation, mobilizing communities and neighborhoods, changing organizational practices, and fostering coalitions and networks) are important for enabling the effectiveness of those oriented to individuals. Table 4 also includes examples of activities at each level of the spectrum to promote increased physical activity, based on an initiative in California.[390] The following narrative, which is organized according to the 4 top bands in the spectrum (influencing policy and legislation, mobilizing neighborhoods and communities, changing organizational practices, and fostering coalitions and networks), provides further highlights of how obesity prevention might be approached at these more upstream levels. Guidance relevant to providers and individual education and counseling is referenced in Appendix 2.

Influencing Policy and Legislation

Initiatives to foster changes in policy and legislation may be undertaken at local, state, and federal levels with a focus on the relative availability or cost of high- versus low-calorie foods or on opportunities to be physically active. Formal or informal policy changes are core to upstream interventions in that they change behavioral options and can reach large numbers of people, regardless of individual health motivations. Food-related policy targets might include snack foods and sweetened beverages, for which the goal would be to decrease consumption, or fruits and vegetables or water, for which the goal would be increase consumption. Activity-related targets might include aspects of community design that are more or less conducive to traveling on foot or by bicycle, availability and cost of recreational facilities, automobile use and availability of public transportation, and factors related to safety (eg, rates of street crime, condition of playgrounds, traffic-related measures to create safe routes for children to walk or bike to school).[7]

Options for types of policies include taxation of snack foods, subsidy of fruits and vegetables, regulations requiring foods served or sold in schools to meet specified nutritional standards, restrictions on advertising high-calorie foods to children, nutrition labeling regulations, financial incentives to industry (eg, to encourage siting of supermarkets in inner city areas with limited food access), or requiring school physical education classes and health education. Taxation mechanisms may be targeted to raising funds to support prevention programs directly. Worksite policies might include providing time off or facilities and equipment for exercise, providing bike racks and showers for people who cycle to work, providing weight-control programs or covering the cost of such programs or of gym memberships. Policies can also address monitoring and surveillance of weight levels (eg, of school children). Receptivity to various types of policy solutions varies among individuals and communities. There may be concerns that some policies will disadvantage commercial interests, limit individual freedom of choice, or create or aggravate social inequities. For example, taxation to raise the price of certain high-calorie foods could be problematic for people with very low incomes who depend on having cheap sources of calories.

The Institute of Medicine committee to evaluate progress to prevent childhood obesity[355] identified 717 bills (of which 123 were passed) and 134 resolutions (of which 53% were passed) relevant to childhood obesity that had been introduced in the United States between 2003 and 2005. Bills with a high rate of passage were related to farmers' markets, walking and biking paths, establishing task forces or study groups, and model school policies and safe routes to school. None of the 74 bills related to taxes on sodas and snacks passed. Policies to protect children specifically may garner more support than those directed to the general population because the potential vulnerability to environmental factors is relatively easier to argue with respect to children than for adults.

Mobilizing Communities and Neighborhoods

This level of the Spectrum of Prevention emphasizes the importance of community engagement, contrasting the traditional medical model, with the provider expert at the center (which also characterizes many public health activities), with the additional need to involve communities directly in assessing needs and planning and taking actions to address identified problems.[389] Such engagement with community members helps to align priorities as viewed by community members with those identified by public health workers and increases the likelihood that resulting initiatives will generate community interest and follow through. Public health workers and academic research partners can support community-generated initiatives through technical assistance. Some obesity prevention research involves community-based participatory research.[391–393] There has been increasing rec-

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Table 4. Components of the Comprehensive "Spectrum of Prevention" as Applied to Obesity Prevention

Prevention Strategy	Rationale	Examples Related to Increasing Physical Activity*
Influencing policy and legislation	Both formal and informal policies have the ability to affect large numbers of people by improving the environments in which they live and work, encouraging people to lead healthy lifestyles, and providing for consumer protections	Land use policy established for community gardens Stable funding for Indian Health Service clinics to promote physical activity and nutrition
Mobilizing neighborhoods and communities	Particularly in low-income communities confronting more urgent concerns of violence, drug use, unemployment, and the struggle to keep families together, engaging community members in developing agendas and priorities is essential	Mapping community assets related to physical activity options Assisting community residents in setting priorities relevant to physical activity Providing technical assistance to help community residents implement action plans related to physical activity
Changing organizational practices	Modifying the internal policies and practices of agencies and institutions can result in improved health and safety for staff of the organization, better services for clients, and a healthier community environment; advocacy for such changes can result in a broad impact on community health	Protocols for physician assessment, sliding fees, counseling, and referral Bilingual staff at YMCA Work site policies Walking trail signage Improve safety in parks Provide fitness programs in public housing
Fostering coalitions and networks	Coalitions and networks, composed of community organizations, policy makers, businesses, health providers, and community residents working together, can be powerful advocates for legislation and organizational change and provide an opportunity for joint planning, system-wide problem solving and collaborative policy development	Local project coalitions and advisory committees Local park and recreation departments Healthy Cities coalitions American College of Sports Medicine volunteers Local Governor's Council on Physical Fitness and Sports
Educating providers	Service providers within and outside the health system can encourage adoption of healthy behaviors, screen for health risks, contribute to community education, and advocate for policies and legislation	Training for physician screening and referrals Park and recreation staff training Community exercise leader training Curriculum at university
Promoting community education	Community education can reach the greatest number of individuals possible with health education messages and also build a critical mass of people who will become involved in improving community health. This includes the use of mass media to shape the public's understanding of health issues—termed "media advocacy"	Community walkathon Media campaign Work site programs Interdenominational sports leagues Community fitness event Community advocate training Community gardens Church and community bulletins
Strengthening individual knowledge and skills	This strategy involves working directly with clients in the home, community settings, or in clinics, providing health information to promote well-being among children, families, senior citizens, and other population groups. It also includes working with both youth and adults to build their capacity in areas such as media advocacy, community mobilizing, and working with policy makers to make positive changes in the health of their communities	Walking club orientation Exercise classes Education classes Field trips Handouts Outreach contacts Home visits/instructions Exercise demonstrations

Adapted from Rattray et al,[389] with permission.

*Examples, except for those related to "mobilizing communities," were taken directly from Reference 390.

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ognition of the importance of community-based participatory research, particularly with respect to research to address health disparities. REACH 2010 (Racial and Ethnic Approaches to Community Health) projects funded by the CDC are examples of such efforts that have specifically mobilized community members through participatory research related to food access and broader issues related to obesity.[394] Resource inventories or assets mapping are useful tools in this approach.[395–397]

Changing Organizational Practices

Schools and child care facilities, workplaces, and primary care are important settings for implementation of policies and programmatic initiatives. Relevant policy or programs may involve specifying the nutrition composition or cost of foods served or sold in cafeterias, instituting requirements for physical education in schools, increasing the availability of physical activity options or the time available to take advantage of these options, implementing training programs to enable school teachers to provide nutrition or physical education, and providing financial support for programs and services related to weight control. The appeal of setting-based approaches of this type includes the ability to work with a "captive audience" and to also influence social norms within the setting, with possible transfer to behavior outside of the setting. For example, policies that foster integration of 10-minute physical activity breaks into the regular work day or school day appear to be feasible, well received, and associated with meaningful increases in physical activity and possibly improved performance. This approach may be sustainable given that the activity breaks can be led by regular staff or teachers.[398–400]

Of the possible setting-based interventions, the Task Force on Community Preventive Services has found sufficient evidence to recommend "multicomponent interventions aimed at diet, physical activity, and cognitive change" in worksite settings.[35] In this report, evidence was deemed insufficient to determine effectiveness of single component interventions in worksites or of school-based programs for children and adolescents, and reviews of evidence to support various types of healthcare system interventions and community-wide interventions were still pending. Key issues for intervening in specific settings relate to perceived or actual competition of the interventions with the mission or other priorities of the setting, fear of liability, resource issues, privacy issues, the potential for increasing discrimination against those with existing weight problems, or consumer dissatisfaction. For example, efforts to increase time spent in physical activity may compete with time needed for academic work. Efforts to change school food options may compete with the use of food sales to raise funds for other school activities, as well as be unpopular with students and parents, leading to other problems for school officials. Screening children for BMI levels is controversial owing to the potential for adverse psychosocial effects of identifying children as overweight or obese and also because it is meaningless without the ability to implement ameliorative interventions.[401] Workplace issues with respect to productivity, consumer acceptance, and the potential for discrimination are similar. Injuries associated with increased physical activity may be a liability concern. In workplaces, there is potential competition with time spent working, where productivity is at issue. Competition with time to address more pressing medical or social issues can be a deterrent to adding weight-related counseling to primary care settings. Although many primary care physicians and their patients may be very motivated to provide or receive such counseling, the length of typical visits is too short to allow this, and reimbursement for obesity-related counseling—if available at all—may be limited to people with established obesity-related comorbidities.

Table 5. Components of the American Heart Association–Clinton Foundation Alliance for a Healthier Generation Initiatives to Foster Childhood Obesity Prevention

Founders	American Heart Association and William J. Clinton Foundation
Co-Lead	Governor Arnold Schwarzenegger of California
Mission	To eliminate childhood obesity and to inspire all young people in the United States to develop lifelong, healthy habits
Goals	To stop the nationwide increase in childhood obesity by 2010 and to empower kids nationwide to make healthy lifestyle choices
	The Alliance is positively affecting the places that make a difference to a child's health: homes, schools, restaurants, doctor's offices, and the community
Programs	*Healthy Schools Program*
	Industry Initiative
	Kids' Movement
	Healthcare Initiative

Source: Reference 402.

The Alliance for a Healthier Generation, a joint initiative of the American Heart Association and the William J. Clinton Foundation,[402] is an increasingly prominent example of a comprehensive national-level obesity-prevention strategy that focuses on school settings. Components of this initiative are listed in Table 5. Indicative of the importance of this program in the national obesity prevention effort, the Robert Wood Johnson Foundation, which has a major commitment to reversing the epidemic of child and adolescent obesity, initially awarded $8 million in 2006 to support the first phase of the Healthy Schools Program. A year later, it announced the award of an additional $20 million to support expansion of the program that will focus on states with the highest obesity rates, as well as expand on-line support for schools nationwide. As shown in Table 5, the Alliance initiatives go beyond a school focus and address several other levels of the Spectrum of Prevention.

Fostering Coalitions and Networks

Community organizations or coalitions of community organizations or members who have a stake in obesity prevention

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may undertake community action to raise awareness of a problem, identify potential solutions, and seek to implement these solutions through changes in policy and practice. Some coalitions have a single focus, while others take on a broader set of community priorities. Community members may mobilize spontaneously (eg, in response to a perceived crisis or intolerable situation). Community mobilization may also be initiated as a health-promotion strategy (eg, through efforts of a state or local public health agency, other health services provider, or a community-based organization with a relevant mandate). Researchers who can provide technical assistance and advice are often partners in these efforts. Broadly based, multisectoral efforts may be particularly effective. For example, the Consortium to Lower Childhood Obesity in Chicago Children (CLOCC) provides a rubric for pooling the efforts of hundreds of organizations representing a variety of entities with relevant interests.[403] CLOCC activities include training public school teachers in strategies to improve student nutrition and physical activity, community-wide health-promotion events, Web site development, and an initiative to foster walk-to-school programs. A School Nutrition Task Force in Philadelphia mobilized a successful effort to create healthier vending options in schools.[404]

Evidence-Based Experience

In contrast to the extensive database available on obesity treatment, research to identify specific interventions to prevent obesity is still at a relatively early stage.[7,20,236,405] Elements of promising strategies for obesity prevention can be identified, and there are many relevant efforts under way. These efforts include programs generated spontaneously in communities, as well as formal research or demonstration projects undertaken based on program logic and combinations of strategies that appear to be effective. However, it is difficult to identify what set of interventions will be effective in shifting the BMI distribution for a whole community (also see Research Challenges). Effective interventions will, separately, improve dietary intake and the level of physical activity, but in combination, they must not only improve dietary quality and energy output or fitness but must also result in the avoidance of positive energy imbalance. Effects must also be sustainable over time in that the risk of excess weight gain is ever present. As explained previously, the applicability to obesity prevention of the literature on obesity treatment may be limited, because the challenges of achieving energy balance are different for prevention from those for treatment at the individual level. In addition, social and environmental changes, although relevant to both prevention and treatment, are fundamental to obesity prevention.

Numerous systematic reviews have assessed available scientific evidence on obesity prevention. Results of selected reviews published during the last decade are shown in Table 6.[405–417] Two reviews focus on adults in primary care settings,[414,415] 2 focus on environmental and policy interventions,[412,413] and 2 cover all ages.[417,418] The remaining articles focus on children or school settings.[405–411] Almost all include studies both in the United States and abroad. Perhaps the most striking finding in Table 6 is the relatively small numbers of eligible studies for these reviews of obesity prevention, although the number is increasing. Searches sometimes identify thousands of possible articles, but the number ultimately reviewed and included is relatively small. This is owing in part to the inclusion and exclusion criteria applicable to many reviews (not all of these criteria are included in the Table 6 entries, for brevity; eg, requirements for controlled trials—either randomized or nonrandomized—inclusion of only completed trials, exclusions on the basis of a rating of poor quality, or exclusion of studies that did not provide a measurement of weight status or fatness). With respect to the findings on weight outcomes, the findings are encouraging in identifying many studies that were successful, although evidence of the ability of interventions to change average BMI levels is limited. The relatively limited breadth of studies identified, mainly school based and mainly individually oriented, indicates an urgent need to explore preventive interventions in other settings and at multiple levels upstream. Ongoing research may broaden the evidence base to some extent, but there is an overall impression that this critical area of research has far too little focus.

Research on how to implement effective environmental and policy change is a relatively new aspect to the field of obesity research, and appropriate measures and evaluation designs are still being developed. These measures and designs are needed not only for deliberate experimentation that involves environmental and policy changes, but also for the many spontaneous changes that are occurring in legislatures and communities on a day-to-day basis. Changes in school food and beverage vending policies are a prominent example of spontaneous changes that are being implemented with a limited empirical basis (ie, natural experiments). In addition, as noted above, evaluation of specific interventions is complicated by the fact that additive or synergistic effects of multiple interventions across different levels and sectors may be necessary to have an impact on behaviors related to energy balance and to see effects on weight.[411,418] This can be addressed in part by multilevel interventions or combinations of studies, but to date, these studies are few in number.[409,411] Another challenging and strongly debated issue is how study designs with the highest level of internal validity, randomized, controlled trials apply in that they may impose limitations on both the feasibility and relevance of testing obesity prevention approaches in naturalistic settings.[418,419]

An example of a promising multilevel intervention, evaluated with a nonrandomized, controlled trial design is the "Shape Up Somerville" study.[420] This study compared the effects of a comprehensive intervention, conducted in partnership with entities in the study communities, on physical activity and food options during the child's entire day on BMI z-scores 1 year after the initiation of the interventions. Participants were 1178 elementary school-aged children in all 30 schools in 3 participating communities: 10 schools in the intervention community; 10 and 5 schools in the 2 control communities, which received no intervention. An extra control group was used to ensure against the spontaneous

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Table 6. Highlights of Selected Systematic Reviews of Intervention Studies Related to Obesity Prevention (Listed Alphabetically by First Author Within Year of Publication, Most Recent First)

Reference	Focus, Scope, and Key Inclusion Criteria	Eligible Studies Identified	Main Findings
Bluford et al[406]	**Preschool children** United States and international, published in 1966 through March 2005 Interventions to prevent or treat obesity in preschool children (ages 2 to <6 years) of at least 3 months' duration	7 studies Settings included schools, day care/Head Start programs, clinics, and home settings	Significant reductions in weight status or body fat were identified in 4 of the 7 studies, of which 3 sustained reductions 1 to 2 years after the program began 2 studies reported no change; the other study found no change in Latino or black children but an increase in weight status in white children
De Mattia et al[407]	**Children and adolescents** United States and international, published in 1966 to February 2005 Interventions to limit sedentary behaviors (recreational screen time but not homework or reading) in children or adolescents in natural settings (eg, at school or home or in a primary care setting	12 studies	All of the studies, including 6 that targeted clinic-based populations and 6 that were population based reduced sedentary behaviors (self-reported) and improved weight outcomes (measured)
Sharma[408]	**Children and adolescents** Only studies from countries outside of the United States, published in 1999–2005 School based interventions for obesity prevention in children; not all studies included measured weight outcomes; and not all had been completed	21 interventions, of which 17 were from elementary schools	Most studies focused on individual level approaches; 16 of the 21 interventions were delivered by existing teachers, often with additional training Measured weight or fatness variables were available in 11 studies, of which 6 showed improvements; all 3 completed studies that included parents improved measured weight outcomes
Doak et al[409]	**Children and adolescents** United States and international, published through August 2005 Interventions and programs to prevent obesity in children and adolescents, with measured weight or fatness outcomes	25 interventions	17 of the 25 interventions reported statistically significant improvements in obesity measures; estimation of effectiveness differed according to whether skinfold or BMI measures were used 5 studies found gender differences in effects and 1 study found differences by ethnicity No ideal age for intervention could be identified from these studies Physical education and reduction of television viewing were highlighted as examples of effective approaches One of the effective interventions was also associated with an increase in underweight prevalence
Flodmark et al[410]	**Children and adolescents** United States and international, published until 2004 Setting or population-based interventions (ie, in groups of children not specifically selected for being overweight or obese to prevent obesity of at least 12 months' duration; with measured weight or fatness outcomes Articles published until 2004 were added to a prior 2002 review; results of 5 other systematic reviews were also evaluated	24 studies in this review 39 total studies when including other reviews	8 studies reported significant positive results on measures of obesity, and 16 were neutral; none had negative results Considering these results together with those of 5 other systematic reviews yielded 39 studies of which 15 had positive results and the other 24 were neutral; no studies reported harmful effects on children Effective programs were relatively limited school-based programs that promoted a combination of healthful eating and increased physical activity

(*Continued*)

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Table 6. Continued

Reference	Focus, Scope, and Key Inclusion Criteria	Eligible Studies Identified	Main Findings
Flynn et al[411]	**Children and adolescents** United States and international, including government reports and other published or unpublished sources identified apart from databases of published articles, 1982–2003 Accounts of programs that could shed light on best practices related to reduction of obesity and related chronic disease risk in children	147 programs were analyzed	No single program emerged as a model of best practice, although promising elements applicable to various populations and settings were identified More upstream and population-focused interventions are needed to balance the emphasis on individually oriented strategies There is a particular need for programs tailored to ethnic minority and new immigrant children and based in community or home settings
Health et al[412]	**Policy and environmental changes** United States and international, published through 2003 Studies of the effectiveness of urban design and land use and transport policies and practices for increasing physical activity; reviewed for the Guide to Community Preventive Services	12 studies on community-scale urban design, 6 studies on street-scale urban design; and 3 studies on transportation and travel policies and practices	Both community-scale and street-scale urban design and land use policies and practices were found effective in promoting physical activity, with evidence rated as "sufficient." The evidence to evaluate the effectiveness of travel and transport policies is insufficient. Also reported are the following additional findings of the Guide to Community Preventive Services with respect to physical activity promotion, based on prior systematic reviews: strong evidence for community-wide campaigns, individually adapted health behavior change, school based physical education, social support in community settings, and the enhancement of access to physical activity options combined with informational outreach activities There is sufficient evidence for point-of-decision prompts
Summerbell et al[405]	**Children and adolescents** United States and international, published in 1990 through February 2005 Interventions to prevent obesity, of at least 12 weeks' duration, in randomized controlled or controlled trials	10 long-term (at least 12 months) and 12 short-term (12 weeks to 12 months)	Of the long-term studies that focused on both diet and physical activity, 5 studies found improvements in weight or fatness outcomes for both boys and girls and 1 found improvements for girls only; a long-term study of a multimedia intervention to improve physical activity was effective; studies that focused on nutrition education only were not effective Two of the short-term studies were effective in improving weight or fatness outcomes; both focused on physical activity; 2 others that focused on physical activity and 10 that focused on both physical activity and diet were not effective
Matson-Koffman et al[413]	**Policy and environmental changes** United States and international, published in 1970–2003 Policy or environmental interventions to promote physical activity or good nutrition, excluding studies of the built environment and media-only campaigns; included studies in whole communities, schools, worksites and restaurants, and healthcare settings	65 studies before 1990 and 64 studies between 1990 and 2003	Strongest evidence was found for - Promoting stair use - Improving access to place and options for physical activity - Improving school physical education - Implementing comprehensive worksite approaches - Increasing availability of nutritious foods - Information at point of food purchase - Systems for reminding healthcare providers to provide nutrition counseling

(*Continued*)

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Table 6. Continued

Reference	Focus, Scope, and Key Inclusion Criteria	Eligible Studies Identified	Main Findings
Pignone et al[414]	**Adults** United States and international, published in 1966–2001 Trials of counseling of adults in primary care settings to promote a healthy diet, of at least 3 months' duration, with behavioral outcomes reported, excluding trials in people selected on the basis of overweight or obesity or a chronic disease; reviewed for the US Preventive Services Task Force	21 trials	Relatively modest improvements in self-reported dietary intakes of saturated fat, fruits and vegetables, and possibly dietary fiber in response to brief interventions using a variety of modalities; greater intensity was associated with better results but had less potential feasibility in these settings
Eden et al[415]	**Adults** United States and international, published in 1994 through March 2002 Trials in which counseling to improve physical activity was provided and some part of the intervention was performed by a primary care clinician (physician, nurse practitioner, nurse, or physician's assistant); reviewed for the US Preventive Services Task Force	8 trials; 5 other trials judged to be of poor quality were excluded	Limited support was found for the effectiveness of these interventions; 3 of the trials that included a usual care control group reported a significant improvement associated with the intervention; in 1 study, a written prescription was more effective than advice alone; another suggested that women may need more intensive counseling than men In the 1 study that reported harm, about 60% of all patients reported some type of musculoskeletal injury and some reported cardiovascular events that required hospitalization; however, no comparison data were available to estimate background rates
Hardeman et al[416]	**All ages** United States and International, published in 1966–1999 Published studies using any type of study design involving testing of an intervention to prevent weight gain among people not preselected on the basis of weight or age; studies in subpopulations such as those stopping smoking and studies of multifactorial interventions targeting specific diseases and studies targeting weight loss were not included	11 articles describing 9 distinct interventions 5 were in schools and 4 were in the community at large; 2 were in adults	Effectiveness seemed to be greater among older participants, men, nonsmokers, and those with high income Of 5 randomized, controlled trials, only 1 reported a significant effect on weight
Glenny et al[417]	**All ages** US and international, published through 1995 Randomized trials of treatment and both randomized and nonrandomized studies evaluating interventions for obesity prevention, at least 12 months' duration	Among 97 eligible trials of obesity treatment or prevention, only 4 were of prevention, 1 in children and 3 in adults	In the study in children, a 12-month family therapy intervention was initially successful compared with conventional treatment or no-treatment control, but effect was not present at 1-year follow-up 2 of the 2 studies involved comprehensive community-wide cardiovascular disease risk reduction programs; 1 reported a significantly smaller BMI increment over time in the intervention compared with control communities; the other study, based on mailed newsletters, optional group contact, and a financial incentive, reported a significant advantage for the intervention group after 1 year of follow-up

development of a nonstudy-related intervention in 1 of the control communities. The numerous activities targeted the home, school, and community environments and included environmental changes and policy development related to food availability and physical activity options, newsletters, training of teachers and medical professionals, and implementation of a restaurant certification program. Children in the intervention community had a more favorable BMI trajectory than those in the comparison arm.

Conclusions

A main objective of this scientific statement is to provide an overview of the types of strategies needed to prevent obesity

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using a comprehensive, population-based approach rather than relying only on clinic-based or individually oriented strategies. Given that the ultimate determinants of obesity are individual eating and physical activity behaviors, the perception that one can solve the problem by refining the ability to help individuals to change their behaviors will persist. Central themes here are that what it will take for individuals on average to change their behaviors to the point of avoiding excess weight gain throughout the life course is affected by environmental factors that are not under their personal control. Research recommendations and programmatic initiatives for obesity prevention call for a broad range of strategies, many of which go beyond the knowledge, skill, and experience base of health professionals.

Investigators involved in pilot studies of obesity prevention identified a number of challenges to the design and conduct of research on obesity prevention in various organizational settings and study populations.[234,421] Foremost among these were the difficulty of motivating people to make the amount of effort needed for prevention of weight gain, the difficulty of measuring energy balance, the need to differentiate adverse weight gain from an increase in weight because of leaner body composition, and the large sample sizes needed to detect statistically significant differences when the primary outcome is no change in weight as opposed to the substantial weight losses obtained in treatment studies.[236] Perhaps partly for these reasons, the evidence to date includes many examples of obesity prevention interventions that have not shown significant differences in weight favoring the intervention group, making it especially important to identify examples of programs that might work.

Although the picture of how to intervene is far from complete, guidance and research recommendations developed by various expert panels,[7,355,422] working groups,[236] and systematic reviews (Table 6) have led to an increase in obesity prevention research. One of these expert reports, developed by the Institute of Medicine, provides a national action plan for childhood obesity prevention and includes more than 50 recommendations for actions applicable to governments, industries, communities at large, schools, and homes.[7] A subsequent Institute of Medicine report provides a framework for evaluating progress and an update on progress in implementing elements of the plan.[355] Targeted funding from the National Institutes of Health,[423] from the CDC (www.cdc.gov), and, for childhood obesity prevention, from the Robert Wood Johnson Foundation (www.rwjf.org), for example, is a major incentive to conduct population-based obesity prevention research. This research includes community-partnered and community action research and research on the effectiveness of policies implemented in various sectors and at various levels. Unproven efforts will continue as an important part of the community response to this pressing health problem, but the mandate to ground these efforts with some type of mechanism for evaluation is increasingly emphasized and funded.[355]

Ongoing activities, such as the CDC Guide to Community Preventive Services[424] and Cochrane evidence reviews,[405] policy tracking, report cards,[425–428] and web sites that serve as clearinghouses for sharing information about available resources and extant community programs[429,430] are creating an increasingly strong platform for action. Several initiatives specifically designed to generate policy and environmental changes and identify effective approaches in this respect have been funded by the Robert Wood Johnson Foundation as part of their commitment to reversing the childhood obesity epidemic by 2015 (see www.rwjf.org). A study of 9 countries in Europe has set the precedent for comprehensive study of how various policy options for obesity prevention are viewed by a broad range of stakeholders.[431] With respect to direct physician involvement, a model of potential interest is the Physicians for Healthy Communities Initiative[432] developed by the California Medical Association Foundation in partnership with the California Nutrition Network for Healthy, Active Families and Kaiser Permanente. This initiative will promote policy and environmental changes in schools and communities and will also assist physicians with training in community collaboration, nutrition messages, and advocacy techniques to enable them to become champions to promote healthy eating and active living throughout California.

Finally, some aspects of the scenario with respect to obesity prevention should sound very familiar to those experienced with CVD prevention. Strategies across the spectrum have been applied to promotion of changes in food intake and physical activity and the needs for upstream interventions clearly articulated, both in the United States and globally.[433] The North Karelia project, in which policy level interventions were implemented to generate population-wide reductions in intake of saturated fat, with benefits for reductions in CVD mortality, is perhaps the best known example of the success of policy changes for CVD risk reduction.[434] The concept of policy level interventions to change contexts for individual behavior is also well known from the experience with tobacco,[435] although the differences between food, which is essential to life and inherently good for health, and tobacco, which is nonessential and inherently bad for health, limit the direct transfer of some concepts and strategies. Many lessons from both tobacco and CVD prevention generally are applicable to obesity prevention. The most overarching lesson is that there is, indeed, the potential for success in combating such a far-reaching and deeply embedded societal pandemic.[435–437] Obesity treatment and prevention have always been a part of CVD prevention but, especially for prevention, have not been the primary focus. The rapid rise in obesity on a population level—associated with changes in the quantities of food available, marketed, and consumed, along with the very low level of obligatory physical activity for most people—makes obesity prevention efforts as a primary focus truly daunting. Furthermore, the inability to specify—at a population or individual level—the exact behaviors expected to result in energy balance considerably adds to the challenge. Avoiding unhealthy weight gain goes beyond the success of individual efforts to achieve good dietary quality and adequate physical fitness. It requires a broad range of strategies that include environmental and societal efforts.

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Appendixes

Appendix 1. AHA Statements and Workshop Proceedings Related to Obesity Etiology, Complications, Prevention, and Treatment, 2004–2006

Reference		Description
Williams et al[22]	Children and adolescents	Provides practical guidelines to clinicians to decrease CVD risk factors in youth, including low physical activity, obesity, insulin resistance and type 2 diabetes, high blood pressure, hypercholesterolemia, and cigarette smoking
Steinberger et al[23]	Children and adolescents	Summarizes evidence to provide a rationale for lifestyle modification and weight control in childhood to reduce risks of developing insulin resistance, type 2 diabetes, and CVD; oriented to clinical practitioners
Hayman et al[24]	Children and adolescents	Provides guidance about how to optimize school environments in population-based strategies to promote cardiovascular health for US children and adolescents; intended for health and education professionals, child health advocates, policy makers, and community leaders; includes recommendations for school curricula, policies, and linkages to community resources and infrastructures
Mullis et al[25]	Adults, children, and families	Explains the complementarity of population-based and high-risk approaches to obesity prevention and treatment; describes important settings for instituting interventions to influence energy balance and the need for creative approaches to developing and evaluating broad policy approaches; makes research recommendations
Klein et al[26]	Adults	Reviews evidence on the clinical effects of weight loss on a variety of cardiovascular risk factors and outcomes and the clinical efficacy of treatments for obesity, including dietary and physical activity change, behavioral modification, pharmacotherapy, and surgery; summarizes guidelines for clinical evaluation and treatment of obese adults
Smith et al[21]	Adults in racial/ethnic minority populations	Highlights the higher-than-average risk of some or all metabolic syndrome components in African Americans, Hispanic Americans, American Indians/Alaska Natives, Asian Americans and Pacific Islanders; makes recommendation to the AHA for initiatives to reduce the related health disparities through professional/lay programs, public policy/advocacy, and research
Daniels et al[27]	Children and adolescents	Summarizes information on the pathophysiology and epidemiology of overweight in children and adolescents; provides an update on adverse health effects of childhood overweight and discusses approaches to prevention and treatment of overweight in children and adolescents
Grundy et al[28]	Adults	Reviews and provides updated information in support of the AHA recommendations for clinical diagnosis, therapeutic goals and management of the metabolic syndrome; identifies related areas of needed research
Gidding et al[29]	Children and adolescents	Summarizes current available information on cardiovascular nutrition in children and makes recommendations for both primordial and primary prevention of cardiovascular disease beginning at a young age; emphasizes the importance of nutrition early in life, including the fetal milieu; includes brief overview of public health issues related to nutrition
Poirier et al[2]	Adults	Updates the evidence for the impact of obesity on CVD, including cardiac structure and function and summarizes the benefits of weight loss on the cardiopulmonary system; discusses potential CVD risks associated with certain clinical weight loss approaches
American Heart Association Nutrition Committee et al[30]	Adults primarily, although applicable to children	Updates the AHA public health and clinical recommendations for diet and other lifestyle behaviors to prevent and manage CVD, including the guideline to "aim for a healthy weight"; includes practical tips for individuals to achieve these guidelines; provides recommendations for practitioners, restaurants, the food industry, schools, and local governments to promote a more supportive environment for achieving goals
Pate et al[31]	Children and adolescents	Highlights physical activity to be a key determinant of weight status, summarizes the evidence supporting schools' potential for effectively improving and promoting physical activity, and recommends several key changes in school policy and practice
Kavey et al[32]	Children and adolescents	Provides guidelines for CVD prevention in children and adolescents who are at high risk for early coronary disease; these guidelines recommend more aggressive treatment of CVD risk factors, including obesity, than in the general population for children and adolescents with conditions such as familial hypercholesterolemia, diabetes, chronic kidney disease, heart transplantation, Kawasaki disease, systemic lupus erythematosus, rheumatoid arthritis, congenital heart disease, and past history of cancer treatment
Hayman et al[33]	Children and adolescents	Reviews rationale for primary prevention of CVD in youth and reports interventions at the population level and in high-risk individuals; provides guidelines with particular emphasis on nursing practice

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Appendix 2. Selected Evidence-Based Recommendations and Guidelines for Obesity Prevention and Treatment in Adults and Child/Adolescent Populations

Source	Relevance*
National Institutes of Health[34]	Adults
McTigue et al[17]	Adults
Katz et al[35]	Children/adolescents and adults
Koplan et al[7]	Children/adolescents
American Heart Association Nutrition Committee et al[30]	Children/adolescents and adults
Lau et al[36]	Children/adolescents and adults
National Initiative for Children's Healthcare Quality et al[37]	Children/adolescents

*Children under age 2 years are not targeted in any of the guidelines listed.

Disclosures

Writing Group Disclosures

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This table represents the relationships of writing group members that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all members of the writing group are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives $10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns $10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

*Modest.

†Significant.

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This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit.

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