SUPPLEMENT ARTICLES

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**Expert Committee Recommendations Regarding the Prevention, Assessment, and Treatment of Child and Adolescent Overweight and Obesity: Summary Report**
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Bonnie A. Spear, Sarah E. Barlow, Chris Ervin, David S. Ludwig, Brian E. Saelens, Karen E. Schetzina, and Elsie M. Taveras
Introduction

Joylene John-Sowah, MD, MPH, Project Director

The American Medical Association, in collaboration with the Department of Health and Human Services’ Health Resources and Services Administration and the Centers for Disease Control and Prevention, convened an expert committee to develop recommendations on the assessment, prevention, and treatment of child and youth overweight and obesity.

In 1997, the Health Resources and Services Administration convened the first expert committee to develop recommendations on the evaluation and treatment of child and youth obesity. At that time, few studies of this problem had been conducted; therefore, the approaches to evaluation and therapy were rarely evidence based. Obesity in children and adolescents continues to represent one of the most frustrating and difficult conditions to treat.

In February 2004, the American Medical Association convened a second expert committee to guide the development of 3 articles that would explore current evidence-based science and form the basis of new recommendations on the assessment, prevention, and treatment of child and adolescent overweight and obesity. Representatives from 15 national organizations formed the second expert committee. The committee used a multidisciplinary model and integrated approaches across disciplines. The conceptual framework is the chronic care model with the goal of achieving family/self-management of childhood obesity.

The product is 4 articles, 1 on each of the aforementioned overview areas of the management of obesity and 1 overarching support document. The articles were written by national experts in the field of childhood obesity who were nominated jointly by the members of the expert and steering committees.

Once the articles and the recommendations were finalized, the representatives took them back to the parent organizations for endorsement. The following organizations have endorsed the recommendations:

- American Academy of Pediatrics
- American Dietetic Association
- National Association of Pediatric Nurse Practitioners
- Association of American Indian Physicians
- American Heart Association
- National Association of School Nurses
- American College of Sports Medicine
- The Obesity Society (formerly NAASO)
- The Endocrine Society
- American College of Preventive Medicine
- American Academy of Child and Adolescent Psychiatry
- National Medical Association

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ABSTRACT

To revise 1998 recommendations on childhood obesity, an Expert Committee, comprised of representatives from 15 professional organizations, appointed experienced scientists and clinicians to 3 writing groups to review the literature and recommend approaches to prevention, assessment, and treatment. Because effective strategies remain poorly defined, the writing groups used both available evidence and expert opinion to develop the recommendations. Primary care providers should universally assess children for obesity risk to improve early identification of elevated BMI, medical risks, and unhealthy eating and physical activity habits. Providers can provide obesity prevention messages for most children and suggest weight control interventions for those with excess weight. The writing groups also recommend changing office systems so that they support efforts to address the problem. BMI should be calculated and plotted at least annually, and the classification should be integrated with other information such as growth pattern, familial obesity, and medical risks to assess the child’s obesity risk. For prevention, the recommendations include both specific eating and physical activity behaviors, which are likely to promote maintenance of healthy weight, but also the use of patient-centered counseling techniques such as motivational interviewing, which helps families identify their own motivation for making change. For assessment, the recommendations include methods to screen for current medical conditions and for future risks, and methods to assess diet and physical activity behaviors. For treatment, the recommendations propose 4 stages of obesity care; the first is brief counseling that can be delivered in a health care office, and subsequent stages require more time and resources. The appropriateness of higher stages is influenced by a patient’s age and degree of excess weight. These recommendations recognize the importance of social and environmental change to reduce the obesity epidemic but also identify ways healthcare providers and health care systems can be part of broader efforts.
I N 1997, WHEN the Department of Health and Human Services Health Resources and Service Administration convened the first expert committee to develop recommendations on the evaluation and treatment of child and youth obesity, few studies of this problem had been conducted to provide evidence for the recommendations. Since then, increasing scientific attention has resulted in an expanded body of literature on the causes, comorbidities, and treatment of this problem. The condition remains frustrating and difficult to treat, but, with more-current scientific information available, in 2005 the American Medical Association, in collaboration with the Health Resources and Service Administration and the Centers for Disease Control and Prevention (CDC), convened a new expert committee that was charged with providing revised recommendations. These new recommendations use current, evidence-based data, as well as clinical experience when evidence does not exist, to provide updated practical guidance to practitioners (see Appendix for the complete recommendations).

Representatives from 15 national health care organizations formed the expert committee. The steering committee, composed of representatives from the American Medical Association, the Health Resources and Service Administration, and the CDC, invited these member organizations because they serve children at high risk of obesity, they represent experts in obesity-related conditions, or they represent experts in aspects of obesity treatment. The representatives from the 15 member organizations submitted nominations for the experts who would compose the writing groups and work on the following 3 areas of focus: prevention, assessment, and treatment of childhood overweight and obesity. Special care was taken both to ensure that a broad range of disciplines, including medicine, nutrition, nursing, psychology, and epidemiology, was represented and to capture the interests of diverse cultural groups. The experts in these groups reviewed the scientific information that forms the basis of the expert committee recommendations. Their work is referred to throughout this report according to the area of review (prevention, assessment, or treatment), and their reports accompany this article.1–3

Each multidisciplinary writing group reviewed the current literature to develop the recommendations. Because the science continues to lag behind the obesity epidemic, many gaps in evidence-based recommendations remain. With few exceptions, randomized, controlled, intervention trials have not been performed to prove or to disprove the effect of a particular behavior on weight control in obese children. The available studies often examine associations between health behaviors and weight or between health behaviors and energy balance. Even less evidence exists about the process of addressing obesity in a primary care setting. The purpose of the expert committee was to offer practical guidance to clinicians by providing recommendations in all areas of obesity care, including those that lack the best possible evidence. When evidence of an effect on obesity was not available, the writing groups considered the literature, clinical experience, the likelihood of other health benefits, the possible harm, and the feasibility of implementing a particular strategy before including it. Although a thorough evidence-based review was beyond the scope of this project, the writing groups provided a broad rating of the evidence, so that readers can appreciate the limitations of these recommendations and watch for new studies that will refine them. The rating categories were as follows:

1. recommends with consistent evidence (CE), that is, multiple studies generally show a consistent association between the recommended behavior and either obesity risk or energy balance;
2. recommends with mixed evidence (ME), that is, some studies demonstrated evidence for weight or energy balance benefit but others did not show significant associations, or studies were few in number or small in sample size;
3. suggests, that is, studies have not examined the association of the recommendation with weight or energy balance, or studies are few, small in number, and/or without clear findings; however, the expert committee thinks that these recommendations could support the achievement of healthy weight and, if future studies disprove such an effect, then these recommendations are likely to have other benefits and are unlikely to cause harm.

The report provides qualitative ratings of evidence for the recommended lifestyle behaviors. The summary report recommends assessment of the lifestyle behaviors that are targets for change but does not rate evidence for the assessment process; the literature in this area, cited in the assessment report,2 is sparse and has limited applicability to an office setting. The writing groups also addressed the implementation of clinical care for obesity. At the level of the family, the writing groups suggested strategies to encourage and to support a patient or family that chooses to change eating or physical activity behaviors. At the level of the provider office, the committee suggested ways in which the office system can change to track overweight and obese children and to support family management of this chronic condition. The scarcity of studies about the process of obesity treatment precluded an evidence review. The recommendations represent a consensus based on the best available information. Ongoing research will eventually provide the best possible evidence for childhood obesity care, and future recommendations will reflect new knowledge. In the meantime, clinicians, who routinely make clinical
decisions in the absence of the best possible evidence, will find updated guidance for this pervasive condition.

The writing groups presented their recommendations to the expert committee for discussion and revision in May 2006. Once consensus was reached, the committee members then presented the recommendations to their member organizations for endorsement (see “Acknowledgments” for expert committee and writing group participants).

EPIDEMIOLOGIC FEATURES

Childhood Obesity Epidemic

The rapid increase in the prevalence of childhood obesity has alarmed public health agencies, health care clinicians, health care researchers, and the general public. On the basis of measured heights and weights from nationally representative samples of US children assessed approximately every 5 years, obesity prevalence has increased from 5% in 1963 to 1970 to 17% in 2003 to 2004. Clinicians are faced with addressing this problem with a steadily increasing number of patients.

Obesity and overweight are defined on the basis of age- and gender-specific BMI normative values that were established when the distribution of BMI values was constant. The increase in obesity prevalence is therefore measured against a stable cutoff point, the 95th percentile BMI for gender and age.

Demographic Features

The obesity epidemic has disproportionately affected some racial/ethnic groups. In 2003–2004, the prevalence rates were particularly high among black girls (24%) and among Mexican American boys (22%). Rates have also increased among Native American and Asian American youths. Overall, poverty has been associated with greater obesity prevalence among adolescents; however, subgroups have differed. In 1 report, for example, obesity prevalence among younger black male adolescents was higher in nonpoor families than in poor families but prevalence among older black male adolescents was higher in poor families. Higher family socioeconomic status is associated with lower obesity prevalence among white girls but not among black girls.

Causes

Both genes and environment contribute to obesity risk. Twin studies have clearly demonstrated a genetic risk, and the discovery of leptin, ghrelin, adiponectin, and other hormones that influence appetite, satiety, and fat distribution provides insight into metabolic mechanisms for physiologic risk. With multiple substances and multiple gene sites associated with obesity, the system is complex, redundant, and likely not amenable to a simple pharmaceutical intervention. However, genes are not destiny. Just as behavior and environment strongly influence a person’s risk of developing skin cancer, behavior and environment influence the development of obesity in genetically at-risk people. At a population level, the increase in prevalence is too rapid to be explained by a genetic shift; rather, it must result from changes in eating and physical activity behaviors that have shifted the balance of energy intake and energy expenditure.

The influence of specific behavior changes on energy balance is difficult to determine. Many cross-sectional studies and some longitudinal studies have examined the relationships between specific behaviors (for instance, intake of sugar-sweetened beverages or participation in daily physical education classes) and obesity. Interventions studies that examine prospectively the impact of a behavior on weight or BMI are rare. Each of the writing groups reviewed the literature for evidence of the influence of behaviors on either energy balance or BMI. The review found evidence for only a few behaviors. One important limitation of these studies is measurement validity. For assessment of energy intake under normal, free-living circumstance, subjects must report the food they consume, through either recall or a food diary. These methods are inaccurate and subject to underreporting. Measuring physical activity is somewhat less problematic, with improved accelerometers and the capacity to measure accurately the total energy expenditure through labeled-water techniques. Probably a bigger challenge in this scientific area is the large number of possible eating and activity behaviors that may contribute to energy imbalance. If greater sugar-sweetened beverage intake, larger portion sizes at all meals and snacks, more-frequent snacks, more ready-to-eat foods, more restaurant eating, more television viewing, fewer physical education classes, less walking to and from school, less outside play at home, more escalators, elevators, and automatic doors, and so forth, all coexist, then the impact of any one of those behaviors on obesity prevalence may be unmeasurable.

Scientists continue to study obesity but, given its complex causes, years or decades may pass before the most effective intervention or prevention strategies are identified. The recommendations presented here are evidence based where evidence is available; where evidence is not available or is incomplete, the expert committee has combined data with clinical judgment, including selected interventions when such interventions are reasonable and are unlikely to cause harm. An example is the recommendation to increase fiber intake. Although studies have not demonstrated that increased fiber intake leads to improved weight, foods that are high in fiber have lower energy density and could displace other foods, resulting in overall reduced energy intake. This diet change, even if unproven, has other nutritional benefits and is unlikely to cause harm. As discussed above, this summary report includes a general
assessments of the quality of evidence for each behavior. The prevention, assessment, and treatment reports provide detailed descriptions of studies for each topic.1-3

DEFINITIONS AND TERMINOLOGY

Measurement of Body Fat

High levels of body fat are associated with increasing health risks. However, no single body fat value, whether measured as fat mass or as percentage of body weight, clearly distinguishes health from disease or risk of disease. Even if body fat level could be measured easily, other factors, such as fat distribution, genetics, and fitness, contribute to the health assessment.

BMI, a measure of body weight adjusted for height, is a useful tool to assess body fat. BMI is defined as weight (in kilograms) divided by the square of height (in meters). BMI levels correlate with body fat13,14 and also correlate with concurrent health risks, especially cardiovascular risk factors.15 High BMI predicts future adiposity, as well as future morbidity and death.16 The sensitivity of BMI of >85th percentile for identifying the fattest children is good,17 and, in contrast to more-precise measures of body fat (such as dual-energy x-ray absorptiometry), health care providers can assess weight and height routinely. Although BMI does not measure body fat directly and therefore may lead to imprecise assessment of adiposity, it is feasible and has acceptable clinical validity if used thoughtfully. Another practical benefit of BMI use for children is the continuity with recommended assessments of adult body weight.

For children, the distribution of BMI changes with age, just as weight and height distributions change. As a result, although absolute BMI is appropriate to define body weight in adults, percentiles specific for age and gender define underweight, healthy weight, overweight, and obesity in children.

The validity of BMI depends in part on the cutoff points used. Like body fat levels, BMI and BMI percentiles are continuous, and any cutoff point will be imperfect in distinguishing those with health risks from those without. When a high cutoff point is selected, patients with “normal” BMI despite high body fat levels will be misclassified as healthy. When the cutoff point is low, patients with high BMI despite normal body fat levels (for example, muscular athletes) will be misclassified as unhealthy. The cutoff point selection must balance overdiagnosis and underdiagnosis. Because body fat levels and health risks are continuous, clinicians should rely on BMI as a useful tool that triggers concern and assessment, but they should recognize that other clinical information influences the need for intervention.

Pediatric Cutoff Points and Terminology: Same Cutoff Points, New Terms

The use of 2 cutoff points, namely, BMI of 95th percentile and 85th percentile, captures varying risk levels and minimizes both overdiagnosis and underdiagnosis. When BMI is <85th percentile, body fat levels are likely to pose little risk. When BMI is ≥95th percentile, body fat levels are likely to be high. BMI of 85th to 94th percentile indicates health risks that vary depending on body composition, BMI trajectory, family history, and other factors. These cutoff points are unchanged from the 1998 expert committee recommendations18 and CDC5 and Institute of Medicine19 recommendations.

The expert committee recommends different terminology. The committee suggests that, when BMI is ≥95th percentile, the term “obesity” should replace “overweight” and, when BMI is 85th to 94th percentile, “overweight” should replace “at risk of overweight.” The compelling reasons for this revision are clinical. The term obesity denotes excess body fat more accurately and reflects the associated serious health risks more clearly than does the term overweight, which is not recognized as a clinical term for high adiposity. Overweight denotes high weight from high lean body mass as well as from high body fat levels and so is appropriate for the 85th to 94th percentile category, which includes children with excess body fat as well as children with high lean body mass and minimal health risks. These terms provide continuity with adult definitions and avoid the vagueness of “at risk of overweight,” which has been confusing to patients and health care providers. Because the recommended cutoff points have not changed, these terms will not affect the prevalence rates of the BMI categories.

Exceptions to the use of 85th and 95th percentile BMI values as cutoff points occur for older and younger children. For older adolescents, BMI of 95th percentile is higher than BMI of 30 kg/m², the adult obesity cutoff point. The committee therefore recommends that obesity in youths be defined as BMI of 95th percentile or BMI of ≥30 kg/m², whichever is lower. For children <2 years of age, BMI normative values are not available. Weight-for-height values above the 95th percentile in this age group can be categorized as overweight.

Stigmatization associated with the term obesity has been one reason for the use of the term overweight. The negative connotation of obesity results from pervasive social prejudice and deserves attention.20-22 However, the committee recommends that clinicians address this concern through supportive demeanor and language in the clinical encounter. The terminology and cutoff points for both adults and children have been debated, but several groups have weighed the advantages and disadvantages and made similar recommendations (Table 1).

Calculators, wheels, tables, and nomograms are some of the tools used to calculate absolute BMI, which then is plotted on current growth charts available on-line from the CDC. Personal digital assistant devices and Internet-based programs can calculate BMI and also report percentiles; to monitor a child’s growth pattern over
time, however, clinicians must plot BMI values on a BMI curve. Electronic health record programs can calculate BMI values, report percentiles, and automatically plot a child’s BMI values over time on a BMI curve (Table 2). For children <2 years of age, providers should plot weight-for-height values over time.

Once a child’s BMI is measured, clinicians must exercise judgment, first in assessing the child’s health and then in choosing language to inform the child and family. Especially for a child with BMI in the overweight category (85th–94th percentile), a clinician may decide that the health risk is low, but he or she should make that decision with knowledge of the BMI category, rather than a visual impression of normal weight, and with a deliberate review or update of the patient’s family and medical history, a review of the BMI trajectory, and an assessment of body fat distribution, diet and activity habits, and appropriate laboratory tests. The clinician may conclude that the overweight child is not “overfat” and can safely reinforce the obesity prevention messages that are appropriate for children with healthy BMI values. Future scientific data on the risk of obesity and the risk of medical problems may improve clinicians’ ability to predict which children need early intervention; currently, however, primary health care providers must use clinical judgment and must regularly review the child’s BMI and reassess health risks. Rarely, children with BMI of >95th percentile are also deemed healthy, although this is less likely to be the case the farther values are above the 95th percentile curve, and some children with BMI somewhat below the 85th percentile may have fat-related health risks. The BMI is an important screening tool, but it must be integrated with other information in the health assessment.

Much legitimate concern exists about stigmatization of overweight and obese children. Public concern followed decisions to assess BMI in schools, because of the potential harm of labeling a child with a condition that is a target of prejudice. Health care visits are generally a good place to identify excess weight, because the setting frames the condition as a health problem and because the visit is private. Therefore, clinicians must take responsibility for identification but must approach the subject sensitively, to minimize embarrassment or harm to self-esteem. Consistent with the 1998 recommendations, the expert committee urges clinicians to be supportive, empathetic, and nonjudgmental. A careful choice of words will convey an empathetic attitude. Adult patients have identified “fatness,” “excess fat,” and “obesity” as derogatory terms, and obese adolescents prefer the term “overweight.” Younger children and their families may respond similarly, and clinicians should discuss the problem with individual families by using more-neutral terms, such as “weight,” “excess weight,” and “BMI.” Therefore, the expert committee recommends the use of the clinical terms overweight and obesity for documentation and risk assessment but the use of different terms in the clinician’s office, to avoid an inference of judgment or repugnance.

Recognition of the need for a third cutoff point to define severe obesity in childhood obesity seems to be evolving. An adolescent weighing 180 pounds and another weighing 250 pounds are in the same BMI category (>95th percentile) but face markedly different social and medical effects. New data indicate that extreme obesity in children is increasing in prevalence, and these children are at high risk for multiple cardiovascular disease risk factors. A definition of severe childhood obesity would help identify these children so that their particular risks and treatment needs can be established. The expert committee proposes recognition of the 99th percentile BMI, which is BMI of ~30 to 32 kg/m2 for youths 10 to 12 years of age and ≥34 kg/m2 for youths 14 to 16 years of age. The marked increase in risk factor prevalence at this percentile provides clinical justification for this additional cutoff point. Although much additional study with larger and more-diverse samples is needed to characterize the medical and social risks of this category, the committee recommends that clinicians recognize this BMI cutoff point and ensure that best efforts are made to provide treatment to these youths and their families. Because the 97th percentile is the highest curve

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**TABLE 1** Terminology for BMI Categories

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Former Terminology</th>
<th>Recommended Terminology</th>
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<tbody>
<tr>
<td>&lt;5th percentile</td>
<td>Underweight</td>
<td>Underweight</td>
</tr>
<tr>
<td>5th–84th percentile</td>
<td>Healthy weight</td>
<td>Healthy weight</td>
</tr>
<tr>
<td>85th–94th percentile</td>
<td>At risk of overweight&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Overweight&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>≥95th percentile</td>
<td>Overweight&lt;sup&gt;a&lt;/sup&gt; or obesity&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Obesity&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Expert committee recommendations, 1998.<sup>15</sup>
<sup>b</sup> International Obesity Task Force, 2000.<sup>45</sup>
<sup>c</sup> CDC recommendations, 2002.<sup>2</sup>
<sup>d</sup> Institute of Medicine, 2005.<sup>16</sup>

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**TABLE 2** BMI Tools

<table>
<thead>
<tr>
<th>Tools</th>
<th>BMI Calculation</th>
<th>BMI Percentile Classification</th>
<th>BMI Percentile Plotting</th>
<th>BMI z Score&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard calculator&lt;sup&gt;b&lt;/sup&gt;</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI wheel</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BMI nomogram</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>BMI growth curves</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internet-based calculator&lt;sup&gt;c&lt;/sup&gt;</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal digital assistant program&lt;sup&gt;d&lt;/sup&gt;</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Electronic health record</td>
<td>X</td>
<td>X</td>
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</table>

BMI calculation, percentile classification, and BMI percentile plotting are required to monitor a child’s growth over time.

<sup>a</sup> Generally not needed in clinical care.
<sup>b</sup> Metric: kilograms/meters/meters; English: pounds/inches/inches × 703.
<sup>d</sup> Example: http://hp2010.nhlbihin.net/bmi/palm.htm.
<sup>e</sup> Potential application; not currently available.
available on the growth charts, Table 3 provides 99th percentile cutoff points according to age and gender.

### OVERVIEW OF PROVIDER OFFICE PROCESS

#### Universal Assessment of Obesity Risk
These recommendations support a shift from simple identification of obesity, which often occurs when the condition is obvious and intractable, to universal assessment, universal preventive health messages, and early intervention. If primary care providers are to have an impact on the childhood obesity epidemic, then their best approach is assessment of obesity risk for all patients, with anticipatory guidance on healthy behaviors to minimize that risk. The work of the expert committee and writing groups addresses all stages of care, from normal-weight, low-risk children to severely obese children. Figure 1 presents an overview of the process to assess obesity risk.

Although it is not a precise measure of body fat or health risk, BMI is the initial screen that should be calculated at each well-child visit and should serve as the starting point for classification of health risks. Children in the healthy-weight category (BMI of 5th–84th percentile) have lower risks, although parental obesity, family medical history, and current diet and physical activity behaviors may alter that assessment. These children and their families should receive support in maintaining or establishing healthy lifestyle (prevention) behaviors. The likelihood of health risks increases in the 85th to 94th percentile (overweight) category and again is influenced by parental obesity, family medical history, and current lifestyle habits, as well as BMI trajectory and current cardiovascular risk factors. Some of these children should receive prevention counseling, whereas others should receive more-active intervention. Children with a BMI above the 95th percentile (obese) are very likely to have obesity-related health risks, and most should be encouraged to focus on weight control practices. Providers must use clinical judgment in assessing

### TABLE 3 Cutoff Points for 99th Percentile BMI According to Age and Gender

<table>
<thead>
<tr>
<th>Age, ya</th>
<th>99th Percentile BMI Cutoff Point, kg/m²</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>5</td>
<td>20.1</td>
</tr>
<tr>
<td>6</td>
<td>21.6</td>
</tr>
<tr>
<td>7</td>
<td>23.6</td>
</tr>
<tr>
<td>8</td>
<td>25.6</td>
</tr>
<tr>
<td>9</td>
<td>27.6</td>
</tr>
<tr>
<td>10</td>
<td>29.3</td>
</tr>
<tr>
<td>11</td>
<td>30.7</td>
</tr>
<tr>
<td>12</td>
<td>31.8</td>
</tr>
<tr>
<td>13</td>
<td>32.6</td>
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<tr>
<td>14</td>
<td>33.2</td>
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<tr>
<td>15</td>
<td>33.6</td>
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<tr>
<td>16</td>
<td>33.9</td>
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<tr>
<td>17</td>
<td>34.4</td>
</tr>
</tbody>
</table>

The data were derived from ~500 children in each year from 5 through 11 years of age and ~850 children in each year from 12 through 17 years of age (adapted from Freedman et al., with permission).

* Cutoff points are at the midpoint of the child’s year (eg, 5.5 years).
health risks, because no formula exists that can integrate BMI pattern, family background, and health behaviors to determine future weight and health. Clinicians use similar information to evaluate underweight children for failure to thrive. Because ideally the children will return to the same provider, the assessment can be revised and the approach adjusted.

Chronic Care Model

The expert committee recommendations are comprehensive and ambitious. Health care-centered efforts alone cannot effect change, but they can complement and potentially enhance evolving public health efforts, such as school wellness policies, parks and recreation programs, and shifts in child-targeted food advertisements. In addition, health care provider offices and health care systems will need to change, in many cases, to implement these recommendations. These recommendations can serve as guides that will improve as new information becomes available.

The traditional office visit model works best for acute problems, such as otitis media or joint injury; the clinician assesses the single problem, orders additional testing as needed, and presents a treatment plan (generally short-term) to the patient. However, the complexity of chronic problems, such as diabetes mellitus or obesity, and their requirement for patient education about self-management often overwhelm both the patient and the clinician during an office visit. The chronic care model28 envisions a new structure that integrates community resources, health care, and patient self-management to provide more-comprehensive and more-useful care. This paradigm envisions offices linked to community resources, such as exercise programs; support for self-management, which requires educating patients and families about assessment and monitoring; an expanded practice team that supports patient self-management and monitors adherence to evidence-based care pathways; and clinical information systems that can remind the team of routine tests and treatments and can monitor the practice’s adherence to goals.28,29 Changes in office procedure require deliberate planning and evaluation, and the rapid-cycle quality improvement method may be a useful approach for continuous quality improvement.10 In this model, practices plan a change and a method to measure that change, implement the change, and then examine the measure of change. The plan is modified depending on how well the goals are met. The cycle is repeated until the practice is satisfied with the change. For example, a practice could plan to include the BMI category next to the vital signs on the patient’s chart for well-child visits. After 3 months, the practice would measure the percentage of charts that included the BMI category. If only 60% of charts included the BMI category, then staff members would discuss barriers and propose a new plan, such as readily available BMI calculators or the need for the office secretary to add growth charts with BMI curves to records of established patients with weight-for-height curves. With the new routine in place, progress toward the goal would again be measured.

The chronic care model has obvious applications in childhood obesity, and several large health maintenance organizations have initiated some of these approaches. Kaiser Permanente has trained staff members to use motivational interviewing, and Wellpoint has distributed parental toolkits in primary care clinics, to help educate office personnel about children’s development and appropriate nutrition and physical activity. Several programs have linked to community efforts, such as community-based exercise programs. The care model for obesity recognizes the importance of changes in the school, worksite, and community. Figure 2 shows how the environment and the medical system support the patient and the family in their management of the condition.

Providers have reported that lack of reimbursement often is a barrier to obesity care.31 Currently, insurance carriers may exclude obesity treatment from the benefits packages they offer. The American Academy of Pediatrics has a fact sheet about appropriate coding (www.aap.org/healthtopics/overweight.cfm) and can answer specific coding questions through electronic mail (aapcodinghotline@aap.org). The prevention report includes tables with billing codes for obesity-related preventive care, as well as diagnostic codes.1 Currently, health maintenance organizations may invest in preventive care more willingly than traditional fee-for-service insurance.

Obesity Care and Cultural Values of Patients

Beliefs about what is an attractive weight or a healthy weight, what foods are desirable or appropriate for parents to provide children, how families should share meals, the importance or enjoyment of physical activity, and the authority parents have over children at different ages, as well as many other attitudes that affect lifestyle habits, are influenced by cultural values and beliefs. Some studies have examined differences between iden-
tified racial, ethnic, or cultural groups, such as the observation that black girls are more satisfied with heavier bodies than are white girls. Low-income mothers may recognize obesity as a problem, not on the basis of growth curves but when they perceive that high weight restricts their child’s tolerance for physical activity. A study of low-income minority parents of preschool-aged children showed that Hispanic parents had indulgent feeding styles more often than did low-income black parents. Population studies indicate that levels of vigorous physical activity differ according to age and racial group. However, studies in these areas are incomplete. Barriers to behavior change may be related to community circumstances, such as lack of safe recreation areas, rather than values and preferences. Clinicians should inform themselves about the values or circumstances that may be common in the population they serve, especially if that population differs from their own. However, a clinician’s knowledge of an individual family’s personal values and circumstances, which are not dictated by the family’s ethnic, racial, or economic group, may be most helpful in tailoring recommendations.

PREVENTION

Importance

Given the difficulty of behavior-based weight loss and subsequent weight maintenance and the expense and potential harm of medication and surgery, obesity prevention should be a public health focus. Efforts must begin early in life, because obesity in childhood, especially among older children and those with more-severe obesity, is likely to persist into adulthood. Therefore, childhood represents an important opportunity to establish healthy eating and activity behaviors that can protect children against future obesity. Pediatric providers are accustomed to addressing health behaviors, such as car seat use, tobacco avoidance, and avoidance of risky sexual behavior, and they provide guidance on nutrition in early childhood routinely. In addition, they know the family’s medical history and social and behavioral interactions. They are well positioned to guide families in the areas of eating and activity.

The targets of obesity prevention should be all children, starting at birth. Lifestyle behaviors to prevent obesity, rather than intervention to improve weight, should be aimed at children with healthy BMIs (5th–84th percentile) and some children with BMIs in the overweight category (85th–94th percentile), depending on their growth pattern and risk factors. Clinicians should be aware of the increased risk of obesity for children with obese parents and those whose mothers had diabetes mellitus during the child’s gestation. Indeed, young children with 1 or 2 obese parents are at high risk of obesity in young adulthood, even if their current weight is normal.

Target Behaviors

The expert committee recommends that clinicians advise patients and their families to adopt and to maintain the following specific eating, physical activity, and sedentary behaviors. These healthy habits may help prevent excessive weight gain and also are unlikely to cause harm, on the basis of current knowledge. The level of evidence is indicated, and the prevention report provides references.

Evidence supports the following:

1. limiting consumption of sugar-sweetened beverages (CE);
2. encouraging consumption of diets with recommended quantities of fruits and vegetables; the current recommendations from the US Department of Agriculture (USDA) (www.mypyramid.gov) are for 9 servings per day, with serving sizes varying with age (ME);
3. limiting television and other screen time (the American Academy of Pediatrics recommends no television viewing before 2 years of age and thereafter no more than 2 hours of television viewing per day), by allowing a maximum of 2 hours of screen time per day (CE) and removing televisions and other screens from children’s primary sleeping area (CE) (although a relationship between obesity and screen time other than television viewing, such as computer games, has not been established, limitation of all screen time may promote more calorie expenditure);
4. eating breakfast daily (CE);
5. limiting eating out at restaurants, particularly fast food restaurants (CE) (frequent patronage of fast food restaurants may be a risk factor for obesity in children, and families should also limit meals at other kinds of restaurants that serve large portions of energy-dense foods);
6. encouraging family meals in which parents and children eat together (CE) (family meals are associated with a higher-quality diet and with lower obesity prevalence, as well as with other psychosocial benefits); and
7. limiting portion size (CE) (the USDA provides recommendations about portions, which may differ from serving sizes on nutrition labels, and a product package may contain >1 serving size).

The prevention writing group also suggests, on the basis of analysis of available data and expertise, the following behaviors:

1. eating a diet rich in calcium (the USDA provides recommendations about serving size and daily number of dairy product servings);
2. eating a diet high in fiber;
3. eating a diet with balanced macronutrients (energy from fat, carbohydrates, and protein in proportions for age, as recommended by Dietary Reference Intakes);
4. encouraging exclusive breastfeeding to 6 months of age and maintenance of breastfeeding after introduction of solid food to 12 months of age and beyond, consistent with American Academy of Pediatrics recommendations;
5. promoting moderate to vigorous physical activity for at least 60 minutes each day; and
6. limiting consumption of energy-dense foods.

Implementation
The complexity of obesity prevention lies less in the identification of target health behaviors and much more in the process of influencing families to change behaviors when habits, culture, and environment promote less physical activity and more energy intake. Helping families create office systems that support the clinician’s ongoing commitment to obesity prevention. The appendix of the prevention report presents an example of office visit structure, interaction between provider and patient, and specific language to illustrate this approach.

The Role of the Family
Several studies of obesity treatment in children have demonstrated the importance of parents’ participation in weight control programs. The commitment of parents and other caregivers to helping the child develop healthy habits to prevent obesity is likely to be very important. Parents can serve as role models, authority figures, and behavioralists to mold their children’s eating and activity habits. Clinicians can influence children’s habits indirectly by teaching and motivating parents to use their authority effectively. For very young children, clinicians should focus the discussion on parenting behavior. The greater independence of adolescents means that clinicians should discuss health behaviors directly with them, although clinicians should encourage parents to make the home environment as healthy as possible.

Parenting actions that support the target behaviors differ with the age of the child, and clinicians can provide appropriate material to assist parents. For instance, clinicians can discuss or provide information about encouraging free safe movement for infants, appropriate food portions for toddlers, limited stroller use for preschoolers, and easy breakfast alternatives for teenagers. The prevention report contains a list of age-specific parent actions.

Clinicians function as counselors in obesity prevention and obesity care. Briefly presented below are some counseling techniques that can be used to encourage parents and patients to improve healthy behaviors. Short courses at local or national meetings can give clinicians greater opportunities to learn counseling techniques, which are generally not taught as part of the usual health care education.

Patient-Centered Communication
The theories that follow assume that a clinician’s instruction to change a behavior will be effective only if the parent or family recognizes a potential problem and wants to address or to prevent that problem. Therefore, part of the clinician’s task is to help motivate families. Counseling techniques are presented here as ways to encourage obesity prevention behaviors, but the same approach has applications in obesity treatment behaviors.

The stages of change theory describes several cognitive stages that precede actual behavior change. According to this theory, a person may initially be unaware of a problem, then move to awareness of the problem but have no plans to address it, then plan a new behavior, and finally actually begin the new behavior. A clinician can help patients and families move along these stages, rather than prescribing a new behavior to those who are not ready. Recent work indicates that parents of overweight and obese children are often unaware of the condition. The technique of motivational interviewing, which also takes into account patients’ readiness to change, uses nonjudgmental questions and reflective listening to uncover the beliefs and values of a parent or patient. By eliciting the concerns of patients, the clinician can evoke motivation, rather than try to impose it, and then help patients formulate a plan that is consistent with their own values. This approach avoids the defensiveness created by a more-directive style.

1. nondirective questions about the parent’s or patient’s attitude should be used (“Your child’s BMI is above the 95th percentile. What concerns, if any, do you have about her weight?”) The clinician’s next steps depend on the parent’s response. This approach differs from a directive style, in which the clinician informs the family of the seriousness of the condition (“Your child’s BMI is very high, and it is important that your child gets control of her weight before it becomes a bigger problem.”);
2. reflective listening, in which the clinician summarizes the parent’s comments without judging them, should
TABLE 4  Fifteen-Minute Obesity Prevention Protocol

<table>
<thead>
<tr>
<th>Step</th>
<th>Sample Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1. Assess</td>
<td>We checked your child’s BMI, which is a way of looking at weight and taking into consideration how tall someone is. Your child’s BMI is in the range where we start to be concerned about extra weight causing health problems.</td>
</tr>
<tr>
<td>Assess weight and height and convert to BMI</td>
<td>Elicit parent’s concerns</td>
</tr>
<tr>
<td>Provide BMI information</td>
<td>What concerns, if any, do you have about your child’s weight? “He did jump 2 sizes this year. Do you think he might get diabetes someday?”</td>
</tr>
<tr>
<td>Elicit parent’s concerns</td>
<td>So you’ve noticed a big change in his size and you are concerned about diabetes down the road. What makes you concerned about diabetes in particular?</td>
</tr>
<tr>
<td>Reflect/probe</td>
<td>(Use verbal questions or brief questionnaires to assess key behaviors) Example: About how many times a day does your child drink soda, sports drinks, or powdered drinks like Kool-Aid?</td>
</tr>
<tr>
<td>Assess sweetened beverage, fruit, and vegetable intake, television viewing and other sedentary behaviors, frequency of fast food or restaurant eating, consumption of breakfast, and other factors</td>
<td>Provide/elicit</td>
</tr>
<tr>
<td>Provide positive feedback for behavior(s) in optimal range; elicit response; reflect/probe</td>
<td>You are doing well with sugared drinks. “I know it’s not healthy. He used to drink a lot of soda, but now I try to give him water whenever possible. I think we are down to just a few sodas a week.” So, you have been able to make a change without too much stress.</td>
</tr>
<tr>
<td>Provide neutral feedback for behavior(s) not in optimal range; elicit response; reflect/probe</td>
<td>Your child watches 4 hours of television on school days. What do you think about that? “I know it’s a lot, but he gets bored otherwise and starts picking an argument with his little sister.” So, watching TV keeps the household calm.</td>
</tr>
<tr>
<td>Step 2. Set agenda</td>
<td>We’ve talked about eating too often at fast food restaurants, and how television viewing is more hours than you’d like. Which of these, if either of them, do you think you and your child could change? “Well, I think fast food is somewhere we could do better. I don’t know what he would do if he couldn’t watch television. Maybe we could cut back on fast food to once a week.”</td>
</tr>
<tr>
<td>Query which, if any, of the target behaviors the parent/child/adolescent may be interested in changing or which might be easiest to change</td>
<td>That sounds like a good plan.</td>
</tr>
<tr>
<td>Agree on possible target behavior</td>
<td>On a scale of 0 to 10, with 10 being very important, how important is it for you to reduce the amount of fast food he eats?</td>
</tr>
<tr>
<td>Step 3. Assess motivation and confidence</td>
<td>On a scale of 0 to 10, with 10 being very confident, assuming you decided to change the amount of fast food he eats, how confident are you that you could succeed?</td>
</tr>
<tr>
<td>Assess willingness/importance</td>
<td>Explore importance and confidence ratings with the following probes:</td>
</tr>
<tr>
<td>Assess confidence</td>
<td>Benefits</td>
</tr>
<tr>
<td></td>
<td>You chose 6. Why did you not choose a lower number? “I know all that grease is bad for him.”</td>
</tr>
<tr>
<td></td>
<td>You chose 6. Why did you not choose a higher number? “It’s quick and cheap and he loves it, especially the toys and fries.” Reflection: So there are benefits for both you and him.</td>
</tr>
<tr>
<td></td>
<td>Barriers</td>
</tr>
<tr>
<td></td>
<td>What would it take you to move to an 8? “Well, I really want him to avoid diabetes. My mother died of diabetes, and it wasn’t pretty; maybe if he started showing signs of it, maybe if I could get into cooking a bit more.”</td>
</tr>
<tr>
<td></td>
<td>Solutions</td>
</tr>
<tr>
<td></td>
<td>(Use verbal questions or brief questionnaires to assess key behaviors) Example: About how many times a day does your child drink soda, sports drinks, or powdered drinks like Kool-Aid?</td>
</tr>
<tr>
<td>Step 4. Summarize and probe possible changes</td>
<td>Agree to follow-up visit within x weeks/months</td>
</tr>
<tr>
<td>Query possible next steps</td>
<td>Let’s schedule a visit in the next few weeks/months to see how things went.</td>
</tr>
<tr>
<td>Probe plan of attack</td>
<td>Sounds like you aren’t quite ready to commit to making any changes now. How about we follow up with this at your child’s next visit? Or although you don’t sound ready to make any changes, between now and our next visit you might want to think about your child’s weight gain and lowering his diabetes risk.</td>
</tr>
<tr>
<td>Summarize change plan; provide positive feedback</td>
<td>Step 5. Schedule follow-up visit</td>
</tr>
<tr>
<td>Agree to follow-up visit within x weeks/months</td>
<td>If no plan is made</td>
</tr>
</tbody>
</table>

be used (“If I heard you correctly, you are concerned about how much television your child is watching, but you know your child is safe and happy watching television when he is home alone.”) Reflections help build rapport and allow the patient to understand and to resolve ambivalence;

3. values and current health practices should be compared; if a parent values her child being healthy and a good student, then the clinician can help the parent examine how activities other than television could improve the child’s health and academic performance;

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2. establishment of procedures to deliver obesity prevention messages to all children. When the patient’s individual risk of obesity is low, these messages can promote appropriate general health or wellness, rather than weight control. One example from collaborative efforts in Maine and Massachusetts is the 5210 message, which reminds families to eat ≥5 fruits and vegetables, spend no more than 2 hours on screen time, include 1 hour of physical activity or active play, and consume little or no sugar-sweetened beverages. Clinicians remind families of these goals at all health supervision visits and have posters in the office and handouts that reinforce these recommendations. Although the specific content of such messages may vary until research establishes the best approach, simple memorable guidelines, presented early and repeated regularly, can be delivered efficiently in the office and are likely to be effective teaching tools;

3. establishment of procedures to address children who are overweight (85th–94th percentile BMI) and obese (≥95th percentile BMI). For instance, when a child is overweight, a practice may plan to review the family history, child’s blood pressure, child’s cholesterol level, and BMI percentile over time and then assess health risks on the basis of that information. Offices should flag charts of overweight and obese children, so that all providers at all visits are aware and can monitor growth, risk factors, and social/emotional issues;

4. involvement and training of interdisciplinary teams, including nurses, physicians, and administrative staff members, regarding their respective responsibilities and skills;

5. chart audits to establish baseline practices, to help set goals for practice improvement, and then to measure the improvement over time. Offices can use the techniques for continuous quality improvement from the rapid-cycle improvement method described above.

The Roles of the School and the Community

These recommendations focus on the office visit and the opportunity to influence the family routine and home environment, but the child’s school and community environments can either support or impede obesity prevention behaviors. Clinicians can support school and community programs that help prevent obesity through local, state, or national advocacy, and they can encourage patients’ families to voice their preference to their schools through parent-teacher organizations or school board meetings or directly to principals, teachers, and after-care program directors. The Institute of Medicine report on obesity prevention provides a model for school policies.19 It recommends adequate physical education and recess periods and the establishment of nutritional standards for all foods served at school, including foods from vending machines and other competitive foods.19 To improve the community environment, providers can advocate for the establishment and maintenance of safe parks and recreation centers, and they can urge local grocery stores to offer healthy, low-cost food that is

The Role of the Provider’s Office

The provider’s office system can enhance or undermine the clinician’s efforts to address obesity prevention consistently. The expert committee endorses the following office practices.

1. routine documentation of BMI. Although clinicians visually recognize obesity in many children without seeing the plotted BMI values, they may overlook excess body fat in children in the overweight (85th–94th percentile BMI) category and miss an opportunity to guide the family toward healthier behaviors. To document BMI consistently and accurately, offices need reliable scales for infants and children, recumbent infant length boards, and wall-mounted stadiometers. This equipment needs regular calibration. Staff members must know how to measure weight and height accurately, how to calculate BMI, and how to plot the measures on the growth curves;

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4. involvement and training of interdisciplinary teams, including nurses, physicians, and administrative staff members, regarding their respective responsibilities and skills;

5. chart audits to establish baseline practices, to help set goals for practice improvement, and then to measure the improvement over time. Offices can use the techniques for continuous quality improvement from the rapid-cycle improvement method described above.
consistent with the most common cultures of the community members.

ASSessment

Risks
When a child’s BMI is above the 85th percentile, the clinician should assess medical and behavioral risks before initiating any intervention. Medical risks include risk of future or persistent obesity, risk of future obesity-related medical conditions, and identification of current obesity-related medical conditions. Behavioral risks include current eating habits, physical activity, and sedentary behaviors that promote energy imbalance. These evaluations must precede behavior-based treatment.

Medical Assessment

Responsibility
Screening children for obesity-related medical problems falls squarely in the purview of health care providers, especially primary care providers. Providers are responsible for considering any current obesity-associated medical conditions, such as hyperlipidemia, risks of future conditions associated with obesity and ameliorated by weight control, and rare conditions that cause obesity, such as primary Cushing syndrome or Prader-Willi syndrome. Because weight control alone may not treat many conditions adequately, diagnosis must be followed by appropriate treatment.

Body Fat Assessment
The BMI percentile, although imperfect, is the recommended screen for body fat in routine office practice. Offices should use the 2000 CDC BMI charts, rather than the International Obesity Task Force standards, because the CDC charts provide the full array of percentile levels (which makes them more appropriate for assessment of individual children), whereas the International Obesity Task Force charts provide only overweight and obesity categories.5,48

Skinfold thickness measurements are not recommended. Although these measurements provide information about body fat and risks of medical conditions,49 they are not feasible in routine clinical care, because they are difficult to perform accurately without careful training and experience and reference data are not readily available.

Similarly, waist circumference measurements are not recommended currently. Waist circumference measurements can provide indirect information about visceral adiposity, which tracks with cardiovascular and metabolic risk factors, and are more easily performed than skinfold thickness measurements,50–52 but reference values for children that identify risk over and above the risk from BMI category are not available. In the future, cutoff points that provide additional information and can influence evaluation or treatment may make waist circumference measurement a useful clinical tool.

BMI percentile categories guide assessment of medical risk; 5th to 85th percentile is healthy weight, 85th to 94th percentile is overweight, and ≥95th percentile is obese, with >99th percentile being an emerging category that indicates a high likelihood of immediate medical problems. Because no objective assessment to distinguish high body fat from high lean body mass is clinically practical, clinicians must also consider the family history of obesity and medical problems, the child’s past BMI pattern, and the child’s current medical conditions and current health behaviors as they decide whether to recommend intervention.

Parental Obesity
Parental obesity is a strong risk factor for a child’s obesity persisting into adulthood, especially for young children.57 Genetic vulnerability plays an important role in the development of obesity. Although it is currently not possible to test for specific genotypes or to adapt therapy on the basis of genetic information, knowledge of strong familial risks for obesity, especially parental obesity, should lead to greater efforts to establish or to improve healthy behaviors.

Family Medical History
Several obesity-related medical conditions are familial. Family history predicts type 2 diabetes mellitus or insu-

### Table 5

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety, school avoidance, social isolation</td>
<td>Depression</td>
</tr>
<tr>
<td>Severe recurrent headaches</td>
<td>Pseudotumor cerebri</td>
</tr>
<tr>
<td>Shortness of breath, exercise intolerance</td>
<td>Asthma, lack of physical conditioning</td>
</tr>
<tr>
<td>Snoring, apnea, daytime sleepiness</td>
<td>Obstructive sleep apnea, obesity hypoventilation syndrome</td>
</tr>
<tr>
<td>Sleepiness or wakefulness</td>
<td>Depression</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>Gastroesophageal reflux disease, constipation, gallbladder disease, NAFLD</td>
</tr>
<tr>
<td>Hip pain, knee pain, walking pain</td>
<td>Slapped capital femoral epiphysis, musculoskeletal stress from weight (may be barrier to physical activity)</td>
</tr>
<tr>
<td>Foot pain</td>
<td>Musculoskeletal stress from weight (may be barrier to physical activity)</td>
</tr>
<tr>
<td>Irregular menses (&lt;9 cycles per y)</td>
<td>Polycystic ovary syndrome; may be normal if recent menarche</td>
</tr>
<tr>
<td>Primary amenorrhea</td>
<td>Polycystic ovary syndrome, Prader-Willi syndrome</td>
</tr>
<tr>
<td>Polyuria, polydipsia</td>
<td>Type 2 diabetes mellitus a</td>
</tr>
<tr>
<td>Unexpected weight loss</td>
<td>Type 2 diabetes mellitus a</td>
</tr>
<tr>
<td>Nocturnal enuresis</td>
<td>Obstructive sleep apnea</td>
</tr>
<tr>
<td>Tobacco use</td>
<td>Increased cardiovascular risk, may be used as form of weight control</td>
</tr>
</tbody>
</table>

*These conditions are often asymptomatic.*
lin resistance, and the prevalence of childhood diabetes is especially high among several ethnic and racial backgrounds common in the United States, including Hispanic, black, and North American Indian. Cardiovascular disease and cardiovascular disease risk factors (hyperlipidemia and hypertension) are also more common when family history is positive. Offices should review and regularly update the family history regarding first- and second-degree relatives.

Evaluation of Weight-Related Problems

Screening

Obesity-related medical conditions affect almost every organ system in the body. A review of systems and a physical examination represent an inexpensive way to screen for many of these conditions, although some conditions are without symptoms or signs. Summarized below are important weight-related medical conditions, with their common symptoms and appropriate screening tests. Tables 5 and 6 present a review of systems and physical examination findings in the order typically followed in an office visit.

Sleep Problems

Obstructive sleep apnea can lead to right ventricular hypertrophy and pulmonary hypertension. In addition, the disturbed sleep leads to poor attention, poor academic performance, and enuresis. This condition is one of the most serious problems that can occur and is more common among children who are severely obese. Prevalence is higher among obese children and may be ≥50% among adolescents with severe obesity. Symptoms that parents may notice are loud snoring with pauses in breathing, restless sleep, and daytime somnolence. On physical examination, children may have tonsillar hypertrophy, although obstructive sleep apnea can occur in the absence of tonsillar hypertrophy or after removal of tonsils and adenoids. Diagnosis is made through polysomnography. Treatment should include removal of tonsils and adenoids if they are enlarged. If this approach is ineffective or not indicated, then a pulmonologist should evaluate the patient for continuous positive airway pressure therapy during sleep.

In obesity hypoventilation syndrome, the weight of fat on the chest and abdomen impairs ventilation; these patients are severely obese. Symptoms are similar to those of obstructive sleep apnea, and diagnosis is made through polysomnography, which demonstrates elevated carbon dioxide levels. These patients may have elevated hemoglobin and hematocrit levels. They require continuous positive airway pressure therapy until substantial weight loss relieves the condition.

Respiratory Problems

Asthma may occur more frequently among obese children. Shortness of breath and exercise intolerance may be symptoms of asthma, rather than signs of poor physical conditioning. Diagnosis is made in the usual way.

### TABLE 6 Physical Examination Findings in Obesity Assessment and Possible Causes

<table>
<thead>
<tr>
<th>System</th>
<th>Findings</th>
<th>Possible Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthropometric features</td>
<td>High BMI percentile</td>
<td>Overweight or obesity</td>
</tr>
<tr>
<td></td>
<td>Short stature</td>
<td>Underlying endocrine or genetic condition</td>
</tr>
<tr>
<td>Vital signs</td>
<td>Elevated blood pressure</td>
<td>Hypertension if systolic or diastolic blood pressure &gt;95th percentile for age, gender,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and height on ≥3 occasions</td>
</tr>
<tr>
<td>Skin</td>
<td>Acanthosis nigricans</td>
<td>Common in obese children, especially when skin is dark, increased risk of insulin resistance</td>
</tr>
<tr>
<td></td>
<td>Excessive acne, hirsutism</td>
<td>Polycystic ovary syndrome</td>
</tr>
<tr>
<td></td>
<td>Iritation, inflammation</td>
<td>Consequence of severe obesity</td>
</tr>
<tr>
<td></td>
<td>Violaceous striae</td>
<td>Cushing syndrome</td>
</tr>
<tr>
<td>Eyes</td>
<td>Papilledema, cranial nerve VI paralysis</td>
<td>Pseudotumor cerebri</td>
</tr>
<tr>
<td>Throat</td>
<td>Tonsillar hypertrophy</td>
<td>Obstructive sleep apnea</td>
</tr>
<tr>
<td>Neck</td>
<td>Goiter</td>
<td>Hypothyroidism</td>
</tr>
<tr>
<td>Chest</td>
<td>Wheezing</td>
<td>Asthma (may explain or contribute to exercise intolerance)</td>
</tr>
<tr>
<td>Abdomen</td>
<td>Tenderness</td>
<td>Gastroesophageal reflux disorder, gallbladder disease, NAFLD*</td>
</tr>
<tr>
<td>Reproductive system</td>
<td>Tanner stage</td>
<td>Premature puberty in &lt;7-y-old white girls, &lt;6-y-old black girls, and &lt;9-y-old boys</td>
</tr>
<tr>
<td></td>
<td>Apparent micropenis</td>
<td>May be normal penis that is buried in fat</td>
</tr>
<tr>
<td></td>
<td>Undescended testes</td>
<td>Prader-Willi syndrome</td>
</tr>
<tr>
<td>Extremities</td>
<td>Abnormal gait, limited hip range of motion</td>
<td>Slipped capital femoral epiphysis</td>
</tr>
<tr>
<td></td>
<td>Bowing of tibia</td>
<td>Blunt disease</td>
</tr>
<tr>
<td></td>
<td>Small hands and feet, polydactyly</td>
<td>Some genetic syndromes</td>
</tr>
</tbody>
</table>

* These conditions are usually without signs.
Obese patients with asthma may need guidance about asthma management during physical activity or outdoor play, to minimize the limitations on exercise.

**Gastrointestinal Problems**

Nonalcoholic fatty liver disease (NAFLD) is a condition of increasing concern because of the increasing prevalence of obesity and diabetes, which are important risk factors. The term NAFLD includes simple steatosis, steatohepatitis, fibrosis, and cirrhosis resulting from fatty liver. Knowledge of prevalence, natural history, and effective management is incomplete, although studies are ongoing. NAFLD generally causes no symptoms, although some patients have right upper quadrant abdominal pain or tenderness or mild hepatomegaly. Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) levels, which are usually elevated, are reasonably good screens. Ultrasonography and other imaging methods can demonstrate changes consistent with nonalcoholic steatohepatitis but cannot indicate the degree of inflammation or fibrosis. Liver biopsy is the standard method for diagnosis. Weight loss leads to improved liver test results and histologic features, and studies of medications are ongoing. When and how often to perform ALT and AST testing have not been determined; pending evidence-based recommendations, the expert committee suggests biannual screening starting at 10 years of age for children with BMI of ≥95th percentile and those with BMI of 85th to 94th percentile who have other risk factors. This schedule coincides with diabetes screening recommendations. ALT or AST results 2 times normal levels should prompt consultation with a pediatric hepatologist.

Gallstones are more prevalent among overweight and obese children. In addition, rapid weight loss increases the risk of gallstones. Intermittent episodes of intense colicky pain in the right upper quadrant of the abdomen are classic symptoms, but milder pain and epigastric pain can occur. On physical examination, the right upper quadrant may be tender. Ultrasonography can identify gallstones and cholecystitis.

Several common pediatric gastrointestinal problems, including gastroesophageal reflux disease and constipation, are exacerbated by obesity. Symptoms, signs, and management are the same as for children of normal weight, but clinicians should be aware of the increased likelihood of these conditions and should provide appropriate medical and behavioral treatment in addition to weight control.

**Endocrine Disorders**

Type 2 diabetes mellitus is one of the most serious complications of childhood obesity. As many as 45% of children with newly diagnosed diabetes mellitus have type 2 rather than type 1 disease. Patients may not have symptoms such as polyuria and polydipsia; consequently, identification requires laboratory screening for children at risk. Risk factors are BMI of ≥85th percentile; family history of diabetes; black, Hispanic, or Native American background; and other related conditions, such as polycystic ovary syndrome, acanthosis nigricans, or cardiovascular risk factors. The American Diabetes Association currently recommends screening with a fasting glucose test when a child is overweight and has 2 additional risk factors. Screening should begin at puberty or 10 years of age and should be performed every 2 years. A fasting glucose level of ≥126 mg/dL or a casual glucose level of ≥200 mg/dL indicates diabetes and requires referral to a pediatric endocrinologist. Fasting glucose levels of ≥100 mg/dL are considered prediabetes, indicating future risk for diabetes.

Polycystic ovary syndrome occurs in 8% of young women 18 to 25 years of age, with prevalence depending on the definition used. Women with polycystic ovary syndrome are more likely to be obese. Infrequent menstrual cycles (<9 cycles per year) is the most important finding that should lead to additional evaluation. Physical examination findings that are common but not diagnostic for polycystic ovary syndrome are hirsutism, excessive acne, and acanthosis nigricans. Women with polycystic ovary syndrome often have insulin resistance or type 2 diabetes and may have metabolic syndrome. Reproductive hormone laboratory tests can diagnose the condition but generally require interpretation by a subspecialist, such as an endocrinologist, gynecologist, or adolescent physician (see the assessment report); these specialists can initiate and monitor treatment to protect fertility.

Hypothyroidism is a frequent concern of parents, but this condition does not usually cause severe obesity. The prevalence is ~1 case per 1000. Symptoms include fatigue and decline in academic performance. Cessation of linear growth is an important sign, and a goiter may be present. Thyroid function tests are generally unnecessary when a child has normal linear growth velocity and no other symptoms of hypothyroidism.

Primary Cushing syndrome is extremely rare. The population incidence is probably ~2 cases per 1 000 000 annually, with onset in adulthood being more common than onset in childhood. Because the condition is treatable, clinicians should be aware of the physical examination findings, which include “moon facies” and “buffalo hump,” although exogenous obesity can also lead to this distribution of adipose tissue. Primary Cushing syndrome generally leads to short stature and therefore is extremely unlikely in a tall obese child. The striae found in Cushing syndrome are violaceous in color and thus differ from the commonly seen striae resulting from rapid weight gain. If Cushing syndrome is suspected, then the child should be referred to an endocrinologist for appropriate testing.

Evaluation of puberty in obese children requires careful attention to physical examination findings and
knowledge of the normal range of puberty onset. Adipose tissue in the breast area must be distinguished from true breast development, which is generally discernible through pigmented areolae. A suprapubic fat pad, which can hide the penis and give it the appearance of a micropenis, must be manually reflected away. Obese children tend to begin puberty earlier than children of normal weight but, when onset is truly premature, these children require an endocrinologic evaluation just as do children of normal weight. Children at risk for endocrine disorders are white girls <7 years of age and black girls <6 years of age with breast tissue or pubic hair and boys <9 years of age with pubic hair or enlargement of the penis.

**Nervous System Disorders**

Pseudotumor cerebri is an extremely rare condition (incidence estimates for children are 1 case per 100 000 annually44), but obesity is one of several risk factors45 and, untreated, the condition can lead to vision loss. Patients describe severe headaches with photophobia. Patients may have double vision if they have impairment of cranial nerve VI. Optic disks are blurred. When suspected, this condition requires urgent referral to the neurology service.

**Cardiovascular Risk Factors**

Approximately 13% of overweight children have elevated systolic blood pressure, and ~9% have elevated diastolic blood pressure.15 Blood pressure should be assessed at all health supervision visits, and offices should have large cuffs, including thigh cuffs, which allow accurate assessment of blood pressure for severely obese youths. The National Heart, Lung, and Blood Institute has updated tables defining elevated blood pressure levels according to age, gender, and height percentile, which offices should have available for easy reference.70 Three or more readings above the 95th percentile for either systolic or diastolic blood pressure indicate hypertension. Information on the National Heart, Lung, and Blood Institute Web site (www.nhlbi.nih.gov/health/prof/heart/hbp/hbp_ped.htm) includes recommendations for evaluation, which may include ambulatory blood pressure monitoring to identify “white coat” hypertension or abnormal diurnal blood pressure patterns. Primary care providers can follow these detailed recommendations for evaluation and treatment or can refer patients to a specialist.

Lipid level abnormalities are among the most common obesity-related medical conditions.15 Because of the high prevalence, a fasting lipid profile should be obtained when BMI is ≥85th percentile, even in the absence of other risk factors. Total cholesterol levels of <170 mg/dL are acceptable, levels of 170 to 199 mg/dL are in the borderline category, and levels of ≥200 mg/dL are high. Low-density lipoprotein levels of <110 mg/dL are acceptable, levels of 110 to 129 mg/dL are borderline, and levels of ≥130 mg/dL are high. Dietitians can guide patients and families regarding the reduced-fat and reduced-cholesterol diets recommended by the National Cholesterol Education Panel.71 If levels are highly elevated and do not respond to diet changes, then a pediatric cardiologist or lipid specialist can assess the benefits and risks of medication use. Abnormal triglyceride levels, defined by the National Cholesterol Education Panel as ≥110 mg/dL for adolescents, and abnormal high-density lipoprotein levels, defined as ≤40 mg/dL, respond to increased physical activity.

**Psychiatric Disorders**

The effects of obesity on quality of life can be severe.72 Depression, an important comorbidity of obesity, may precede or result from obesity. Clinicians should look for flat affect, anxiety, body dissatisfaction, excess eating, fatigue, and difficulty sleeping. Sexual and physical abuse may increase the risk of severe obesity.73,74 Youths with binge eating or purging behavior should be evaluated for eating disorders.

**Orthopedic Disorders**

Blount disease (tibia vara) occurs more often among obese children, and onset generally occurs after 8 years of age.75 Often painless, Blount disease presents as visible bowing of the lower extremity and is diagnosed with anteroposterior radiographic views of the affected knee obtained while the patient is standing. An orthopedic surgeon can determine how to treat this condition, to correct bowing and to prevent progression.

Slipped capital femoral epiphysis occurs between 9 and 16 years of age, affects boys more often than girls, and has an incidence estimated at ~11 cases per 100 000 children.76 It occurs more frequently when a child is obese.77 These children have hip or knee pain and pain with walking. On examination, hip range of motion is impaired. Bilateral frog-leg radiographic views of the hips should be obtained, and the child should be referred to the orthopedic surgery service.

A recent study revealed that overweight children and adolescents reported more fractures and musculoskeletal discomfort.78 Because injury and pain interfere with physical activity, early intervention (including physical therapy, when indicated) may reduce weight gain in these children.

**Skin Conditions**

Acanthosis nigricans is present in ~10% of obese white children and 50% of obese black children.79 Although it is associated with hyperinsulinemia, acanthosis nigricans is associated more strongly with high BMI. The prominence of acanthosis nigricans diminishes with weight loss.
Severely obese children can have chronic irritation and infection in the folds of the skin, especially in the lower abdomen and axilla. This intertrigo and furunculosis requires good hygiene, use of topical antibiotic and antifungal ointments, and sometimes systemic antibiotic therapy.

**Genetic Syndromes**

Well-defined genetic syndromes that cause obesity, such as Prader-Willi syndrome, are very rare. The assessment report lists some of these syndromes and their presentations. Clinicians should consider referral for genetic testing, especially when the obese child is short and has developmental delay. Unfortunately, diagnosis of these genetic syndromes does not modify treatment options.

**Laboratory Testing**

History and physical examination cannot effectively screen for abnormal cholesterol levels, NAFLD, and type 2 diabetes mellitus. Therefore, these conditions must be identified with laboratory tests. The expert committee recommends that children with BMI of 85th to 94th percentile should undergo lipid panel testing and, if risk factors are present, then fasting glucose, ALT, and AST levels should be measured every 2 years for individuals ≥10 years of age. For children with BMI of ≥95th percentile, the committee suggests that fasting glucose, ALT, and AST levels be measured every 2 years starting at 10 years of age, regardless of other risk factors. Elevation of ALT or AST levels above 60 U/L on 2 occasions may indicate the need for additional evaluation, probably with guidance from pediatric gastroenterology/hepatology experts.

The results of the primary care provider’s history, physical examination, and screening laboratory tests may indicate the need for additional diagnostic tests. A table of more-specialized diagnostic testing to be performed after initial positive screening is presented in the assessment report. Table 7 summarizes the medical assessment according to BMI category.

**Implementation of Medical Assessment**

Many practices develop checklists of symptoms and family history for patients or parents to complete. Clinicians can include weight-related symptoms and conditions on the list and then review these with families. Forms in the chart may help trigger the recommended evaluation once the BMI category of the child is flagged.

**Behavior Assessment**

**Goals**

The purpose of the behavior assessment is twofold. The first goal is to identify the child’s dietary and physical activity behaviors that may promote energy imbalance and that are modifiable. The second goal is to assess the capacity of the patient and/or the patient’s family to change some or all of these behaviors. Families must have both the means and the motivation to make changes. For instance, a child may benefit from increased outdoor play but, if no safe play area exists or if the parents do not perceive the benefit of this behavior change, then no change will occur and the child will “fail treatment.” The clinician should work with the family to target behavior changes that are appropriate and possible.

**Dietary and Physical Activity Assessments**

Because comprehensive dietary and physical activity assessments, such as diet or physical activity diaries, are impractical in a typical office setting, the expert committee recommends a focused assessment of behaviors that have the strongest evidence for association with energy balance and that are modifiable. It should be noted that current evidence generally reveals an association between specific behaviors and energy consumption or expenditure or between a behavior and weight status, leaving the direction of the relationship unknown.

For eating behavior assessment, the following behaviors should be addressed:

- frequency of eating food prepared outside the home, including food in restaurants, school and work cafeterias, and fast food establishments and food purchased for “take out”;
- ounces, cups, or cans of sugar-sweetened beverages consumed each day;
- portions that are large for age (qualitative assessment);
- ounces or cups of 100% fruit juice consumed each day;
- frequency and quality of breakfast;
- consumption of foods that are high in energy density, such as high-fat foods;
- number of fruit and vegetable servings consumed each day; and
- number of meals and snacks consumed each day and quality of snacks.

For physical activity assessment, the following behaviors should be addressed:

- time spent in moderate physical activity each day (including organized physical activity and unstructured activity, including play), to estimate whether the goal of 60 minutes of moderately vigorous activity each day is achieved;
- routine activity patterns, such as walking to school or performing yard work;
- sedentary behavior, including hours of television, videotape/DVD, and video game viewing and computer
<table>
<thead>
<tr>
<th>BMI Percentile</th>
<th>Recent History</th>
<th>Medication Use</th>
<th>Review of Symptoms</th>
<th>Family History (First- and Second-Degree Relatives)</th>
<th>Physical Examination</th>
<th>Laboratory Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th–84th BMI percentile change</td>
<td>Medications that may affect weight gain (eg, neuropsychiatric medications)</td>
<td></td>
<td>Obesity, type 2 diabetes, hypertension, lipid level abnormalities, heart disease</td>
<td>Blood pressure (correct cuff)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85th–94th BMI percentile change</td>
<td>Medications that may affect weight gain (eg, neuropsychiatric medications)</td>
<td>Snoring/sleep, abdominal pain, menstrual irregularities, hip, knee, or leg pain, polyuria, thirst, depression</td>
<td>Obesity, type 2 diabetes, hypertension, lipid level abnormalities, heart disease</td>
<td>Blood pressure (correct cuff), acanthosis nigricans, tonsils, goiter, tender abdomen, liver, bowing of legs, limited hip range of motion, optic discs if headaches, acne and hirsutism</td>
<td>Fasting lipid profile; if age 10 y and other risk factors, fasting glucose level biannually; ALT and AST levels biannually</td>
<td></td>
</tr>
<tr>
<td>95th–99th BMI percentile change</td>
<td>Medications that may affect weight gain (eg, neuropsychiatric medications)</td>
<td>Snoring/sleep, abdominal pain, menstrual irregularities, hip, knee, or leg pain, urination, thirst, depression</td>
<td>Obesity, type 2 diabetes, hypertension, lipid level abnormalities, heart disease</td>
<td>Blood pressure (correct cuff), acanthosis nigricans, tonsils, goiter, tender abdomen, liver, bowing of legs, limited hip range of motion, optic discs if headaches, acne and hirsutism</td>
<td>Fasting lipid profile; if age 10 y and other risk factors, fasting glucose level biannually; ALT and AST levels biannually</td>
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<tr>
<td>&gt;99th BMI percentile change</td>
<td>Medications that may affect weight gain (eg, neuropsychiatric medications)</td>
<td>Snoring/sleep, abdominal pain, menstrual irregularities, hip, knee, or leg pain, urination, thirst, depression</td>
<td>Obesity, type 2 diabetes, hypertension, lipid levels abnormalities, heart disease</td>
<td>Blood pressure (correct cuff), acanthosis nigricans, tonsils, goiter, tender abdomen, liver, bowing of legs, limp, limited hip range of motion, optic discs if headaches, acne and hirsutism, skin inflammation</td>
<td>Fasting lipid profile; if age 10 y and other risk factors, fasting glucose level biannually; ALT and AST levels biannually</td>
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use, to determine whether viewing is >2 hours per day.

**Implementation of Behavior Assessment**

Standardized instruments simplify assessment of usual diet and activity behaviors, and several are available (see the assessment report\(^2\)). None assesses all of the targeted behaviors comprehensively, and none has been tested for reliability and validity in a clinical setting. Additional research in this area is urgently needed.

Targeting of realistic behavior changes requires an assessment of practical resources and barriers. Neighborhood parks, grocery stores, recreation centers, and neighborhood children with whom to play can all support a healthier lifestyle. Clinical offices can maintain a list of nearby community resources. Within the household, finances, time, and caregivers other than parents may affect behavior changes. A family’s cultural values, which are influenced by ethnicity, religion, educational background, and many other factors, often affect the family’s perception of appropriate physical activity or customary food and eating practices. Clinicians who become familiar with attitudes common among the patients they serve and who pay attention to the specific values of individual families will be able to tailor recommendations. For example, if a family prefers a traditional Mexican diet, then the clinician might suggest that the family members learn to prepare the foods with less fat and more whole grains; if a family places a high priority on religious worship and family time on Sundays, then the clinician might suggest that the family members develop a tradition of walking, biking, or bowling together. Offices should provide educational material appropriate for the particular patient population. For example, an office that serves Cambodian patients should offer information about a healthy Cambodian diet, in the appropriate language.

Because behavior change requires sustained commitment by the patient and family members, their motivation is the most important but most challenging aspect of obesity care. Motivational interviewing, as discussed above, is a technique that merges assessment and intervention and provides a framework for communicating physical and laboratory findings. The clinician helps the patient and family members determine their priorities, consider how current behaviors support or undermine those priorities, and assess the resources and barriers in their family and environment that may influence their capacity to improve behaviors. For example, a family may decide to improve portion sizes but not to add fruits and vegetables, or a family may want to explore other possible resources before choosing a behavior change. Through the process of behavior assessment, the clinician and family members together identify treatment goals.

Whether the child or the parent is the target of behavior changes depends on the age of the child. When the child is young, the parents and caregivers should take responsibility for providing a healthy diet, limiting the amount of television and screen time, and creating opportunities for active play. Parents should not expect the child to choose between soda and water or to turn off the television at the end of 2 hours. Therefore, clinicians should address concerns and motivation with parents when children are young. However, adolescents generally have many opportunities away from home to make eating and physical activity choices. Although parents can support an adolescent’s efforts by making the home environment healthy, the adolescent’s own concerns and motivation are paramount in any weight control efforts and should be the focus of the clinician’s assessment.

**TREATMENT**

**Goals**

The primary goal of obesity treatment is improvement of long-term physical health through permanent healthy lifestyle habits. Implementation of these habits alone will lead to improved weight (weight loss or weight maintenance during linear growth) for some children, but other children and youths may need additional focused efforts to achieve negative energy balance. Others may need additional help with behavior modification strategies to develop and to sustain healthy habits. Emotional health (good self-esteem and appropriate attitudes toward food and body) is also an important outcome. To achieve these goals, the treatment writing group recommended that providers present a staged approach, with 4 treatment stages of increasing intensity. Patients can begin at the least-intensive stage and advance depending on responses to treatment, age, degree of obesity, health risks, and motivation. Providers may identify some obese youths who are motivated to begin behavior change at a more-intensive stage. This approach may lead to greater success when obesity is more severe, as long as the patient is motivated.

**Outcomes**

The establishment of permanent healthy lifestyle habits is a good outcome, regardless of weight change, because of the long-term health benefits of these behaviors. Improvement in medical conditions is also an important sign of long-term health benefits. The metric for improved weight is BMI percentile, generally to <85th percentile, although some children are healthy in the overweight category (85th–94th percentile). Although improvement in BMI percentile is the goal, monitoring this metric in the short-term with BMI curves may be difficult. Serial weight measurements can reflect energy balance in the short-term. Weight maintenance leads to reductions in absolute BMI because of ongoing linear
growth, and even slow weight gain can result in lower BMI percentiles because the BMI for a given percentile curve increases with age. In general, younger and more mildly obese children should change weight more gradually than older and severely obese youths. When a patient’s weight or BMI percentile does not improve as desired over 3 to 6 months of planned treatment, the provider and family should consider advancing to the next, more-intensive stage of treatment.

Staged Treatment

The expert committee’s proposed systematic approach integrates aspects of treatment that have evidence to support them, although the approach as a whole is untested. This approach promotes brief, office-based intervention for the greatest number of overweight and obese children and then a systematic intensification of efforts, tailored to the capacity of the clinical office, the motivation of the family, and the degree of obesity, with the most aggressive treatment stage being considered only for those who have not responded to other interventions.

Providers’ offices need to prepare by implementing a system for evaluation; by identifying resources, such as pediatric dietitians or behavioralists, or training staff members for diet and activity assessments; and by identifying community resources and referral centers, if available. Referral centers may emerge in response to the needs of area practices. For each stage of obesity treatment, the expert committee has recommended a process for implementation, suggesting how the primary care provider can provide this care or identify support beyond the office.

Stages of Obesity Treatment

Stage 1: Prevention Plus

As a first step, overweight and obese patients and their families could focus on basic healthy lifestyle eating and activity habits that form the obesity prevention strategies. However, the outcome would be improved BMI status rather than maintained healthy BMI, and the provider would offer more-frequent monitoring to motivated patients and families.

Specific healthy eating and activity habits are as follows.

1. consume ≥5 servings of fruits and vegetables every day (ME). Families may subsequently increase to 9 servings per day, as recommended by the USDA. The USDA Web site (www.mypyramid.gov) recommends the number of cups of fruits and vegetables per day according to age, ranging from 2 cups per day for 2-year-old children to 4.5 cups per day for 17- and 18-year-old youths;

2. minimize sugar-sweetened beverages, such as soda, sports drinks, and punches (ME). Ideally, these beverages will be eliminated from a child’s diet, although children who consume large amounts will benefit from reduction to 1 serving per day;

3. decrease television viewing (and other forms of screen time) to ≤2 hours per day (CE). If the child is <2 years of age, then no television viewing should be the goal. To assist with this change, the television should be removed from the room where the child sleeps;

4. be physically active ≥1 hour each day (ME). Unstructured play is most appropriate for young children. Older children should find physical activities that they enjoy, which may include sports, dance, martial arts, bike riding, and walking. Activity can be structured, such as a dance class, or unstructured, such as dancing to music at home, and children can perform several shorter periods of activity over the day;

5. prepare more meals at home rather than purchasing restaurant food (ME);

6. eat at the table as a family at least 5 or 6 times per week (ME);

7. consume a healthy breakfast every day (ME);

8. involve the whole family in lifestyle changes (CE);

9. allow the child to self-regulate his or her meals and avoid overly restrictive feeding behaviors (CE for children <12 years of age);

10. help families tailor behavior recommendations to their cultural values (suggest).

For implementation of Prevention Plus, the following points should be noted.

1. families and providers can work together to identify the behaviors that are appropriate to target. Considerations include current behaviors that most contribute to energy imbalance, the family’s cultural values and preferences, the family’s specific financial situation, neighborhood, and schedule, and the motivation of the child and family to make particular changes. By using motivational interviewing techniques, the provider allows the child and family to determine the priority behaviors, which naturally integrates the family situation and values;

2. patients may need to achieve the target behaviors in steps. For example, obese children may need to begin with 15 minutes of physical activity per day and work up to 60 minutes, or a family may choose 3 goals at the beginning and expand the number of targeted behaviors over time;
3. follow-up visit frequency should be tailored to the individual family, and motivational interviewing techniques may be useful to set the frequency;
4. the Prevention Plus stage of obesity treatment can take place in the office setting;
5. physicians, advanced practice nurses, physician assistants, and office nurses, with appropriate training, can provide this level of treatment;
6. after 3 to 6 months, if the child has not made appropriate improvement, the provider can offer the next level of obesity care, that is, structured weight management.

**Stage 2: Structured Weight Management**

This level of obesity treatment is distinguished from Prevention Plus less by differences in the targeted behaviors and more by the support and structure provided to the child to achieve those behaviors. Specific eating and activity goals in addition to the goals in Prevention Plus are as follows:

1. a planned diet or daily eating plan with balanced macronutrients, in proportions consistent with Dietary Reference Intake recommendations, emphasizing foods low in energy density (such as those with high fiber or water content) (suggest);
2. structured daily meals and planned snacks (breakfast, lunch, dinner, and 1 or 2 scheduled snacks, with no food or calorie-containing beverages at other times, may reduce excess intake) (suggest);
3. additional reduction of television and other screen time to ≤1 hour per day (suggest);
4. planned, supervised, physical activity or active play for 60 minutes per day (ME);
5. monitoring of these behaviors through use of logs (for example, the patient or family members can record the minutes spent watching television and can keep a 3-day recording of food and beverages consumed) (CE); and
6. planned reinforcement for achieving targeted behaviors (suggest).

For implementation of structured weight management, the following points should be noted.

1. the eating plan requires a dietitian or a clinician who has received additional training in creating this kind of eating plan for children;
2. office staff members who have some training in motivational interviewing and in teaching of monitoring and reinforcement techniques can establish initial goals with families and see them for follow-up care;
3. some families need a counselor for help with parenting skills, resolution of family conflict, or motivation;
4. depending on the child and family, referral to a physical therapist or exercise therapist can help the child and family develop physical activity habits;
5. monthly office visits are probably most appropriate at this level;
6. a provider’s office staff can provide much of this treatment, with some additional training;
7. some practices may find group sessions to be effective and efficient.

**Stage 3: Comprehensive Multidisciplinary Intervention**

This approach increases the intensity of behavior changes, the frequency of visits, and the specialists involved, to maximize support for behavior changes. Generally, this type of program would exceed the capacity of a primary care office to offer within the typical visit structure. However, an office or several offices could organize specialists to offer this kind of a program. Eating and activity goals are generally those of the structured weight management stage.

For implementation of comprehensive multidisciplinary intervention, the following points should be noted.

1. a structured program in behavior modification should include, at a minimum, food monitoring, short-term diet and physical activity goal setting, and contingency management (CE);
2. negative energy balance resulting from structured dietary and physical activity changes is planned (ME);
3. parental participation in behavior modification techniques is needed for children <12 years of age (CE). Parental involvement would be progressively less with older youths;
4. parents should be trained regarding improvement of the home environment (suggest);
5. systematic evaluation of body measurements, diet, and physical activity should be performed at baseline and at specified intervals throughout the program (suggest);
6. a multidisciplinary team with experience in childhood obesity, including a behavioral counselor (for example, social worker, psychologist, other mental health care provider, or trained nurse practitioner), registered dietitian, exercise specialist (physical therapist or other team member with training or a community program prepared to assist obese children), and primary care provider who continues to monitor medical issues and maintains a supportive alliance with the families, should be involved;
7. frequent office visits should be scheduled; weekly visits for a minimum of 8 to 12 weeks seem to be
most efficacious (CE). Subsequently, monthly visits can help maintain new behaviors;

8. group visits may be more cost-effective and have therapeutic benefit (ME);

9. an established pediatric weight management program may be best suited to provide this type of intervention, although such programs are sparse and often are not covered by insurance plans;

10. commercial weight management programs can be considered, but the primary care provider’s office needs to screen the programs to ensure that the approach is healthy and appropriate for the age of the child. Information to guide this evaluation is included in the treatment report.3

Stage 4: Tertiary Care Intervention

Interventions

The intensive interventions in this category may be offered to some severely obese youths. These interventions move beyond the goal of balanced healthy eating and activity habits that are the core of the other stages. Candidates for consideration should have attempted weight control in the comprehensive multidisciplinary intervention stage, should have the maturity to understand possible risks, and should be willing to maintain physical activity and, if consistent with the additional intervention, a healthy diet with appropriate behavior monitoring. However, lack of success with the comprehensive multidisciplinary intervention is not by itself an indication to move to this level of treatment.

The interventions listed below have been used for adolescents, and some patients may be candidates for one of these interventions. Consideration of each of these interventions depends on the patient and the resources in the geographic area.

Medications

Two medications have been used for adolescents.82 Sibutramine is a serotonin reuptake inhibitor that increased weight loss for adolescents who were in a diet and exercise program, compared with diet and exercise alone. Adolescents who received medication lost 3 kg more than did those in the control group.83,84 In 1 study, use of orlistat, which causes fat malabsorption through inhibition of enteric lipase, led to less weight gain, compared with diet and exercise alone, among adolescents.85 The effect of these medications (always studied in conjunction with diet and exercise) has been modest. The Food and Drug Administration has approved sibutramine for patients ≥16 years of age and orlistat for patients ≥12 years of age.

Very Low-Calorie Diet

There are few reports on the use of highly restrictive diets for children or adolescents. A restrictive diet was used as the first step in a childhood weight management
program, followed by a mildly restrictive diet. Long-term outcome data have not been reported.

Weight Control Surgery

Because of the increasing number of youths with severe obesity that is not responsive to behavioral intervention, a few centers offer bariatric surgery, either gastric bypass or gastric banding. This treatment generally leads to substantial weight loss and improvement in medical conditions. However, perioperative risks, postprocedure nutritional risks, and the necessity of lifelong commitment to altered eating make this approach unattractive or inappropriate for many. Selection criteria proposed by Inge et al include BMI of \( \geq 40 \) kg/m\(^2\) with a medical condition or \( \geq 50 \) kg/m\(^2\); physical maturity (generally 13 years of age for girls and \( \geq 15 \) years of age for boys); emotional and cognitive maturity; and weight loss efforts for \( \geq 6 \) months in a behavior-based treatment program. Those investigators also recommended strongly that bariatric surgery centers maintain databases, so that these criteria can be modified as appropriate on the basis of outcomes. Furthermore, adolescents who undergo such procedures need careful evaluation before surgery and prolonged nutritional and psychological support after surgery, and many youths who might otherwise qualify live too far from an adolescent bariatric center.

Implementation

For implementation of tertiary care intervention, the following points should be noted.

1. these interventions should occur in pediatric weight management centers with comprehensive services;
2. the multidisciplinary team should have expertise in childhood obesity and its comorbidities, with patient care provided by a physician or nurse practitioner, registered dietitian, behavioral counselor, and exercise specialist. Standard clinical protocols for patient selection should evaluate patient age, degree of obesity, motivation and emotional readiness, previous efforts to control weight, and family support. Standard clinical protocols should be in place for evaluation before, during, and after intervention. These evaluations should focus on the physical and emotional effects of the treatment. These protocols should be established by a physician, dietitian, and behavioralist;
3. some patients who are appropriate candidates for one of these interventions may not have access because programs are not available in their geographic area or insurance does not cover the treatment.

Staged Approach for Individual Patients

When a clinician identifies health risks resulting from excess fat (most patients with BMI of \( \geq 95 \)th percentile and many patients with BMI of 85th–94th percentile), the provider can first offer Prevention Plus. If the child and family are already attempting these behaviors as part of prevention efforts or if 3 to 6 months of Prevention Plus do not lead to expected improvement, then the patient can move on to structured weight management. Similarly, after 3 to 6 months in a structured weight management program, some patients who have not achieved goals can move on to a comprehensive multidisciplinary intervention. The timing of these stages should be adapted to individual families and the availability of programs. For instance, providers may suggest a comprehensive program immediately when youths are motivated to begin such treatment, especially if they have urgent medical issues. If families must wait for an opening in a comprehensive program, then clinicians could provide Prevention Plus or structured weight management in the interim. Suggested weight goals and highest treatment stage recommended according to age and BMI category are presented in Table 8.

Patients <2 years of age require different evaluation and intervention approaches. Measurement and plotting of weight and height are unchanged but, because the growth curves do not include BMI percentiles, weight-for-height values should be plotted; children with weight-for-height values above the 95th percentile are classified as overweight. Risk of excess body fat increases as weight-for-height values increase above the 95th percentile, although no cutoff points currently define obesity. At this age, parental weight status is very important in assessing future obesity risk and predicts obesity in young adulthood more accurately than does the toddler’s current weight status. Therefore, an 18-month-old child with 2 obese parents is at very high risk, even if the toddler’s weight-for-height value is <95th percentile.

Until normative values for individual longitudinal growth are well established, energy restrictions designed to reduce weight are not recommended for this age group. However, providers should discuss the potential long-term risks and should encourage parents to establish obesity prevention strategies. For infants 0 to 12 months of age, pediatric providers can encourage exclusive breastfeeding until 6 months of age and continued breastfeeding to 12 months of age and beyond, after introduction of solid foods. Parents can be encouraged to offer new foods repeatedly and to avoid sugar-sweetened beverages (such as soda) and snack foods (such as French fries and potato chips). Providers can recommend that televisions not be in the infant’s sleeping room. Caregivers other than the parents should follow the same “parenting” strategies. When providers identify overweight toddlers 12 to 24 months of age, the providers should recommend age-appropriate obesity prevention strategies, such as avoidance of sugar-sweetened beverages and excessive juice intake and avoidance of excessive milk intake (>16–24 oz of milk per day may
add extra energy or displace other nutrients). Providers can encourage establishment of 3 meals per day eaten at the table with other family members, with the television off. Families should not restrict how much their children eat at meals and snacks but should be sure that all of the food available is healthy, with plenty of fruits and vegetables. At this age, children frequently consume 2 snacks in addition to their meals but, between meals and snacks, parents can offer water when children are thirsty, rather than providing constant access to caloric beverages such as juice. Children should have ample opportunity for active play, with limitation of television and DVD viewing and no televisions in their bedrooms. When weight is extremely high, the infant or toddler may have a genetic condition, especially if height is low or development is delayed.

Severe obesity combined with low motivation or lack of concern creates a distressing situation for clinicians, especially when the child has urgent medical conditions such as sleep apnea or diabetes. Particularly challenging are situations in which the child is young and the parents, on whom the child relies for healthy eating and physical activity structure, are unwilling to make changes. Providers can use empathy and persistence; they should maintain their relationship with the family and encourage change without scolding. Scolding or a sense of failure may lead the family to seek care elsewhere. If providers search for the source of resistance, then they may find ways to address it. A social worker could help address financial limitations, an adult psychiatrist could help a parent who is depressed, family therapy could help a family cope with a divorce, and Big Brother/Big Sister programs could offer a weekly outing that is physically active. Offices should actively keep these families engaged (eg, encouraging follow-up appointments to evaluate weight, rather than waiting for the next well-child check). Office staff members can check with the family by telephone after missed appointments. When families agree to meet with a specialist, such as a dietician, office staff members can inform the specialist of the situation, to ensure that the appointment goes smoothly, and also can address practical problems, such as transportation issues. These strategies communicate the clinician’s concern about the child’s health but also the desire to support the family.

Although providers often feel overwhelmed by obesity care in the face of the environmental forces that promote it, increasing public concern, increasing attention directed at school and community policies, and refined understanding of the most-effective interventions will eventually come together to meet this challenge successfully. Meanwhile, health care providers have the potential to improve outcomes by performing early identification, by helping individual families create the best possible home environment, and by providing more-structured guidance to overweight and obese children and their families.

APPENDIX: EXPERT COMMITTEE RECOMMENDATIONS ON THE ASSESSMENT, PREVENTION, AND TREATMENT OF CHILD AND ADOLESCENT OVERWEIGHT AND OBESITY

Assessment Recommendations

1. The expert committee recommends that physicians and allied health care providers perform, at a minimum, a yearly assessment of weight status for all children and that this assessment include calculation of height, weight (measured appropriately), and BMI for age and plotting of those measures on standard growth charts.

2. With regard to classification, the expert committee recommends that individuals 2 to 18 years of age with BMI of ≥95th percentile for age and gender or BMI of >30 (whichever is smaller) should be considered obese and individuals with BMI of ≥85th percentile but <95th percentile for age and gender should be considered overweight; this term replaces “at risk of overweight.”

3. The expert committee recommends the use of 99th percentile BMI values for age as cutoff points (indicated by using a table with cutoff points for the 99th percentile BMI according to age and gender), to allow for improved accessibility of the data in the clinical setting and for additional study.

4. The expert committee recommends against the routine clinical use of skinfold thickness measurements in the assessment of obesity in children.

5. The expert committee was unable to recommend waist circumference measurements for routine clinical use at the present time, because of incomplete information and the lack of specific guidance for clinical application.

6. The expert committee recommends that qualitative assessment of dietary patterns for all pediatric patients be conducted, at a minimum, at each well-child visit for anticipatory guidance and that assessment include self-efficacy and readiness to change and identification of the following specific dietary practices, which may be targets for change: frequency of eating outside the home at restaurants or fast food establishments, excessive consumption of sweetened beverages, and consumption of excessive portion sizes for age. Additional practices to be considered for evaluation during the qualitative dietary assessment include excessive consumption of 100% fruit juices, breakfast consumption (frequency and quality), excessive consumption of foods that are high in energy density, low consumption of fruits.
and vegetables, and meal frequency and snacking patterns (including quality).

7. The expert committee recommends that assessment of levels of physical activity and sedentary behaviors should be performed for all pediatric patients, at a minimum, at each well-child visit for anticipatory guidance and should include the general areas of (a) self-efficacy and readiness to change, (b) environment and social support and barriers to physical activity, (c) whether the child is meeting recommendations of 60 minutes of at least moderate physical activity per day, and (d) levels of sedentary behavior (including hours of behaviors such as watching television and/or DVDs, playing video games, and using the computer, in comparison with a baseline value of <2 hours per day).

8. The expert committee recommends that physicians and allied health care providers obtain a focused family history for obesity, type 2 diabetes mellitus, cardiovascular disease (particularly hypertension), and early deaths resulting from heart disease or stroke, to assess the risks of current or future comorbidities associated with a child’s overweight or obese status.

9. The expert committee recommends that a thorough physical examination be performed and that, for a child identified as overweight or obese, the following measurements be included, in addition to the aforementioned recommendations on BMI: (a) pulse, measured in the standard pediatric manner; (b) blood pressure, measured with a cuff large enough that 80% of the arm is covered by the bladder of the cuff; and (c) signs associated with comorbidities of overweight and obesity (see the assessment report).2 Waist circumference is not recommended for routine use. Although high waist circumference can indicate insulin resistance and other comorbidities of obesity and may be useful to characterize risks for obese children, measurement is difficult and appropriate cutoff values are uncertain.

10. The expert committee recommends that the following laboratory tests be considered in the evaluation of a child identified as overweight or obese. If the BMI is 85th to 94th percentile for age and gender with no risk factors, then a fasting lipid profile should be obtained. If the BMI is 85th to 94th percentile for age and gender with risk factors in the history or physical examination, then AST, ALT, and fasting glucose levels should also be measured. If the BMI is >95th percentile for age and gender, even in the absence of risk factors, then all of the tests listed for 85th to 94th percentile BMI with risk factors should be performed. Guidelines for laboratory assessment and testing for more-detailed evaluation, typically performed and interpreted by subspecialists, are also provided (see assessment report).2

Treatment Recommendations

1. The expert committee recommends that all physicians and health care providers address weight management and lifestyle issues with all patients, regardless of presenting weight, at least each year.

2. The expert committee recommends that all children between 2 and 18 years of age with BMI values between the 5th and 84th percentile follow the recommendations for prevention outlined in the prevention report.3

3. The expert committee recommends that the treatment of overweight children be approached with a staged method based on the child’s age, BMI, related comorbidities, parents’ weight status, and progress in treatment and that the child’s primary caregivers and family be involved in the process.

4. The expert committee recommends the following staged approach for children between the ages of 2 and 19 years whose BMI is >85th percentile. Stage 1 is the Prevention Plus protocol. These recommendations can be implemented by the primary care physician or an allied health care provider who has some training in pediatric weight management or behavioral counseling. Stage 1 recommendations include the following. (a) Consume ≥5 servings of fruits and vegetables per day (ME). (b) Minimize or eliminate sugar-sweetened beverages (ME). (c) Limit screen time to ≤2 hours per day, with no television in the room where the child sleeps (CE). (d) Engage in ≥1 hour of daily physical activity (ME). The patient and the family of the patient should be counseled to facilitate the following eating behaviors: (a) eating a daily breakfast (ME); (b) limiting meals outside the home (ME); (c) eating family meals at least 5 or 6 times per week (ME); and (d) allowing the child to self-regulate his or her meals and avoiding overly restrictive behaviors (CE for children <12 years of age and suggested for children >12 years of age). Providers should acknowledge cultural differences and help families to adapt recommendations to meet these differences (suggest). Within this category, the goal should be weight maintenance, with growth resulting in decreasing BMI as age increases. Monthly follow-up assessment should be performed. After 3 to 6 months, if no improvement in BMI or weight status has been noted, then advancement to stage 2 is indicated, on the basis of patient/family readiness to change. Stage 2 is a structured weight management protocol. These recommendations can be implemented by a primary care physician or an allied
health care provider who is highly trained in weight management. Stage 2 recommendations include the following: (a) development of a plan for use of a balanced macronutrient diet, emphasizing small amounts of energy-dense foods (suggest); (b) provision of structured daily meals and snacks (breakfast, lunch, dinner, and 1 or 2 snacks per day) (suggest); (c) supervised active play of ≥60 minutes per day (ME); (d) screen time of ≤1 hour per day (suggest; CE for ≤2 hours); (e) increased monitoring (eg, screen time, physical activity, dietary intake, and restaurant logs) by provider, patient, and/or family (CE); and (f) reinforcement for achieving targeted behavior goals (not weight goals) (suggest). Within this category, the goal should be weight maintenance that results in decreasing BMI as age and height increase; however, weight loss should not exceed 1 lb/month for children 2 to 11 years of age or an average of 2 lb/week for older overweight/obese children and adolescents. If there is no improvement in BMI or weight status after 3 to 6 months, then the patient should advance to stage 3. Stage 3 is a comprehensive multidisciplinary intervention. At this level of intervention, optimally the patient should be referred to a multidisciplinary obesity care team. Eating and activity goals are the same as in stage 2. Activities within this category should also include the following: (a) planned negative energy balance achieved through structured diet and physical activity (ME); (b) structured behavioral modification program, including food and activity monitoring and development of short-term diet and physical activity goals (CE); (c) involvement of primary caregivers/family members for behavioral modification for children <12 years of age (CE); (d) provision of training for all families to improve the home environment (suggest); and (e) frequent office visits. Weekly visits for a minimum of 8 to 12 weeks seem to be most efficacious (CE), and subsequent monthly visits help maintain new behaviors. Group visits may be more cost-effective and have therapeutic benefit (ME). Systematic evaluation of body measurements, dietary intake, and physical activity should be conducted at baseline and at specific intervals throughout the program. Within this category, the goal should be weight maintenance or gradual weight loss until BMI is <85th percentile. Weight loss should not exceed 1 lb/month for children 2 to 5 years of age or 2 lb/week for older obese children and adolescents.

5. The expert committee recommends stage 4 for children >11 years of age with BMI of >95th percentile who have significant comorbidities and who have not been successful in stages 1 to 3 or children with BMI of >99th percentile who have shown no improvement in stage 3 (comprehensive multidisciplinary intervention). Stage 4 is a tertiary care protocol, that is, referral to a pediatric tertiary weight management center with access to a multidisciplinary team with expertise in childhood obesity, operating under a designed protocol. This protocol should include continued diet and activity counseling and the consideration of such additions as meal replacement, very low-calorie diet, medication, and surgery (suggest).

6. The expert committee recommends that the following weight loss targets be considered when the staged treatment plan is implemented: the recommendations are based on clinical recommendations and judgment because of the limited amount of evidence: age 2 to 5 years: BMI of 85th to 94th percentile: weight maintenance until BMI is <85th percentile or slowing of weight gain is indicated by a downward deflection in the BMI curve; BMI of ≥95th percentile: weight maintenance until BMI is <85th percentile; however, if weight loss occurs with a healthy adequate diet, then it should not exceed 1 lb/month (if greater loss is noted, then the patient should be monitored for causes of excessive weight loss); BMI of >21 or 22 kg/m² (rare, very high): gradual weight loss, not to exceed 1 lb/month (if greater loss occurs, then the patient should be monitored for causes of excessive weight loss); age 6 to 11 years: BMI of 85th to 94th percentile: weight maintenance until BMI is <85th percentile or slowing of weight gain is indicated by a downward deflection in the BMI curve; BMI of 95th to 98th percentile: weight maintenance until BMI is <85th or gradual weight loss of ~1 lb/month (if greater loss is noted, then the patient should be monitored for causes of excessive weight loss); BMI of ≥99th percentile: weight loss not to exceed an average of 2 lb/week (if greater loss is noted, then the patient should be monitored for causes of excessive weight loss); age 12 to 18 years: BMI of 85th to 94th percentile: weight maintenance until BMI is <85th percentile or slowing of weight gain is indicated by a downward deflection in the BMI curve; BMI of 95th to 98th percentile: weight maintenance until BMI is <85th or gradual weight loss of ~2 lb/week (if greater loss is noted, then the patient should be monitored for causes of excessive weight loss); BMI of ≥99th percentile: weight loss not to exceed an average of 2 lb/week (if greater loss is noted, then the patient should be monitored for causes of excessive weight loss).

7. The expert committee recommends that, for children 12 to 18 years of age with BMI of >99th percentile, primary care physicians and allied health care providers may begin treatment at stage 1, 2, or 3, as indicated by the patient’s and family’s readiness to change.
1. The expert committee recommends that physicians and allied health care providers counsel the following for children 2 to 18 years of age whose BMI is 5th to 84th percentile: (a) limiting consumption of sugar-sweetened beverages (CE); (b) encouraging diets with recommended quantities of fruits and vegetables (ME); (c) limiting television and other screen time by allowing no more than 2 hours per day, as advised by the American Academy of Pediatrics (CE), and removing television and computer screens from children’s primary sleeping areas (CE); (d) eating breakfast daily (CE); (e) limiting eating at restaurants, particularly fast food restaurants (CE); (f) encouraging family meals in which parents and children eat together (CE); and (g) limiting portion sizes (CE).

2. The expert committee also suggests that providers counsel families to engage in the following behaviors: (a) eating a diet rich in calcium; (b) eating a diet high in fiber; (c) eating a diet with balanced macronutrients (energy from fat, carbohydrates, and protein in proportions appropriate for age, as recommended by Dietary Reference Intakes); (d) initiating and maintaining breastfeeding; (e) participating in 60 minutes of moderate to vigorous physical activity per day for children of healthy weight (the 60 minutes can be accumulated throughout the day, rather than in single or long bouts; ideally, such activity should be enjoyable to the child); and (f) limiting consumption of energy-dense foods.

Practice- and Community-Level Interventions

1. The expert committee recommends that physicians, allied health care professionals, and professional organizations (a) advocate for the federal government to increase physical activity at schools through intervention programs from grade 1 through the end of high school and college and through the creation of school environments that support physical activity in general and (b) support efforts to preserve and to enhance parks as areas for physical activity, inform local development initiatives regarding the inclusion of walking and bicycle paths, and promote families’ use of local physical options by making information and suggestions about physical activity alternatives available in doctors’ offices.

2. The expert committee recommends the use of the following techniques to aid physicians and allied health care providers who may wish to support obesity prevention in clinical, school, and community settings: (a) actively engaging families with parental obesity or maternal diabetes, because these children are at increased risk for developing obesity even if they currently have normal BMI; (b) encouraging an authoritative parenting style in support of increased physical activity and reduced sedentary behavior (authoritative parents are both demanding and responsive, providing tangible and motivational support for children); (c) discouraging a restrictive parenting style (restrictive parenting involves heavy monitoring and controlling of a child’s behavior) regarding child eating; (d) encouraging parents to model healthy diets and portions sizes, physical activity, and limited television time; and (e) promoting physical activity at school and in child care settings (including after-school programs) by asking children and parents about activity in these settings during routine office visits.

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Assessment of Child and Adolescent Overweight and Obesity

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ABSTRACT

Accurate appropriate assessment of overweight and obesity in children and adolescents is a critical aspect of contemporary medical care. However, physicians and other health care professionals may find this a somewhat thorny field to enter. The BMI has become the standard as a reliable indicator of overweight and obesity. The BMI is incomplete, however, without consideration of the complex behavioral factors that influence obesity. Because of limited time and resources, clinicians need to have quick, evidence-based interventions that can help patients and their families recognize the importance of reducing overweight and obesity and take action. In an era of fast food, computers, and DVDs, it is not easy to persuade patients to modify their diets and to become more physically active. Because research concerning effective assessment of childhood obesity contains many gaps, this report is intended to provide a comprehensive approach to assessment and to present the evidence available to support key aspects of assessment. The discussion and recommendations are based on >300 studies published since 1995, which examined an array of assessment tools. With this information, clinicians should find themselves better equipped to face the challenges of assessing childhood overweight and obesity accurately.

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Key Words
obesity, clinical assessment, BMI, diet, physical activity

Abbreviations
IOTF—International Obesity Task Force
CDC—Centers for Disease Control and Prevention
PPV—positive predictive value
DGAC—Dietary Guidelines Advisory Committee
HDL—high-density lipoprotein
LDL—low-density lipoprotein
T2DM—type 2 diabetes mellitus
CVD—cardiovascular disease
WAVE—weight, activity, variety, and excess

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OBESITY AND OBESITY are terms commonly used in the clinic as well as on the street corner, often with a wide range of meanings. For medical purposes, obesity refers to excess body fat; however, the exact meaning of excess has not been defined. Obesity most often is regarded as an excess percentage of body weight that is fat, but no widely accepted diagnostic definitions or cutoff points are available for children. For an understanding of developmental patterns, mean body fat percentages (derived from bioelectrical impedance analyses) are available for US children >12 years of age.2 and percentile curves have been published for British children 5 to 18 years of age.2

MEASUREMENTS OF OVERWEIGHT AND OBESITY

Defining Obesity

In the absence of established criteria that define childhood obesity on the basis of whole-body fatness and its relationship to health outcomes, cutoff points based on distributions of anthropometric measurements (eg, weight and BMI) generally are used. To define obesity in US children, the percentile distributions relative to gender and age in the Centers for Disease Control and Prevention (CDC) 2000 growth charts3 are now the preferred reference. The CDC 2000 growth charts were not developed as health-related standards of how healthy children should grow. Rather, the growth charts present percentiles as points of reference, primarily based on national surveys of US children. Although the most-recent growth charts were published in 2000, they include selected data from 1963 to 1995, which makes them statistically nonrepresentative of the US population in 2000.1 Nevertheless, the CDC 2000 growth charts were developed carefully and provide the best reference data available for the growth of US children.

Several expert and advisory groups have recommended BMI as the preferred measure for evaluating obesity among children and adolescents 2 to 19 years of age.4–7 BMI expresses the weight-for-height relationship as a ratio, that is, weight (in kilograms)/[height (in meters)]². Experts recommend BMI because it can be obtained easily, it is correlated strongly with body fat percentage (especially at extreme BMI levels), it is associated only weakly with height, and it identifies the fattest individuals correctly, with acceptable accuracy at the upper end of the distribution (eg, ≥85th or ≥95th percentile for age and gender).

In 1994, the Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services recommended that children whose BMI exceeds 30 kg/m² or is ≥95th percentile for age and gender (whichever is smaller) should be considered overweight.5 The BMI limit of 30 kg/m² was recommended because, at the oldest ages of adolescence for which the 95th percentile values exceed 30 kg/m² (>17 years), elevated BMI is associated with early adulthood patterns of risk for obesity-related disease and death,8,9 as well as to provide continuity with recommendations for adults. The expert committee considered adolescents whose BMI was ≥85th percentile but <95th percentile to be “at risk of overweight.” The committee deliberately avoided the term obese, because of the inference regarding adiposity and body composition and the inability of height and weight data, even as BMI, to measure total body fat specifically. These definitions are considered standard in describing the weight status of children and adolescents 2 to 18 years of age.4,10

In 2005, the Institute of Medicine consciously departed from the previously described terminology and elected to define children with BMI of ≥95th percentile for age and gender as obese, rather than overweight.6 The Institute of Medicine report conveyed the seriousness, urgency, and medical nature of childhood obesity, as well as the need to take action. The current expert committee endorses the position of the Institute of Medicine report and recommends that individuals 2 to 18 years of age with BMI of >30 kg/m² or ≥95th percentile for age and gender (whichever is smaller) should be considered obese (see summary report). We think that the nature of the current epidemic and the need for medical professionals and others to address the problem actively justifies this change.11 Moreover, we recommend that individuals with BMI of ≥85th percentile but <95th percentile or 30 kg/m² (whichever is smaller) now be considered overweight and that this term replace the term “at risk of overweight.” The Institute of Medicine report published in 2005 was silent regarding this category of BMI.

The expert committee concluded that the scientific data linking elevated BMI to risk factors and morbidity12,13 as well as the difficulty of changing early trajectories of weight gain, support the change in terminology. The terms overweight and obese also may be easier than “at risk of overweight” for parents to understand. This new terminology will allow US medical practice to parallel the recommendations of the International Obesity Task Force (IOTF)14 and to align with the International Classification of Diseases, Ninth Edition, diagnosis codes. Finally, these changes in descriptions of weight status for children and adolescents will provide continuity with the recommended adult cutoff points of BMI of ≥25 kg/m² and ≥30 kg/m² for overweight and obesity, respectively.15

We are aware that the BMI categories for adults that are linked to minimal subsequent mortality rates are not without controversy.16 However, the threshold levels of 25 and 30 kg/m² for adult BMI are still recommended by national and international organizations.7,15

For children ≤2 years of age, the weight-for-recumbent length percentiles from the CDC 2000 growth charts are appropriate for evaluating weight relative to linear growth, but the term obese generally should not be applied to children this young. Weight-for-length
percentiles of ≥95th identify these children as overweight.3

Little evidence is available regarding the most effective way to evaluate the severity of obesity for children with BMI of ≥97th percentile (the highest level on the CDC growth charts). Inge et al17 recommended that bariatric surgery for adolescents should be restricted to those with BMI of ≥40 and significant comorbidities that may be improved with surgery. In research settings, age-specific z scores or SD scores are used for extreme values of anthropometric measures. These scores describe the number of SD units above or below the median for the individual value. For example, in a normally distributed population, the 99th percentile is equivalent to a z score of ~3.0. Unfortunately, a computer program is needed to calculate BMI z scores, and many clinicians are unfamiliar with their use and interpretation. A BMI z score calculator is available on the Internet (www.kidsnutrition.org/bodycomp/bmi_z2.html). Limited available data suggest that BMI-for-age values of ≥99th percentile are associated strongly with the presence of comorbidities, excess adiposity, and persistence of obesity into adulthood.18 This severity of obesity may well warrant more-aggressive therapeutic interventions. Although they are not available currently on growth charts, more-routine availability of 99th percentile BMI cutoff points would likely be valuable for tailoring optimal treatment approaches.

**Anthropometric Methods and Determination of BMI**

Weight, height (sometimes referred to as stature), and recumbent length of children are measured routinely in most clinics. Nevertheless, the importance of careful accurate measurements should be emphasized to clinic staff members. Staff members should take particular care when BMI is calculated, compared to reference data, and made the basis for important decisions regarding the child’s health. Detailed protocols are available for measuring recumbent length, height, and weight in a manner comparable to that for reference data.19

BMI may be calculated directly as weight (in kilograms)/[height (in meters)]² or determined from published tables or nomograms.5,20,21 Many BMI tables, nomograms, and calculator programs are available online (eg, www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm or http://nhlbi.sphost.com/bmi/bmicalc.htm). The National Heart, Lung, and Blood Institute provides a free program for calculating BMI on hand-held devices (http://hp2010.nhlbhin.net/bmi_pal.htm). If BMI is calculated from height and weight measured in inches and pounds, then the formula is BMI = [weight (in pounds)/[height (in inches)]²] × 703. Some BMI tables and charts are designed for adults and either may not accommodate the smaller heights and weights appropriate for children or may not provide age/gender-specific percentiles.

**Development of BMI References and Implications**

The developmental pattern for BMI differs somewhat from the more-familiar patterns for height and weight (Fig 1). The normal pattern is for BMI to decrease from ~2 years of age until 5 or 6 years of age and to increase thereafter. This early decrease in BMI reflects a corresponding decrease in subcutaneous fat and the percentage of body fat.22 The resulting V-shaped pattern in early childhood has been termed the “adiposity rebound.”23 It coincides with the period between the ages of 4 and 7 years when BMI reaches its nadir and then begins to increase through the remainder of childhood and into young adulthood. Early adiposity rebound has been cited as a risk factor for the development and persistence of later obesity.24 More-recent analyses suggest that this primarily is a reflection of rapid weight gain during infancy and early childhood and that it identifies young children with high BMI percentiles and/or children who are crossing percentiles upward.24,25 Rapid weight gain in infancy, including during the first week,26 the first 4 months,27 and the first year,28 has been found to predict later obesity. In one prospective cohort, increased weight gain during the first 3 years of life was associated independently with higher BMI, fat mass, and waist circumference at 17 years of age.29 For clinical purposes, the utility of assessing adiposity rebound is limited, because it is difficult to determine for an individual child and it is, by definition, a retrospective determination. Identification of the age of adiposity rebound as a strategy for clinicians to identify children at risk of overweight or obesity is unlikely to contribute more than plotting of weight and length for age and determination of BMI percentiles for young children.

Another distinctive feature of the BMI developmental curve is that it lacks the marked increase in growth velocity during the adolescent spurt that is characteristic of height and weight growth curves. Although BMI increases during the adolescent spurt, the slope with age is dampened by the nature of the BMI ratio and the difference in timing of the growth spurts of height and weight.22 Because the upper percentiles of BMI increase so dramatically with age, the BMI levels used to identify overweight and obese children are usually presented according to age. BMI percentiles also must be gender-specific, because of the systematic physiologic differences between boys and girls. Finally, as is evident in the percentiles presented in Fig 1, the statistical distribution of BMI at any age is asymmetric or skewed toward the higher values.

An attractive aspect of BMI is that it correlates closely with total body fat30,31 and other risk factors for obesity-related morbidity in adults.32,33 Such correlations are based on the joint associations of the entire distributions of BMI and related outcomes. Interpretation of assessments of overweight in children using only BMI for age and gender should include the realization that some
children may have relatively high weights primarily because of high lean mass, rather than high body fat levels. This is most common among male adolescents, for whom gains in BMI during adolescence may have a large component of lean mass.\textsuperscript{34,35} At \( \geq 95\)th percentile, however, almost all of those who are identified as obese on the basis of BMI have high weights because they have high total body fat levels. In clinical practice, the important question is whether the criteria for overweight and obese that are based only on the upper portion of the BMI distribution (ie, \( \geq 85\)th percentile or \( \geq 95\)th percentile) identify correctly the fattest children and those at greatest health risk.

This sort of categorical identification often is evaluated by using the same sensitivity/specificity approach that is used to evaluate medical screening procedures.\textsuperscript{36} Sensitivity (or the true-positive rate) in this case represents the proportion of children who are considered the fattest with a standard method for assessment of total body fat (eg, dual-energy X-ray absorptiometry) and who also are identified correctly with the BMI criteria. The complement of sensitivity is specificity, or the proportion of children who are considered not the fattest with the standard method and who are identified correctly as not overweight or obese with the BMI criteria. Finally, the positive predictive value (PPV) is the pro-

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**FIGURE 1**

portion of children who are identified as overweight or obese with BMI criteria who are truly the fattest children identified with the standard method. The PPV is important for clinical applications because its complement (1 − PPV) is an estimate of the proportion of children who may be identified incorrectly as overweight or obese when BMI is used. Such children may be labeled, treated, or referred inappropriately.

The sensitivities of the 85th BMI percentiles on the CDC 2000 growth charts in identifying correctly the fattest children range from 75% to 93% in several studies, and the corresponding specificities range from 67% to 96%. The accompanying PPVs (presented or calculated from sensitivity, specificity, and prevalence values) range from 61% to 98%. The sensitivities of the 95th BMI percentiles on the CDC charts in identifying correctly the fattest children range from 54% to 100%, and the corresponding specificities range from 96% to 99%. PPVs for the ≥95th BMI percentile criterion range from 56% to 99%.

Some of the aforementioned estimates of sensitivity, specificity, and PPV are difficult to compare directly across studies, because of the differing samples and standard criteria used. Nevertheless, several general conclusions can be drawn from these and similar studies. Most important is that the BMI criteria, although imperfect, perform reasonably well in identifying correctly children who have the highest percentages of body fat. As the BMI criteria become more restrictive (ie, ≥95th percentile versus ≥85th percentile), the sensitivities in identifying the fattest children decrease and the specificities increase. Finally, the specificities and PPVs are almost always higher than the corresponding sensitivities. This means that there should be relatively few children diagnosed incorrectly as overweight or obese by using BMI.

The CDC 2000 BMI-for-age percentiles are recommended for US children from all racial/ethnic backgrounds. Some evidence exists that, in general, black children tend to have relatively less body fat and Mexican American children tend to have relatively more body fat, compared with white children with the same BMI. Also, South Asian adolescents living in England have higher percentages of body fat than do their peers of European heritage with the same BMI. Because the racial/ethnic differences in body fat/BMI relationships have not been described fully for children, however, the same BMI reference values are currently recommended for assessment of all children. Any racial/ethnic differences in health risks assessed by using the CDC BMI reference values should be small.

The validity of using high BMI to identify children with the highest total body fat levels seems to be approximately the same for healthy children and children receiving growth hormone, children with inflammatory bowel disease, and children treated previously for malignancy. Differences between boys and girls in the sensitivities and specificities of BMI for identifying the fattest children are inconsistent and probably not important clinically. Similarly, available data show no consistent age patterns in BMI sensitivities and specificities between the ages of 6 and 18 years.

Pediatric obesity is associated with increased risks of concomitant psychological or psychiatric problems, cardiovascular risk factors, chronic inflammation, type 2 diabetes mellitus (T2DM), and asthma. In an important study, Katzmarzyk et al assessed the validity of BMI and waist circumference criteria for overweight and obesity for identifying correctly youths 5 to 18 years of age who had ≥3 of 6 risk factors (low high-density lipoprotein [HDL] cholesterol levels, high low-density lipoprotein [LDL] cholesterol levels, high triglyceride levels, high plasma glucose levels, high plasma insulin levels, or high blood pressure). The overall sensitivities and specificities for BMI of ≥85th percentile were 69% and 76%, respectively, and those for BMI of ≥95th percentile were 49% and 90%, respectively. These sensitivities and specificities are quite low, and the corresponding PPVs calculated from the authors’ data are 36% and 50%, respectively, for BMI of ≥85th and ≥95th percentiles. Therefore, even among children with ≥3 risk factors, the least-restrictive and therefore most-sensitive BMI cutoff point (BMI of ≥85th percentile) still identified correctly only approximately two thirds. Moreover, of all children with BMI of ≥85th percentile who were considered overweight, approximately two thirds did not have ≥3 risk factors. The authors concluded that waist circumference added substantially to BMI alone for assessment of cardiovascular disease (CVD) risk. If these results can be replicated in other samples, they argue strongly that BMI criteria by themselves are insufficient to identify children who are most likely to have clusters of risk factors and that additional screening and assessment criteria should be applied to estimate risks.

**Implications for Overweight and Obese Children in Adulthood**

Systematic reviews confirm the persistence of obesity from childhood into adulthood. Predictably, the higher the BMI is in childhood, the greater the probability is of obesity in adulthood. Guo et al analyzed lifelong data from the Fels Longitudinal Study and estimated the probabilities of having a BMI of ≥30 kg/m² at 35 years of age. For girls with BMI of 95th percentile during childhood, the probabilities of being obese as an adult were 20% to 39.9% from 3 to 5 years of age, 40% to 59.9% from 6 to 11 years of age, and ≥60% from 12 to 20 years of age. For boys with BMI of 95th percentile during childhood, the probabilities of being obese as an adult were <20% from 3 to 4 years of age, 20% to 39.9% from 5 to 11.5 years of age, 40% to 59.9% from 11.5 to 16 years of age, and ≥60% from 17 to 20 years of age.

For children with BMI of 85th percentile during childhood, the probabilities of adult obesity were lower. For girls, the probabilities of being obese as an adult were...
<20% from 3 to 4 years of age, 20% to 39.9% from 5 to 17 years of age, and 40% to 59.9% from 18 to 20 years of age. For boys with BMI of 85th percentile during childhood, the probabilities of being obese as an adult were <20% from 3 to 16 years of age, 20% to 39.9% at 17 years of age, and 40% to 59.9% from 18 to 20 years of age. On the basis of these data, the odds ratios for being obese (BMI of $\geq 30$ kg/m²) at 35 years of age were 19.3 for boys and 15.7 for girls if BMI at 18 years of age was >72nd percentile (the most discriminating level). Clearly, if individuals end their adolescence with moderately elevated BMI, then the likelihood of obesity as an adult is high.

Overweight and obesity in childhood and adolescence have been associated with adverse socioeconomic outcomes, increased health risks and morbidities, and increased mortality rates in adulthood. Must et al. studied children in Boston (13–18 years of age) who were evaluated initially between 1922 and 1935 and were assessed in 1988. Compared with those with BMI of 25th to 50th percentile in adolescence, those with BMI of >75th percentile in adolescence had increased heart disease, atherosclerosis, T2DM, colorectal cancer (men), gout (men), hip fracture (women), arthritis (women), and all-cause mortality (men) rates.

**Alternative Reference Data and Measures of Fatness**

**IOTF Standards**

In 2000, reference BMI categories based on 6 pooled international data sets were developed for children 2 to 18 years of age. These reference curves have become known as the IOTF standards. They assume that the most-appropriate cutoff points for overweight and obesity in children are those corresponding to the locations of BMI of 25 kg/m² and 30 kg/m², respectively, in the BMI distribution for adults, points that are recognized internationally as defining overweight and obesity. Particularly outside the United States, the IOTF standards have been widely used to classify overweight and obesity in children. The IOTF charts provide only overweight and obesity categories and not a full array of percentile levels. Therefore, they are not recommended for monitoring the BMI progress of individual children. Sensitivities and specificities of IOTF cutoff points in identifying the fattest children and predicting adult morbidity are similar to those of the CDC 2000 BMI charts. The IOTF reference values are not recommended for routine clinical use.

In various research settings and in the scientific literature, measures other than BMI that are related to childhood fatness and obesity are used frequently. These were investigated, and consideration was given to their appropriateness for routine clinical use in the assessment of pediatric overweight and obesity, as well as whether each provides important information beyond that available from BMI.

**Skinfold Thickness**

Skinfolds are double, compressed thicknesses of subcutaneous fat and skin that are measured with standardized calipers at selected sites (eg, triceps, subscapular, and suprailiac sites). Skinfold measurements have a long history in studies of nutrition and body composition. They are considered attractive research tools because measurements are noninvasive and specific to subcutaneous fat. Previous expert committees considering childhood obesity recommended that skinfold measurements be included in in-depth medical assessments, to distinguish those who are overweight from those who are overfat.

Without question, skinfold thicknesses are predictive of total body fat in children and adolescents. Moreover, when skinfold measurements are included in regression models, they provide unique information beyond height and weight in accounting for variations in risk indicators, including blood lipid levels, lipoprotein levels, blood pressure, plasma glucose levels, plasma insulin levels, insulin resistance, and inflammation.

When categories of skinfold thicknesses or ratios based on percentile cutoff points are used to identify the fattest individuals or those with metabolic syndrome, the skinfold measurements perform as well as BMI or waist circumference values. Nevertheless, there is little evidence that, once height and weight (or BMI) are known, skinfold thickness categories increase the accuracy of identifying those with the most total body fat or other risk factors.

Therefore, the expert committee does not recommend the routine clinical use of skinfold thickness measurements in the assessment of childhood obesity. The basis for this conclusion includes the lack of readily available reference data on skinfold thicknesses for US children, the considerable potential for measurement errors without rigorous training and regular experience, and the lack of optimal criteria as a basis for intervention.

**Waist Circumference**

Waist circumference has attracted much recent attention as an indicator of fatness and health risks in children and adults. The interest in waist circumference stems from research linking accumulated visceral adipose tissue to increased health risks and metabolic disorders in children and adults. Compared with BMI, waist circumference in children provides a better estimate of visceral adipose tissue measured with MRI at the level of the fourth lumbar vertebra (65% vs 56% of variance), whereas BMI is better at estimating subcutaneous adipose tissue (89% vs 84% of variance). In multivariate regression models, waist cir-
cumference is significantly more efficient than BMI in predicting insulin resistance, blood pressure, serum cholesterol levels, and triglyceride levels.67–69 Consequently, measurements of waist circumference provide unique predictive information regarding health risks, especially for adolescents.

The overall ability of waist circumference percentile cutoff points to identify the fattest boys (as assessed with areas under the receiver operating curves), however, was no greater than that of triceps skinfold or BMI percentiles.63 Also, Moreno et al64 found no overall differences in the ability of BMI, waist circumference, and triceps/subscapular skinfold ratio cutoff points to identify correctly Spanish children with the metabolic syndrome.45

Translation of the available information on waist circumference into meaningful clinical application for the assessment of overweight and obesity in children is difficult. No data are available to identify waist circumference cutoff points that are appropriate for identifying children with the most visceral fat or the greatest risk for cardiovascular or metabolic problems, having been identified as overweight or obese through BMI. Consequently, it is not known exactly which waist circumference percentile clinicians should use and what clinical actions that value would indicate. Nevertheless, clinicians, especially those in subspecialty referral settings, may add waist circumference to the tools they use to assess risk. If they do, clinicians should use a high, age-specific, percentile cutoff point, such as the 90th or 95th percentile, to evaluate risk.

Waist circumference may prove useful in the future, but the expert committee withheld recommending it for routine clinical use at the present time because of incomplete information and the lack of specific guidelines for clinical application. Waist circumference percentiles are now available for US children70 and for other populations.71–73 One possible approach may be to calculate the best waist circumference cutoff points for identifying at-risk children within BMI categories, as has been proposed for adults.74

**HEALTH BEHAVIOR CHANGES**

The history portion of assessment of childhood obesity should be directed, in part, toward identifying modifiable behaviors. Physicians and other health care professionals are more likely to provide successful treatment if they work with patients to target behaviors for change, rather than working from a “top-down” approach. Several approaches are available to negotiate lifestyle behavior changes that can improve health. The principles described below are intended for use with overweight or obese patients, but they apply to any circumstance in which health behavior changes are desired.

Self-efficacy is the personal belief that one can attain or accomplish successfully what one sets out to do. Because patients and families are more likely to do what they perceive to be both pleasant and feasible, providers should assess which activities patients enjoy and think they are capable of performing. Interventions and recommendations should be tailored accordingly.75–79

“Readiness to change” is a behavioral approach that assesses an individual’s readiness to adopt a particular behavior (otherwise known as the transtheoretical model).80,81 This approach stresses the interest in and motivation for thinking about, starting, or maintaining a behavior and allows for tailored messages and interventions based on 5 stages of change, as follows: stage 1, precontemplation; the patient is not yet considering the change; stage 2, contemplation; the patient is evaluating reasons for and against the change; stage 3, preparation; the patient is planning for the change; stage 4, action; the patient has made the change (<6 months); stage 5, maintenance; the patient has maintained the change (>6 months).

Individuals may not go through each step sequentially, and they may not spend the same amount of time in each stage. Behavior is seen as a dynamic process and not an “all-or-none” phenomenon. Assessing a person’s stage of change acknowledges the patient’s attitudes, respects his or her perspective, and is a vital step in ensuring that the behavioral intervention is delivered in a manner that is most beneficial for the patient and/or family.76,78,82,83 For example, recommending that a family change its food choices when the parent is not aware or convinced of the child’s weight being problematic (precontemplative) may not be as successful as first identifying the issue and discussing the rationale for concern.

Rollnick et al84 incorporated the principles described above into an approach called motivational interviewing. They defined motivational interviewing as a “client-centered counseling style for eliciting behavior change by helping clients explore and resolve ambivalence.” For a brief clinical assessment, they suggest asking 2 questions to gauge a patient’s motivation to change an unhealthy behavior, that is, (1) how important (on scale of 1–10) the change in behavior is to the patient and (2) how confident the patient feels in his or her ability to

**ASSESSMENT COMPONENTS OF THE MEDICAL HISTORY**

**Importance**

The medical history is critical for 3 purposes, namely, identification of modifiable lifestyle behaviors (eg, dietary and physical activity practices), assessment of current and future risks for medical comorbidities, and assessment of the patient’s and/or family’s readiness to make behavioral changes. Although obesity is a condition with medical consequences, the treatment inevitably involves behavior changes, which pose exceptionally difficult challenges for successful treatment implementation, compared with many other medical conditions.
make the change.84 These 2 concepts help direct the focus of the interaction between the clinician and the patient. If a patient does not identify a condition (e.g., a child’s high BMI) as important, then the discussion may target health-related risks. If the patient or family member recognizes the problem and its importance but is not confident in making a change, then the discussion may usefully target strategies for change, as well as barriers that may interfere with the change. This approach allows health care professionals to collaborate with patients to promote change by using a brief, patient-centered assessment that can be adapted easily to the clinic setting.

A related approach put forth as a general clinical prevention tool is the 5As, that is, ask/assess, advise, agree, assist, and arrange follow-up care.85 The exact wording of the 5As varies slightly among different publications, but the intent and process remain the same. These steps reinforce the concept that health care professionals need to assess behavior patterns and health belief structures to agree on a plan of action or intervention that is most appropriate for each patient.

Preliminary data on successful behavior changes using these approaches in health care settings show mixed results, and these approaches have been applied most often in the adult population86–91 for tobacco, alcohol, and drug use/addiction. Several studies that applied these methods to nutrition and physical activity assessment showed successful short-term results but less-convincing long-term results.92 Ongoing projects are examining the feasibility of these behavior change strategies in primary care settings, including pediatric practices.93

**Dietary Assessment**

**Assessment Methods**

Many complex dietary factors are associated with obesity, and age, gender, and genetic predisposition are likely to influence their effects. Although individual nutrients have been linked to obesity, few attempts have been made to identify eating patterns that may lead to obesity. Scientists have reached a consensus that obesity results from an imbalance in the energy balance equation; energy intake exceeds energy expenditure. Therefore, assessment should address both sides of the equation (diet and physical activity) in efforts to prevent or to treat obesity. Assessment of energy intake is challenging even under the most-controlled research conditions, and typically assessment includes a combination of assessment methods. Traditional dietary assessment methods include 24-hour recalls, food records, and food frequency questionnaires.93 In a 24-hour recall, the interviewer asks an individual what he or she ate and drank in the past 24 hours. Ideally, this is repeated several times, to obtain a view of the individual's usual dietary intake. To complete food records, patients write down, for several days, the foods, amounts, recipes, and preparation methods for everything they consume. A food frequency questionnaire asks patients how often they consume specific foods and beverages and the sizes of their usual portions.

All of the methods described above have advantages and disadvantages in research settings, but they are impractical for use in most clinical settings. These interventions are time-consuming, expensive, and difficult for health care professionals to administer in the office. Furthermore, the value of estimating energy intake per se is limited because it is virtually impossible to assess energy expenditure accurately and precisely and therefore to determine energy balance. A few rapid assessment methods are available for practitioners to evaluate their patients’ eating behaviors and physical activity, as well as to deliver effective nutrition counseling (Table 1). The weight, activity, variety (in diet), and excess (WAVE) tool allows a quick assessment of the patient’s weight status, activity and inactivity patterns, variety of foods, and potential excessive consumption of selected foods. The evidence base for the WAVE tool and other potential assessment tools is presented in Table 2.

**TABLE 1 Rapid Dietary Assessment Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Internet Address</th>
</tr>
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<tbody>
<tr>
<td>WAVE (adult version)</td>
<td><a href="http://biomed.brown.edu/nutrition">http://biomed.brown.edu/nutrition</a></td>
</tr>
<tr>
<td>WAVE (child version)</td>
<td><a href="http://biomed.brown.edu/nutrition">http://biomed.brown.edu/nutrition</a></td>
</tr>
<tr>
<td>REAP</td>
<td><a href="http://biomed.brown.edu/nutrition">http://biomed.brown.edu/nutrition</a></td>
</tr>
<tr>
<td>REAP physician key</td>
<td><a href="http://biomed.brown.edu/nutrition">http://biomed.brown.edu/nutrition</a></td>
</tr>
<tr>
<td>Rate Your Plate</td>
<td><a href="http://biomed.brown.edu/nutrition">http://biomed.brown.edu/nutrition</a></td>
</tr>
<tr>
<td>Healthy Eating Index</td>
<td><a href="http://www.cnpp.usda.gov/Publications/HEI">www.cnpp.usda.gov/Publications/HEI</a></td>
</tr>
</tbody>
</table>

REAP indicates Rapid Eating and Activity Assessment.

**Targets for Behavior Change**

Diverse eating patterns confound our understanding of the relationship between nutrient intake and chronic diseases, including obesity.104 Factors that are named frequently as contributors to relative excess energy intake include restaurant food, sweetened beverages, 100% fruit juice, large portion sizes, and the frequency of meals and snacks. A body of research has addressed each of these dietary components as it relates to energy intake and to overweight. These eating patterns seem to be related more consistently to increased total energy intake than to actual weight status.

An important consideration in the interpretation of the results of this research is that the percentage variance in the eating pattern/overweight models was extremely small,105,106 which suggests that weight status likely stems from a combination of interrelated eating patterns, rather than a single eating pattern. In addition, the effects of these interrelated patterns on weight status may be cumulative, and they may vary according to gender, ethnicity, and genetic factors. Limitations of the
<table>
<thead>
<tr>
<th>Authors and Year</th>
<th>Study Population</th>
<th>Study Design</th>
<th>Control Variables</th>
<th>Measures</th>
<th>Association</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soroudi et al,96 2004</td>
<td>111 first-year medical students (mean age: 24 y)</td>
<td>Completed as part of basic science course</td>
<td>NA</td>
<td>WAVE screener (adult version)</td>
<td>NA</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: NA; validity: NA</td>
</tr>
<tr>
<td>Segal-Isaacson et al,97 2004</td>
<td>110 first-year medical students (mean age: 24.2 y); 53% male, 44% female, 65% white, 21% Asian, 8% Hispanic, and 6% black</td>
<td>NA</td>
<td>Rapid Eating and Activity Assessment (short version) and semiquantitative Block food frequency questionnaire</td>
<td>$r = -0.20$ to $0.51$ ($P = .685-.0001$)</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: NA; validity: NA</td>
<td></td>
</tr>
<tr>
<td>Prochaska et al,98 2001</td>
<td>Study 1: 278 middle/high school students; study 2: 62 middle/high school students</td>
<td>2 middle schools; 2 high schools</td>
<td>NA</td>
<td>Assessment of fat intake and 3-d food records</td>
<td>ICC $&gt;0.60$; $r = 0.36$ ($P &lt; .01$)</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: good; validity: good</td>
</tr>
<tr>
<td>Block et al,99 2000</td>
<td>200 adults</td>
<td>Employees of company</td>
<td>NA</td>
<td>Fruit, vegetable, fiber screener, Block food frequency questionnaire, and Healthy Eating Index</td>
<td>$r &gt; 0.60$</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: NA; validity: good</td>
</tr>
<tr>
<td>Gans et al,100 1993</td>
<td>102 adults (age: 18–64 y)</td>
<td>Cross-sectional biennial household interview surveys in Pawtucket, Rhode Island, and comparison city</td>
<td>NA</td>
<td>Rate Your Plate and Willett questionnaire</td>
<td>$r = 0.28$ to $−0.48$ ($P = .004-0.001$)</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: NA; validity: good</td>
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<tr>
<td>Prochaska and Sallis,101 2004</td>
<td>138 middle school students (mean age: 12.1 y); 65% female, 28% white, 23% Asian, 7% black, 5% Hispanic, 2% multiracial, and 13% other</td>
<td>1 school</td>
<td>NA</td>
<td>Fruit and vegetable screening measure and 3-d food records</td>
<td>ICC $= 0.47$ (1 mo); ICC $= 0.80$ (same day); $k = 44%$ (1 mo); $k = 59%$ (same day); $r = 0.23$ ($P = 0.008$)</td>
<td>Feasibility: acceptable; acceptability: acceptable; reliability: good; validity: good</td>
</tr>
<tr>
<td>Weinstein et al,102 2004</td>
<td>16,467 adults (age: ≥17 y)</td>
<td>National Health and Nutrition Examination Survey</td>
<td>Age, race/ethnicity, gender, census region, poverty income ratio, pregnancy, BMI, energy intake, alcohol intake, smoking, vitamin or mineral, and energy intake</td>
<td>Healthy Eating Index, dietary intakes, and blood nutrient levels</td>
<td>Dietary intakes: $r = −0.03$ to 0.29; blood nutrients: $r = −0.005$ to 0.30 ($P = .05-.0001$)</td>
<td>Feasibility: NA; acceptability: NA; reliability: NA; validity: good</td>
</tr>
<tr>
<td>Kennedy et al,103 1995</td>
<td>7463 (age: ≥2 y)</td>
<td>Continuing Survey of Food Intake by Individuals</td>
<td>NA</td>
<td>Healthy Eating Index and 3-d dietary intake data</td>
<td>Dietary intakes: $r = 0.06$ to $0.42$</td>
<td>Feasibility: NA; acceptability: NA; reliability: NA; validity: acceptable</td>
</tr>
</tbody>
</table>

NA indicates not applicable; ICC indicates Intraclass correlation.
literature include the predominance of cross-sectional studies, rather than prospective longitudinal studies, small sample sizes, and limited study populations (particularly a dearth of studies with children). Therefore, results often are inconsistent, and the findings of many studies have not been replicated. Despite these limitations, studies that identify eating patterns that may contribute to excessive energy intake, and that propose targets for behavior changes are useful for clinicians who are helping their patients prevent excessive weight gain.

**Restaurant Food Consumption**

Consumption of foods away from home increased considerably in children and adults between 1977 and 1996. The proportion of foods that children consumed from restaurants and fast food outlets increased by nearly 300% during that 19-year period. Fast food consumption was reported by 42% of children and 37% of adults, although investigators noted that there is no uniform definition of fast food and definitions varied among studies. The percentage of energy obtained from food prepared away from home also increased during that period, from 18% to 32%. Portion sizes in restaurants increased from 1970 to 1999 with the result that soft drinks contained an additional 206 kJ, hamburgers 407 kJ, and French fries 286 kJ.

Portion sizes influence energy intake. Diliberti et al found that customers who purchased a larger portion of the entree served at a fast food outlet increased their intake of the entree by 43% and that of the entire meal by 25%, resulting in greater energy intake. Some studies showed that children and adolescents who consumed fast food more frequently had higher energy intakes and poorer diet quality, compared with those who did not. Interestingly, overweight adolescents were less likely than their leaner counterparts to compensate for the increased energy in the food by adjusting energy intake throughout the day.

Studies have reported that the frequency of eating fast food is associated with BMI and body fatness in children and adults. In a longitudinal study of 101 girls 8 to 12 years of age, the frequency of eating quick-service food at baseline was associated positively with changes in BMI z scores at 11- and 19-year follow-up evaluations. In young adult women, increases in frequency of fast food restaurant use were associated with increases in body weight over 3 years in a randomized, prospective, intervention trial on weight gain. In the Coronary Artery Risk Development in Young Adults study of 3031 young adults, Pereira et al reported that changes in fast food frequency were associated with changes in body weight but the changes varied according to racial group. Data from another study suggested that older children who consumed fried foods away from home more frequently over a 1-year period were heavier and had greater total energy intake, compared with children with low frequency of fried food consumption away from home. In contrast, French et al reported that the frequency of fast food consumption by adolescents was not associated with overweight status. Although not entirely consistent, the data suggest that fast food consumption may be related to BMI. For individuals and families that eat regularly at restaurants or fast food establishments, reducing the frequency of these meals may be a strategy to decrease total energy intake.

**Sweetened Beverage Consumption**

 Experts have raised concerns about high intakes of sweetened beverages and their possible association with the increasing prevalence of overweight and obesity among children. Over the past 4 decades, national data on individuals ≥2 years of age showed an increase in sweetened beverage consumption for all age groups. Soft drink consumption accounts for one third of added sugar intake in the US diet. In one study of fourth-grade and fifth-grade children, sweetened beverages constituted 51% of the average daily intake of beverages consumed. This large intake of sweetened beverages could contribute to increased energy intake, tilting the energy balance toward excessive weight gain.

Most cross-sectional studies have shown a positive relationship between greater intake of added sugars and total energy intake. Energy intake has been reported to be related positively to consumption of sweetened beverages by children and adolescents. In another report, children who drank the most sweetened beverages consumed ~1390 kJ more per day than did those who did not drink sweetened beverages. The Bogalusa Heart Study examined energy intake among 10-year-old children from 1973 to 1994. Findings from the study showed that children who did not consume sweetened beverages did not have increased energy intake. However, energy intake did increase among children who consumed small to moderate to large amounts of sweetened beverages. Of interest, mean BMI increased in all categories of sweetened beverage consumption, including children who did not consume sweetened beverages.

Although several studies showed an association between sweetened beverage consumption and risk of obesity, other studies found no association, and a few indicated a negative relationship. In a pilot intervention study, Ebbeling et al showed that reducing sweetened beverage consumption reduced body weight in adolescents in the upper baseline BMI tertile. In their comprehensive review of studies that examined the relationship between sweetened beverages and adiposity, Bachman et al concluded that the association between sweetened beverages and overweight is unclear and that the evidence is inconsistent. In another review, however, the authors came to a completely different conclusion.

The strongest current evidence supports a positive...
association between sweetened beverage consumption and energy intake. These conclusions were similar to those made by the 2005 Dietary Guidelines Advisory Committee (DGAC). Decreasing sweetened beverage consumption may be one strategy to decrease total energy intake. More intervention studies are needed, particularly in children, for better understanding of the relationship between sweetened beverage consumption and weight gain. However, it may be concluded intuitively that, if an individual consumes excessive sweetened beverages, then the resulting increase in energy intake may lead to weight gain.

**Fruit Juice Consumption**

Recently, 100% fruit juice has received much attention as a potential culprit in the prevalence of obesity among young children. In 2001, the Committee on Nutrition of the American Academy of Pediatrics concluded that 100% fruit juice had no beneficial effect over whole fruit for infants >6 months of age and children. For a number of reasons, the recommendations included limiting 100% fruit juice to 4 to 6 oz/day for children 1 to 6 years of age and 8 to 12 oz for older children. The 2005 DGAC recommended that no more than one third of the total fruit group intake recommended come from fruit juice.

Limited data are available to assess the relationship between 100% fruit juice consumption and body weight in children. Two separate studies by Dennison et al showed that consumption of 100% fruit juice (>12 fl oz/day) and apple juice only was associated positively with BMI in samples of children 2 to 5 years of age. Tanasescu et al found that fruit juice and possibly fruit drinks were associated with overweight in 29 obese Puerto Rican children 7 to 10 years of age. In contrast, 6 longitudinal and cross-sectional studies reported either a negative or neutral association between 100% fruit juice intake and weight status in children. Overall, the current evidence shows only a weak association between 100% fruit juice consumption and excessive weight gain.

**Portion Sizes**

A number of short-term feeding studies, 1 longitudinal study, and 3 observational studies showed that portion sizes influence energy intake. Adults served large portion sizes consumed more food and more total energy than did individuals who were served smaller portion sizes; there was no evidence of meal-to-meal compensation for higher intakes.

Several well-controlled, laboratory-based studies showed that providing older children and adults with larger food portions could lead to significant increases in food and energy intakes, independent of the energy density of the food. This effect was demonstrated for snacks, delicatessen-style sandwiches, and entrees. The responses to the variations in portion sizes were not influenced by gender or BMI. Therefore, increases in portion sizes and energy density may lead to independent and additive increases in energy intake.

The responses of young children to portion sizes seemed to be similar to those of adults: presentation of larger portion sizes resulted in increased energy intake. One study found that larger portion sizes resulted in greater energy intakes for children 5 years of age but not for children 3 years of age. Another study by the same group found that, when children 3 to 5 years of age were presented with a large portion size of an entree, they consumed 25% more of that entree and their energy intake increased 15% for the whole meal, compared with children who were presented with an age-appropriate portion size. That study also reported that the children consumed 25% less of the entree when they were allowed to serve themselves than when the entree was served to them on individual plates.

Two cross-sectional studies of preschool-aged children, using national data, examined the relationships between portion sizes, energy intake, and body weight. Portion size alone accounted for 17% to 19% of the variance in energy intake, whereas body weight predicted only 4%. Body weight was related positively to energy intake and portion size but not the number of different foods or the number of eating occasions.

More studies with infants and children are needed to understand how larger portion sizes at a single feeding or meal affect total energy intake over a 24-hour period. There are no longitudinal studies with children showing an association between increased portion size and BMI. Data suggest, however, that reducing food portion sizes may be an effective strategy for decreasing energy intake, especially for energy-dense foods. For clinicians, however, determining the appropriateness of portion sizes presented to and consumed by a child is difficult, as is making specific recommendations for age-appropriate portion sizes.

**Energy-Dense Foods**

Energy density refers to the amount of energy in a given weight of food and depends on the content of fat, carbohydrate, protein, and water. Water has the greatest impact on energy density, because it adds weight without energy. The high-energy content of fat also influences the energy density of food. Fiber can decrease the energy density of foods.

In several feeding studies, ad libitum consumption of foods that were high in energy density resulted in significantly greater total energy intake, compared with foods that were low in energy density. Delayed satiety may be the reason why some individuals consumed large amounts of energy-dense foods.
A number of other laboratory studies indicated that energy density was associated with a reduction in energy intake. For example, eating low-density foods such as salad or soup as the first course of a meal reduced total energy intake, compared with eating a meal that consisted entirely of foods high in energy density. Rolls et al showed that adding air to test meals that had similar macronutrient compositions and energy contents reduced energy intake significantly, which suggests that the mass and volume of a meal are important. For foods that are low in energy density, satisfying portions should be encouraged, because they provide little energy and produce satiety.

Low-fat diets have been associated with lower energy intake, possibly because of a reduction in energy density. Laboratory studies showed that fat content, independent of energy density, had little influence on energy intake. Because lower-fat diets generally have lower energy density, reducing the intake of total fat may be one strategy for reducing energy intake.

What is the relationship between energy-dense foods and weight? Two clinical trials tested the influence of variations in energy density on body weight. In one study, adults who incorporated 2 servings of soup (which is low in energy density) into a calorie-restricted diet lost significantly more weight than did those who incorporated a similar number of calories as energy-dense snacks. In another study, investigators examined how 2 strategies to reduce energy density in the diet affected body weight during a 1-year period. One group was counseled to reduce fat intake and to limit portions. The other group was counseled to increase intake of water-rich foods and to choose reduced-fat foods. Both groups succeeded in lowering the energy density of their diets, and they lost significant amounts of weight and kept the weight off over the year. These studies provide promising results, but more long-term intervention studies are needed to understand whether diets with reduced energy density prevent weight gain, particularly in children. One cross-sectional study with children 10 years of age found that consumption of energy-dense foods was a predictor of being overweight. However, those results were not confirmed by others.

On the basis of the current studies, insufficient evidence exists to determine the contribution of energy-dense foods to weight gain; no studies of children are available. However, consuming energy-dense foods may contribute to excessive energy intake. The DGAC came to a similar conclusion in its report. Encouraging consumption of foods low in energy density, including those with high fiber and/or water contents and those with modest fat content, may be a useful strategy for individuals who are trying to lose weight or to maintain their current weight. Unfortunately, there is no standard calculation method for determination of energy density in foods. No published studies, particularly involving children, have examined the impact of consuming high-energy density foods on diet quality and intake of fat-soluble vitamins, essential fatty acids, and amino acids. One adult study showed that low energy density of diets was associated with high diet quality. Unfortunately, there were some concerns about the study and the definition of the energy density categories. More studies are needed in this area of research, particularly involving children.

**Fruit and Vegetable Consumption**

The specific relationships between fruit and vegetable consumption, energy balance, and obesity prevention represent an emerging area of research. Fruits and vegetables are high in fiber and water content, and they may play a role in promoting satiety and decreasing total energy intake by displacing energy-dense foods. Despite long-standing recommendations to eat several servings of fruits and vegetables each day, intake among US children remains low.

Findings from observational studies are equivocal, with some studies showing an inverse association and others showing no relationship between fruit and vegetable consumption and a measure of body adiposity. The studies showing an inverse association, however, have not been consistent with respect to gender, ethnicity, age group, and type of fruit or vegetable. Two studies reported that fruit consumption was associated inversely with weight status in children, but a relationship with vegetable intake was not apparent. Several observational studies did not control for potential confounders (physical activity and, in some cases, dietary energy intake). The percentage of the variance in children’s BMI explained by fruit and fruit juice consumption was <3%.

The lack of association between vegetable consumption and weight status may be specific to the type of vegetable consumed. Some vegetables typically are consumed with fat added during preparation, such as fried potatoes. This may explain why the study by Lin and Morrison found a positive association between intake of potatoes and weight status among adults. Clearly, more studies are needed to better understand these inconsistencies in the findings across studies.

Numerous interventions have been designed to promote increased consumption of fruits and vegetables, but very few studied weight status or change in BMI as an outcome variable. Some interventions included multiple components, making the identification of an independent effect of fruit and vegetable consumption in the prevention of overweight or weight gain difficult.

A number of adult trials examined the effects of increased fruit and vegetable consumption on weight; those studies were reviewed by Rolls et al. The DGAC concluded that data from those studies showed...
that, without advice to lose weight, increased fruit and vegetable consumption by itself did not lead to weight loss.134

Intervention studies in children that examined fruit and vegetable consumption targeted mainly changes in intake and not effects on body weight. Encouragement to eat more fruits and vegetables often has been one of several messages aimed at modifying energy balance.218,219 However, efforts to increase knowledge and to improve attitudes toward fruit and vegetable consumption have had modest effects on actual consumption.220,221

In one randomized trial examining weight loss in children, Epstein et al221 reported that a message that targeted specifically increasing fruit and vegetable consumption resulted in greater weight loss than did an intervention message that focused on reducing high-fat and high-sugar food intakes. More studies with children are needed to understand the independent effect of increased fruit and vegetable consumption in randomized, controlled trials on prevention of weight gain. Encouraging greater fruit and vegetable consumption is a sound message in general, and limited evidence suggests that it may be a useful strategy in efforts to achieve and to sustain weight loss.

**Breakfast Consumption**

Several studies showed that skipping breakfast decreased the nutritional quality of the diets of children107,222–224 and adults.225–227 The average total energy intake was significantly lower for children who did not consume breakfast, and they did not make up the differences in energy intake at other meals.222 The energy content of school breakfasts has increased in the past 15 years.228

A few cross-sectional and longitudinal studies and one randomized, clinical trial have examined the association between breakfast consumption and BMI. A number of cross-sectional studies have shown a positive association between overweight and skipping breakfast among children216,229–232 and adults.233 However, other studies, particularly one with children,107 found no association.

Two longitudinal studies, one each with children and adults, have been reported. The first was conducted with >14 000 children 9 to 14 years of age.234 After a 1-year follow-up period, overweight children who never ate breakfast had a greater decline in BMI than did overweight children who ate breakfast. Normal-weight children who never ate breakfast, however, had weight gains comparable to those of normal-weight children who ate breakfast. The adult study found that skipping breakfast was associated with an increased prevalence of obesity.235 In a randomized, clinical trial,235 adults who ate no breakfast at baseline and who were assigned randomly to eat 3 meals per day lost slightly more weight by 12 weeks, compared with those who were assigned randomly to consume no breakfast and to eat 2 meals per day. However, of breakfast eaters at baseline, those who were assigned randomly to eat only 2 meals per day lost more weight than did those who continued to eat breakfast. The authors suggested that the effects might have been influenced by subjects having to make the most-substantial changes to their usual routine.235

Clearly, more studies are needed, because current evidence related to the effect of breakfast consumption and the content of the meal is inconclusive. Children should not be encouraged to skip breakfast. More importantly, skipping breakfast may result in poorer nutritional quality of the diet and may have adverse effects on performance in school.236–238

**Meal Frequency and Snacking**

Previous studies demonstrated an inverse association between meal frequency and the prevalence of obesity in children239,240 and adults.241,242 Four studies examined this association. Three found no association between the number of eating episodes and overweight in children 10 years of age.105,243 However, a cross-sectional study with 4370 German children 5 to 6 years of age found that the prevalence of obesity decreased according to the reported number of meals consumed each day.240 The prevalence of obesity was 4.2% among children who consumed ≤3 meals per day, compared with 1.7% among those who consumed ≥5 meals. Although some studies suggested that a “nibbling” or “grazing” meal pattern may be associated with leanness, those studies were vulnerable to methodologic errors that might have generated spurious relationships because of dietary underreporting and posthoc alterations in eating patterns in response to weight gain. Moreover, the association between increased eating frequency and lower body weight status might have been influenced by increased physical activity and a reduction in the mean energy consumed per eating episode. More longitudinal studies are needed to better understand the association, if any, between meal frequency and overweight in children.

On the basis of national data, the prevalence of snacking has increased for individuals 2 to 18 years of age,244,245 although the average size of snacks and energy per snack have remained relatively constant.246 There has been a shift from meals to snacks in the past 20 years.228 In contrast, one study showed that snacking decreased among children 10 years of age from 1973 to 1994 in Bogalusa, Louisiana,247 although the prevalence of obesity increased. These conflicting findings may reflect differences in age groups studied, regions of the country, methodologic changes over time, or the definition of what constitutes a snack or a snacking occasion.

In adults, increased snacking resulted in increased energy intake but was not associated with BMI.246 Other studies showed that obese adults were more frequent snack-
ergs\textsuperscript{247,248} and total energy intake was higher for snackers\textsuperscript{248} than for reference adults. Two cross-sectional studies of children 10 years of age showed no association between snacking and overweight status.\textsuperscript{105,243} More longitudinal studies are needed to better understand the associations between snacking, total energy intake, and overweight in both children and adults. The data on meal frequency and snacking are inconclusive and therefore do not represent a priority area of inquiry for all patients.

**Summary**

A number of studies have been conducted with adults, but far fewer with children, that address the associations between specific eating patterns and weight status. Results are inconsistent, largely because of methodologic limitations and small sample sizes. More well-designed, longitudinal studies and randomized, controlled trials are needed before any definitive statements can be made regarding which eating patterns are associated most strongly with overweight and how age, gender, ethnicity, and geographic location affect these associations. Evidence supports an association between at least some of the eating patterns discussed in this report and increased energy intake for some individuals, and these patterns represent behaviors that can be targeted for change.

**Overall Recommendations for Dietary Assessment**

The assessment of dietary patterns among children and adolescents should address the following: (1) assessment of self-efficacy and readiness to change, (2) qualitative assessment of dietary patterns, and (3) working in conjunction with patients and families to identify dietary practices that are targets for change. The assessment writing group recommends the following. (1) Qualitative assessment of dietary patterns should be performed for all pediatric patients at each clinic visit, at a minimum, for anticipatory guidance. (2) Assessment should address dietary practices for which evidence supports a positive association with energy intake and behaviors for some individuals and that represent behaviors that can be targeted for change. By decreasing energy intake without increasing energy intake throughout the day or from other foods, changes in these behaviors may prevent excessive weight gain. These behaviors include the frequency of eating outside the home at restaurants or fast food establishments, excessive consumption of sweetened beverages, and consumption of excessive portion sizes for age.

The assessment writing group also suggests assessment of additional dietary practices that have a weaker evidence base for association with energy intake but may be important for some individuals and that represent behaviors that can be targeted for change. The writing group suggests consideration of (1) excessive consumption of 100% fruit juice, (2) breakfast consumption (frequency and quality), (3) excessive consumption of foods that are high in energy density, (4) low consumption of fruits and vegetables, and (5) meal frequency and snacking patterns (including quality). The child version of the WAVE assessment tool (Table 1), which provides a means for quick assessment of both diet and activity, may be useful to clinicians in primary care settings.

**Physical Activity Assessment**

**Levels of Physical Activity**

Physical activity is an important component of health and well-being for people of all ages. Children who are physically active may gain immediate and long-term positive effects, such as improved mental health status and self-esteem; increased physical fitness, which enhances performance of daily activities; promotion of bone formation; weight maintenance; and prevention of cardiovascular risk factors.\textsuperscript{76,249} In addition, physical activity patterns established during childhood may continue into adulthood, establishing healthier choices over the entire lifespan.\textsuperscript{250,251} Health benefits for physically active adults include lower risks of coronary artery disease, T2DM, hypertension, hyperlipidemia, osteoporosis, certain cancers, and depressive symptoms.\textsuperscript{76,252,253}

Despite these benefits, results from the 2003 Youth Risk Behavior Surveillance Study and the 2002 Youth Media Campaign Longitudinal Survey showed that many children and adolescents do not meet recommended physical activity levels.\textsuperscript{234,235} Nationwide, 62.6% of students in the ninth through 12th grades met the recommendations for vigorous physical activity (≥20 minutes on ≥3 of the past 7 days), and 24.7% of students nationwide met recommendations for moderate physical activity (≥30 minutes on ≥5 of the past 7 days). Overall, ~33% of this group of students reported some but insufficient levels of physical activity, and 11.5% reported no moderate or vigorous physical activity.\textsuperscript{235} In addition, 38.2% reported watching ≥3 hours of television per day, on average. Twenty-three percent of younger children (9–12 years of age) had not engaged in any free-time physical activity outside of school in the past 7 days, and 61.5% had not participated in organized physical activity during nonschool hours.\textsuperscript{234} Higher levels of physical activity were reported by boys than by girls and by non-Hispanic white youths than by other racial and ethnic groups. Levels of physical activity also decline as children get older. It is estimated that physical activity levels decrease by 1.8% to 2.7% per year for boys 10 to 17 years of age and by 2.6% to 7.4% per year for girls 10 to 17 years of age.\textsuperscript{77}

Diet and physical activity are inextricably linked. Overweight and obesity result when daily energy intake is greater than daily energy expenditure over time. This concept of energy balance is crucial for successful assessment, prevention, and management of overweight and
obesity in childhood and adolescence. Energy intake is a relatively easy concept, because it includes all foods and beverages consumed during the day. Energy expenditure is more complex, because it is a combination of resting metabolic rate, the thermic effects of food, and the variety of activities the individual performs during the day. Therefore, measurement of physical activity is not equivalent to measurement of total energy expenditure; rather, physical activity is one (albeit the most variable and modifiable) element of total energy expenditure. For children and adolescents, a certain amount of positive energy balance is necessary for proper growth and development. The overall energy balance should tip in favor of slightly greater energy intake, relative to expenditure, although the percentage of total energy required for growth is small after infancy.

Clarification of several terms is necessary to understand what is being measured when physical activity is being discussed. Physical activity is defined as any bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above the basal level. Physical activity thus encompasses movement resulting from free play, structured activities such as sports, and general activities of daily living. Exercise is planned, structured, and repetitive bodily movement performed specifically to improve or to maintain physical fitness. Children and adolescents often participate in planned activities during physical education classes or in structured sports activities; however, the goal is not necessarily physical fitness. Physical fitness is a set of attributes that people have or achieve, such as cardiorespiratory fitness, muscular strength, flexibility, endurance, and body composition. This report focuses on the assessment of physical activity for the purpose of preventing or managing overweight and obesity in childhood and adolescence. Total energy expenditure, exercise, and fitness are beyond the scope of this report.

Assessment Methods

Appropriate assessment of physical activity patterns requires valid (accurate) and reliable (reproducible) instruments. Researchers have developed several approaches for measuring physical activity in children and adolescents, and most are reasonably reliable, with low to moderate validity. Briefly, these include questionnaires (self-report or interviewer-administered), direct observation, and electronic or mechanical monitoring (with a pedometer, accelerometer, or heart rate monitor). Methods such as double-labeled water testing and calorimetry assess total energy expenditure and resting metabolic rate, respectively, and can be used to estimate physical activity. Each method has strengths and weaknesses, which are described elsewhere. This report discusses the methods most adaptable to the clinic setting, that is, brief questionnaires and accelerometers or pedometers.

Questionnaires

The most common method for measuring physical activity is a self-report survey or checklist of the frequency, intensity, and duration of specific activities within a defined period (eg, past 24 hours, 1 week, or 1 month). Recurring problems with any self-report survey include recall bias and the documented tendency to overestimate activity levels, compared with observation, movement monitoring, or estimations from total energy expenditure. Depending on the goals of the questionnaire, this limitation may be tolerable. It is also a challenge to determine the lower age limit at which children can recall accurately what they did, as well as the intensity and duration of their physical activity. In general, children <10 years of age are considered too young to give reliable answers to physical activity questions. Parents should be used for proxy responses; however, they do not always capture accurately the physical activity levels for their children, either at home or in other settings.

An additional challenge is the sporadic unstructured nature of physical activity among children, especially those <10 years of age. Unlike adolescents and adults, who can sustain 10 to 60 minutes or more of physical activity, young children typically have multiple frequent bursts of activity followed by periods of rest. Questions that aim to assess 30 minutes of moderate-intensity activity or 20 minutes of vigorous-intensity activity are not realistic for children; alternate assessment questions would be more appropriate. For example, proxy measures such as time spent outside or involvement in community sports programs have been shown to be predictive of physical activity in children.

A review of the literature reveals that very few questionnaires have been developed and validated for pediatric age groups. Most focus on adolescents, are quite lengthy, and have not been assessed for use in the clinic setting. Examples include written, verbal, and computer-based questionnaires. More-detailed information about these research questionnaires can be found elsewhere. A few questionnaires with the potential for clinic use have been designed and are discussed in Table 3.

Accelerometers and Pedometers

Most accelerometers measure quantity, duration, and intensity in the vertical plane. Newer products measure movement in 3 planes. Accelerometers are relatively easy to use, but they are more expensive than pedometers, and some require frequent downloading of information into a computer. Resource limitations and inconvenience will likely preclude their routine use in clinical settings for assessment of baseline physical activity levels.

Pedometers are easier to use and measure physical activity as steps walked, distance walked, or energy expended. Several studies have shown the reliability (correlation range: 0.51–0.92) and validity (correlation...
<table>
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<tr>
<th>Authors and Year</th>
<th>Study Design Measures</th>
<th>Results and Conclusions</th>
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<tbody>
<tr>
<td>Burdette et al, 2004</td>
<td>Cross-sectional study; (1) outdoor time checklist (average daily score) (2) questions using parental report for preschool-aged children, (2) outdoor time recall questions (average daily minutes), (2) questions using parental report for preschool-aged children, and (3) television or videotape viewing time (average daily minutes) (2) questions using parental report for preschool-aged children</td>
<td>Acceptability: NA; feasibility: tools like this approximate physical activity in preschool-aged children and may be easy to use in clinic setting; reliability: checklist (tool 1) compared with recall (tool 2), r = 0.57 (P &lt; .001); validity (comparison with accelerometer): checklist (tool 1), r = 0.33 (P &lt; .001); recall (tool 2), r = 0.20 (P = .003); minutes of television/ videotapes (tool 3), r = −.16 (P = .2)</td>
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<tr>
<td>Jimmy and Martin, 2005</td>
<td>Randomized, controlled trial; (1) Revised Physical Activity Readiness Questionnaire (waiting room written assessment identifying contraindications for physical activity), (2) stages of change (waiting room assessment with 2 written questions identifying in-active adolescents and adults and their intention to become more active), (3) acceptability (in-person interviews with providers and patients), and (4) modified 7-d physical activity recall questionnaire (telephone assessment 7 wk and 14 mo after intervention)</td>
<td>Acceptability: providers generally acceptable for patients ≥ 15 y of age (needed 2–10 min to review written answers to questions, discuss issue, and recommend counseling); patients: perceived as good and useful; office support staff members and counselors: NA; feasibility: general clinic workflow was reported as feasible; reliability: NA; validity: NA</td>
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<td>Koo and Rohan, 1999</td>
<td>Retrospective cohort study; (1) perspiration score (1 question assessing times of physical activity that caused heavy perspiration per week in past year), (2) stairs score (1 question assessing flights of stairs per day over past year), (3) Godin–Shephard score (1 question assessing weekly average of ≥15 min of strenuous, moderate, or mild exercise in past year), and (4) specific activity score (11 questions assessing the average time per week in 11 sports activities over past year)</td>
<td>Acceptability: NA; feasibility: authors suggest tools 1, 3, and 4 may be simple and practical physical activity measures for 7–15-y-old youths; reliability (reproducibility of repeat testing with same measure 11 mo apart): perspiration score (tool 1), r = 0.44; stairs score (tool 2), r = 0.59; Godin–Shephard score (tool 3), r = 0.48; specific activity score (tool 4), r = 0.53; validity: NA</td>
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<tr>
<td>Ortega-Sanchez et al, 2004</td>
<td>Randomized, controlled trial; (1) 13 physical activity assessment questions verbally asked by physician during medical visit, allowing for calculation of frequency (days per week), duration (minutes per week), and intensity (mild, moderate, or vigorous) of school physical education, organized sports, and leisure time physical activity; categories of physical activity are: (a) active (met MPA or VPA recommendations at baseline), (b) partially active (active but does not meet physical activity recommendations), and (c) inactive; and (2) same questions administered at clinic visit or in telephone assessment at 6 and 12 mo</td>
<td>Acceptability: NA; feasibility: reliability (comparison of resting heart rate between patients in active and inactive physical activity categories): significant t score for 12–21-y-old boys; not significant for 12–21-y-old girls</td>
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<tr>
<td>Prochaska et al, 2001</td>
<td>Randomized, control trial; (1) brief self-report of physical activity that measures days per week of MPA and VPA consistent with various behavior change methods, using previously validated questions (performed interactively on computer in waiting room), (2) assessment of disordered eating; (3) same questions in telephone assessment at 4 mo; (4) acceptability (patient and parent satisfaction at 1 wk and at 4 mo), and (5) feasibility (no measure)</td>
<td>Acceptability: generally high satisfaction (range: 3.31–3.84 of 5); feasibility: general conclusion that approach seems feasible for 11–18-y-old youths if computers can be made available; reliability (reproducibility of repeat testing of same measure 1 wk apart): days per week of ≥20 min of VPA, r = 0.67 (P = .02); days per week of ≥30 min of MPA, r = 0.55 (P = .16); validity (comparison with accelerometer): days per week of ≥20 min of VPA, r = 0.31 (P = .02); days per week of ≥30 min of MPA, r = 0.20 (P = .16)</td>
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<tr>
<td>Prochaska et al, 2001</td>
<td>Cross-sectional/convenience sample; (1) study 1: total of 9 measures using Youth Risk Behavior Surveillance modified physical activity assessment questions, including (a) days in past week, days in typical week, and composite measure of ≥20 min of VPA, (b) days in past week, days in typical week, and composite measure of ≥30 min of MPA, and (c) days in past week, days in typical week, and composite measure of ≥60 min of MPA; (2) study 2 (subset of subjects from study 1 who also wore accelerometers), including (a) same 9 measures from study 1 and (b) average minutes of MPA and VPA per day on accelerometer; (3) study 3: (a) days per week, days in typical week, and composite measure of ≥60 min of MPA and VPA combined and (b) average minutes of MPA and VPA per day on accelerometer</td>
<td>Acceptability: NA; feasibility: authors recommend composite measure of days per week of accumulated 60 min of MPA and VPA from study 3 for clinical assessment of physical activity among adolescents in middle or high school (brief, easy to score, most reliable, and greatest validity); reliability (reproducibility of repeat testing of same measure): study 1: VPA, r = 0.66–0.76; MPA, 30 min, r = 0.55–0.71; MPA, 60 min, r = 0.65–0.79; study 3: r = 0.76 (range of 0.53 for 1-mo retest to 0.88 for same-day retest); validity (comparison with accelerometer): study 2: VPA, r = 0.31–0.37 (P &lt; .05); MPA, 30 min, r = 0.20–0.26 (P &gt; .05); MPA, 60 min, r = 0.37–0.46 (P &lt; .01); study 3: r = 0.40 (P &lt; .001)</td>
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<td>Souroudi et al, 2004</td>
<td>Cross-sectional/convenience sample; quick WAVE screener developed to be used in primary care settings (1 page, 17 total items, 3 items to assess sedentary behavior and physical activity; one version for children and one version for adolescents), Adapted from Youth Risk Behavior Surveillance and Paffenbarger physical activity questionnaire; dialogue guide available, based on behavior change theories such as motivational interviewing and stages of change</td>
<td>Acceptability: providers: patients generally were comfortable taking the screener assessment; feasibility: potentially feasible (takes 5–10 min during clinic visit); reliability: NA; validity: NA</td>
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MPA indicates moderate physical activity; VPA, vigorous physical activity; NA, not applicable.
range: 0.49–0.93) of pedometer use for children and adolescents. Two studies found that, on average, children 8 to 10 years of age take between 12,000 and 16,000 steps per day. Jago et al determined that taking 4000 steps in 30 minutes and taking 8000 steps in 60 minutes (fast walking) meet current US physical activity recommendations.

Pedometers could be used at home to assess baseline physical activity levels for children and adolescents, and specific activities could be recorded in conjunction with times the monitor is worn. For example, a clinic visit with BMI screening may prompt a physical activity assessment and counseling on the basis of overweight or obese status. The patient can be instructed to wear a pedometer daily for 1 week, to record specific physical activities in a diary, and to determine a baseline average number of daily steps (with the assistance of a parent, if necessary). Results can be used as a proxy for overall physical activity and compared with documentation in the activity diary. Discussion at a follow-up visit with a designated clinic staff member can determine necessary modifications and can address any barriers to increasing physical activity levels. No studies have assessed the feasibility, reliability, and validity of using pedometers for baseline assessment in this way. For a list of available pedometers, see the report by Bjornson (and www.pedometers.com).

Behavior Changes
Approaches such as readiness to change, motivational interviewing, and the 5As (see above) emphasize the assessment of psychological readiness, so that providers can more effectively help their patients increase physical activity levels. Pediatric health care professionals can assess briefly the self-efficacy and readiness to change of patients and their families by asking the following 2 questions. (1) How important is it to become more physically active? (2) How confident do you feel in your ability to become more physically active? If time allows, health care professionals should assess specific activities their patients enjoy and consider within their capabilities and should tailor interventions and recommendations accordingly. Practitioners also can determine the readiness to change of patients and their families. This approach may allow greater acceptance of the plan of action/intervention by the patient and perhaps increase motivation and compliance.

Environment and Social Support
Patients of any age rarely, if ever, act or respond independently of their social and physical environments. Children and adolescents are influenced by home, school, and after-school environments, as well as by family and peer dynamics. Practitioners should assess barriers and facilitators in these settings, to determine the best way to increase physical activity levels of children and adolescents. Table 4 provides a list of items identified in the literature as important to address. Although practitioners may not have the time or ability to change everything on the list, knowing which unique barriers and facilitators for physical activity exist should allow more effective messages and interventions to be tailored for each patient.

Current Levels of Physical Activity and Sedentary Behavior
Physical activity research has centered on measuring the type, frequency, intensity, and duration of physical activity. The consensus of recommendations from a variety of government and professional organizations is that children and adolescents should accumulate 60 minutes of at least moderate physical activity on a daily basis. This total duration does not have to be consecutive, and briefer bouts can be added up for a total of 60 minutes.

Age is an important consideration for assessment of physical activity in children and adolescents. Adolescents have physical activity patterns similar to those of adults, which can be assessed by using the moderate/vigorous physical activity framework that is widely used with the adult population. Self-reporting is reasonable with this age group, with the acknowledgment that self-report options likely overestimate the amount of physical activity performed. Children <10 years of age should not be relied on for self-reporting of physical activity; parental responses should be used instead. Questions should be centered on time in organized sports programs or outdoor unstructured play, to account for the sporadic and unsustained nature of physical activity among children.

Research also has stressed the importance of balancing sedentary behaviors, such as television/DVD/ videotape watching and computer games (“screen time”), and less-active hobbies with physical activity. Time spent in sedentary behaviors, especially television viewing, should be reduced, and preliminary research results suggest limiting screen time to <2 hours/day. Television viewing is the only sedentary behavior that has been associated with an increase in BMI, and 2 studies have shown that

<table>
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<th>Table 4: Social and Environmental Barriers to and Facilitators of Physical Activity in Children and Adolescents</th>
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<tr>
<td><strong>Home</strong></td>
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<tr>
<td>Television in bedroom (6, 274)</td>
</tr>
<tr>
<td>Family physical activity routines (7, 82, 91, 275)</td>
</tr>
<tr>
<td>Willingness of family members to be active with patient (75)</td>
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<tr>
<td>Encouragement from parents (6, 79)</td>
</tr>
<tr>
<td>Options and access for free play and organized sports (76, 77, 282)</td>
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<tr>
<td><strong>School</strong></td>
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<tr>
<td>Physical education classes and recess (72)</td>
</tr>
<tr>
<td>Affordability/socioeconomic status (76, 77, 282)</td>
</tr>
<tr>
<td>Safety (76, 77, 282)</td>
</tr>
<tr>
<td>Discretionary activity (eg, walking or biking to school, taking stairs, and running errands) (72)</td>
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altering this behavior can affect weight gain.\textsuperscript{286,287} Interestingly, only weak associations between television viewing time and decreased levels of physical activity have been documented.\textsuperscript{285,288,289} Epstein et al\textsuperscript{290} reported that children do value various sedentary behaviors and may work to substitute physical activity with sedentary behavior. More research is needed to assess accurately the balance of sedentary behavior with physical activity and the associated outcomes.

To provide the most-effective weight maintenance and management interventions for children and adolescents, practitioners need to assess baseline levels of physical activity and sedentary behaviors and to determine whether each patient is likely to be meeting recommended levels. It may be prudent to assess parents’ baseline levels briefly, to illuminate family physical activity patterns and routines during leisure time at home and on weekends. Fulkerson et al\textsuperscript{75} found that parents being physically active with their children may be more important than simply giving verbal encouragement. Practitioners should ask about and record physical activity patterns at each visit, to determine patterns over time. Table 5 provides a list of commonly cited categories that practitioners could ask about routinely and document for their pediatric patients. These categories are suggested on the basis of both the research literature and the ability to target these behaviors for change.

### Available Tools for Measuring Physical Activity Among Children and Adolescents in Clinical Settings

The nature of the clinician-patient interaction is based on sharing information verbally. The patient and/or family, with direction from the physician, communicates pertinent health, wellness, and illness information. The clinician incorporates that information with physical examination findings to determine health status and to establish other required steps, such as prevention interventions and laboratory or radiologic tests. Therefore, use of a brief, 5- to 10-minute, age-appropriate, self-report assessment and intervention tool seems the most logical and practical approach. Ideally, this tool would assess the 2 components of energy balance (dietary intake and physical activity) at the same time.

This report is not intended to develop a reliable and validated assessment tool to be used in the clinic setting. Rather, it draws attention to those tools that are most ready to use now and it highlights gaps in the research that, when filled, could lead to improved assessment of physical activity and sedentary behavior in children and adolescents.

In the clinic setting, comprehensive assessment usually is not the goal; the challenge is to develop a brief assessment tool that captures the usual amount of physical activity and sedentary behaviors the patient performs over time. A systematic review of the literature shows that few clinic-based questionnaires have been developed and validated for children and adolescents.

Six have been documented in the literature,\textsuperscript{92,96,98,263,266,267} and all except one\textsuperscript{96} are directed toward adolescent assessment. One additional research study tool for preschool-aged children may be adaptable to the clinic\textsuperscript{264} (Table 3).

Four criteria were used to determine the quality of the physical assessment tool used in these 7 studies, that is, acceptability, feasibility, reliability, and validity. For the purpose of these recommendations, these terms were defined as follows: (1) acceptability is the degree to which which providers and patients are comfortable with the duration, wording, and other intangibles of the questionnaire; (2) feasibility is the degree to which implementation of the questionnaire is affordable and fits easily into the office environment and workflow; (3) reliability is the ability of the questionnaire to produce the same results when administered at different times or by different practitioners to the same patient (ie, reproducibility); and (4) validity is the ability of the questionnaire to measure the correct frequency, duration, and intensity of physical activity for each patient (ie, accuracy).

As is evident in Table 3, none of the studies was designed to assess all 4 criteria, and no single tool stands out as the most effective for use in the clinic setting. The WAVE tool for older children and adolescents, also described in the dietary assessment section, is feasible and acceptable from the provider perspective, and it focuses on the concept of energy balance in its assessment of weight, physical activity, variety of diet, and excess. Unfortunately, there are no reliability and validity studies to support its immediate use in the clinic setting. The Patient-Centered Assessment and Counseling for Exercise brief questionnaire for adolescents is a feasible, reliable, valid, brief physical activity questionnaire that has yet to be applied in the clinic setting. The longer Patient-Centered Assessment and Counseling for Exercise computer-based physical activity and nutrition questionnaire is acceptable, reliable, and valid for use in clinics that have computers available.\textsuperscript{267} However, its feasibility and acceptability for all patients and practices need to be examined more closely. The tool described by Burdette et al\textsuperscript{264} is the only brief and valid approach to be used for children <10 years of age; however, it has not been applied in the clinic setting.

### TABLE 5 Physical Activity and Sedentary Behaviors to Explore With Patients

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours of television watched and/or screen time daily and/or weekly (&lt;2 h/d)\textsuperscript{5,9,9,25,26,285}</td>
<td></td>
</tr>
<tr>
<td>Type, frequency, duration, and intensity of physical activity daily and/or weekly\textsuperscript{25,9,266}</td>
<td></td>
</tr>
<tr>
<td>Time spent in organized physical activity, unstructured activity/play/ time outside, and routine activity (eg, walking to school)\textsuperscript{25,8,1,3,41}</td>
<td></td>
</tr>
<tr>
<td>Time spent in sedentary activity\textsuperscript{203}</td>
<td></td>
</tr>
</tbody>
</table>
Overall Recommendations for Physical Activity Assessment

Four general categories to be addressed in the assessment of physical activity among children and adolescents have been identified, as follows: (1) self-efficacy and readiness to change, (2) environment and social support, (3) level of physical activity, and (4) level of sedentary behavior. The assessment writing group recommends the following. (1) Assessment of physical activity levels should be performed for all pediatric patients at least at each well-child visit for anticipatory guidance, to determine whether they are meeting recommendations of 60 minutes of at least moderate physical activity per day. (2) Assessment of sedentary behaviors such as watching television and/or DVDs, playing video games, and using the computer should be performed at each well-child visit, in comparison with a suggested baseline of <2 hours/day.

The assessment writing group also suggests the following. (1) Assessment of social and environmental barriers and facilitators for physical activity should be performed at each visit at which physical activity levels and sedentary behaviors are assessed. Results should be used to discuss and to develop reasonable prevention and treatment interventions for patients not meeting recommended levels of physical activity. (2) Assessment of readiness to change and motivation to change should be performed at each visit at which physical activity and sedentary behaviors are assessed. The 2 questions (importance and confidence) established by Rollnick et al. represent a brief way to perform such an assessment. (3) Until additional research delineates a standardized approach, providers should use one of the tools in Table 2, rather than developing their own physical assessment tools. The WAVE tool shows the most promise, because it is based on reliable validated questionnaires; however, it has yet to be evaluated in the clinic setting.

Medications

Some classes of medications are particularly associated with weight gain, including conventional and atypical antipsychotic agents, selective serotonin reuptake inhibitors, tricyclic antidepressants, anticonvulsants/mood stabilizers, conventional mood stabilizers, prednisone, and oral contraceptives. The mechanisms of weight gain vary among the drug classes, and the responses vary among individuals. Clinicians should thus recognize the potential for a variety of medications to act as confounding factors in excessive weight gain and in efforts to lose weight.

Family History

Risk Assessment

Clinical risk assessment is important to help gauge the likelihood of adverse medical consequences (current and future) from a child’s weight status. Although persistence of overweight status generally is less likely for younger children, the risk of persistence for an individual child is influenced strongly by parental weight status. Similarly, an overweight child’s risk for comorbidities is influenced by genetic factors and may influence the intensity of interventions (eg, those aiming for prevention of additional weight gain, compared with those aiming for actual weight loss). The family history is an important aspect of risk assessment, along with other clinical and especially anthropometric and biochemical data. The 3 conditions recommended for family history evaluation (among first- and second-degree relatives) for all children are obesity, T2DM, and CVD (including hyperlipidemia and hypertension).

Susceptibility to Obesity

For the vast majority of individuals, weight status is attributable to interactions of multiple genetic and environmental factors, resulting ultimately in positive energy balance. As discussed by Barsh et al., susceptibility to obesity is determined largely by genetic factors but the environment determines the phenotypic expression. A corollary is that, for different genotypes, the impact of environmental factors differs. Testing for specific genotypes currently is quite limited but, as more-refined testing becomes available, such assessments may help guide therapy.

From a practical standpoint, the clinician is faced with assessing an individual child’s risk of persistence of overweight. Relevant in this context is a retrospective analysis of a large group of records for newborns monitored through 21 years of age, along with their parents’ medical charts, in a health maintenance organization. The weight status of a child’s parents was associated strongly with the child’s risk of persistence of overweight. At all ages, the risk of adult obesity was greater if one or both parents were obese. This applied especially to both obese and nonobese children <10 years of age. In that study, the “obese” categorization applied to BMI of ~85th percentile for age, whereas the “very obese” categorization applied to BMI of ~95th percentile. The very obese children with at least one obese parent were at highest risk for adult obesity. In early childhood (1–3 years of age), parental weight status was found to be a stronger predictor than the child’s actual weight status. After 3 years of age, both child and parental weight status predicted adult obesity; as the child aged (≥6 years of age), his or her own weight status became the more important predictor. For children who were obese at any age, parental obesity was more important than either severity or duration of the child’s obesity.

Results of a cross-sectional study of school-aged children in Italy supported the strong impact of parental weight status. Maternal and paternal BMI influenced the child’s BMI independently and significantly, even when multiple other factors, including lifestyle, parental education, and parental history of diabetes and/or hyperten-
sion, were considered. A prospective longitudinal study of growth from birth to 6 years of age in children born to either lean or obese mothers confirmed the influence of parental weight on the weight of young children. By 6 years of age, nearly one third of the children born to obese women had BMI of >85th percentile for age, compared with <3% of those born to lean women (odds ratio: 15.7). There were no differences in growth between the low-risk and high-risk groups during the first 2 years of life, whereas weight and lean body mass were higher in the high-risk group by 4 years of age and fat mass was significantly greater by 6 years of age. The limitations of that study, which were partially offset by the longitudinal design, included the relatively small sample size (~35 subjects per group), inclusion of only white subjects, and limited information (beyond income) on educational and behavioral characteristics of the parents or the subjects’ environment.

Genetic influences have been estimated to explain up to 70% of interindividual differences in BMI. Furthermore, heritability is estimated to account for 30% to 40% of such interrelated factors as adipose tissue distribution, physical activity, energy expenditure, eating behaviors, hunger and satiety, food preferences, lipoprotein lipase activity, lipid synthesis, and lipolysis. Ravussin and Bogardus estimated that ≥40% of the variability in BMI is related to genetic factors involved in the regulation of food intake and/or volitional activity. These findings do not explain the cause of an individual’s weight status but highlight the complexity of potential influences.

Despite the recognized important genetic role in obesity, the multigenic nature of the condition is also abundantly clear. Single-gene disorders that result in severe obesity (eg, Prader-Willi, Bardet-Biedl, Alstrom, and Cohen syndromes) are relatively rare. As the study of obesity through molecular genetic methods expands inevitably, greater insight into these monogenic forms of obesity is likely to be forthcoming and, following from that, better understanding for assessment and treatment of larger subgroups of the obese population may result. Several reviews of this topic are available.

**T2DM**

The genetic component of T2DM is quite strong, and a positive family history has been found to be an independent predictor or risk factor for insulin resistance in children of several ethnic/racial backgrounds. The prevalence of T2DM is especially high in children of non-European ancestry, including Hispanic, black, and North American and Pima Indian children. The prevalence of insulin resistance also varies considerably among different racial/ethnic groups. White European children had a much lower prevalence than did those of South Asian ancestry, with the latter having a risk ratio of 13.7, compared with white children. A positive family history explained 29% to 88% of the variability. Hemoglobin A1c data for individuals 5 to 24 years of age from National Health and Nutrition Examination Survey III identified 3 factors associated with higher hemoglobin A1c levels in young adolescents of all ethnic/racial groups: positive family history of T2DM, overweight status, and lower socioeconomic status.

In a series examining insulin resistance and metabolic syndrome in US Latino children 8 to 13 years of age, ~90% of the children who had a positive family history of T2DM and who were overweight had ≥1 feature of metabolic syndrome. In a T2DM surveillance study involving Japanese children, 56.5% of the diabetic children had a positive family history in either first- or second-degree relatives.

**CVD (Hyperlipidemia and Hypertension)**

High BMI has been associated with a positive family history of CVD and with markers of CVD. In a series of patients from referral clinics, approximately one third of obese children, both with and without hypertension, were found to have a positive family history of CVD (defined as CVD, myocardial infarction, stroke, or recognized CVD risk factors, including obesity, hypertension, and diabetes). Conversely, a positive family history of CVD alone was shown in a number of studies to be a poor predictor of hyperlipidemia. Risk of T2DM, identified by family history and clinical screening, also is associated with risk of CVD, with both conditions reflecting effects of insulin resistance. Inquiries should address a history of early cardiac arrest or stroke in first-degree relatives.

Both obesity and family history of hypertension seem to be independent risk factors for hypertension in children. On the basis of a retrospective analysis of medical charts from a clinical population referred for treatment of primary or secondary hypertension, Robinson et al found that BMI was greater in those with primary hypertension, compared with secondary hypertension. Family history of hypertension was associated with higher child BMI. Family history of hypertension also was associated significantly with primary hypertension independent of obesity in the child. In a case-control heritability analysis with a similar group of patients, 49% of patients with primary hypertension had parents with primary hypertension, whereas only 24% of patients with secondary hypertension had parents with hypertension. The heritability of primary hypertension was calculated to be 0.80, indicating that 80% of the variance in liability of primary hypertension is attributable to additive genetic factors. In an analysis of CVD risk factors among pediatric patients with hypertension, family history of hypertension was found for 61% and 72% of hypertensive children with and without obesity, respectively. A small study of normotensive adolescents with positive family history for hypertension reported proximal renal tubular dysfunction independent of BMI. In the same series, obese adolescents had higher
aldosterone levels, regardless of family history of hypertension, which was interpreted to indicate increased distal tubule sodium reabsorption in the obese subjects (ie, a different renal function profile, compared with the nonobese subjects). These results were interpreted as indicating independent effects of family history and obesity.

In summary, family history of obesity, especially in the parents, yields substantial risk for a child’s propensity for overweight. This relationship is strongest for children <6 years of age. Therefore, when a young child is found to have a high BMI, consideration of parental weight status provides an important determinant of risk for the persistence of overweight. Positive family history is an independent risk factor for insulin resistance in children of several ethnic/racial backgrounds, especially those of non-European ancestry, including Hispanic, black, and North American Indian children.

Overall Recommendation for Family History Assessment
It is strongly recommend that clinicians obtain a focused family history regarding obesity, T2DM, and CVD (particularly hypertension) in first-degree (parents) and second-degree (grandparents) relatives, to assess the risks of current or future comorbidities associated with a child’s overweight status.

Review of Systems for Weight-Related Problems
Approach to Assessment
Assessment of symptoms associated with recognized comorbidities is an important aspect of evaluating the risks associated with a child’s degree of overweight. The severity of overweight does not predict strictly the presence of associated health conditions, many of which are influenced by genetic predisposition and environmental factors. In addition, families may not recognize some of the symptoms, such as sleep disturbances, that are related to weight status. Therefore, such symptoms may not be acknowledged unless the clinician specifically asks about them. Table 6 provides a summary reference, and the following text elaborates on some of the most common conditions that the medical history may help to identify. Of note, insulin resistance and T2DM are relatively asymptomatic conditions, and diagnosis depends more on laboratory testing than on the review of systems.

Sleep Disorders
Disordered sleep may be one of the many contributors to excessive weight during childhood. Overweight individuals are at risk for more symptoms of sleep-disordered breathing, later sleep onset, shorter sleep time, and more-disrupted sleep, compared with those with normal weight. One of the categories of sleep-disordered breathing is obstructive sleep apnea syndrome, which is a disabling condition characterized by excessive daytime sleepiness, disruptive snoring, repeated episodes of upper airway obstruction during sleep, and nocturnal hypoxemia. Excessive weight is a risk factor for obstructive sleep apnea; between 13% and 33% of overweight children have obstructive sleep apnea, which is several times the prevalence in lean children. Differences in academic performance and depressive symptoms were in part attributable to short sleep times and daytime sleepiness.

Longitudinal studies have documented that shorter sleep times predict the later emergence of overweight. Sleep deprivation hampers attention, impulse control, and higher-level problem-solving, providing an indirect route through which dietary choices may be undermined. Sleepiness may contribute to more sedentary behaviors, although activity levels have not been found to mediate statistically the link between short sleep times and overweight. A cross-sectional study indicated that obese adolescents experienced less sleep than did nonobese adolescents (P < .01), and daytime physical activity diminished by 3% for every 1-hour increase in sleep disturbance.

Sleep debt may affect human hormonal mechanisms that affect metabolic and endocrine functions, including glucose metabolism and the release of serotonin and other neuropeptides that affect eating behavior. Serotonin has been implicated in both within-meal and postmeal satiety, with regard to the signals arising from food intake. Carbohydrate craving, which may be driven by the need for increased serotonin levels and subsequent feelings of well-being, has been implicated in obesity. Typically, serotonin levels are replenished during sleep.

Menstrual Irregularities
Many women with polycystic ovary syndrome are overweight or obese, but obesity itself is not considered to be etiologic in the development of the syndrome. Excess adiposity, however, can exacerbate associated reproductive and metabolic disorders. The syndrome can be diagnosed when other medical conditions that cause irregular menstrual cycles and androgen excess have been excluded and when ≥2 of the following are present: oligoovulation or anovulation (usually manifested as oligomenorrhea or amenorrhea), elevated levels of circulating androgens (hyperandrogenemia) or clinical manifestations of androgen excess (hyperandrogenism), and polycystic ovaries, as defined with ultrasonography.

Abdominal Pain
Vague recurrent abdominal pain may be an indicator of nonalcoholic fatty liver disease, the prevalence of which has been estimated to range from 10% to 20% in obese children and adolescents. Depending on the presence and character of other symptoms, abdominal pain can also be a clue to the presence of gastroesophageal reflux, gallstones, or constipation, all of which are not uncommon in obese children.
Potential for Harm Resulting From Screening

The potential for harm resulting from screening was examined because of the impact it may have on the willingness of practitioners to address overweight and obesity with their pediatric patients. There is no direct evidence of harm resulting from screening for childhood overweight and obesity. One study provided preliminary evidence that genetic susceptibility testing for obesity in undergraduate students may motivate healthier dietary behaviors. However, data also suggested that individuals may engage in less-healthy behaviors after receiving results that indicate an average risk for obesity.

Numerous studies have demonstrated the social and psychological consequences of obesity. Theoretically, these could be triggered and/or amplified with screening.
ing. The potential adverse effects related specifically to obesity screening include labeling and social stigmatization,195,328–330 low self-esteem,331–333 depressive feelings,334,335 negative body image,336 disordered eating or self-managed dieting,336–338 and negative effects resulting from parental concerns and attitudes.339 Available evidence, however, does not indicate that screening per se causes these potential harms. A recent evidence-based review by the US Preventive Services Task Force concluded that the evidence was insufficient to make conclusions about harms resulting from screening.340

**CLINICAL DATA: PHYSICAL EXAMINATION AND LABORATORY TESTING**

**Physical Examination**

Physical examination reflects the customary pediatric examination with a few extra foci. A summary of physical examination signs related to obesity or its comorbidities is provided in Table 7.

**Anthropometry**

Anthropometric features should be assessed. Height is to be measured in bare or stocking feet with a stadiometer, not a platform scale with a moveable rule on top. Children >2 years of age who are unable to stand erect but who are able to lie supine and fully extended should have recumbent length measured; 1.0 cm should be subtracted to approximate erect height before BMI is calculated. Measurement should be made in centimeters rather than inches, which encourages rounding errors (see www.cdc.gov/nchs). Weight is to be measured with a calibrated balance-beam scale in light clothing and bare feet or, if possible, in a gown (if it is to be worn during the upcoming physical examination). Expression in kilograms is preferred. BMI should be calculated as BMI = weight (in kilograms)/[height (in meters)]² or calculated with the use of an automated calculator (www.cdc.gov/nccdphp/dnha/bmi/calc-bmi.htm, or other sites noted above). Circular slide-rule BMI calculators are available and can be used to calculate BMI. These calculators do not indicate the BMI percentile for age.

Height, weight, and BMI for age are plotted on standard growth charts (available at www.cdc.gov/growthcharts) or from various industry sources. BMI should be calculated and plotted once per year for all children and adolescents.4 The growth velocity may also be determined and compared with standard charts; if growth velocity decreases, then the likelihood of endocrine disease increases, because non–endocrine disease-related obesity usually is associated with tall stature. Growth velocity charts can be obtained from growth hormone manufacturers. As a general rule, no child should grow <5 cm/y after 4 years of age and before puberty, although actual growth rates vary with age. The velocity and age of onset of increased weight velocity are of importance, because early inexorable weight gain is more consistent with a monogenic form of obesity, as noted above.

Waist circumference is now more-frequently invoked as an indicator of comorbidities of obesity, but it does not necessarily add more to the evaluation, compared with BMI, as reviewed above.70 Measurement is made horizontally at the level just above the right ileum (reference data are available at www.cdc.gov/growthcharts).

<table>
<thead>
<tr>
<th><strong>System or Condition Assessed</strong></th>
<th><strong>Assessment</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthropometric features</strong></td>
<td>Calculation of BMI (weight in kilograms and height in centimeters)</td>
</tr>
<tr>
<td><strong>Vital signs</strong></td>
<td>Pulse and blood pressure (use correct cuff size; often must be checked manually because of “white coat hypertension”)</td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>Body fat distribution and affect</td>
</tr>
<tr>
<td><strong>Skin</strong></td>
<td>Acanthosis nigricans, keratosis pilans, skin tags, intertrigo, excessive acne, hirsutism, or violaceous striae of Cushing syndrome</td>
</tr>
<tr>
<td><strong>Eyes</strong></td>
<td>Papilledema</td>
</tr>
<tr>
<td><strong>Throat</strong></td>
<td>Tonsillar size and abnormal breathing</td>
</tr>
<tr>
<td><strong>Neck</strong></td>
<td>Gait</td>
</tr>
<tr>
<td><strong>Chest</strong></td>
<td>Auscultation for rhythm and sounds (heart) and rhonchi, rales, and wheezes (lungs)</td>
</tr>
<tr>
<td><strong>Abdomen</strong></td>
<td>Palpation for liver size, right upper quadrant tenderness, and epigastric tenderness</td>
</tr>
<tr>
<td><strong>Secondary sexual characteristics</strong></td>
<td>Premature/abnormal appearance of pubic hair, breast development, testicular enlargement, acne or comedones, axillary odor, appearance of microphallus because penis is buried in fat, or gynecomastia</td>
</tr>
<tr>
<td><strong>Prader-Willi syndrome</strong></td>
<td>Short stature, acromia, characteristic facies, hypotonia, and developmental delay</td>
</tr>
<tr>
<td><strong>POMC mutation</strong></td>
<td>Red hair, pale skin, low blood pressure or rapid pulse, and corticotropin deficiency/adrenal insufficiency</td>
</tr>
<tr>
<td><strong>Albright hereditary osteodystrophy</strong></td>
<td>Developmental delay, short stature, and short fourth and fifth metacarpals</td>
</tr>
<tr>
<td><strong>Laurence-Moon or Bardet-Biedl syndrome</strong></td>
<td>Short stature, developmental delay, retinitis pigmentosum, and polydactyly</td>
</tr>
<tr>
<td><strong>MC4R mutation</strong></td>
<td>Tall stature and rapid growth</td>
</tr>
<tr>
<td><strong>Down syndrome</strong></td>
<td>Typical phenotypic features</td>
</tr>
</tbody>
</table>

**TABLE 7 Physical Examination in Primary Care Settings**
**Vital Signs**

Pulse should be measured in the standard pediatric manner. At <4 years of age, the heart rate is counted by listening to the heart at approximately the fourth intercostal space, at the midclavicular line, by using the bell device of a pediatric stethoscope. The heart rate should be recorded after the child rests for 4 minutes. At >4 years of age, the radial pulse is measured and compared with age-specific standards. Increased pulse rates in the resting state could be consistent with low fitness levels, whereas decreased pulse rates could be consistent with hypothyroidism. Blood pressure should be measured with a cuff large enough that 80% of the arm is covered by the bladder of the cuff. Very large cuffs are needed for obese youths. Blood pressure is interpreted according to age, gender, and height; reference tables are available. Because of “white coat hypertension” (which is defined as blood pressure in the 95th percentile in the physician’s office or clinic but normal values during daily life, as assessed with a 24-hour monitor), repeated measurement, after the subject rests for 10 to 15 minutes, often is necessary. Initial volatility of blood pressure is present for 10% to 15% of children and adolescents. Automatic measuring devices often are inaccurate, and careful manual evaluation may be indicated. Ambulatory 24-hour monitoring may be necessary if repeated measurements in a standard office situation are not less than 95th percentile. Masked hypertension also may be determined with this method.

**Head, Eyes, Ears, Nose, Throat**

Optic disks should be observed specifically for the papilledema or decreased venous pulsations of pseudotumor cerebri, particularly if there is a significant history of headache, particularly in the prepubertal population. The neck should be examined for goiter. Most acquired hypothyroidism is autoimmune in origin and is associated with a goiter. Hypothyroidism is not a cause of extreme obesity, however, especially in the absence of growth failure. The pharynx should be examined for enlarged tonsils, with observation for obstructed breathing.

**Skin**

The skin should be examined for acanthosis nigricans, in which hyperpigmented, hyperkeratotic, velvety plaques are found on the dorsal surface of the neck, in the axillae, in body folds, and over joints. The association of acanthosis nigricans with insulin resistance is weaker than thought previously and may be found more often in dark-skinned individuals than in white individuals. Acanthosis nigricans may be a valid indicator of insulin resistance and decreased plasma HDL cholesterol levels in Mexican American adolescents. Keratosis pilaris, or skin tags, are a strong sign of insulin resistance. Intertrigo and furunculosis may develop independently in skinfolds and increase pigmentation. The deep purple striae of Cushing syndrome, the “buffalo hump” at the back of the neck, and the ruddy complexion and round face of the condition should be assessed, as should xanthelasmas of dyslipidemias.

**Cardiopulmonary**

The heart should be auscultated for irregular rhythms or sounds and the lungs for pulmonary edema if heart failure is considered. Wheezes of asthma, often associated with or intensified by obesity, should be evaluated. Heart and lung sounds may be difficult to hear.

**Abdomen**

The abdomen should be examined for organomegaly, especially hepatomegaly of nonalcoholic liver disease. The abdomen may be difficult to palpate because of abdominal girth and excess adiposity.

**Secondary Sexual Development**

Signs of secondary sexual development should be assessed, including early appearance of pubic hair (<7 years for white girls, <6 years for black girls, or <9 years for boys is presently considered early), early onset of comedones, acne, or axillary odor and hair. Obesity often is associated with premature pubarche, which in turn may be an early marker for later polycystic ovary syndrome in girls. Early enlargement of the penis in boys (9 years) should be assessed; alternatively, the penis may be partially hidden by fat, which gives it the appearance of being too small when it is normal in size. Early appearance of breast tissue in girls (<7 years for white girls and <6 years for black girls) should be evaluated. This may be a difficult examination, because of adipose tissue that often covers glandular tissue. If the areolae are more pigmented or erectile, however, then there is likely an estrogen effect. Gynecomastia in boys may be false, because of adipose tissue causing the appearance of development or conversion of precursors to estrogen in the local adipose tissue. Hirsutism involving the body or face in girls or excessive acne should be noted as an indication of polycystic ovary disease.

**Extremities**

The lower extremities should be evaluated for limitations of motion or pain, including the hips (slipped capital femoral epiphyses), knees (Blount disease), and ankles. Slipped capital femoral epiphyses are indicated by a waddling gait or limited hip motion. Radiograph evaluation may be diagnostic for orthopedic conditions. The lower back should be evaluated through physical examination, as well as history of low back pain. If there is a history of severe trauma to the central nervous system or previous central nervous system surgery near the hypothalamus, then physical evaluation for neurologic signs
is more important, because of the possibility of hypothalamic damage and increased appetite.350

**Signs of Syndromes**
Signs of syndromes should be evaluated. Prader-Willi syndrome manifests as short stature, small hands and feet, almond-shaped eyes, round face, hypogonadism, and developmental delay.351 POMC mutation manifests as red hair and pale skin and is associated with adrenal insufficiency attributable to corticotropin deficiency.352 Pseudohypoparathyroidism, when manifesting as Albright hereditary osteodystrophy, is associated with round face, short fourth and fifth metacarpals, and developmental delay, and it may present with hypocalcemic syndromes.353 Individuals with Laurence-Moon or Bardet-Biedl syndromes have retinitis pigmentosa, polydactyly with short stature, elevated BMI, and developmental delay.354 MC4R mutation is associated with tall stature and rapid growth, with rapid bone age advancement.355 Mentation may be decreased in other syndromes associated with obesity, such as Down syndrome, Prader-Willi syndrome, and fragile X syndrome (with macroorchia on examination), among others. Hypotonia is also found. Many other syndromes are associated with obesity, and suspicion suggests that the patient be referred to a geneticist.

**Laboratory Assessments**
For laboratory and radiographic evaluations of childhood obesity, the degree of investigation depends on the BMI, physical and historical findings, and the presence of risk factors. Clinicians should also consider the likely impact on treatment strategies of the results obtained. If results are unlikely to alter treatment, then the value of the testing may be limited. Assessments recommended for primary care professionals (Table 8) and specialists, such as pediatric endocrinologists, geneticists, or pediatric gastroenterologists (Table 9), are indicated. Risk factors, as used below, include family history of obesity-related diseases, including hypertension, early cardiovascular deaths, and strokes, elevated blood pressure (in the patient), hyperlipidemia, and tobacco use.

### TABLE 8  Laboratory Assessments to be Considered in Primary Care Settings

<table>
<thead>
<tr>
<th>BMI</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;85th–94th percentile, with no risk factors</td>
<td>Fasting lipid levels</td>
</tr>
<tr>
<td>&gt;85th–94th percentile, with risk factors (eg, family history of obesity-related diseases, elevated blood pressure, elevated lipid levels, or tobacco use)</td>
<td>Fasting lipid levels, AST and ALT levels, and fasting glucose levels</td>
</tr>
<tr>
<td>≥95th percentile</td>
<td>Fasting lipid levels, AST and ALT levels, and fasting glucose levels</td>
</tr>
</tbody>
</table>

AST indicates aspartate aminotransferase; ALT, alanine aminotransferase.

### TABLE 9  Laboratory Assessments to Be Considered by Subspecialists

If cardiac disease is suspected
- Electrocardiography, assessing length of QTc interval and cardiac rhythm, and echocardiography; consider measurement of lipoprotein(a)
- 24-h ambulatory blood pressure monitoring

If blood pressure is elevated
- Ultrasoundography of liver and α1-antitrypsin, ceruloplasmin, antinuclear antibody, and hepatitis antibody measurements; liver biopsy if recommended by pediatric gastroenterologist

If nonalcoholic fatty liver disease is suspected
- Serum free thyroxine measurement or total thyroxine measurement with resin triiodothyronine uptake, serum thyroid-stimulating hormone measurement, and antithyroid peroxidase and antithyroglobulin antibody measurements

If diabetes is suspected
- Glucose tolerance test (measuring insulin levels as well as glucose over 3 h) and urinary microalbumin (first morning void) or microalbumin/creatinine ratio measurement

If sleep apnea is suspected
- Polysomnography; oxygen saturation measurement, and carbon dioxide measurement for carbon dioxide retention

If orthopedic disease is suspected
- Radiographs of hip, knee, and foot
- 24-h urinary free cortisol measurement or salivary cortisol measurement at bedtime or midnight

If Cushing syndrome is suspected
- Serum calcium and phosphate measurements

If Albright hereditary osteodystrophy is suspected
- Plasma 17-hydroxyprogesterone (basal or corticotropin-stimulated), plasma DHEAS (basal or corticotropin-stimulated), androstenedione, testosterone and free testosterone, and sensitive (third-generation) LH and FSH measurements

If hirsutism and oligomenorrhea is present
- Sensitive (third-generation) LH and FSH, sensitive testosterone (for boys) or estradiol (for girls), and DHEAS measurements

If precocious puberty is suspected
- Plasma LH and FSH, sensitive testosterone (for boys) or estradiol (for girls)

If specific syndromes are suspected
- MC4R evaluation, fluorescent in situ hybridization for Prader-Willi syndrome, or fragile X evaluation (high-resolution chromosomal analysis)

The results of these tests require detailed interpretation. LH indicates luteinizing hormone; FSH, follicle-stimulating hormone; DHEAS, dehydroepiandrosterone sulfate.

For BMI for age of 85th to 94th percentile with no risk factors, a fasting lipid profile should be obtained.53 The American Heart Association and the American Academy of Pediatrics recommend screening at 2 years of age if there is a family history of lipid abnormalities or if risk factors are present in the absence of a positive family history.282

For BMI for age of 85th to 94th percentile with risk factors, fasting lipid profiles, glucose tolerance testing, and thyroid-stimulating hormone measurement should be considered. If specific syndromes are suspected, evaluation with fluorescent in situ hybridization for Prader-Willi syndrome, or fragile X evaluation (high-resolution chromosomal analysis) should be considered.

For BMI for age of 95th percentile with no risk factors, a fasting lipid profile should be obtained.53
factors in the history or physical examination, serum chemistry determinations should be performed, in addition, at the time of the fasting lipid profile, including aspartate aminotransferase and alanine aminotransferase measurements for assessment of possible nonalcoholic fatty liver disease. If transaminase levels are normal, then measurements may be repeated every 2 years for obese children after 10 years of age. α-1-Antitrypsin, ceruloplasmin, antinuclear antibody, or hepatitis antibodies indicate other reasons for elevated liver enzyme levels. Ultrasonography of the liver is more sensitive in detecting nonalcoholic fatty liver disease but does not predict fibrosis. Liver biopsy is the standard method and provides more sensitivity if suggested and performed by a pediatric gastroenterologist. Glucose levels should be measured to determine diabetes mellitus (fasting level: >126 mg/dL; casual level: >200 mg/dL) or impaired glucose tolerance (fasting level: >100 mg/dL; casual level: >140 mg/dL). The American Academy of Pediatrics and the American Diabetes Association recommend empirically that, beginning at 10 years of age or the onset of puberty and every 2 years thereafter, overweight individuals with ≥2 risk factors for diabetes (eg, family history, high-risk ethnic/racial group, or signs associated with insulin resistance syndrome) should be tested for T2DM, with fasting plasma glucose measurement as the primary screening test. Fasting plasma insulin measurements are not generally recommended, because of lack of standardization of results and reflection of any medical condition in addition to obesity that predisposes patients to insulin resistance.

For BMI of >95th percentile, all of the tests listed for the preceding category are recommended, even in the absence of risk factors.51 Urinary microalbumin levels in first morning void or the microalbumin/creatinine ratio can be used to screen for focal segmental glomerulosclerosis, which has been described for obese children.356 Abnormal results are a urinary albumin excretion rate of >20 μg/minute or a urinary albumin/creatinine ratio of >30.

The National Cholesterol Education Program guidelines for the metabolic syndrome in adults have been adapted for adolescents and include triglyceride levels of ≥110 mg/dL, HDL cholesterol levels of ≤40 mg/dL, waist circumference of ≥90th percentile (from National Health and Nutrition Examination Survey III), and blood pressure of ≥90th percentile.357 Although there are no readily available clinical tests for LDL particle size and density, the presence of small, dense, LDL particles in adults is reported in the metabolic syndrome. For children, elevated triglyceride levels and decreased HDL cholesterol levels may serve as proxies for the presence of small, dense, LDL particles.358 Lipoprotein(a) measurements in adults are related to cardiac disease, and levels track from infancy. Obesity increases lipoprotein(a) levels, and it has been suggested that children with a family history of cardiac disease have lipoprotein(a) levels measured.359

If there are appropriate historical features, then specialty tests are indicated. If there is history suggesting sleep apnea (snoring, interrupted breathing while asleep, secondary enuresis, daytime sleepiness, and falling school performance), polysomnography is the standard method for diagnosis.360 Polysomnography may miss cases requiring treatment, however, which indicates the importance of clinical evaluation.361 Electrocardiography can be used to search for prolongation of the QTc interval, ventricular arrhythmias, or right ventricular hypertrophy; echocardiography can be performed on the basis of pediatric cardiology consultation. Oxygen saturation can be measured to search for hypoxia, and carbon dioxide values can be measured to search for carbon dioxide retention. If blood pressure is elevated without explanation, then 24-hour ambulatory blood pressure monitoring may be an appropriate first step to rule out white coat volatile hypertension before extensive laboratory evaluation for other causes.

If orthopedic disease is suspected, then appropriate extremity films should be obtained (hip for slipped capital femoral epiphyses, knee for Blount disease, and foot for localized foot pain). Orthopedic consultation may be helpful. If there is a goiter, poor growth, and slow pulse, then free thyroxine and sensitive thyrotropin determinations are indicated (thyroid function tests have low yield in obesity without suggestive findings; hypothryroidism should not cause this extent of obesity, although some coarseness of features may occur).

If Cushing syndrome is suspected, then overnight, dexamethasone-suppressed, early morning, salivary cortisol measurements should be used for screening. Cortisol would not be suppressed, and the subtleties of diagnosis would require a pediatric endocrine consultation.

If Albright hereditary osteodystrophy associated with pseudohypoparathyroidism is suspected, then serum calcium, phosphorus, and parathyroid hormone levels should be measured. Calcium levels would be low, and phosphorous levels would be high.

If hirsutism and excessive acne are seen in a girl with irregular menses (if she is old enough), then the following should be measured in a laboratory with pediatric standards and sensitive methods:362–365: (1) serum 17-hydroxyprogesterone levels; basal levels would be high (if the index of suspicion is high, then a corticotropin-stimulated test is indicated); (2) dehydroepiandrosterone sulfate levels; basal levels would be high (if the index of suspicion is high, then a corticotropin-stimulated test is indicated); (3) androstenedione levels; (4) testosterone and free testosterone levels; and (5) third-generation, follicle-stimulating hormone and luteinizing hormone levels. If true precocious puberty is suspected, then the following should be measured:366: (1) third-generation, follicle-stimulating hormone and luteinizing hormone levels; (2) radiographs of the left femoral epiphyses, knee for Blount disease, and foot for localized foot pain. If there are appropriate historical features, then orthopedic consultation may be helpful. If there is a goiter, poor growth, and slow pulse, then free thyroxine and sensitive thyrotropin determinations are indicated (thyroid function tests have low yield in obesity without suggestive findings; hypothryroidism should not cause this extent of obesity, although some coarseness of features may occur).
hormone levels and (2) testosterone (boys) or estradiol (girls) levels and dehydroepiandrosterone sulfate levels (both boys and girls).

Genetic tests are not available for all syndromes and mutations but are indicated in the presence of specific findings. MCR1 mutation could be measured with continuous and rapid weight gain since birth (test available at Athena Diagnostics, Worcester, MA) but the cost is approximately $1000 and the test cannot yet be recommended widely. Follicle-stimulating hormone testing should be performed if a boy has macroorchidism and developmental delay (see the Appendix in the summary report for the complete expert committee recommendations on the assessment, prevention, and treatment of childhood overweight and obesity).

**Summary**

This document provides a comprehensive review of the thorough assessment of an overweight or obese child. Although much of the content will be beyond the scope of the primary care setting, the goal is to provide the evidence base and practical considerations for categorization of weight status, identification of targets for behavior change, and assessment of medical risk. Further, the document can serve as a reference for selected, more in-depth evaluations.

The complexity and magnitude of the current epidemic of child and adolescent overweight and obesity likely preclude clinicians from being the sole, or even the major, agents of treatment. Nevertheless, the access to children and their health information, the authority and respect that physicians and other clinicians earn from families, and the potential to apply their knowledge to the very real medical aspects of obesity and its associated conditions, make an imperative that all clinicians be familiar with at least a rudimentary assessment of the overweight or obese child. Furthermore, the well child visit offers a unique opportunity to track a child’s growth and to routinely assess for risk from lifestyle practices, family history, or other conditions. Every clinician who provides care to children can use the recommendations in this document, from the simplest screening procedures to more comprehensive evaluation, to guide preventive and therapeutic interventions.

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Recommendations for Prevention of Childhood Obesity

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ABSTRACT

The majority of US youth are of healthy weight, but the majority of US adults are overweight or obese. Therefore, a major health challenge for most American children and adolescents is obesity prevention—today, and as they age into adulthood. In this report, we review the most recent evidence regarding many behavioral and practice interventions related to childhood obesity, and we present recommendations to health care providers. Because of the importance, we also suggest approaches that clinicians can use to encourage obesity prevention among children, including specific counseling strategies and practice-based, systems-level interventions. In addition, we suggest how clinicians may interact with and promote local and state policy initiatives designed to prevent obesity in their communities.
Obesity threatens the health of today’s children to such an extent that they may, for the first time in US history, have a shorter lifespan than their parents. The considerable challenges of addressing and treating obesity throughout the life cycle have led to increasing interest in preventing obesity altogether.

Recent summaries of evidence on the prevention of obesity reviewed comprehensively the body of research in this field. Following those efforts, we have focused this report on what health care providers can do to prevent childhood obesity in their clinical practices and in their communities, on the basis of evidence from the literature. Current evidence is clearly stronger in some areas than in others, and we have endeavored to inform providers about the relative strength of evidence by classifying available evidence at distinct levels (in descending order of strength). In addition, the prevention writing group has recommended specific clinical strategies, on the basis of analysis of available data from obesity interventions and other medical and behavioral interventions, as well as from clinical experience.

The goal of this set of recommendations is to enable children’s health care providers (physicians, nurse practitioners, dieticians, counselors, and others) to find in one document the latest summary of evidence for prevention opportunities in health care settings and local communities. The main areas of evidence reviewed for this report include (1) food and nutrients, (2) eating behaviors, (3) family interactions around food and meals, (4) physical activity and sedentary behaviors, and (5) working with parents to address children’s eating and activity behaviors. In each of these domains, we review the evidence; at the end of the report, we present our recommendations to providers for prevention of childhood obesity.

We complement our evidence review with a separate section regarding approaches to obesity prevention, which details how clinicians can adopt and implement specific counseling approaches and practice-based interventions regarding childhood obesity prevention. Our goal is to provide practitioners with practical strategies they can readily apply in their clinical work to address childhood obesity. Finally, we assess opportunities to interact with and to advocate for local and state policy initiatives, as a means for clinicians to address childhood obesity in their communities through coordination with, and advocacy for, community prevention efforts.

EVIDENCE

Foods, Nutrients, and Childhood Obesity

Total Energy Intake
Total energy intake, as measured by using current dietary assessment methods, does not seem to have a strong association with obesity in children. This lack of association is likely attributable to the difficulty of accurately assessing dietary intake by using current dietary assessment tools such as dietary recalls and food frequency questionnaires. These methods are subject to the serious and pervasive problem of underreporting, which worsens as children age and is especially prevalent among obese adolescent girls.

An analysis of data from the 1994 to 1996 and 1998 US Department of Agriculture Continuing Surveys of Food Intakes by Individuals determined that 55% of children 3 to 19 years of age reported implausible energy intakes. Reported energy intake was not associated with BMI percentile in the total sample. In the sample of children who reported plausible energy intakes, however, reported energy intake was associated positively with BMI percentile for boys 6 to 11 years of age and adolescents 12 to 19 years of age. No relationship was found for children 3 to 5 years of age or girls 6 to 11 years of age. Therefore, it is important for future studies to exclude implausible dietary reports to discern dietary associations with BMI.

Dietary Fat
Evidence supports an unclear association between dietary fat and obesity in children. The American Dietetic Association (ADA) conducted an evidence analysis and identified 15 longitudinal studies from 12 different cohorts of children, 3 months to 18 years of age, published between 1992 and 2003. Four studies found positive associations between dietary fat intake and adiposity. Four studies had mixed results and found both positive associations and nonsignificant associations between dietary fat intake and adiposity. The other 7 studies found no significant associations between dietary fat intake and adiposity.

In a longitudinal study of 70 white children 2 to 8 years of age, mean dietary fat intakes recorded between the ages of 2 and 8 years were positive predictors of BMI at 8 years. In a tracking study conducted in China, 6- to 13-year-old obese children were monitored for a 2-year period. Those who remained obese after 2 years had higher fat intakes (as a percentage of energy), in comparison with children who shifted from obese to not obese. There is no evidence in the literature to support the suggestion that low dietary fat intake is associated with childhood obesity.

Calcium and Dairy Products
Recent research from some observational studies suggests that lower intakes of dairy products and/or calcium are associated with obesity in children. Of 7 observational studies published between 1995 and 2004, 4 found no associations and 3 found negative associations between calcium intakes and various measures of adiposity.

In a longitudinal study of 52 white children monitored from 2 months to 8 years of age, dietary calcium...
intake from milk, cheese, and yogurt was associated with lower percentage of body fat at 8 years of age. Other researchers found that children who consumed cereal with milk were at lower risk of being obese than were children who ate less cereal. Girls 9 to 14 years of age who consumed diets rich in calcium weighed less and had less abdominal fat than did girls who consumed less calcium.

Numerous intervention trials involving calcium and/or dairy supplementation and a measure of adiposity were identified in an ADA evidence analysis, with the majority showing no difference between intervention and control groups. Therefore, it is possible that calcium and dairy products are serving as markers for a better diet and/or healthier lifestyle in the observational studies and are not themselves the cause of lower body fatness in children.

**Fruits and Vegetables**

An ADA evidence analysis concluded that the evidence supports a modest effect of fruit and vegetable intake in protecting against increased adiposity in children. Fruits and vegetables have been promoted for the prevention of childhood obesity because of their low energy density, high fiber content, and satiety value. Fruits and vegetables are most likely, compared with other food groups, to be consumed in inadequate amounts by children. Several studies found no association between fruit and vegetable intake and childhood adiposity; nevertheless, in none of the 17 studies reviewed in the ADA evidence analysis was increased fruit and vegetable intake related to increased adiposity. The studies that found a significant inverse relationship between fruit or vegetable intake and adiposity tended to have larger sample sizes, compared with those that found no relationship. The evidence was stronger for fruits alone or for fruits and vegetables combined than for vegetables alone. Part of this disparity may be attributable to the fact that different fruits and vegetables may have different effects on childhood obesity and overweight. For instance, more than one third of the total daily amount of vegetables in the US food supply consisted of iceberg lettuce, frozen potatoes (mostly french fries), and potato chips.

**Fruit Juice**

Intake of 100% fruit juice is not related to adiposity in children unless it is consumed in unusually large quantities. The ADA reviewed 15 studies on the impact of fruit juice consumption on childhood obesity. Four of 6 longitudinal studies found no association between fruit juice intake and obesity, whereas 2 other longitudinal studies found either no association or an inverse association. Neither of 2 nationally representative, cross-sectional studies found a relationship between fruit juice consumption and reported BMI. One case-control study and 3 other cross-sectional studies found a positive association between fruit juice intake and a measure of adiposity. In 2 studies of related cohorts, only large amounts of juice (12 fl oz/day) were associated with increased obesity. The remaining 3 cross-sectional studies found no relationship between 100% fruit juice intake and obesity.

Largely on the basis of this evidence, the American Academy of Pediatrics recommends that intake of fruit juice should be limited to 4 to 6 oz (1 serving) per day for children 1 to 6 years of age. For children 7 to 18 years of age, juice intake should be limited to 8 to 12 oz (2 servings) per day.

**Sugar-Sweetened Beverages, Including Soft Drinks**

Evidence strongly supports a positive association between the intake of calorically sweetened beverages and adiposity in children. A total of 19 observational studies published between 1999 and 2004 that assessed intake of sweetened beverages and the association with some measure of adiposity in children were reviewed, including 6 longitudinal studies, 3 nationally representative, cross-sectional studies, and 10 case-control or other cross-sectional studies. The ADA concluded that the larger, more strongly designed, and higher-quality studies substantiated that sweetened beverage intake is related to obesity among children.

Since completion of the ADA evidence analysis, additional studies support a positive association between sugar-sweetened beverages and childhood overweight and obesity. Nationwide food consumption survey data collected in the 1999 to 2000 National Health and Nutrition Examination Survey demonstrate that soft drinks and sugar-sweetened fruit drinks are the principal source of energy in the diets of US male and female adolescents.

In a separate sample of 10 904 low-income children 2 to 3 years of age, consumption of sweetened drinks increased the odds of becoming obese among those who were at risk for obesity at baseline and of remaining obese among those who were already obese by 60%. The authors concluded that reducing sweetened drink consumption is one strategy to manage the weight of preschool children.

Several nutrition policy documents make recommendations regarding sugar-sweetened beverages. The American Academy of Pediatrics policy statement on soft drinks in schools recommends that pediatricians should work to eliminate sweetened drinks in schools. The 2005 Dietary Guidelines Advisory Committee stated that “available prospective studies suggest a positive association between the consumption of sweetened beverages and weight gain. A reduced intake of added sugars (especially sugar-sweetened beverages) may be helpful in

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weight control and in achieving recommended intakes of nutrients.” The 2005 Institute of Medicine report Preventing Childhood Obesity stated that “much remains to be learned about whether a unique association exists between intake of sweetened beverages and changes in BMI. Because of concerns about excessive consumption of sweetened beverages and the displacement of more nutrient-rich or lower calorie alternatives, children should be encouraged to avoid high-calorie, nutrient-poor beverages.”

Childhood Eating Behaviors and Obesity

Breakfast Skipping
Evidence supports the view that obese children and adolescents are more likely to skip breakfast than their leaner counterparts. Obese children also have been reported to eat smaller breakfasts than their nonobese peers.

A total of 15 observational studies published between 1994 and 2004 were reviewed, including 2 longitudinal studies, 36,68 2 nationally representative studies, 57,69 and 11 other cross-sectional studies.42,60,70–78 The ADA concluded that the preponderance of evidence suggested that breakfast skipping may be a risk factor for increased adiposity, particularly among older children or adolescents. However, the strength of the evidence is somewhat limited because what constitutes a breakfast has not been defined consistently.

Eating Out, Including Fast Food
Evidence supports the view that consumption of food away from home, particularly at fast food establishments, may be associated with adiposity, especially among adolescents.4 A total of 10 observational studies published between 1996 and 2004 were reviewed, including 2 longitudinal studies, 36,79 1 nationally representative, cross-sectional study, 57 and 7 other cross-sectional studies.40,71,74,80–83 Study sample sizes ranged from >60 000 to just over 50.80 A limiting factor in these studies is that “eating out” and “fast food” were not defined or assessed systematically. However, the evidence that is currently available suggests that frequent patronage of fast food restaurants may be a risk factor for obesity in children.

Portion Sizes
Increased portion sizes may be associated with increased adiposity in children.4 Of note, appropriate portion sizes vary according to age, and discussions with parents about portion sizes should reflect age-specific normative values, as suggested in the Food and Drug Administration Food Guide Pyramid (available at www.mypyramid.gov).

Research indicates that portion sizes may contribute to the increasing prevalence of overweight among children by promoting excessive energy intake. Three- to 5-year-old children consumed 25% more of an entrée and 15% more energy at lunch when presented with portions that were twice as large as the age-appropriate standard size.84 In a nationally representative sample of 1-year-old children, food portions were related positively to body weight.85

A study of 16 preschool children 4 to 6 years of age found that the most powerful determinant of the amount of food consumed at meals was the amount served. These children displayed poor regulation of energy intake.86

Other investigators used the 1994–1996 and 1998 Continuing Surveys of Food Intakes by Individuals to categorize children 3 to 19 years of age according to plausible and implausible self-reported energy intake. Among children with plausible reported energy intake, meal portion size was associated positively with age-specific BMI percentiles for boys 6 to 11 years of age and adolescents 12 to 19 years of age.8 Others examined intakes of 2- to 5-year-old children in the 1994–1996 and 1998 Continuing Surveys of Food Intakes by Individuals and found that portion size accounted for 17% to 19% of the variance in energy intake.87

Snacking
Snacking frequency or snack food intake is not likely associated with adiposity in children.4 The majority of studies that examined snack food intake in a recent ADA evidence analysis found no association with adiposity.† The research on snacking is confounded by unclear definitions in the literature of what constitutes a snack or snack food.4 Nevertheless, longitudinal studies demonstrate that snacking frequency has increased concurrently with the prevalence of overweight. Snacks tend to be higher in energy density and fat content than meals, and high levels of snack consumption have been associated with greater intakes of fat, sugars, and energy.4

Since completion of the ADA evidence analysis, additional studies of children’s snack behaviors have been published. In the Growing Up Today study of 9- to 14-year-old girls and boys, there was no relationship between intake of snack food and subsequent changes in BMI among the boys; there was a weak inverse association with weight change among the girls. The authors concluded that, although snack foods may have low nutritional value, they are not an important independent determinant of weight gain among children and adolescents.91 In the Growth and Development Study of 196 nonobese, premenarcheal, 8- to 12-year-old girls, energy-dense snack food intake did not influence subsequent weight status or fatness change.61 In contrast, an analysis of data from the Bogalusa Heart Study found that, among 1562 children 10 years of age, the total

†Refs 29, 36, 37, 44, 60, 61, 70, 76, 78, and 88–90.
amount of food consumed, specifically from snacks, was associated positively with overweight status.160

Family Interactions Involving Meals and Nutrition

Family Meals
Evidence supports a positive association between frequency of family meals and dietary quality in adolescents.52,93 Increased frequency of family meals is associated with greater intakes of fruits, vegetables, and milk and lower consumption of fried food and soft drinks. It is also associated with higher nutrient intakes (including calcium, iron, vitamins, and fiber) and lower intakes of saturated and trans fats. The Growing Up Today cohort also associated with greater intakes of fruits, vegetables, and milk and lower consumption of fried food and soft drinks. It is generally accepted that the energy expenditure required to reduce total mortality rates among originally sedentary adults is 630 to 1680 kJ/day above habitual energy expenditure levels.101,102 It is more difficult to quantify the energy expenditure required to produce beneficial health effects among children and adolescents. Ultimately, the prevention of obesity requires a balance between energy intake and expenditure over time. Energy expenditure includes resting metabolic rate, thermogenesis, and physical activity, but only physical activity is amenable to clinical or community prevention programs for obesity.

Although reviews have identified many benefits of physical activity in youths, including reduced blood pressure levels, improved lipid profile, increased bone mass and density, improved self-esteem, reduction of anxiety, and reduced symptoms of depression, this report focuses on overweight and obesity prevention. Physical activity among youths is challenging to measure because the capacity to understand and to recall the concepts of time, duration, and intensity of past activity is associated inversely with age and because the nature, context, and practice of physical activity vary with age. Objective measures of physical activity used more commonly in recent studies, such as accelerometry, represent an important improvement in physical activity measurement.

Longitudinal Trends in Physical Activity
Data from the Youth Risk Behavior Survey (YRBS) suggest decreases in physical activity among US adolescents over the past decade.103,104 The proportion of adolescents in grades 9 to 12 defined as inactive increased from 10.9% in 1993 to 14.7% in 2003 for boys, but values remained stable for girls (20.8% and 22.2%, respectively).104 The odds of being inactive in 2003, compared with 1993, were increased significantly only for boys (odds ratio [OR]: 1.41; 95% confidence interval [CI]: 1.16-1.71) and for adolescents in ninth or 10th grade (ninth grade: OR: 1.63; 95% CI: 1.27-2.09; 10th grade: OR: 1.32; 95% CI: 1.06-1.63).104 In contrast, surveys conducted in Canada from 1981 to 1998 reported substantial increases in leisure time physical activity energy expenditure among youths 12 to 19 years of age.105 In addition, the prevalence in the United Kingdom of vigorous exercise at least 3 times in the past week increased from 32% to 53% for boys 12 to 13 years of age and from 36% to 49% for boys 14 to 15 years of age from 1987 to 2003. Among girls, increases were from 24% to 37% and from 20% to 31%, respectively.106

The YRBS was conducted biannually from 1993 to 2003; in each survey, inactivity increased from grades 9 to 12 and was higher in black youths than in non-Hispanic white youths and in girls than in boys. Other reports confirm that girls report less physical activity than boys, both before107 and during108-109 adolescence. Differences between girls and boys are particularly apparent for vigorous physical activity, with girls being less likely than boys to engage in vigorous physical activity during their free time, in the context of organized physical activity, during school, and outside of school.109 In addition, the decline in physical activity with increasing age103 and with lower socioeconomic status is well documented.110,111 Longitudinal studies show that only 12% of youths who originally achieve desirable levels of physical activity (≥5 weekly bouts of moderate or vigorous physical activity) remain as active as young adults.112

Increasing competition for classroom time has put pressure on physical education (PE) classes in schools in many countries, including Australia and the United Kingdom.106 In the United States, the YRBS indicated that participation in daily PE classes decreased from 42% in 1991 to 32% in 2001.103 The amount of time spent being active during PE classes has also decreased.113 Boys have substantially higher energy expenditures during PE classes, compared with girls.109,113,114 Although girls and boys are equally likely to be enrolled in organized physical activity and lessons outside school,115 girls are less likely to belong to sports clubs or to participate in unor-
organized physical activity or in school sports outside PE classes. Boys and girls differ substantially in their physical activity preferences and in their patterns of physical activity involvement. Participation in organized sports has declined in Australia and Sweden but seems to have remained stable in the United Kingdom.

Individual and environmental factors do not influence all children equally. There is evidence both for and against genetic effects on sports participation and leisure time physical activity among youths. Boys and girls differ in their attitudes and beliefs regarding physical activity, as well as their motivation for increased from 50% in 1969 to 15% in 2003. Similar declines have been reported in the United Kingdom.

Active transport (eg, walking or cycling) can be an important method of successfully integrating physical activity into people’s daily lives. However, the frequency of walking and cycling by US children decreased by 37% between 1977 and 1995. The proportion of schoolchildren who used active transport to or from school decreased from 50% in 1969 to 15% in 2003. Similar declines have been reported in the United Kingdom.

Longitudinal Trends in Sedentary Behavior
A review concluded that total media use among youths in industrialized countries has remained stable in the past decades. The most recent data from an extensive review of the literature show that boys watch an average of 137 minutes of television each day, compared with 128 minutes for girls. Boys 0 to 6, 7 to 12, and 13 to 18 years of age watch an average of 126, 135, and 121 minutes of television each day, respectively. Girls of the same age categories watch television 126, 125, and 106 minutes per day, respectively. Approximately 30% of boys and 25% of girls of all ages watch ≥4 hours of television per day. Boys play video games twice as much as girls (59 and 23 minutes per day, respectively, on average) and spend more time using computers (38 and 26 minutes per day, respectively).

Physical Activity and Obesity
The evidence is strong that daily moderate/vigorous physical activity helps reduce adiposity in overweight/obese youths. For normal-weight children, the evidence is inconsistent for an association of physical activity with prevention of obesity. Nevertheless, there is expert consensus that daily moderate/vigorous physical activity of ≥60-minute cumulative duration is likely to have a beneficial effect for normal-weight youths and is unlikely to harm them. In the following summary of studies, we include some studies in the physical activity section that also included measures of sedentary behavior, and vice versa; they appear in specific sections on the basis of the primary focus of each study.

Several reviews of observational epidemiologic studies have summarized the literature on the association between physical activity and obesity in youths. Most studies conducted between 1940 and 2000 were cross-sectional and involved highly selected patient groups, often of obese and nonobese subjects. Older studies measured energy expenditure with physical activity questionnaires only and more recent studies with heart rate monitoring, double-labeled water testing, or a combination of the 3 methods. The studies reviewed generally (but not universally) reported significant inverse associations between physical activity and obesity, with no significant positive associations. The authors also reviewed 2 large, nationally representative surveys, the US National Children and Youth Fitness Study II, which recruited children in grades 1 to 4 and found strong positive associations between activity and reduced skinfold thickness, and a Finnish survey of 15-year-old youths, which failed to find any relationship between physical activity and obesity measures. Of the 7 longitudinal studies reviewed, 4 found significant inverse associations with physical activity levels measured with questionnaires or energy expenditure measured with double-labeled water testing, but 3 did not.

A more-recent review (including articles published between 2000 and 2004) identified 16 new cohort studies of children (age range: 3–14 years), including 11 studies with follow-up periods of ≥2 years and 4 studies with ≥1000 children. Of the 11 studies that used questionnaires to assess physical activity, 5 found no association between activity levels and measures of adiposity but the other 6 reported that weight gain was associated inversely with activity levels and associated positively with sedentary activities. Five studies used objective measures to assess energy expenditure, and all had small sample sizes (26–115 subjects). The Framingham Children’s Study reported an inverse association between energy expenditure measured with heart rate monitoring and changes in BMI after 8 years of follow-up monitoring for 103 children initially 3 to 5 years of age. Another study of 47 subjects 4 to 9 years of age showed that energy expenditure measured with double-labeled water testing resulted in changes in fat mass measured with dual-energy x-ray absorptiometry after 1.6 years but not after 2.7 years of follow-up monitoring. The other 3 studies, with follow-up periods of 1 to 3 years, showed no inverse association between energy expenditure and change in fat mass.

Another review assessed 11 recent trials intended to prevent unhealthy weight gain by increasing physical activity or reducing sedentary behavior in children and adolescents, including 9 trials consisting of school-based interventions and 1 trial that measured outcomes ≥3 months after the end of the intervention. Three trials...
showed a small intervention effect on adiposity indices, including 2 that demonstrated effects only in boys \(^{162,163}\) and 1 in both boys and girls. \(^{164}\) The other trials failed to show intervention effects on body composition, although several trials reported improvements in physical activity measures. \(^{165–172}\)

Three other reviews of randomized trials have been published, including 9 studies not previously reviewed. \(^{129,173,174}\) Most of those studies were published before 2000; 8 were conducted in schools and 1 exclusively in the community. All except 3 of the intervention programs combined nutrition and physical activity components \(^{175–180}\); 2 trials focused exclusively on physical activity promotion \(^{181,182}\) and 1 focused chiefly on reduction of sedentary activities. \(^{183}\) Significant positive effects were reported in 5 of the 8 school-based trials \(^{177–179,182,183}\) including 2 trials that showed positive effects only among girls. \(^{177,179}\)

Finally, a comprehensive review of evidence on physical activity for school-aged youths, published in 2005, reported that programs of 30- to 60-minute duration, performed 3 to 7 days per week, demonstrated reductions in total body fat and visceral adiposity among obese children and adolescents but did not influence the percentage of body fat in normal-weight children and adolescents. \(^{184}\) The review also cited more-limited evidence that longer and more-intensive sessions (\(>80\) -minute duration) were more successful in reducing the percentage of fatness in normal-weight youths. This led to the consensus recommendation from the review that school-aged youths should participate every day in \(\approx 60\) minutes of moderate to vigorous physical activity that is developmentally appropriate and enjoyable.

**Sedentary Behavior and Obesity**

Evidence supports a strong association between limiting sedentary behavior (watching television and playing video/computer games) and preventing obesity, although the effect size of the association varies across studies. A review of the literature on the effect of sedentary behavior on body composition identified 52 independent studies on television and adiposity, 39 studies on television and physical activity, 6 studies on video/computer games and body weight, and 10 studies on video/computer games and physical activity. The authors concluded that, although television and video/computer games have a positive relationship with BMI and a negative impact on physical activity, these effects are small and are unlikely to be of clinical relevance. \(^{185}\)

In contrast, more-recent cross-sectional studies report significant associations between sedentary activities and body fat. Stettler et al \(^{186}\) reported that, among 922 Swiss children in grades 1 to 3, use of electronic games (OR: 2.0; 95% CI: 1.6–2.6), television (OR: 2.8; 95% CI: 2.1–3.9), and physical activity (OR: 0.80; 95% CI: 0.72–0.88) were associated independently with obesity.

Among a nationally representative sample of Finnish adolescents 14, 16, and 18 years of age, the ORs of being overweight were 1.4 and 2.0 for girls watching 1 to 3 hours or \(\geq 4\) hours of television, respectively, compared with girls who watched \(< 1\) hour per day. \(^{187}\) The use of computer games for \(> 1\) hour (compared with \(< 1\) hour) increased the OR by 1.5. Similar results were found for boys but did not reach statistical significance. Finally, analysis of the 1999 YRBS data indicated that watching \(> 2\) hours of television per day was associated with being overweight among white male and female youths and among Hispanic female youths. \(^{188}\)

Three recent reports from cohorts of children and adolescents support a relationship between sedentary behavior and excess weight. A report from the 1970 British Birth Cohort, involving \(> 11\) 000 subjects monitored for 30 years, showed that the mean number of hours spent in front of a television set at 5 years of age predicted higher BMI \(z\) scores 25 years later, even when adjusted for television viewing at 10 years of age, birth weight, parental BMI, gender, and socioeconomic status. \(^{189}\) Each additional 1 hour of television watched during weekends increased the risk of adult BMI of \(\approx 30\) kg/m\(^2\) by 7% (OR: 1.07; 95% CI: 1.01–1.13).

Other studies that included measures of sedentary behavior as well as physical activity found, in a cohort of \(\approx 150\) children initially 3 to 4 years of age who were monitored from 1986 to 1989, that physical activity and sedentary behavior (television viewing) were the only significant predictors of BMI (other than baseline BMI). \(^{119}\) Finally, a cohort of 355 adolescents in grade 7 in Wales were monitored for 4 years. \(^{190}\) Multivariate regression analysis showed that sedentary behavior and physical activity predicted BMI measured in follow-up assessments, after adjustment for several sociodemographic variables.

**APPROACHES TO OBESITY PREVENTION**

**Basis of Suggestions**

In this section, we endeavor to present practitioners with helpful insights about addressing obesity prevention in clinical practice and in their communities. Given the state of the science in obesity prevention in the clinical setting, this section is based on a combination of best available evidence and consensus opinion and on expert opinion when the former are lacking.

**Partnering With Parents to Prevent Childhood Obesity**

**Family Health Promotion**

Families have a critical role in influencing children’s health. \(^{191}\) and health is a de facto characteristic of the family lifestyle. \(^{192}\) Interventions in the parent-child dynamic have evolved from traditional psychotherapeutic models to direct coaching of parents as they interact with their children and to the current view of parenting...
through the lens of social learning theory. Social learning theory is based on the premise that changing a parent’s behavior leads to a change in a child’s behavior.193 Including parents as active participants with their children in lifestyle changes has produced positive long-term improvement in weight control.195 Two major reviews of obesity prevention in children by the Institute of Medicine2,3 delineated and emphasized the pivotal role of parents in obesity prevention. Specifically, parents can have a strong influence on obesity prevention in their children through direct support, such as playing with their children, paying fees for programs that promote physical activity, and transporting their children to locations in their communities where they can be active.195

Parenting Styles
“Parenting styles” describe parent-child interactions across a wide range of situations and apply to the interactions independent of content.196 The relationship between parents and children may be reflected in and affected by parenting style.197 One classification of parenting style includes the categories of authoritative, authoritarian, permissive, and disengaged. Authoritarian parents are described as valuing obedience, favoring punitive forceful measures, and not encouraging verbal “give and take.”198 Authoritative parenting values both “self-will and disciplined conformity,” using a reason as well as authority to discipline a child.199 A permissive parent allows a child to regulate his or her own activities and is accepting, nonpunitive, and affirmative.198 A disengaged style has been described as neglectful.199 An authoritative parenting style has been associated with reduced smoking initiation200 and increased physical activity and reduced sedentary behavior in girls.201 Parental acceptance and behavioral control are 2 dimensions that can frame these 4 parenting styles (Table 1).202

Child Developmental Stages and Obesity Prevention

Prenatal Environment
The association of particular risk factors with childhood obesity manifests in very different ways, depending on a child’s developmental stage. Maternal health status can have a direct impact on the risk for childhood obesity and obesity-related comorbidities.203 Exposure to maternal diabetes mellitus increases an infant’s risk of future diabetes and obesity.204 Infants born small for gestational age are also at increased risk for obesity, diabetes, and hypertension, further suggesting the vulnerability of the child to the intrauterine environment,205,206 although postnatal parenting factors may also play a role.

Infancy
Parent-child interactions regarding food and activity start at birth. There is evidence to suggest that breastfeeding has a small protective effect on later obesity.207 The mechanism of action is unclear but may involve enhancement of the infants’ ability to regulate intake and the effect of mother-infant feeding interactions. Associations with parental weight, socioeconomic status, and smoking may be confounders.208 Practitioners’ support of breastfeeding is recommended for obesity prevention by the American Academy of Pediatrics.209

Preschool Age
Parents are responsible for the type of food presented to young children, the portion sizes offered, and the emotional context in which food is eaten. Transitional diets of toddlers often mirror the problem areas found in parents’ diets.210,211 A majority of 1- to 2-year-old children consume dessert, ice cream, and/or candy once per day, and up to one half consume sweetened beverages daily; in contrast, only 1 of 10 consume a dark green vegetable daily.212 Advice to parents to “provide a healthy array of foods in the correct portion size and allow children to decide what and how much to eat from what they are offered” has been suggested as an appropriate parental approach to feeding.213 Parents’ activity level can also influence activity in children.214 Moreover, television viewing and having a television in the bedroom both have been associated with overweight in 1- to 5-year-old children.215

School Age
School age is a time when parents and children are focused on development of competence, where “rules channel behavior into productive activities.”216 Although parents are transitioning self-care skills to children, parents need to recognize their continuing enormous influence over nutrition and activity. Overweight in school-aged girls has been associated with their fathers’ energy intake and enjoyment of activity and their mothers’ BMI.15 Parental exercise has been associated with increased fitness and extracurricular sports participation in children.217 Reduction in television viewing in the school-aged population has been associated with obesity prevention and treatment,183,218 emphasizing the continuing role of parents in managing a child’s energy environment.

Adolescence
Adolescent sedentary behavior is correlated with parental sedentary behavior.219 Parental support of adole-
cents’ activity was a stronger predictor of child activity than was parental activity. Parental support was thought to act by increasing adolescent self-advocacy, by providing resources and motivation.220

Supporting parents through their children’s adolescence is important for helping them maintain efficacy in influencing and supporting their adolescents’ positive lifestyle behaviors. Before the 1980s, theories on adolescent development were based on a conflict-oriented model221; since then, a more-positive approach has emphasized continuity in the adolescent-parent relationship and continued acceptance of parental values,222 with adolescents looking to adults for support and control.223

Parenting Interventions for Obesity
Each family and child is at a unique point in their readiness to accomplish lifestyle changes. Evaluating the stage of change has been recommended as a way of tailoring intervention to the family’s needs. In a study of parents of obese and overweight children, 44% were in the precontemplation stage, 17% in the contemplation stage, and 38% in the preparation/action stage of change. Parents of overweight children and parents who thought that they themselves were overweight were more likely to be in the precontemplation stage. Parents of older and obese children were more likely to be in the preparation/action stage. Significantly, parents who were worried about their child’s weight in the context of a health problem were more likely to be in the preparation/action stage. This effect was increased when the child’s physician had commented about the effect of the child’s weight on his or her health.224

In a study comparing parent-only versus child-only interventions, children in the parent-only intervention group had greater initial weight loss and follow-up weight loss at 7 years, compared with the child-only intervention group. Two patients in the child-only intervention group developed eating disorder symptoms during long-term follow-up monitoring, compared with no children in the parent-only intervention group. Weight change in the parent-only intervention group was hypothesized to be mediated through better control of the nutritional environment and possibly change toward the authoritative parenting style, which was emphasized in the intervention.225

Clinician Counseling Skills
In this section, we address ways in which clinicians can intervene in the dietary and activity behaviors discussed above, providing a concrete set of suggested strategies and approaches for obesity prevention in practice settings. Counseling in medical practice can be reduced to 4 essential skills, that is, (1) asking, (2) informing, (3) advising, and (4) listening. A framework for understanding how these skills are used in client-centered counsel-

ing was proposed by Rollnick et al.226 The framework delineates how these 4 skills manifest as 3 styles of communication, namely, following, guiding, and directing. These styles are differentiated by the skills used and the phase of the counseling encounter. The early phase is predominantly characterized by following. In the following phase, by using reflective listening and open-ended questions, the counselor gathers information from the patient to determine the position of the patient with respect to the behavior or health issue in question. The clinician establishes the basic facts of the story, often with a discussion of the behavioral history and the advantages and disadvantages of change. During this phase, the patient and counselor identify collaboratively what behaviors can be addressed. The emphasis is on building rapport and communicating that the clinician is not going to push the client to change. In the opening phase, the counselor often simply reflects what is being said; during later phases of the consultation, more-challenging reflections, which perhaps build discrepancy and move the patient toward an action plan, are used.

Once the clinician has obtained the basic story, the transition to discussing and planning change can begin. This is the hallmark of the guiding phase. In this phase, specific strategies (discussed below) to elicit change talk, such as the 0 to 10 importance/confidence rulers and a values clarification activity, are often used. The counselor gently helps guide the patient toward a behavioral decision.

Directing, the third phase, generally occurs after a patient has made a behavioral decision. The focus may shift to helping the client make concrete plans, such as setting goals and delineating an action plan. As the encounter moves from following to guiding and directing, there is generally a shift from simply listening and asking to informing, advising, problem-solving, and goal-setting.

Action reflections are key tools during the guiding and directing phases. This type of reflection involves moving the patient forward by incorporating into the reflective statements possible solutions to barriers or potential action steps. Unlike unsolicited advice and direct persuasion, action reflections use words or solutions either mentioned directly or alluded to by the patient. Reflections can involve reframing a barrier into a possible action step or listing a possible plan that the client mentioned directly or that developed logically from the discussion. The tone of the reflection often “undersells” the action step or solution, with words such as “could work” or “might consider.”

When practitioners over-rely on a directing style, they overuse questions, information, and advice. This can take the form of informing patients about what the clinician thinks they should do and why they should do it. Traditional anticipatory guidance can take this form. The clinician may adopt the role of an “expert” who is
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numerous randomized trials have demonstrated its clinical efficacy for addictive behaviors.239,240 In the past decade, there has been considerable interest from public health, medical, and dietetic practitioners in adapting MI to address various chronic disease behaviors.240–251 Although MI has been used to modify diet and physical activity behaviors in adults, the evidence base for obesity prevention and treatment in children is just beginning to emerge.252 In the current absence of health care-based interventions for childhood obesity prevention, using MI is an interim step clinicians can take that has some basis in evidence.

Overview of MI

MI is a patient-centered style of counseling that relies heavily on strategies such as reflective listening, shared decision-making, and agenda-setting. A key element of MI is that ambivalence is considered a normal phase in the behavior change process, rather than an obstacle to change. Patients are encouraged to express their ambivalence, while clinicians subtly place greater emphasis on exploring the potential benefits of change without dismissing or counter-arguing the barriers to change. MI seems to be particularly effective for individuals who are initially less ready to change.237,249,253,254

The tone of MI is nonjudgmental, empathetic, and encouraging. Clinicians establish a nonconfrontational and supportive climate in which patients feel comfortable expressing both positive and negative aspects of their current behavior. Many counseling models rely heavily on therapist insight, whereas traditional patient and nutrition education emphasizes information exchange. In contrast, a MI approach requires patients themselves to do much of the psychological work. MI counselors generally make no direct attempts to dismantle denial, to confront irrational or maladaptive beliefs, or to convince or to persuade patients. Instead, clinicians help patients think about and verbally express their own reasons for and against change, as well as how their current behavior or health status affects their ability to achieve their life goals or to fulfill core values. MI encourages patients to make fully informed and deeply contemplated life choices, even if the decision is not to change.

MI assumes that behavior change is affected more by motivation than by information. Although the essence of MI lies in its spirit, there are specific techniques and strategies that, when used effectively, help ensure that such a spirit is evoked. To achieve these ends, MI counselors rely heavily on reflective listening.

Reflective listening can be conceptualized as a form of hypothesis testing. The hypothesis can be stated in generic terms as “If I heard you correctly, this is what I think you are saying . . .” or “Where you are going with this is . . .” Reflections, particularly by counselors who are new to the technique, often begin with the phrase, “It sounds like . . .” More-skilled counselors often phrase their reflections as more-direct statements, such as, “You are having trouble with . . .,” omitting the assumed, “It sounds like . . .” The goals of reflecting include demonstrating that the counselor has heard and is trying to understand the client, affirming the client’s thoughts and feelings, and helping the client continue the process of self-discovery. One of the most-important elements of mastering MI is suppressing the instinct to respond with questions or advice. Questions can be biased by what the counselor may be interested in hearing about, rather than what the client wants or needs to explore.

Reflecting helps ensure that the direction of the encounter remains client-driven. Reflections involve several levels of complexity or depth. The simplest level tests whether the counselor understood the content of the client’s statement. Deeper levels of reflection explore the meaning or feeling behind what was said. Effective deeper-level reflections can be thought of as the next sentence or next paragraph in the story, that is, “where the client is going with it.” A high level of reflective listening involves selectively reinforcing positive change.
talk that may be embedded in a litany of barriers. Similarly, skilled MI counselors selectively reflect statements that build efficacy, by focusing on previous successful efforts or reframing past unsuccessful attempts as practice rather than failure.

In the directing style, practitioners often provide information about the risks of continuing a behavior or the benefits of change with the intent of persuasion. For the parent of an overweight child, a traditional counseling statement might be, “It is very important that your child get control of his/her weight now, before it becomes a bigger problem.” In this style of communication, the practitioner often attempts to “push” motivation by increasing perceived risk. In contrast, information is presented through MI by first eliciting the client’s understanding and information needs, providing new information in a more-neutral manner, and then eliciting what this means for the client with a question such as, “How do you make sense of all this?” MI practitioners avoid persuasion with “predigested” health messages and instead allow clients to process information and to find their own personal relevance. To this end, the guideline elicit-provide-elicit has been proposed as a framework for exchanging information in the spirit of MI. An outline of a patient-centered obesity prevention counseling session using these techniques is provided in the Appendix.

Confronting patients can lead to defensiveness, rapport breakage, and, ultimately, poor outcomes. Therefore, MI counselors avoid argumentation and instead “roll with resistance.” A MI encounter resembles a dance more than a wrestling match. For example, a parent may raise doubts that the child’s weight is a problem or may suggest that the child’s weight will improve on its own as the child ages. Rather than stating facts to counter such beliefs or to persuade the parent, a MI practitioner reflects the parent’s doubt and then provides opportunities for the parent to voice any concerns he or she may have about the child remaining overweight or gaining weight. In cases in which a parent’s resistance is severe, the practitioner may use an amplified negative reflection, such as, “It appears that you see no real problem with your child’s weight,” or “Having your child watch television most of the afternoon really works for you and your family.” This potentially risky strategy is designed to “unstick” the entrenched client by short-circuiting the “yes-but” cycle.

A core principle of MI is that individuals are more likely to accept and to act on opinions that they voice themselves. Patients are therefore encouraged to express their own reasons and plans for change (or lack thereof). This process is referred to as eliciting change talk. One technique to elicit change talk is the use of importance/confidence rulers. This strategy begins with 2 questions. (1) “On a scale from 0 to 10, with 10 being the highest, how important is it to you to change your child’s/family’s (insert target behavior)?” (2) “On a scale from 0 to 10, with 10 being the highest, assuming you wanted to change this behavior in your child/family, how confident are you that you could (insert target behavior)?” These 2 questions assess the client’s importance and confidence for change, respectively. Clinicians follow each of these questions with 2 probes. If the client answered “5,” for example, then the counselor would probe first with the question, “Why did you not choose a lower number, like a 3 or a 4?” and then with the question, “What would it take to get you to a 6 or a 7?” These probes elicit positive change talk and ideas for potential solutions from the client.

Another strategy to elicit change talk is to help build discrepancy between the patient’s personally held values and goals and his or her current health practices. The strategy can be used for counseling parents or working directly with older children or adolescents. To execute this strategy, patients select 2 or 3 values from a list provided by clinicians (Tables 2 and 3). Practitioners then probe how, if at all, changing the behavior in question can help patients achieve their goals. Conversely, practitioners can understand how, if patients do not or cannot change, such values and goals may be impeded.

Other Specific Cognitive and Behavioral Strategies

Use of Other Strategies

Whereas MI represents a style of communication, a framework for how to talk with families about diet and physical activity, specific cognitive and behavioral strategies may be helpful to assist families in achieving their health goals. Relevant behavioral strategies include goal-setting, positive reinforcement, and self-monitoring. Cognitive strategies include counteracting “all-or-nothing” thinking and exaggerating negative consequences or “worsting.” Some examples of how clinicians can incorporate these strategies into obesity prevention counseling are presented below.

Goal-Setting

Clearly defined behavioral goals for the target behaviors identified through the prevention assessment should be elicited from parents and children. Generally, initial goals should entail relatively modest changes. For example, goals could include adding 1 serving of fruits and vegetables or 15 minutes of physical activity each day or reducing 1 serving of sweetened beverages or 30 to 60 minutes of television viewing each day. Setting and achieving smaller, attainable goals may lead to increased feelings of self-efficacy, which in turn may spur additional persistence and continued progress while reducing disappointment and perceptions of failure. Having parents and/or children verbally express the behavioral
goal may help solidify the behavioral contract and increase ownership over the proposed goals.

**Positive Reinforcement**

Children’s efforts should be recognized and encouraged. Reinforcement may take the form of verbal praise for changes made or simply recognition of attempts at change. Tangible reinforcement, including financial incentives, can be considered, although there is some debate regarding whether such “extrinsic” motivation decreases long-term behavioral persistence.

**Monitoring**

Both clinicians and family members can monitor children’s progress toward their agreed-on goals. For clinicians, this may entail inquiring about progress at subsequent visits, with simple prompts such as, “How have things gone with your eating or activity plan since we met a few months back?” If specific goals were set at a previous visit, then the clinician should refer to those goals. A more-detailed monitoring plan that entails daily charting of the child’s behavioral progress can also be considered, particularly for children with BMI of 85th to 95th percentile without health complications. Generally, for healthy children following a prevention protocol (ie, BMI of <85th percentile or BMI of >85th to <95th percentile without obesity-associated complications), frequent monitoring of weight is not recommended.

**Cognitive Restructuring**

How children internally define their progress and interpret their actions can affect behavioral persistence significantly. One common maladaptive pattern of which clinicians should be aware is all-or-nothing thinking. All-or-nothing thinking, which is also referred to in the addiction field as abstinence-violation syndrome, entails exaggerated negative interpretation of small lapses or failures to adhere perfectly to a behavioral plan. For a child attempting dietary changes, this may take the form of “I failed at it” or “I can’t do this,” when in fact the child might have been successful on most days. This faulty thinking pattern tends to arise from expectations of perfect adherence, which can be anticipated and defused by clinicians and/or parents. This may entail pre-

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<table>
<thead>
<tr>
<th>Code</th>
<th>Designation/Situation</th>
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</table>
| Preventive medicine visit<sup>a</sup> | New patient, preventive medicine visit; patient is 12–18 y of age  
| 99384–99385 | Established patient, preventive medicine visit; patient is 12–18 y of age  
| 99394–99395 | Health check under Medicaid  
| WN016-WN019 or WR016-WR019 | Evaluation and management codes  
| 99201–99205 | New patient, office or other outpatient visit  
| 99212–99215 | Established patient, office or other outpatient visit  
| 99241–99245 | Consultation, office, or other outpatient visit  
| Health and behavior assessment or intervention<sup>b</sup> | Health and behavior assessment (eg, health-focused clinical interview, behavioral observations, psychophysiological monitoring, health-oriented questionnaires)  
| 96150 | Reassessment  
| 96151 | Health and behavior intervention  
| 96152 | Health and behavior intervention with ≥2 patients  
| 96153 | Health and behavior intervention with family, with patient present  
| 96154 | Health and behavior intervention with family, without patient present  
| Medical nutrition therapy<sup>b</sup> | Medical nutrition therapy, initial assessment and intervention, individual, face to face with patient; each 15 min  
| 97802 | Medical nutrition therapy, reassessment and intervention, individual, face to face with patient; each 15 min  
| 97803 | Medical nutrition therapy, group, individual, face to face with patient; each 15 min  
| 97804 | Other codes<sup>c</sup>  
| 59445 | Patient education, not otherwise classified, nonphysician provider, individual, per session  
| 59446 | Patient education, not otherwise classified, nonphysician provider, group, per session  
| 59449 | Weight management classes, nonphysician provider, per session  
| 59452 | Nutrition class, nonphysician provider, per session<sup>d</sup>  
| 59455 | Diabetic management program, nurse visit  
| 59465 | Nutritional counseling, dietitian visit<sup>e</sup>  
| No counseling provided (measurement only or pedometer download)<sup>b</sup> | Minimal visit, established patient (nurse visit)  
| 99211 |<sup>a</sup> Counseling is included in the preventive medicine visit codes. The total time spent with the patient and the amount of counseling time must be documented, and discussion items must be delineated in the medical record.  
|<sup>b</sup> These codes can be used for subsequent visits, including those with a nurse, counselor, or dietician.  
|<sup>c</sup> For nutritional therapy assessment and/or intervention performed by the physician, the evaluation and management codes should be used.
Disparities Collaboratives on asthma, diabetes, and depression.258–262 There is indirect evidence from these collaborations that addressing the needs of overweight children is an important issue. Interventions recommended to prevent obesity in children are changes to be made at the system level in the health care providers’ practice and are extrapolated from experience with the National Health Disparities Collaboratives on asthma, diabetes, and depression.258–262

Training in Patient-Centered Communication

Extensive training in communication skills of any kind is uncommon in pregraduate and postgraduate medical training. Therefore, it is often necessary for clinicians to obtain advanced training in counseling as part of their ongoing medical education. Although autodidactic resources exist (eg, DVD- and Internet-based teaching products), clinicians are encouraged to obtain “hands-on” training that includes supervised clinical practice and real and/or simulated patient encounters. Such workshops are often available at regional and national medical and behavioral health conferences.

Framework for Practice-Based Interventions

Basis of Changes

Practice-based interventions recommended to prevent obesity in children are changes to be made at the system level in the health care providers’ practice and are extrapolated from experience with the National Health Disparities Collaboratives on asthma, diabetes, and depression.258–262 There is indirect evidence from these collaborations to suggest that the following practice changes may improve care to prevent obesity in children.

Recommended Changes

Recommended practice-level changes include staff development in assessing and documenting BMI, practice-level self-assessment regarding obtaining BMI data and counseling families on appropriate interventions, quality improvement processes to evaluate practice performance, and disease management strategies adopted from the chronic care model. The chronic care model includes recommendations for self-management support, decision support, delivery-system redesign, and clinical information systems. The final issue to be addressed is reimbursement for obesity prevention visits.

Staff Development Skills

The health care provider involves the practice staff members in addressing the problem of preventing obesity in children by delegating the accurate measurement and documentation of BMI to them and by training them to perform these tasks. The Centers for Disease Control and Prevention and the US Department of Health Resources and Services Administration have established guidelines for accurate measurement and provide teaching modules on accurate measurement and BMI calculation (available at www.cdc.gov/nccdphp/dnpa/growthcharts/training/modules/index.htm and www.mchb.hrsa.gov/mchirc/dataspeak). The practice needs to obtain a reliable scale for infants and older children; regular calibration of the equipment should be assigned to a staff member. Recumbent length boards should be used for all children ≤2 years of age. Wall-mounted height stadiometers should be used to measure height for children >2 years of age. Staff members need to be trained and annually updated on accurate measurement techniques. Among physicians and nurse practitioners, staff development should include training for the motivational and behavioral counseling strategies described above.

Practice Self-assessment

The practice needs to establish a mechanism to evaluate its current procedures for assessing and addressing children at risk for overweight/obesity. A chart audit is suggested for evaluation of whether BMI is being measured, calculated, and documented on the growth charts. Children who meet the criteria for overweight or obesity should have growth documented on the problem list. The chart audit would reveal whether blood pressure, Tanner stage, and family history of overweight/obesity and cardiovascular risk factors are being documented on the charts. An initial chart audit can provide the practice staff with baseline data regarding the current status of the practice in addressing the needs of children at risk of overweight/obesity and can be used to evaluate the practice after changes are implemented.

### Table 3: Diagnosis Codes for Obesity-Related Visits

<table>
<thead>
<tr>
<th>Code</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>278.0</td>
<td>Obesity, unspecified</td>
</tr>
<tr>
<td>401.9</td>
<td>Essential hypertension, unspecified</td>
</tr>
<tr>
<td>611.1</td>
<td>Hypertrophy of breast</td>
</tr>
<tr>
<td>701.2</td>
<td>Acquired acanthosis nigricans</td>
</tr>
<tr>
<td>783.1</td>
<td>Abnormal weight gain</td>
</tr>
<tr>
<td>V18.0</td>
<td>Family history of diabetes mellitus</td>
</tr>
<tr>
<td>V18.1</td>
<td>Family history of endocrine or metabolic diseases</td>
</tr>
<tr>
<td>V61.20</td>
<td>Counseling for parent-child problem, unspecified</td>
</tr>
<tr>
<td>V62.89</td>
<td>Other psychological or physical stress, not elsewhere classified</td>
</tr>
<tr>
<td>V62.9</td>
<td>Unspecified psychosocial circumstances</td>
</tr>
<tr>
<td>V69.0</td>
<td>Lack of physical exercise</td>
</tr>
<tr>
<td>V69.1</td>
<td>Inappropriate diet and eating habits</td>
</tr>
<tr>
<td>V69.8</td>
<td>Other problems related to lifestyle; self-damaging behavior</td>
</tr>
<tr>
<td>V69.9</td>
<td>Problem related to lifestyle, unspecified</td>
</tr>
<tr>
<td>V65.3</td>
<td>Dietary surveillance and counseling</td>
</tr>
<tr>
<td>V65.41</td>
<td>Exercise counseling</td>
</tr>
<tr>
<td>V65.49</td>
<td>Other specified counseling</td>
</tr>
</tbody>
</table>

TABLE 3: Diagnosis Codes for Obesity-Related Visits
Self-assessment measures regarding initiation of motivational and behavioral counseling strategies may also be considered.

**Quality Control/Quality Improvement**

Indirect evidence from the quality improvement literature suggests that the use of the rapid-cycle improvement model results in improved processes of change to improve practice. The rapid-cycle improvement model, built on the work of Langley et al, suggests that the practice needs to have a specific aim that is measurable and then needs to develop a plan to make practice changes by using the plan-do-study-act model (including assessment, documentation, and addressing of children at risk of becoming overweight). The plan-do-study-act model starts with the plan; the practice plans for the changes that need to occur to improve the prevention of overweight in youths and plans the method of measuring whether those changes are occurring. Do refers to implementing the changes that have been created to improve care for youths at risk of becoming overweight. Study refers to collecting the data on the current status of the practice and assessing the changes over time. The data are reviewed by the practice to monitor its progress. Act refers to modifying or changing the plan if the goals have not been achieved or cannot be implemented as planned. The cycle is repeated until the goals have been met; at that point, the next step is to disseminate the successful changes throughout the practice and to other practices.

**Disease Management With the Chronic Care Model**

**Components of the Model**

We propose approaching the issue of prevention of overweight/obesity in children with the disease management techniques outlined in the chronic care model. The chronic care model is a synthesis of evidence-based system changes that organizations can use to guide quality improvement and disease management activities. The model includes practice changes to provide self-management support for patients and family members, decision support for providers, delivery-system redesigns to promote better care, and clinical information systems to provide data for evaluation of the progress the practice is making in meeting its goals. Indirect evidence from the National Health Disparities Collaboratives on asthma, diabetes, and depression suggests that improved patient outcomes result from use of the chronic care model.

**Self-management Support**

Self-management support empowers and prepares patients to manage their health and health care. We propose collaborative goal-setting between the patient and family and the provider, development of an action plan with the patient and family, and provision of education to the patient and family that gives them the necessary tools to monitor changes and addresses lifestyle changes needed to improve weight status.

**Decision Support**

Decision support refers to education for providers and support staff members regarding the latest evidence on preventing overweight in youths, assessment and monitoring of weight in children, counseling in effective techniques for behavior change, and rapid-cycle improvement to monitor practice improvement strategies. Decision support promotes clinical care that is consistent with scientific evidence and patient preferences.

One strategy is to embed available evidence-based guidelines or best-practice recommendations into daily clinical practice. We suggest ongoing continuing education for providers that updates them on recent literature and future clinical practice guidelines to promote effective care of children at risk of overweight. Support staff members may need training in calculating and documenting BMI. Primary care providers may need training in tracking the child’s BMI and discussing the findings with the child and family. Another aspect of decision support is the integration of specialty expertise with primary care. Providers need to establish referral criteria so that providers know when to send patients for specialist care.

Indirect evidence from the National Health Disparities Collaboratives on diabetes suggests that ongoing provider education using interactive education strategies with case studies improves providers’ knowledge and management skills. Similarly, embedding the BMI into daily practice by including the information in the daily routine and encounter forms helps to achieve the practice changes necessary to improve care.

**Delivery-System Redesign**

Delivery-system redesign ensures the delivery of effective, efficient, clinical care and self-management support. Indirect evidence from the National Health Disparities Collaboratives on asthma, diabetes, and depression shows improved outcomes with changes in the delivery-system design, such as planned visits that include regular patient assessment, review of the action plan, and routine updating of self-management goals. Delivery-system redesign strategies that may be used to provide the care include group visits, case management, and the use of primary care teams.

Indirect evidence on the use of group visits suggests that it is a cost-effective and efficient way to deliver care. The group setting allows the provider to offer information to larger groups of individuals at one time and allows family members to interact with others who are facing the same challenges.

Indirect evidence also suggests the value of case man-
We suggest flagging charts to identify those who are at risk of overweight or are gaining weight at an accelerated rate, so that future providers can address the effects of weight gain on the child’s health. Practice changes may be needed to provide ongoing support to clients in the at-risk category. The chronic care model also suggests that providers identify community resources and make referrals to specialists when appropriate.

Another aspect of practice redesign is implementation of primary care teams. These are interdisciplinary teams created within the practice that include physicians, nurses, dieticians, behavioral health clinicians, and support staff members who provide the education and create tools to give patients and family members the information needed to implement changes. Each member of the team has an assigned role and duties specific to that team role. The primary care team incorporates the patient action plan into the routine clinic flow sheets, to ensure that the provider addresses the plan at each visit.

**Clinical Information Systems**

Clinical information systems organize patient and population data to facilitate efficient effective care. Clinical information systems provide timely reminders and feedback for providers and patients. Patient registries can be developed to identify subpopulations for proactive care and to facilitate individual patient care planning.

The electronic medical chart is an effective tool that practice staff members have available to facilitate the identification of children at risk for overweight and to monitor practice changes in the identification and care of overweight children. Electronic medical charts are available to calculate BMI values and to graph them on the BMI growth charts. Some electronic medical charts can also provide “red flags” to providers regarding patients with BMI of ≥85th percentile or ≥95th percentile. Some electronic medical charts also generate appointment cards as reminders to patients. The use of electronic medical charts also facilitates the practice of self-monitoring and use of data to evaluate progress, as part of quality improvement.

**Reimbursement**

A challenge to health care providers in delivering adequate care and support to children at risk of overweight/obesity is the issue of reimbursement for health care visits. Coding for care of children at risk for obesity and related comorbidities is straightforward. The Current Procedural Terminology and International Classification of Diseases, Ninth Edition, codes (Table 2) are available for reporting of the services provided for management of pediatric overweight. However, the American Academy of Pediatrics advises practitioners that obtaining appropriate reimbursement is more complicated. Many insurance carriers deny claims submitted with “obesity” codes. The American Academy of Pediatrics suggests that coding for obesity-related care is a 2-step process. The first step is to submit claims with appropriate codes (Table 2); the second step involves practice-level issues of denial management and contract negotiation. The American Academy of Pediatrics has developed a strategy and a template letter to be used by practices that are in negotiation regarding denial management (available at www.aap.org/moc/loadsecure.cfm/reimburse/denialtemplateltr.pdf). Diagnostic codes that may be appropriate for the initial and recurring assessments performed by the provider are presented in Table 3.

**OCCUPATIONAL OPPORTUNITIES FOR OBESITY PREVENTION IN THE COMMUNITY AND ENVIRONMENT**

**Collaborative Opportunities for Health Care Providers**

**Need for Coordination**

One of the greatest obstacles to effective obesity prevention at the community level is the lack of coordination of efforts across different sectors, that is, from the clinician’s office to schools and day care settings, to parks and playgrounds, and to grocery stores and restaurants. Therefore, an important step for health care providers in addressing childhood obesity is to become aware of the status of ongoing obesity prevention initiatives in their communities and to interact with leaders of those initiatives to express and to offer their support. Where initiatives do not yet exist, health care providers are in positions of natural leadership and can help other community leaders shape prevention efforts, on the basis of the growing body of evidence regarding what works in other settings.

**School-Based Initiatives**

School-based obesity prevention efforts take 3 primary forms, that is, promotion of healthy foods and restriction/discouragement of less-healthy foods in the cafeteria and from vending machines, expanded and intensified health curricula regarding the importance of nutrition and physical activity, and availability of opportunities for exercise through PE and recess programs. The challenge of school-based efforts is that studies of their effects have generally demonstrated increases in program participation and improvements in desirable eating and activity behaviors but have less consistently demonstrated changes in body weight or fatness.

Promoting healthy foods and discouraging less-healthy foods during the school day is an area of intense debate and mixed success in previous research. Some studies have demonstrated that it is possible to influence consumption strongly by limiting access to “competitive” foods (compared with school meal plans) during school hours, by enhancing availability of healthier alternative foods in vending machines, and by pricing healthier...
alternative foods more favorably than less-healthy foods in the a la carte setting.269 There are instructive instances in which schools have negotiated successfully with beverage distributors to place healthier alternatives in vending machines.270

The majority of states specify that diet and activity/fitness must be components of the health education curriculum in schools, but <10 hours/year are spent on these subjects together, on average.269 Therefore, providing expanded and enhanced health curricula regarding nutrition and physical activity in schools may help students consider, adopt, and maintain healthier diets and more physically active habits.2 Behavior-oriented, rather than solely information-focused, curricula are effective in promoting healthful food choices and physical activity. The Institute of Medicine report on childhood obesity prevention recommends ≥30 minutes of activity during each school day, as either PE classes or recess.2

The National Association for Sport and Physical Education recommends 150 minutes of PE per week for children in elementary school and 225 minutes of PE per week for children in middle or secondary school.271 Health care providers can support efforts to prioritize physical activity during the school day by asking about children’s participation during routine office visits and then providing feedback to schools and school systems regarding physical activity as a central priority for health and wellness. An opportunity exists for providers to play a concrete role in the establishment and refinement of school wellness policies within their local districts and state educational systems.

Schools have been the central focus of most studies on nutrition and PE in childhood, and similar issues in child care settings for preschool-aged children and school-aged children (after school) have received increasing attention. As summarized recently, studies using accelerometers have demonstrated the importance of planned physical activity in the daily preschool schedule, organized as structured activity sessions that emphasize a wide variety of movements.272 Nutrition programs in child care settings, particularly for school-aged children after the end of the regular school day, are also potential opportunities to prevent obesity and should be a topic of conversation with children and their families for health care providers.

Community-Based Initiatives

The “built environment” in the United States has attracted increasing attention as a contributor to the childhood obesity epidemic and as a growing threat to effective prevention of obesity.273 Children with less access to opportunities for physical activity in their neighborhoods are more likely to be obese, and such access is more limited in lower-income communities of color. The movement of populations out of inner cities and into suburbs has generally created a greater dependence on automobile transportation and has left behind inner-city neighborhoods that used to offer superb connectivity and direct routes for pedestrians from point to point but that today (if perceived as unsafe by parents) no longer offer appealing options for regular physical activity for children through walking or riding bicycles. To address these challenges, children’s health care providers can support efforts to preserve and to enhance parks as areas for physical activity, inform local development initiatives regarding the inclusion of walking and bicycle paths, and promote families’ use of local physical activity options by making information and suggestions about physical activity alternatives available in their offices.

Obesity Policy Advocacy Opportunities for Health Care Providers

Children’s health care providers will have opportunities to promote and to enhance child obesity prevention policies in their communities, states, regions, and the nation, as they have in recent policy efforts on tobacco and alcohol control and firearms and traffic safety. Although obesity prevention has much in common with those efforts, a key distinction is that eating is essential to life, whereas tobacco, alcohol, firearms, and automobiles are not. Therefore, the ways in which childhood obesity policy efforts evolve, particularly with respect to the role of the food industry, will need to strike a balance regarding food consumption; this is fundamentally more challenging than seeking blanket bans on cigarette sales and advertising to minors.274

A key role for health care providers will be to help childhood obesity efforts focus on a limited set of specific messages to the public regarding nutrition and activity and on a related set of specific policy goals that can be pursued at the local (eg, school and community), state, and national levels. Policy researchers at the University of Baltimore have developed a state “obesity policy report card” that assigns grades to states on the basis of the legislation they have passed and considered.275 Providers can use this report card as a source of information about their own states and as a comparative tool to see what other states have done.

Another role for providers related to advocacy is following up state and local policy initiatives within the office setting. For example, a few states now require schools to measure height and weight and to report BMI values to students and their families, with encouragement to follow up with their health care providers.269 Such programs are intended to raise general awareness about the challenges of the obesity epidemic and to alert children and their families regarding individual opportunities to address obesity when it can be reversed more easily, during the childhood and adolescent years. Health care providers can play a central role in helping children and families interpret and respond to these “BMI report cards,” which also help providers detect
children whose BMI values are in the overweight or obese ranges. Providers can also play critical roles in helping children, families, and communities address issues of stigma and low self-esteem that can result from detection and information programs.

RECOMMENDATIONS FOR PREVENTION OF CHILDHOOD OBESITY

Patient-Level Interventions

1. The expert committee recommends that physicians and allied health care providers counsel the following for children 2 to 18 years of age whose BMI is 5th to 84th percentile: (a) limiting consumption of sugar-sweetened beverages (consistent evidence); (b) encouraging diets with recommended quantities of fruits and vegetables (mixed evidence); (c) limiting television and other screen time by allowing no more than 2 hours per day, as advised by the American Academy of Pediatrics (consistent evidence), and removing television and computer screens from children's primary sleeping areas (consistent evidence); (d) eating breakfast daily (consistent evidence); (e) limiting eating at restaurants, particularly fast food restaurants (consistent evidence); (f) encouraging family meals in which parents and children eat together (consistent evidence); and (g) limiting portion sizes (consistent evidence).

2. The expert committee also suggests that providers counsel families to engage in the following behaviors: (a) eating a diet rich in calcium; (b) eating a diet high in fiber; (c) eating a diet with balanced macronutrients (energy from fat, carbohydrates, and protein in proportions appropriate for age, as recommended by Dietary Reference Intakes); (d) initiating and maintaining breastfeeding; (e) participating in 60 minutes of moderate to vigorous physical activity per day for children of healthy weight (the 60 minutes can be accumulated throughout the day, rather than in single or long bouts; ideally, such activity should be enjoyable to the child); and (f) limiting consumption of energy-dense foods.

Practice- and Community-Level Interventions

1. The expert committee recommends that physicians, allied health care professionals, and professional organizations (a) advocate for the federal government to increase physical activity at schools through intervention programs from grade 1 through the end of high school and college and through the creation of school environments that support physical activity in general and (b) support efforts to preserve and to enhance parks as areas for physical activity, inform local development initiatives regarding the inclusion of walking and bicycle paths, and promote families' use of local physical options by making information and suggestions about physical activity alternatives available in doctors' offices.

2. The expert committee recommends the use of the following techniques to aid physicians and allied health care providers who may wish to support obesity prevention in clinical, school, and community settings: (a) actively engaging families with parental obesity or maternal diabetes, because these children are at increased risk for developing obesity even if they currently have normal BMI; (b) encouraging an authoritative parenting style (authoritative parents are both demanding and responsive) in support of increased physical activity and reduced sedentary behavior, providing tangible and motivational support for children; (c) discouraging a restrictive parenting style (restrictive parenting involves heavy monitoring and controlling of a child's behavior) regarding child eating; (d) encouraging parents to model healthy diets and portions sizes, physical activity, and limited television time; and (e) promoting physical activity at school and in child care settings (including after-school programs) by asking children and parents about activity in these settings during routine office visits.

APPENDIX: 15-MINUTE OBESITY PREVENTION PROTOCOL

Step 1: Assess

Weight/Height


Diet

Assess intake of fruit and vegetables (suggested measure: 2 items on daily usual intake; measure can be provided in handout), sweetened beverages (suggested measure: 2 items on daily usual intake; measure can be provided in handout), and fast food (suggested measure: 1 item on weekly average of meals at fast food establishments).

Activity

Assess sedentary time/screen time (suggested measure: 2 items on hours per day of television/video games/movies/computer; measure can be provided in handout) and daily activity (at least 60 minutes/day of moderate-to-vigorous activity).

Optional Behaviors to Assess

Consider assessing breakfast consumption (suggested measure not established), portion sizes (suggested measure not established), and family meals (suggested measure not established).
Provide/Elicit
Provide positive feedback for behavior(s) in optimal range. Elicit response. Reflect and probe. Provide behavior(s) not in optimal range. Elicit response. Reflect and probe.

Step 2: Set Agenda
Query which, if any, of the target behaviors not in the optimal range the parent/child/adolescent may be interested in changing or may be easiest to change. Sample language is as follows. Which, if any, of these might you and your child be able to change? Which of these might be a good place to start? Which of these do you think might be the easiest one to start with? Agree on possible target behaviors.

Step 3: Assess Motivation and Confidence

Willingness/Importance
Assess willingness and importance, as follows. On a scale of 0 to 10, with 10 being very important, how important is it for you/child/family to change (insert target behavior) or to lose weight?

Confidence
Assess confidence, as follows. On a scale of 0 to 10, with 10 being very confident, assuming you decided to change (insert target behavior) or weight, how confident are you that you/she/he could succeed?

Probes
Explore importance and confidence ratings with the following probes. Why did you not choose a lower number (benefits)? Why did you not choose a higher number (barriers)? What would it take to move you to a higher number (solutions)? Use reflective statements to explore the advantages and disadvantages of changing.

Step 4: Summarize and Probe Possible Changes
Summarize the advantages and disadvantages of change. Query possible next steps. Sample language is as follows. So where does that leave you? From what you mentioned, it sounds like (insert target step) may be a good first step. How are you feeling about making a change? If change is indicated, probe the plan of attack. Sample language is as follows. What might be a good first step for you and your child? What might you do in the next week or even day to help move things along? What ideas do you have for making this happen? From our discussion, it sounds like (insert possible suggestions raised in session) might be a good place to start. If the patient has trouble generating ideas, consider offering the following: If it’s okay with you, I’d like to suggest a few things that have worked for some of my patients. Summarize the change plan. Provide positive feedback.

Step 5: Schedule Follow-up Visit
If a change plan emerges, agree to follow up within x weeks/months. Sample language is as follows. Let’s schedule a visit in the next few weeks/months to see how things went. If no change plan emerges, agree to revisit the topic within x weeks/months. Sample language is as follows. Sounds like you aren’t quite ready to commit to making any changes now. How about we follow up with you at your next visit? Although you (or your family) do not sound ready to make any changes, between now and our next visit you might want to think about (insert discussion point raised in session).

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SUPPLEMENT ARTICLE

Recommendations for Treatment of Child and Adolescent Overweight and Obesity

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ABSTRACT

In this article, we review evidence about the treatment of obesity that may have applications in primary care, community, and tertiary care settings. We examine current information about eating behaviors, physical activity behaviors, and sedentary behaviors that may affect weight in children and adolescents. We also review studies of multidisciplinary behavior-based obesity treatment programs and information about more aggressive forms of treatment. The writing group has drawn from the available evidence to propose a comprehensive 4-step or staged-care approach for weight management that includes the following stages: (1) Prevention Plus; (2) structured weight management; (3) comprehensive multidisciplinary intervention; and (4) tertiary care intervention. We suggest that providers encourage healthy behaviors while using techniques to motivate patients and families, and interventions should be tailored to the individual child and family. Although more intense treatment stages will generally occur outside the typical office setting, offices can implement less intense intervention strategies. We not only address specific patient behavior goals but also encourage practices to modify office systems to streamline office-based care and to prepare to coordinate with professionals and programs outside the office for more intensive interventions.
TREATMENT FOR CHILDREN who are overweight or obese seems easy, that is, just counsel children and their families to eat less and to exercise more. In practice, however, treatment of childhood obesity is time-consuming, frustrating, difficult, and expensive. In fact, choosing the most effective methods for treating overweight and obesity in children is complex at best. This is especially true for primary care providers, who have limited resources to offer interventions within their offices or programs and few providers to whom they can refer patients.

The need for evidence-based treatment recommendations is a critical health care issue, because obese children and adolescents are at risk for developing many of the comorbidities seen in obese adults. Studies demonstrated that fasting serum glucose, insulin, and triglyceride levels and the prevalence of impaired glucose tolerance and systolic hypertension increase significantly as children become obese (BMI of ≥95th percentile).1 Even children and adolescents who are overweight (BMI of 85th to 94th percentile) are at risk for comorbidities. Therefore, interventions using dietary modifications, increased physical activity, and behavioral therapy may be beneficial for overweight children and adolescents, with more-aggressive intervention directed toward obese children and adolescents.2

Health care professionals, however, may find it difficult to determine which interventions will be most efficacious for their patients. To date, no clinical trials have determined whether specific dietary modifications alone (i.e., without behavioral interventions and increased physical activity) are effective in reducing childhood overweight and obesity rates. Comprehensive interventions that include behavioral therapy along with changes in nutrition and physical activity are the most closely studied and seem to be the most successful approaches to improving long-term weight and health status.3,4 However, the clinical trials testing these interventions often are limited in their ability to determine the relative efficacy of individual strategies. Ultimately, children and adolescents (and adults, for that matter) become overweight or obese because of an imbalance between energy intake and expenditure. Dietary patterns, television viewing and other sedentary activities, and an overall lack of physical activity play key roles in creating this imbalance and therefore represent opportunities for intervention.

This report reviews evidence about the treatment of obesity that may have application in the primary care setting. It examines current information about eating behaviors, physical activity behaviors, and sedentary behaviors that may affect weight gain. Many of the studies are correlational, rather than interventional. Also examined are studies of multidisciplinary, behavior-based, obesity treatment programs and information about more-aggressive forms of treatment, such as bariatric surgery. Reviews are followed by evidence-based treatment recommendations.

Studies of obesity treatment in the primary care setting have not been conducted. To provide guidance on obesity treatment to providers, the treatment writing group has drawn from the available evidence to propose a comprehensive approach (as yet untested) that is reasonable, feasible, and flexible. This report suggests that providers encourage healthy behaviors, use techniques to motivate patients and families, establish office systems that support monitoring and care of these children, and implement a staged approach to intervention that is tailored to the individual child and family.

NUTRITIONAL TREATMENT

Data Limitations

Virtually no clinical trials examining the effects of any specific dietary prescription on body weight or adiposity in children control for the effects of potentially confounding factors, such as treatment intensity, behavioral intervention strategies, and physical activity. Although comprehensive approaches aiming to modify diet, physical activity, family behavior, and the social and physical environment are undoubtedly needed, studies involving multiple modalities cannot assess the efficacy of any specific component (e.g., diet). In the absence of data on the relative efficacy of various dietary prescriptions in the treatment of obesity in children, it is sometimes necessary to make inferences from the childhood obesity prevention and adult treatment literature.

Food Groups and Childhood Overweight

Fruits and Vegetables

Eight studies evaluating the relationship between fruit and/or vegetable intake and body weight were reviewed; none was longitudinal. A nationally representative study found an association between lower intake of fruits and vegetable consumption, but the effect of these dietary changes on weight or weight loss has not been evaluated. School-based studies frequently combine increased
fruit and vegetable intake with decreased fat intake, which makes it difficult to comment on the association between fruit and vegetable intake and weight. It should be noted, however, that in none of the studies reviewed was increased fruit and vegetable intake related to increased adiposity. The evidence was more compelling for fruits alone or for fruits and vegetables combined than for vegetables alone, possibly because different fruits and vegetables have differing effects on children’s weight. Some of the most commonly consumed vegetables are relatively high in energy because of the way they are prepared. For example, more than one third of the total vegetable intake in the United States consists of iceberg lettuce, frozen potatoes (usually French fries), and potato chips. On balance, the evidence indicates that greater fruit and vegetable intake may provide modest protection against increased adiposity. Research indicates that children are least likely to consume adequate amounts of foods from the fruit and vegetable groups, compared with other food groups.

### Fruit Juice

Intake of 100% fruit juice does not seem to be related to childhood obesity unless it is consumed in large quantities. Of the 10 articles reviewed, 3 found a positive association between consumption of large amounts of 100% juice (>12 fl oz/day) and increased incidence of overweight and 1 found a positive association with BMI of >95th percentile. However, none of the longitudinal studies or the nationally representative studies reported any relationship between 100% fruit juice consumption and BMI.

In a small case-control study of 7- to 10-year-old children, obese children consumed greater amounts of 100% fruit juice than did nonobese control subjects. One limitation of that study, however, beside small sample size, was the fact that the beverages reported as fruit juice on a food frequency questionnaire might have included artificially flavored drinks containing little or no fruit juice. This does not seem to have been a weakness of other studies.

In a cross-sectional study of 2- to 5-year-old children, those (n = 19) who consumed >12 oz of 100% fruit juice per day were at increased risk of short stature and overweight. Additional analysis of the same study population found that only apple juice was significantly related to BMI. Welsh et al found that fruit juice consumption among children 2 to 3 years of age with a BMI of ≥95th percentile was associated with continued obesity 1 year later. There was no significant difference in children with BMI of <95th percentile 1 year later. In that study, fruit juice was defined as vitamin C-containing juice (orange juice or juice with vitamin C added).

Skinner et al monitored children longitudinally from 24 to 72 months of age and found no relationship between 100% juice intake and anthropometric measurements. However, one criticism of that study was that only 3 children consumed 12 oz of juice per day over time and only 1 of those reported 12 oz/day at all 7 dietary interviews. When fruit juice consumption was examined as a continuous variable, there still was no significant association between intake and BMI. In fact, children with a higher intake of fruit juice were more likely to have a lower Ponderal index (an indicator of weight status analogous to BMI but calculated as weight divided by height to the third power).

The 1994 Continuing Survey of Food Intakes by Individuals data on preschool-aged children who reported intake of >12 oz of 100% juice daily found no relationship between fruit juice consumption and BMI. Similarly, a study of preschool-aged children enrolled in the Supplemental Nutrition Program for Women, Infants, and Children program, 79% of whom reportedly consumed >12 oz of fruit juice daily, found no relationship between 100% fruit juice consumption and BMI. A study of preschool-aged children in Germany found no association between excessive consumption of fruit juice and BMI. Similar data for adolescents are lacking, but data suggest that fruit juice consumption declines as children mature.

The American Academy of Pediatrics recently recommended that fruit juice consumption be limited to 4 to 5 oz/day for children 1 to 6 years of age and 8 to 12 oz/day for children 7 to 18 years of age. These recommendations, however, were based on considerations of nutrient and gastrointestinal problems. More research was deemed necessary before overweight could be considered a consequence of excess fruit juice consumption. The US Department of Agriculture has stressed the important contribution to nutrient intake of 100% fruit juices and advises that, when consumed in quantities consistent with the Dietary Guidelines for Americans, fruit juice is advantageous for healthy children.

### Sweetened Beverages

Intake of soft drinks and sweetened fruit drinks has increased dramatically among US children, particularly among adolescents, in recent decades. According to a national survey, soft drinks were the sixth leading food source of energy among children, constituting >50% of total beverage consumption and representing the primary source of energy intake for US adolescents. Although there is no clear evidence that consumption of sugar per se affects food intake and weight gain, there is evidence to suggest that “liquid sweets,” or energy consumed as a liquid, may be less well regulated by the body than energy consumed in a solid form. Furthermore, several studies suggest that consumption of soft drinks and other sweetened beverages is related to increased energy intake.

Of the 19 studies reviewed, 6 were longitudinal studies, 3 were nationally representative, cross-sectional studies, and 10 were case-control studies or other cross-
Dairy Foods and Calcium

As early as 1984, it was reported that dietary calcium intake was related inversely to BMI in adults. Only recently have additional research reports been published relating low dietary calcium intake to human adiposity. The data suggest a potential role for calcium and dairy foods in the development of overweight and the potential for preventing weight gain by improving the dairy food intake of youths, indicating that a low intake of calcium may be associated with increased adiposity. However, the relative importance of calcium and dairy foods, in comparison with other factors involved in the development of overweight, remains to be established.

Dietary Fiber

Many governmental and scientific health agencies recommend that adults consume at least 20 to 25 g of fiber per day. Because children require less total energy, an “age + 5” rule for dietary fiber intake has been recommended. Currently, dietary fiber intake throughout childhood and adolescence averages ~12 g/day or 5 g/1000 kcal (4200 kJ), a level of intake that has not changed in the past 30 years. Because total carbohydrate content has increased considerably during this period, most of this increase seems to be in the form of fiber-poor refined grains, starchy vegetables, and sugar-sweetened beverages. It is worth investigating whether this apparent increase in consumption of fiber-poor foods is causally related to the observed increase in childhood obesity prevalence.

Dietary fiber may be related to body weight regulation through plausible physiologic mechanisms that have considerable support in the scientific literature. A large number of short-term studies suggest that high-fiber foods induce greater satiety. Epidemiologic studies generally support a role for fiber in body weight regulation among free-living individuals consuming self-selected diets, although conclusive intervention studies that address this are lacking. Therefore, there is considerable reason to conclude that fiber-rich diets containing nonstarchy vegetables, fruits, whole grains, legumes, and nuts may be effective in the prevention and treatment of obesity in children. Such diets may have additional benefits, independent of changes in adiposity, in the prevention of cardiovascular disease and type 2 diabetes mellitus.

sectional studies. Although the evidence is mixed, the larger, more strongly designed, and higher-quality studies substantiated the idea that sweetened beverage intake is related to overweight among children. Of the 6 longitudinal studies, 3 found intake of soda or total sweetened beverages to be associated positively with at least 1 measure of adiposity, whereas 3 found no significant associations. A large, nationally representative study by Troiano et al that measured height and weight directly found a positive association between energy from soda and overweight. Two smaller national studies by Forshee and Storey, which found no such association, were based on reported heights and weights.

In a nationally representative sample of 2- to 19-year-old youths, soft drink intake was greater among overweight youths than among nonoverweight youths in all age groups. Furthermore, the Growing Up Today Study, a 1.5-year longitudinal study of children 9 to 14 years of age, found that high levels of consumption of sweetened beverages at baseline were associated with increased BMI.

In a recently published, randomized, controlled trial conducted among 103 high school students who regularly consumed sugar-sweetened beverages, students were assigned to either an experimental group that received home deliveries of noncaloric beverages or a control group that received no intervention. After 6 months, responses to the intervention were associated inversely with baseline BMI values. Among the heaviest one third of the cohort, BMI was significantly lower in the experimental group, compared with the control group (~0.75 ± 0.34 kg/m²).

Consuming excessive quantities of low-nutrient, energy-dense foods such as sugar-sweetened beverages is a risk factor for obesity. Reducing intake of sugared beverages may be one of the easiest and most-effective ways to reduce ingested energy levels.

Dairy Foods and Calcium

As early as 1984, it was reported that dietary calcium intake was related inversely to BMI in adults. Only recently have additional research reports been published relating low dietary calcium intake to human adiposity.

Of the 7 studies reviewed that assessed dietary calcium intake, 4 found no associations and 3 found inverse associations between calcium intakes and various measures of adiposity. In a cross-sectional study of primarily white youths, intake of calcium, after controlling for dietary energy and intake of dairy foods, was lower among overweight than nonoverweight 9- to 14-year-old youths. No studies found a positive association between calcium intake and adiposity.

Although energy intake was controlled for in most of those analyses, such epidemiologic findings may be misleading, because dairy products reportedly are avoided by individuals concerned about their weight. However, prospective studies of preschool-aged children confirmed that greater longitudinal intake of calcium was associated with lower body fat.

The data suggest a potential role for calcium and dairy foods in the development of overweight and the potential for preventing weight gain by improving the dairy food intake of youths, indicating that a low intake of calcium may be associated with increased adiposity. However, the relative importance of calcium and dairy foods, in comparison with other factors involved in the development of overweight, remains to be established.
Macronutrient Alterations

**Carbohydrates and Fat**

Several adult studies have shown that significant weight loss can be achieved over 3 to 6 months with energy-restricted or ad libitum dietary prescriptions varying widely in macronutrient composition. However, follow-up rates have been disappointing. Weight loss at follow-up times of 12 to 18 months rarely exceeds 5% of baseline weight. Although ad libitum, very-low-carbohydrate diets seem to be more efficacious than energy-restricted, low-fat diets over the short term, Foster et al found no significant group difference in mean body weight at 12 months. A study by Stern et al, which included patients with type 2 diabetes, had similar results. With regard to pediatric data from a short-term study, Sondike et al reported greater weight loss (−9.9 kg, compared with −4.1 kg) for adolescents who were instructed to follow an ad libitum, very-low-carbohydrate diet, compared with an ad libitum, low-fat diet, for 12 weeks. Findings from that study must be interpreted cautiously, however, in light of data on adults indicating poor compliance and weight regain over the long term on an "Atkins-type" diet. In addition, there is widespread concern about the safety of severe carbohydrate restriction, especially for children. Although very-low-carbohydrate diets may have some beneficial effects on risk factors for cardiovascular disease and type 2 diabetes, the overall effects of this approach on other disease processes and on growth and development are unknown.

Very-low-fat diets have been shown to promote weight loss in several studies with adults. However, those studies were not included in our systematic review for one of the following reasons: the design was not a randomized control trial, body weight was not a primary outcome, the intensity of intervention varied (ie, very-low-fat diets combined with other intensive lifestyle changes were compared with usual care), or long-term follow-up data were not included.

**Protein**

Evidence of long-term effectiveness (>1 year after treatment) of a high-protein, low-carbohydrate diet (also known as a protein-sparing modified fast [PSMF]) is extremely limited. There are 2 obvious reasons for this lack of evidence. First, relatively few studies of programs that use this type of intervention have been conducted. Second, the studies that do exist suffer from substantial methodologic limitations. For example, all studies were from the same treatment program and all analyzed only 1 component of a multicomponent intervention that included diet and physical activity. A major concern with the use of a PSMF diet to treat childhood overweight is that the very low energy intake may compromise children’s growth.

The PSMF is not a diet to be used for long-term treatment of overweight. Rather, the purpose of using a PSMF diet is to bring about rapid weight loss during the initial phase of treatment while minimizing the negative effects of a very-low-energy diet. In studies using PSMF, patients were on the diet for a relatively short initial treatment period and then were placed on a reduced-energy, balanced-macronutrient, maintenance diet. The goal was for the children to maintain the significant weight loss achieved during the “acute” treatment phase. All studies reported a statistically significant decrease in measures of overweight at the end of the initial treatment period. However, only 1 study actually compared the outcomes with a PSMF diet versus a balanced-macronutrient diet. That study found that subjects on the PSMF diet lost significantly (P < .001) more weight from baseline to after treatment (BMI decrease: 5.2 ± 1.3 kg/m²) than did the children on the comparison, balanced-macronutrient diet (BMI decrease: 2.4 ± 1.4 kg/m²). Although the investigators found significant weight loss after the initial treatment, the same degree of weight loss was not maintained at 1 year. In contrast, other researchers at the same facility studying longer-term outcomes found that children were generally able to maintain the weight loss after the initial treatment. Average BMI values were significantly lower than baseline values (P < .0001) both immediately and 1 year after treatment. In summary, these studies demonstrated that children initially treated with a PSMF diet were able to maintain some weight loss at 1 year. However, the researchers did not provide a true diet comparison, because the PSMF diet contained ~200 kcal (840 kJ) less per day than did the balanced-macronutrient control diet and potential differences in other aspects of the multicomponent program were not accounted for.

**Alternative Approaches**

Dietary interventions based on energy density (ie, energy per mass of food) also have been considered as an approach to weight management. A series of short-term feeding studies, summarized by Rolls, suggest that decreasing energy density decreases energy intake independent of macronutrient ratio, possibly because of effects on satiety. Diets of low energy density, which are typically rich in vegetables, fruits, legumes, and minimally processed grain products, allow individuals to consume satisfying portions of food while reducing their energy intake. Other studies included in the review indicate that the volume of food consumed exerts a stronger effect than energy content. Decreasing the energy density but maintaining or increasing the volume of core foods in a weight management program may help decrease energy intake. In a preliminary report of ad libitum diets in obese women, greater weight loss was achieved at 6 months by reducing energy density, with emphasis on increasing consumption of water-rich foods.
and decreasing consumption of high-fat foods, than by reducing fat intake alone; however, weight loss did not differ between dietary intervention groups at 12 months.

The glycemic index (GI) has been proposed to affect body weight regulation and risk for obesity-associated complications. The GI is defined as the area under the glucose dose-response curve after consumption of 50 g of available carbohydrate from a test food, divided by the area under the curve after consumption of 50 g of available carbohydrate from a control food (either white bread or glucose). Short-term feeding studies indicated that hunger and cumulative food intake were greater 3 to 5 hours after a high-GI versus low-GI meal, controlled for macronutrient and energy contents. However, not all observational studies found a direct association between GI and weight gain. Translational studies found that pair-fed rodents consuming nutrient-controlled, high-GI diets had 70% to 90% greater adiposity than did those consuming low-GI diets. Few long-term clinical trials evaluating low-GI diets in children have been conducted. After controlling for potentially confounding factors, 1 nonrandomized study found that children attending an obesity treatment clinic and assigned to a low-GI diet lost more weight than did those assigned to a low-fat diet. A small-scale, randomized, controlled trial found that adolescents lost more weight on a diet with low glycemic load (mean GI × carbohydrate amount) than on a low-fat diet. Studies comparing the effects of high-GI versus low-GI diets on body weight in adults have produced conflicting results; some showed that low-GI diets led to weight loss, whereas others showed no difference in weight.

**Summary of Macronutrient Alterations**

Data on optimal dietary approaches for weight management in children are lacking, and long-term studies of available interventions in adults have not demonstrated efficacy. Therefore, research into the development and testing of novel dietary approaches to obesity prevention and treatment is warranted. An emerging body of literature suggests that a focus on the macronutrient ratio is too simplistic and the quality of dietary carbohydrates and fats is an important consideration. The evidence for children and adolescents does not support any specific macronutrient or dietary strategy at this time.

**FOOD BEHAVIORS**

**Breakfast Skipping**

Evidence supports observations that obese children are more likely to skip breakfast or to eat smaller breakfasts than leaner children. The evidence seems to suggest that breakfast skipping may be a risk factor for increased adiposity, particularly among older children or adolescents. However, the strength of the evidence is limited because what constitutes a breakfast has not been defined consistently.

Fifteen studies examining the link between breakfast skipping and adiposity were reviewed. Two studies were longitudinal studies, and 2 were nationally representative, cross-sectional studies, and 11 were other types of cross-sectional investigations. Both longitudinal studies found that, for girls, breakfast skipping was related to weight gain among those who had normal weight at baseline but was related to weight loss among those who were overweight at baseline. For boys, no relationship was found with breakfast skipping except for weight loss among those who were overweight at baseline in 1 of the 2 studies. The 2 nationally representative studies did not find an association between breakfast skipping and reported BMI in younger children, but Siega-Riz et al, who studied food intake patterns for adolescents, did find a positive association.

Of the remaining 11 studies, 5 found a positive association between breakfast skipping and a measure of adiposity, indicating that breakfast skippers were more likely to have a weight higher than normal. Four studies found no relationship between breakfast skipping and a measure of adiposity, and 2 studies reported a negative relationship between breakfast skipping and a measure of adiposity, indicating that breakfast skipping was associated with lower measures of adiposity.

Population-based surveys have revealed that many children, particularly adolescents, skip breakfast and other meals but consume more food later in the day, and this pattern has increased in recent years. Overweight children and adolescents have been shown to be more likely to skip breakfast and to consume a few large meals each day than their leaner counterparts, who are more likely to consume smaller, more-frequent meals. Overweight children have also been reported to eat smaller breakfasts and larger dinners, in comparison with nonoverweight children. It has been suggested that eating breakfast reduces fat intake and limits snacking over the remainder of the day.

**Snacking**

In a review of the literature, the American Dietetic Association found that snacking frequency or snack food intake might not be associated with adiposity in children. The majority of the studies reviewed found no association between snacking and adiposity. Francis et al found no relationship between snacking and changes in BMI among girls with nonoverweight parents. Among girls with overweight parents, only fat intake from energy-dense snacks was associated with increased BMI over the 4-year study. However, mixed results were reported among the 7 case-control and other cross-sectional studies that examined the amount of snack food consumed in relation to adiposity. Two
found a positive relationship, whereas 5 found no relationship. Comparisons of the findings from those studies are limited because there was no clear definition of what constituted a snack or snack food. The best evidence suggests that snacking frequency is not associated with adiposity in children; however, studies that examined total snack food intake produced more-mixed results.

According to national surveys, although the average size of snacks and the energy per snack remained relatively constant, the frequency of self-defined snacking increased from 1977 to 1996 among children in all age groups between 2 and 18 years. Reportedly, between one fourth and one third of the energy intake of adolescents is derived from snacks. Furthermore, snacks tend to have higher energy density and fat content than meals, and frequent snacking has been associated with high intakes of fat, sugar, and energy. The primary snacks selected by teens include potato chips, ice cream, candy, cookies, breakfast cereal, popcorn, crackers, soup, cake, and carbonated beverages.

Eating Out
Evidence shows that consuming food away from home, particularly at fast food establishments, may be associated with adiposity, especially among adolescents. A total of 12 observational studies were reviewed, including 2 longitudinal studies with children and 1 longitudinal study with adults, 2 nationally representative, cross-sectional studies, and 7 other cross-sectional studies. Study sample sizes ranged from just over 50 to > 60 000. The majority of studies focused on older children and adolescents. In a longitudinal study of girls, Thompson et al reported a positive association between eating at fast food establishments and BMI z scores for elementary school-aged girls but no association with eating at coffee shops or other types of restaurants. Taveras et al found, in a study of > 14 000 girls and boys, that greater consumption of fried foods eaten away from home was evident for heavier adolescents and that greater consumption of fried foods eaten away from home over time led to an increase in BMI. In addition, the frequency of eating fried foods away from home was associated with greater intakes of total energy, sugar-sweetened beverages, and trans fats, as well as less consumption of low-fat dairy foods and fruits and vegetables. The other longitudinal study, which was conducted in Japan, found no relationship between eating out in general and BMI among preschool-aged children. A nationally representative study by Lin et al found no association between food eaten away from home and reported BMI. Pereira et al found in the Coronary Artery Risk Development in Young Adults (CARDIA) study that consumption of fast foods was associated directly with body weight and insulin resistance over 15 years among young black and white adults. Findings from the other studies were mixed, ranging from positive associations to inverse relationships. Because both the largest longitudinal study and the largest cross-sectional study took place outside the United States (in Japan and Iran, respectively), their findings are not directly applicable to the US fast food environment. However, the limited evidence currently available suggests that frequent patronage of fast food restaurants may be a risk factor for overweight/obesity in children and fast food ingestion year after year may accumulate into larger weight gains that can be clinically significant.

**DIETARY INTERVENTIONS**

**Use of Balanced-Macronutrient/Low-Energy Diets**

As stated previously, limited research exists for evaluating dietary treatment programs in isolation. However, a few dietary components have been evaluated. Although the outcomes are mixed, evidence does suggest that, in both the short term and the long term, a reduced-energy diet (less energy than required to maintain weight but not less than 1200 kcal [5040 kJ]/day) may be an effective part of a multicomponent weight management program in children 6 to 12 years of age. Use of a reduced-energy diet (not less than 1200 kcal [5040 kJ]/day) in the acute treatment phase for adolescent overweight is generally effective for short-term improvement in weight status; without continuing interventions, however, weight is regained.

Six studies that used a reduced-energy diet (not less than 1200 kcal [5040 kJ]) for 6- to 12-year-old youths were reviewed. The studies indicated that the majority of treatment groups decreased in ≥1 measure of adiposity. Only 2 studies reported an increase in weight at posttreatment or follow-up assessments. Six studies used an energy-deficit dietary treatment for adolescents. Five focused exclusively on adolescents, whereas the sixth provided treatment for 11- to 16-year-old youths. Five of the 6 studies reported a decrease in ≥1 measure of adiposity. Saelens et al reported a statistical difference in posttreatment weight status among teens who received a behaviorally based treatment, compared with a single-session, energy-deficit and activity approach, but differences diminished at the 3-month follow-up assessment. Only 2 studies reported follow-up periods of ≥1 year. In both of those studies, follow-up weight status was not higher than baseline. Generalizing the results of these studies is difficult because of differences in the treatment environment, duration, and intervention strategies. Treatment settings were outpatient clinics or boarding schools, whereas interventions ranged from computer-based programs with additional nutrition and activity counseling to health center-based, multicomponent programs.
Traffic Light Diet
Much of our current understanding of individual/family treatment of pediatric overweight comes from 4 long-term, family-based studies conducted by Epstein et al.118–123 The studies by Epstein et al.118–123 targeted children 6 to 12 years of age. The traffic light diet (sometimes called the stoplight diet) was developed by Epstein et al.118–123 for use in research on overweight. Perhaps because of the groundbreaking nature of their research, the traffic light diet has become broadly recognized and in some cases copied. The traffic light diet is part of a larger core package of interventions that generally includes family components, physical activity, and interactions with a behavioral therapist. The core intervention program was used in all studies, whereas other variables were manipulated. This presents a problem in trying to isolate the independent effects of the specific dietary intervention on weight loss.

The goal of the traffic light diet was to provide the most nutrition with the lowest energy intake. Daily energy intakes ranged from 900 to 1200 kcal (3780–5040 KJ), with later studies increasing intake to 1500 kcal (6300 KJ)/day.122 Food groups were divided into 3 categories, namely, green, yellow, and red. Low-energy, high-nutrient foods (eg, most fruits and vegetables) are considered “green” and may be eaten often. Moderate-energy foods (eg, most grains) are considered “yellow” and may be eaten in moderation, whereas high-energy, low-nutrient foods are considered “red” and should be eaten sparingly. Families were instructed to stay within a prescribed energy range and to reduce “red” food servings to less than a prescribed value for the week (eg, < 4 times per week). In addition to the basic diet, and depending on the arm of the intervention study, participants might have been given self-monitoring training and support, praise and modeling, therapist contact, and/or behavioral contracting, in which children were given rewards for meeting dietary and activity goals. Once children/families met their weight goals, counseling was provided to ensure consumption of a balanced diet that would maintain a healthy weight.

The intervention and research program by Epstein et al.118–123 demonstrated modest sustained weight loss in children 5 years and even 10 years after the intervention.123 However, not all of the behavioral interventions provided sustained weight loss.123 It remains unclear what part the diet itself played in these overall results. Because the research by Epstein et al.118–123 focused primarily on white, middle-class, intact families with younger children (6–12 years of age), it is also unclear how well results may be generalized beyond this population.13

Food Guide Pyramid
The Food Guide Pyramid was designed as a general guide for diet and exercise and not as a weight loss tool. Although it may be used as a component of a comprehensive childhood weight management program, the evidence does not indicate that, by itself, the Food Guide Pyramid is an effective weight loss tool. Only 1 study was identified that used the pyramid as a weight loss tool. Saelens et al.114 found that adolescents who used the Food Guide Pyramid as part of their weight management program gained weight over the course of treatment and at follow-up evaluations. This was compared with adolescents in the control group who ate a balanced, lower-energy diet, whose weight either stabilized or decreased slightly.

PHYSICAL ACTIVITY
Importance of Physical Activity
Although obesity has a complex development, involving environmental, physiologic, and genetic factors, the basic cause of this condition is an imbalance between energy intake and energy expenditure. Physical activity is the only modifiable component of the energy expenditure portion of the energy balance equation. Consequently, increasing physical activity has the potential to improve weight loss and maintenance. Studies indicate that an increase in sedentary activities, particularly television viewing, and an overall decrease in physical activity are contributing to an increased incidence of overweight and obesity in children and adolescents.124–127 Strategies to increase physical activity should include increases in structured and nonstructured physical activity and reductions in the amount of time spent in sedentary activities. Schools have a unique combination of factors, including facilities, fitness instructors, and contact with large numbers of young people for many hours each day during much of the year, that make them a good environment in which to study physical activity interventions for weight management and to implement proven approaches.128

Role of Physical Activity in Weight Management
Noting that accurate measurement of physical activity is complex and that comparisons between studies are difficult because of differences in designs and methods, some researchers have questioned whether it is possible to demonstrate an effect of physical activity in reducing obesity.129 Because it is easier to reduce energy intake by 500 to 1000 kcal (2100–4200 KJ)/day than to increase energy expenditure by a similar amount, physical activity has less impact on weight loss than does dietary intervention.
In adults, increasing physical activity did not result in significant weight loss over a 6-month period. Most weight loss occurred as a result of decreased energy intake. Sustained physical activity did reduce the risk of weight regain and also decreased cardiovascular and diabetes risk factors, independent of the reductions in these risks that are associated with weight loss.130

Several but not all studies have demonstrated that increased physical activity is associated with decreased BMI in children and adolescents.131–133 The largest of those studies133 examined the association between changes in BMI over 1 year and same-year changes in self-reported recreational physical activity and in recreational inactivity (television, videotapes, and video games) among 11,887 boys and girls 10 to 15 years of age. After correction for growth- and development-related changes in BMI, an increase in physical activity was associated with decreasing relative BMI for girls (−0.06 kg/m² per 1-hour increase in daily activity; 95% confidence interval [CI]: −0.11 to −0.01 kg/m² per 1-hour increase) and for overweight boys (−0.22 kg/m² per 1-hour increase; CI: −0.33 to −0.10 kg/m² per 1-hour increase). Conversely, higher levels of inactivity were correlated with increased BMI in girls (+0.05 kg/m² per 1-hour increase in television, videotapes, and video games; CI: +0.02 to +0.08 kg/m² per 1-hour increase). One study found a relationship between inactivity in overweight preschool-aged boys but not girls.132 The third study, involving 47 boys and girls 5 to 10.5 years of age, measured total energy expenditure directly by using the double-labeled water technique and calculated basal metabolic rate by using the Schonfield equation. It used these measurements to calculate physical activity levels, as follows: physical activity level = total energy expenditure/basal metabolic rate. Body fat and BMI were used to estimate body composition. Body fat and BMI were found to be significantly inversely correlated with physical activity levels.131

Studies that use weight loss as the only criterion with which to assess the value of increased physical activity may miss other important benefits this confers. In a meta-analysis, P. McGovern, PhD (unpublished data, 2006) found that physical activity decreased fat mass but not BMI. Other studies indicated that exercise also improved cardiovascular risk factors.134,135

**Risks of Physical Inactivity**

Physical activity may play a role in preventing weight gain and other health problems. Physical inactivity has been shown to be a risk factor for obesity and insulin resistance in school-aged children.136 Inactive children may be at increased risk of developing health problems later in life. Several studies suggest that sedentary children are more likely than active children to become sedentary adults and to have increased risks of obesity, diabetes, hypertension, dyslipidemias, and cardiovascular diseases.129,135,137,138 A sedentary lifestyle is also associated with increased risks of several cancers common in adults.139

**Structured Versus Nonstructured Physical Activity**

There is some debate in the literature regarding whether structured or unstructured activities should be promoted as a means to increase physical activity. The position of the American Academy of Pediatrics on physical fitness and activity in schools advocates increases in both forms of activity.140 It states that the development of a physically active lifestyle should be a goal for all children. Opportunities to be physically active should include team, individual, noncompetitive, and lifetime sports, as well as recreational activities. The opportunity to be active on a regular basis, as well as the enjoyment and competence gained from activity, may increase the likelihood that a physically active lifestyle will be adopted.140

Beyond the school setting, increasing physical activity, even unstructured physical activity, seems to be beneficial.113 It is thought that increasing the frequency or intensity of physical activity can reduce sedentary activities, particularly television viewing. This, in turn, can reduce excess energy balance effectively.141 The goal is not to eliminate television watching; data suggest that children and adolescents can engage in both television viewing and physical activity as long as sedentary behavior is not at the expense of physical activity.142–145

**Amount of Physical Activity**

Since 2000, the US Department of Agriculture has recommended that children and adolescents participate in ≥60 minutes of moderate-intensity physical activity most days of the week, preferably daily.146 This position was reaffirmed in the 2005 Dietary Guidelines for Americans147 and is supported by the American Academy of Pediatrics148 and the Centers for Disease Control and Prevention (CDC).149 The American Academy of Pediatrics recommends that 30 minutes of this activity occur during the school day.150 Very obese children may need to start with shorter periods of activity and gradually increase the time spent being active. The CDC suggests that parents can help children meet this activity goal by serving as role models, incorporating enjoyable physical activity into family life, monitoring the time their children spend watching television, playing video games, and using the computer, and intervening if too much time is spent in sedentary pursuits.146

**Barriers to Physical Activity**

Barriers to physical activity for the pediatric population include lack of opportunities for activity during the school day and environmental factors, such as lack of access to facilities in which to be active and urban environments designed for vehicular transportation that limit activity outside of school.149–156 In the past decade,
schools have been urged to spearhead improvements in childhood wellness through changes in the food and activity programs they offer. The amount of time spent on physical education, however, has decreased in the past 15 years. Between 1991 and 2003, the percentage of high school students enrolled in daily physical education classes decreased from 41.6% to 28.4%. Only 8% of elementary schools, 6.4% of middle/junior high schools, and 5.8% of senior high schools provided daily physical education or allocated the recommended amount of time per week (150 minutes for elementary and 225 minutes for junior and senior high schools), according to a 2000 study.

More consideration needs to be given to the types of activities performed during physical education class, because time spent in class does not correlate with activity. Data for 37,000 students collected by the CDC as part of the annual Youth Risk Behavior Surveillance Survey found that high school students were active for only 16 of the 50 minutes in an average gym class. Spending more time in physical education classes did not help. When states required an extra year of physical education classes for high school students, which is ~200 more minutes of physical education per week, male students reported, on average, another 7.6 minutes per week spent exercising or playing sports in gym class. Female students reported, on average, an extra 8.1 minutes per week spent exercising in class.

Increasing the intensity of activity during gym class can improve fitness and reduce body fat measurably. Fifty overweight (BMI of ≥95th percentile) children in middle school were assigned randomly to lifestyle-focused, fitness-oriented, gym classes or standard gym classes for 9 months. The children were evaluated for fasting insulin and glucose levels and body composition and assessed with maximal oxygen consumption treadmill testing at the beginning and at the end of the school year. Overweight children who participated in the fitness-oriented gym classes for 9 months showed significant improvements in body composition, fitness, and insulin levels. These studies indicate that public health policies should focus on revising school curricula to include adequate time for and intensity of physical activity.

Safety concerns, such as heavy traffic and highcrime rate, lack of equipment, lack of space, and urban development that favors vehicular transportation are barriers to activity outside of school. The World Health Organization has identified transport-related physical activity as an important intervention with which to address the global obesity epidemic, as well as environmental issues such as traffic congestion and its associated pollutants. In the United States, a decrease in transport activity parallels the increase in pediatric obesity. Walking or biking to and from school can help students meet their physical activity needs. However, heavy traffic, lack of bicycle lanes, unmarked intersections, and other obstacles have reduced the number of children who transport themselves to school today, compared with previous generations.

Currently, only one third of students who live within 1 mile of school walk or bike there and <3% of students who live within 2 miles of school walk or bike there. Initiatives such as the government-sponsored, community-implemented, Safe Routes to School program may help reverse this trend. A pilot study conducted in Marin County, California, found that the number of children walking to school increased from 14% in 2000 to 23% in 2002 and the number riding bicycles more than doubled, from 7% to 15.5%, in the same period. Similar results have been observed in other communities around the country. These experiences highlight the need for parents and other interested community members to take an active role in reducing barriers to physical activity.

Lack of access to safe exercise environments is of particular concern in low-socioeconomic status and minority communities, because this may account for racial and economic disparities in health, obesity, and physical activity rates. Burdette and Whitaker found an inverse association between neighborhood safety and television viewing among preschool-aged children. Parents who rated their neighborhoods as unsafe were more likely to report that their preschool-aged children watched >2 hours of television daily. No association was found between television viewing and obesity in these young children; however, early television viewing may establish a pattern of sedentary activity that leads to obesity in later childhood. An observational study examined the associations between community physical activity-related settings (eg, sports areas, public pools and beaches, parks and green spaces, and bicycle paths) and race, ethnicity, and socioeconomic status in 409 communities throughout the United States. The researchers reported that higher median household incomes and lower poverty rates were associated with increasing levels of available physical activity-related facilities and settings. Communities with greater proportions of ethnic minorities had fewer physical activity-related settings. Using data from the first wave of the National Longitudinal Study of Adolescent Health (N = 20,745), Gordon-Larsen et al demonstrated a direct relationship between decreased access to physical activity facilities and overweight. They found that communities with low socioeconomic status and large minority populations had reduced access to recreational facilities. These factors were associated with decreased physical activity levels and increased incidence of overweight. These associations suggest that lack of opportunities for physical activity may contribute to the disproportionately greater incidence of obesity in ethnic minority groups and groups with low socioeconomic status.
Other researchers have found that schools with large minority populations are less likely to have programs that support healthy eating and physical activity. A survey of 3600 households with children 9 to 13 years of age that was conducted by the CDC in 2002 found that non-Hispanic black parents and Hispanic parents cited concerns about transportation, lack of local facilities, and expense as barriers to their children participating in physical activity and organized sports outside of school more often than did non-Hispanic white parents. There are many communities and neighborhoods in which inadequate school wellness programs, lack of access to facilities for physical activity outside of the classroom, and lack of discretionary income may contribute to the high obesity rates seen among economically disadvantaged individuals.

Higher economic status does not guarantee that people will live in neighborhoods that encourage more activity. Built environments in suburban communities often are not conducive to walking, biking, and other physical activities. Neighborhood comparison and correlational studies with physical activity transport outcomes suggest that residents from communities with higher density, greater connectivity, and more land use mixture have higher rates of walking/cycling for utilitarian purposes than do low-density, poorly connected, and single-use neighborhoods. Environmental variables seem to add to the variance accounted for beyond sociodemographic predictors of walking/cycling for transport.

In what is thought to be the first study to examine the link between obesity in rural communities and environmental factors, Boehmer et al. from the St Louis University School of Public Health, found that residents of rural communities who felt isolated from recreational facilities, stores, churches, and schools were more likely to be obese than those who thought they were closer to such facilities. Closeness counted; people who thought that safe walking and/or biking routes were within 10-minute walking distance of their homes were more likely to be active. Approximately 25% of the population in states in the South and Midwest live in rural environments. To ensure that people of all income levels have opportunities to be physically active as part of their daily routines, community leaders and environmental planners need to address safety and access issues.

Psychosocial barriers such as perceptions of class rank and self-esteem, and their impact on physical activity, have been studied but are not well understood. Physical activity self-efficacy (confidence in one’s ability to participate in exercise) has been widely studied as a potential psychosocial correlate of increased levels of physical activity. However, this association is not clear for children and adolescents.

Reducing Sedentary Activities
As a first step toward addressing neighborhood safety barriers to activity, the American Academy of Pediatrics recommends that activities that can be performed indoors, such as exercising to videotapes, using hula hoops, and dancing to popular music, should be encouraged. A complementary strategy for promoting physical activity among children and adolescents is to decrease their inactivity by decreasing the time spent in sedentary activities such as television viewing, leisure time use of the computer, and video game playing. Staying active while watching television by stretching, performing calisthenics, or using exercise equipment can also reduce the time spent in sedentary pursuits. Television viewing may have a negative effect on both sides of the energy balance equation. It may displace active play and physical activity time and it is associated with increased food and energy intake, as an accompaniment to television viewing and as a result of food advertising.

Summary
Addressing childhood obesity requires a comprehensive holistic approach. Although the evidence is limited, increased physical activity alone has not improved children’s weight status substantially. Promotion of routine physical activity in children from preschool age on may help prevent the development of overweight and obesity and has other benefits, including reductions in cardiovascular disease risk factors. Particular consideration should be given to methods of increasing activity in adolescents. Studies suggested that time, cost, availability, and convenience were key factors that influenced what adolescents ate and whether they were physically active. Students reported that social support from friends and family members, as well as teachers and adults who modeled healthy behaviors, enhanced their likelihood of eating healthy foods and being physically active. Finally, the American Academy of Pediatrics recommends that (1) all children meet the goal of 60 minutes of moderate activity per day; (2) schools be provided with the necessary resources to incorporate 30 minutes of moderate to intense activity into each student’s daily schedule; (3) clinicians instruct parents on techniques for increasing activity in the home environment, including reducing time spent in sedentary activities; and (4) health care providers become involved in the community to address access and safety issues.

TELEVISION VIEWING AND MEDIA USAGE
Television Viewing and Obesity
Investigators have examined many aspects of diet and physical activity, but some of the strongest evidence of a behavioral risk for overweight in children points to the impact of television viewing. Epidemiologic and experimental evidence from the past decade supports de-
increased television viewing as a primary preventive intervention for the reduction of overweight and other chronic disease risks. Many cross-sectional and longitudinal observational studies in the United States document the effect of television viewing on overweight. These studies are reinforced by others in at least 12 other countries. The observational studies have been corroborated by randomized, controlled trials designed to reduce levels of both television viewing and overweight. In a randomized, controlled trial, Gortmaker et al showed that reductions in television viewing were associated with decreased obesity. Among girls, each 1-hour reduction in television viewing predicted reduced obesity prevalence. Guillaume et al found a significant relationship with BMI and systolic blood pressure for television viewing in boys. In a randomized, controlled, school-based trial, Robinson showed that intervention groups had statistically significant decreases in BMI with reductions in television viewing and eating meals in front of the television. That author also found reductions in waist circumference and waist/hip ratios. In a randomized trial, Epstein et al found that, at 1-year follow-up assessments, children who were counseled regarding decreasing sedentary activities versus increasing physical activity or a combination of the 2 had a greater decrease in the percentage of overweight than did children from the other 2 groups. In fact, children in the sedentary activity-reduction group increased their liking for high-intensity activity and reported lower energy intake than did children in the exercise group.

Influences on Diet, Physical Activity, and Chronic Disease Risks
Television viewing is likely to influence overweight by replacing more vigorous activities, as well as affecting diet. Foods are heavily advertised in children’s television programming, and television viewing is associated with children’s between-meal snacking. A randomized trial indicated that increased television viewing resulted in increased energy intake and decreased energy expenditure.

Other studies documented similar effects of television viewing on overweight among preschool-aged children. Reducing excess television viewing among youths is a national health objective for 2010. Since 1986, the American Academy of Pediatrics has recommended limiting television viewing to no more than 2 hours/day for children ≥2 years of age. The American Academy of Pediatrics has broadened this guideline by recommending no television viewing for children <2 years of age and suggesting that total entertainment media time be limited to no more than 1 to 2 hours/day for children ≥2 years of age. Other studies demonstrated that having a television in the room where a child sleeps is a major predictor of television viewing and that, once in the room, televisions often are not removed. These data point to the utility of early intervention strategies to limit television viewing.

An important fact about television viewing is that it correlates only minimally with measures of moderate and vigorous physical activity and therefore is an independent risk factor for overweight. Similar findings on the impact of television viewing on overweight, independent of the effects of moderate and vigorous physical activity, have been reported in prospective studies of adults and in studies of television viewing, physical activity, and diabetes incidence among men and women.

Several studies also indicated that television viewing has substantial effects on other risk factors for chronic disease, including smoking, reduced fruit and vegetable consumption, increased aggression, and less time spent reading and doing school homework. During the developmental period in which television viewing becomes an entrenched habit (i.e., the preschool/early primary school years), children also are developing physical activity skills and learning to read. Other potential benefits of reduced television viewing in this age group may be increased physical activity and reading.

Socioeconomic Status, Ethnicity/Race, Television Viewing, and Overweight
The prevalence of childhood and adolescent overweight in the United States has grown most rapidly among black and Hispanic youths, and health disparities have widened in the past decade. The treatment writing group strongly supports the Healthy People 2010 goal of eliminating gender-, race/ethnicity-, and socioeconomic status-associated disparities in health status, risks, and use of preventive services. Groups with lower socioeconomic status and racial/ethnic minority groups generally are at greater risk of morbidity and death resulting from chronic diseases, including cardiovascular disease, stroke, and diabetes mellitus. Therefore, reducing television viewing among young ethnic minority children in the United States has the potential to reduce excess chronic disease among youths, as well as to reduce adult rates of morbidity and death resulting from chronic illnesses. Several studies have noted substantially higher levels of television viewing among ethnic minority children, particularly black children, and among boys, compared with girls. A number of studies also reported stronger associations between television viewing and overweight among girls, compared with boys, including a randomized trial that found that the strongest effects of reduced television viewing were in black girls. These differences according to gender and ethnicity indicate the need to focus on cultural diversity in developing interventions, as well as increasing awareness that efforts to reduce tele-
vision viewing have the potential to reduce ethnic and gender disparities in overweight.

Other Media Usage
In the past 5 years, media use by children has increased significantly. However, limited research is available on uses of “screen time” other than television, such as computers, video games, DVDs, and instant messaging. In a recent study of parents of children 0 to 6 years of age, Vandewater et al found that, on a typical day, 75% of children watched television and 32% watched videotapes/DVDs, for ~1 hour and 20 minutes, respectively, on average. New media also are making inroads with young children; 27% of 5- to 6-year-old children used a computer (for 50 minutes, on average) on a typical day. Many young children (one fifth of 0- to 2-year-old children and more than one third of 3- to 6-year-old children) also have a television in their bedrooms. The most common reason given was that this frees up other televisions in the house so that other family members can watch their own shows (54%). The majority of children 3 to 6 years of age fell within the American Academy of Pediatrics guidelines, but 70% of 0- to 2-year-old children did not.

Another study of older children and adolescents found that approximately one half (53%) of all 8- to 18-year-old youths said that their parents gave them no rules about television watching. Nearly one half (46%) said that they did have rules regarding screen time but only 20% said that the rules were enforced most of the time. Most importantly, youths with rules that were enforced reported 2 hours less of media exposure per day than did those in homes without this supervision. Despite the concerns parents express about the impact of media on their children, this study did not find much evidence of major parental efforts to curb or to monitor viewing habits.

Summary
Epidemiologic and experimental evidence from the past decade supports decreased television viewing as a primary preventive intervention for the reduction of overweight and other chronic disease risks. Screen time for children >2 years of age should be limited to no more than 1 to 2 hours/day. Television viewing is not recommended for children <2 years of age. Parents need to take an active role in setting total screen time limits and monitoring their children’s viewing habits. Health care professionals should encourage parents not to put a television in the room where their child sleeps and to remove the television if it is already there.

BEHAVIORAL APPROACHES

Techniques
Behavioral therapy for pediatric obesity uses a number of techniques that modify and control children’s food and activity environments in ways that bring about weight loss. These techniques include removing unhealthy foods from the home, monitoring behavior by asking children or parents to keep track of the foods consumed, setting goals for energy consumption and physical activity, and rewarding children’s and sometimes parents’ successful changes in diet and physical activity. Additional behavioral approaches include training in problem solving and other parenting skills. These techniques have been described in detail elsewhere.

Subjects, Settings, and Delivery Formats
Most published trials of behavioral interventions have taken place in specialty treatment centers staffed by physicians, nutritionists, exercise therapists, and/or psychologists. The programs studied were conducted or designed by a multidisciplinary team of providers, including a psychologist, and included children and adolescents 5 to 17 years of age. These programs generally included behavioral interventions in conjunction with changes in diet and physical activity, delivered at least in part in a group setting. Comparative data that identify the optimal frequency of visits do not exist. However, most outpatient-based interventions included 8 to 16 initial weekly group sessions lasting 45 to 90 minutes, followed by visits of decreasing frequency for a total duration of 4 to 12 months.

In one trial, group-only treatment was as effective in producing weight loss and was more cost-effective than combined group and individual family sessions. Two inpatient programs based in Belgium and an 8-week summer camp program in Massachusetts showed efficacy in producing weight loss and improved psychological well-being. Another trial, conducted in Germany in an inpatient treatment program with 9- to 19-year-old obese adolescents, compared self-management of weight and muscle relaxation training as additions to a structured exercise and diet program and found no added benefit beyond inpatient effects.

Few studies of pediatric obesity treatment have been conducted as part of primary care. One trial of overweight adolescents included a single session with a primary care provider, followed by either telephone- and mail-based behavioral intervention or no additional treatment. There was some evidence of better efficacy among the behaviorally treated adolescents, although absolute efficacy was less than with more-intensive clinic- and inpatient interventions. Approaches using Internet-based treatment offer some evidence that, even when delivered in this nontraditional format, behavioral treatment is more efficacious than dietary and physical activity education alone.

Several researchers have addressed a key question, namely, who should be the target for change. Including parents as agents of change seems critical for children’s success, particularly for younger children. Several stud-
ies by Epstein et al\textsuperscript{118,123,232} of children 8 to 12 years of age demonstrated that targeting and reinforcing behavioral changes in parents as well as their children was more effective than targeting children alone. Another study of obese adolescents 12 to 16 years of age produced similar findings.\textsuperscript{233} Studies conducted in Israel with children 6 to 11 years of age suggested that targeting exclusively parents for change was superior to targeting only children for change.\textsuperscript{234,235} Israel et al\textsuperscript{236} found that providing training in parenting skills sustained improved child weight status at 1-year follow-up assessments. Although parents need to be active in helping their children make healthy diet and physical activity choices,\textsuperscript{237} the evidence suggests that targeting parents to lose weight improves their child’s outcomes, particularly for children <12 years of age.\textsuperscript{234} The evidence on the amount and type of parental involvement in adolescents’ weight control is far more inconsistent.

**Evidence for Efficacy of Behavioral Therapy Components**

The most effective treatments for childhood obesity include both dietary and physical activity interventions; however, simply providing education about needed changes is inadequate.\textsuperscript{238–241} A number of behavioral therapy techniques, including environmental control approaches (such as parental modeling of healthful eating and physical activity), as well as monitoring, goal-setting, and contingency management, can facilitate recommended changes in children’s diet and physical activity.\textsuperscript{225} A nonrandomized trial conducted in Israel by Eliakim et al\textsuperscript{242} demonstrated that children and adolescents who completed a 12-week program that included behavioral therapy sessions with a psychologist reduced their BMI more than did untreated control subjects. An early study of children 5 to 8 years of age by Epstein et al\textsuperscript{239} demonstrated that family-based behavioral therapy, including praise, modeling, and contracting, produced greater benefits than did diet and exercise education without behavioral therapy. Similarly, in their study of children 10 to 11 years of age, Flodmark et al\textsuperscript{08} found that the addition of family therapy to dietary counseling and medical visits was effective.

Published descriptions of various weight management interventions and programs indicate that self-monitoring or parental monitoring is a nearly universal component, even in pharmacologic intervention trials. Monitoring usually consists of written documentation of foods eaten (or categories of foods, on the basis of the prescribed dietary plan) and/or physical activity performed. Goal-setting and contingency management are commonly reported behavioral tools, but interventions differ in their dietary and activity targets and in whether specific weight change is a rewarded goal. Environmental control is a less common behavioral strategy, but more than one half of the studies reviewed described specifically how caregivers were encouraged to make obesity-discouraging changes in the home and other environments.

Several factors complicate efforts to determine the relative efficacy of individual behavioral strategies. A major obstacle is that strategies included in interventions often are not described completely. Another obstacle, with only a few exceptions,\textsuperscript{243} is the limited number of dismantling trials that test the efficacy of single strategies in isolation. Furthermore, most intervention programs teach and encourage the use of many behavioral strategies to help children change their diet and/or physical activity levels; however, few report on whether participants use these strategies and whether their level of use, individually or collectively, is associated with observed changes in weight. Some evidence supports their collective effectiveness and, to a lesser degree, their individual impact. In one study, Epstein et al\textsuperscript{118} found that children’s reports of seeking low-energy snacks, graphing their weight, and eating fewer items classified as “red foods” (on the traffic light diet) were related to weight outcomes and an association with weight loss did exist. Others have reported that more-frequent and more-accurate self-monitoring is related to better outcomes in children.\textsuperscript{244–246} Still others have found that positive parental modeling of healthy choices and parental praise of such choices are related to better outcomes.\textsuperscript{247} It is noteworthy that children whose parents mastered various behavioral strategies had better treatment outcomes than did children whose parents did not master the strategies.\textsuperscript{248}

Many interventions encourage children and caregivers to use additional behavioral techniques that can be classified as problem-solving approaches, including strategies such as preplanning and relapse prevention. The addition of structured or formal problem-solving training to a family-based, behavioral, weight loss program was found to be more effective in one trial\textsuperscript{249} but not in another.\textsuperscript{248} Cognitive strategies, such as cognitive restructuring, have been used to augment behavioral strategies, but cognitive strategies alone seem less effective than behavioral strategies alone,\textsuperscript{249} and addition of cognitive strategies fails to improve the efficacy of behavioral strategies alone.\textsuperscript{250}

Behavioral strategies seem efficacious in changing both dietary and physical activity behaviors. Several trials by Epstein et al\textsuperscript{144,243} have examined how behavioral approaches can be used to affect activity levels. Using environmental control and providing reinforcement to reduce sedentary behaviors were reported to be effective in improving weight status. A study by Faith et al\textsuperscript{251} of obese children 8 to 12 years of age demonstrated that simply placing an exercise bike in front of the television was not effective but making viewing contingent on pedaling reduced viewing and increased physical activity.

Overall, systematic training and parental adoption of
various behavioral skills for helping change children’s dietary and physical activity behaviors are core and seemingly necessary components of pediatric obesity treatment. However, it is unclear whether all skills are necessary for all families or whether tailoring can be used to optimize outcomes while minimizing intervention resources.

Potential Psychological Complications of Behavior-Based Treatment

Only one study, a 10-year follow-up study of children who completed behavioral interventions for obesity, reported on potential complications of treatment. Epstein et al.\(^\text{123}\) found increased rates of psychiatric disorders such as depression, substance abuse, and eating disorders, but it was unclear whether these conditions were a result of treatment or simply comorbid conditions associated with obesity. Other trials showed improvements in children’s psychological functioning and did not find higher rates of eating disorders among children treated with a family-based, behavioral, weight management intervention.\(^\text{251}\)

OTHER INTERVENTIONS

Weight Loss Medications in the Treatment of Pediatric Obesity

The use of weight loss medications in obesity treatment has a complicated history. Many medications used to treat obesity were eventually withdrawn from the market or their use restricted after documentation of dangerous side effects.\(^\text{252–255}\) The most-recent examples are the withdrawal of the prescription medication fenfluramine, which was banned in the United States in 1997, because of associated cardiac valve abnormalities\(^\text{254–255}\) and the removal of ephedra from the over-the-counter market because of cardiovascular concerns.\(^\text{256}\) These experiences underscore the need to use weight loss medications conservatively for all obese patients. Particular care must be taken when the use of weight loss medications is considered for children, because the long-term effects of these substances on growth and development have not been studied.

Pharmacotherapy alone has not proved to be an effective obesity treatment.\(^\text{252,254,255}\) Medication used as part of a structured lifestyle modification produces an average weight loss of 5% to 10%, which typically plateaus at 4 to 6 months of therapy, after which weight regain may occur. Weight regain is common if the drug is withdrawn.\(^\text{252,254,255}\) Despite these limitations, pharmacologic agents may be helpful in the treatment of obesity for carefully selected patients, as part of a multimodal therapy\(^\text{257}\) that includes diet, exercise, and behavior modification.

Few guidelines are available regarding the use of weight loss medications in the pediatric population. Weight loss through lifestyle changes is optimal. However, when clear health risks are present and lifestyle changes alone have not been effective, medications may be used as adjunctive therapy. Freedman et al.\(^\text{257}\) used cross-sectional (\(N = 10\,099\)) and longitudinal (\(N = 2392\)) analyses to assess risk factors associated with excess adiposity in very overweight children and adolescents between 1973 and 1996. They concluded that the 99th percentile of BMI for age may be an appropriate threshold for identifying children and adolescents who are at very high risk for biochemical abnormalities and severe adult obesity and thus may be candidates for more-aggressive treatment such as pharmacotherapy.\(^\text{257}\) Obese pediatric patients who seem to be candidates for drug therapy should be referred to a tertiary care center for evaluation and treatment. Presently, the Food and Drug Administration (FDA) approves 6 drugs specifically for obesity treatment,\(^\text{254}\) only 2 of which, orlistat and sibutramine, have been approved for limited use among pediatric patients. Some research suggests that drugs developed and approved for the treatment of insulin resistance also may improve weight control. Preliminary research suggests that metformin may improve weight control, but this has not been tested in children and the drug is not approved for this indication.

Medications Approved by the FDA for Limited Use in the Treatment of Pediatric Obesity

Sibutramine, an appetite suppressant, is a nonselective reuptake inhibitor. It is most effective against serotonin and norepinephrine but also blocks dopamine reuptake.\(^\text{254}\) Sibutramine is currently licensed in the United States for use for persons \(\geq 16\) years of age. The FDA has extended the period of treatment to 2 years.\(^\text{259}\) Tolerability and side effects of sibutramine are similar for adults and adolescents.\(^\text{259}\) The major undesirable side effect of sibutramine is vasoconstriction, leading to increased heart rate and blood pressure. This effect persists even after significant weight loss,\(^\text{259}\) limiting the usefulness of this drug for obese individuals with concomitant hypertension.

A 1-year, multicenter study of 498 adolescents 12 to 16 years of age found that those who received sibutramine plus behavioral therapy lost significantly more weight than did those who received a placebo and behavioral therapy.\(^\text{260}\) Patients in the sibutramine group lost an average of 6.35 kg during the study, whereas those in the placebo group gained 1.8 kg. The adolescents in the sibutramine group also exhibited significant decreases in insulin and triglyceride levels. The main adverse reaction was tachycardia, which was twice as common in the sibutramine group (12.5%) as in the placebo group (6.2%).\(^\text{260}\) A previous but much smaller (\(N = 82\)) randomized, control study at the same medical center found that sibutramine used in combination with behavioral therapy increased weight loss by 4.6 kg, compared with placebo.\(^\text{244}\) However, weight loss in the sib-
orlistat group plateaued after 6 months of therapy, and serious side effects such as hypertension and tachycardia were observed for 19 of 44 patients. A second group of researchers who studied the safety and efficacy of sibutramine in a double-blind control study involving 60 obese adolescents reported an average weight loss of 8.1 kg at 6 months in the sibutramine group but did not observe any significant changes in blood pressure. All investigators concluded that more research is required to determine the long-term safety and efficacy of sibutramine in adolescents.

Orlistat is a reversible lipase inhibitor. It binds lipase in the lumen of the stomach and intestine, making it unavailable to hydrolyze dietary fat (triglycerides) and cholesterol to free fatty acids and glycerol. Intact triglycerides and cholesterol cannot be absorbed; they pass through the intestine and are excreted in the feces. Through this mechanism, orlistat reduces fatty acid absorption by ~30% (16 g/day) in persons consuming a 30% fat diet. The side effects of orlistat are consistent with its method of action on intestinal lipase. The drug’s most common side effects are abdominal cramping and flatus. The most troubling side effects are oily bowel movements, flatulence with discharge, and oily spotting on underwear caused by unabsorbed fat in the feces. In a tolerability study with 20 adolescent patients, 3 patients dropped out and those who completed the study reported taking 80% of their prescribed medication. Side effects were usually mild to moderate and generally decreased in frequency with continued treatment. The observed decrease may be attributable to improved compliance with the recommended dietary changes (no more than 30% of energy from fat), reinforced by unpleasant side effects. Orlistat does not inhibit other intestinal enzymes. It is minimally absorbed and exerts no effect on systemic lipases. Because it can interfere with the absorption of fat-soluble vitamins, patients taking the drug must also take a daily supplement.

In a 54-week, double-blind, randomized, control trial of 539 obese adolescents 12 to 16 years of age, those taking orlistat reduced their BMI (~0.55 kg/m²), whereas those taking a placebo showed a slight increase in BMI (~0.31 kg/m²). This difference was significant (P < .001). Changes in waist circumference followed a similar pattern. Waist circumference decreased in the orlistat group (~1.33 cm) but increased in the placebo group (~0.12 cm; P < .05). No significant between-group differences in blood glucose and lipid levels were observed, however, which suggests that the weight loss was too small to change metabolic risk factors. Up to 50% of participants reported moderate side effects. The 17 adolescents who completed the tolerability study lost an average of 5.4 kg (BMI change: ~2.0 kg/m²) at 6 months. In adult studies, the drug improved weight loss among people on a weight-reducing diet and helped them maintain weight loss for up to 2 years. One disadvantage of using orlistat in the pediatric population is that it must be taken with each meal, which may reduce its usefulness for children who typically eat lunch at school. In 2006, the FDA recommended that orlistat be approved for over-the-counter use.

Choosing the Right Medication

More than 120 potential drugs for treatment of obesity are currently in various stages of research, but presently no agent that treats obesity effectively as a single therapy is available. Weight management medications should be prescribed only for patients who have significant weight-related health risks, who have not reduced their weight successfully with a structured diet and lifestyle modifications, and who understand the limitations of available pharmacotherapy, including the need for concomitant lifestyle changes and the fact that the effectiveness of currently approved medications decreases after 6 months of treatment. Obese pediatric patients who may benefit from pharmacotherapy should be referred to a tertiary care center for evaluation and treatment. The choice of pharmacotherapy should be made on an individual basis, taking into account the patient’s weight-related health risks, the mechanism of action and adverse effects associated with various medications, patient/family preferences, and, if known, the cause of obesity. Medication should be used only as part of a multimodal weight loss therapy that includes diet, physical activity, and behavior modification.

Discontinuing Medications

It is not possible to provide uniform guidelines regarding the duration of pharmacotherapy. Physicians must recognize that weight regain is common after drugs are withdrawn. Patients should participate in an intensive lifestyle-modification program while using medications, so that they will be better able to manage their weight on their own. Lifestyle-management techniques may need to be intensified when medication is discontinued.

Bariatric Surgery

Severe obesity has proved difficult to treat through diet and lifestyle changes, even with the addition of weight management medications. The increased use of bariatric surgery to treat morbid obesity and associated comorbidities in adults has generated interest in using this therapy for adolescents. There is limited research on the safety, efficacy, and long-term outcomes of bariatric surgery for adolescents; therefore, data from adult studies must be considered as surrogate evidence.

Bariatric Surgical Procedures

Bariatric weight loss procedures can be divided into 3 main categories, that is, malabsorptive, restrictive, and combination. Combination procedures, such as the
Roux-en-Y gastric bypass, restrict food intake and limit the amounts of energy and nutrients the body absorbs. Gastric bypass procedures are the only form of bariatric surgery currently approved by the FDA for use in adolescents, because they are the most extensively studied. European and Australian researchers have reported success with a restrictive procedure known as a laparoscopic adjustable-gastric band procedure. The least-invasive bariatric procedure, it has the added advantages of being totally reversible and having the least potential for adverse nutritional consequences. However, the laparoscopic adjustable gastric band has not been approved by the FDA for use in people <18 years of age, because of a lack of both short-term and long-term safety and efficacy data for adolescent patients. Currently, a multicenter clinical trial of the laparoscopic adjustable gastric band is being conducted with adolescents.

**Case Series**

Two retrospective case series on bariatric surgery in adolescents, totaling ~40 patients who underwent gastric bypass procedures, reported significant weight loss for most patients, with resolution of most comorbid conditions. Complications included nutritional deficiencies, including iron and folate deficiencies. Perioperative complications included pulmonary embolism, wound infection, and dehydra tion, with later complications such as small bowel obstruction, incisional hernias, and weight regain in up to 15% of cases. Apovian et al reviewed 8 retrospective case-series studies of weight loss surgery in children and adolescents between 1980 and 2004. They found that bariatric surgery in adolescents could promote durable weight loss for most patients; however, there seemed to be significant complications and mortality rates. Appropriately designed trials are needed to determine whether other bariatric surgical procedures are acceptable for use in adolescents.

**Recommendations and Controversies**

An expert panel of pediatricians and pediatric surgeons made recommendations about selection criteria for bariatric surgery in minors. The panel recommended that patients be physically mature, have a BMI of ≥50 kg/m² or ≥40 kg/m² with significant comorbidities, have experienced failure of a formal, 6-month, weight loss program, and be capable of adhering to the long-term lifestyle changes required after surgery. In addition, centers should offer this procedure only if surgeons are experienced in bariatric surgery and a team of specialists is capable of long-term follow-up care of the metabolic and psychosocial needs of the patient and family. In response to these recommendations, others have proposed a lower BMI cutoff point, similar to adult recommendations, citing greater success with earlier intervention and lower operative risks when patients are at lower weights. Freedman et al using cross-sectional (N = 10 099) and longitudinal (N = 2392) analyses to assess risk factors associated with excess adiposity in very overweight children and adolescents, concluded that the 99th percentile of BMI for age may be an appropriate threshold for identifying candidates for more-aggressive treatment, including bariatric surgery. Attainment of physical maturity can be assessed through Tanner stage and bone age. Generally, girls should be ≥13 years of age and boys ≥15 years of age. Assessing the patient’s psychological readiness for bariatric surgery is often more difficult than determining physical readiness. Patients must be capable of and willing to adhere to nutritional guidelines postoperatively, must demonstrate decisional capacity, and must provide informed consent for surgical treatment.

After the procedure, meticulous, lifelong, medical supervision of patients who undergo bariatric procedures during adolescence is essential to ensure optimal postoperative weight loss, eventual weight maintenance, and overall health. This is particularly important for adolescents, because the long-term effects of bariatric surgery in younger, reproductively active populations have not been well characterized. Given the limited quantity and scope of data on the risks and benefits of adolescent bariatric surgery, a conservative approach is needed.

**RECOMMENDATIONS**

**Stages of Treatment**

On the basis of the evidence in this report, a step or staged approach for weight management in the pediatric population is recommended. Evidence supports the components of these stages, but the staged approach itself has not been evaluated. We suggest this approach as a practical way to address childhood obesity. The staged care process is divided into 4 stages, that is, (1) Prevention Plus (healthy lifestyle changes), (2) structured weight management, (3) comprehensive multidisciplinary intervention, and (4) tertiary care intervention. Each stage and its appropriate application are described. Two primers have been developed to help primary care providers and other practitioners assess the ability of commercial weight loss programs and bariatric surgery centers to treat pediatric obesity patients.

The purpose of this article is to offer practical guidance to providers by providing recommendations, including those that lack the best possible evidence. When evidence of an effect of obesity treatment was not available, the writing group considered the literature, clinical experience, the likelihood of other health benefits, the possible harm, and the feasibility of implementing a particular strategy before including it. Although a thorough, evidence-based review was beyond the scope of this project, the writing group provided a broad rating of
<table>
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<tr>
<th>Stage</th>
<th>Components</th>
<th>Where Implemented</th>
<th>Implemented by Whom and Skills Needed</th>
<th>Frequency of Visits/Duration Before Moving to Next Stage</th>
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<tr>
<td>1. Prevention plus</td>
<td>Recommend ≥5 servings of fruits and vegetables per day, ≤2 h of screen time per day, no television in room where child sleeps, and no television if &lt;2 y of age; Minimize or eliminate sugar-sweetened beverages; Address eating behaviors (eg, eating away from home, daily breakfast, family dinners, and skipping meals); Recommend ≥1 h of physical activity per day. Amount of physical activity may need to be graded for children who are sedentary; they may not achieve 1 h/d initially. Involve whole family in lifestyle changes. Acknowledge cultural differences.</td>
<td>Primary care office</td>
<td>Primary care provider or trained professional staff member (eg, registered nurse)</td>
<td>Visit frequency should be based on accepted readiness to change/behavioral counseling techniques and tailored to patient and family. Provider should encourage more-frequent visits when obesity is more severe. Advance to more-intensive level of intervention depending on responses to treatment, age, health risks, and motivation. A child in this stage whose BMI has tracked in same percentile over time with no medical risks may have low risk for excess body fat. Clinicians can continue obesity prevention strategies and not advance treatment stages.</td>
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<td>2. Structured weight management</td>
<td>Develop plan with family for balanced-macronutrient diet emphasizing small amounts of energy-dense foods. Because diet provides less energy, ensure that protein is high quality and sufficient to prevent loss of muscle mass. Increase structure of daily meals and snacks. Reduce screen time to ≤1 h/d. Increase times spent in physical activity (≥60 min of supervised active play per day). Instruct patient and/or parent in monitoring (eg, screen time, physical activity, dietary intake, and restaurant logs) to improve adherence. Perform medical screening (eg, vital signs, assessment tools, and laboratory tests).</td>
<td>Referral to dietitian; primary care office</td>
<td>Registered dietitian or physician/nurse practitioner with additional training, including assessment techniques, motivational interviewing/behavioral counseling (may need to provide specific information with environmental change and reward examples), parenting skills and managing family conflict, food planning (including energy density and macronutrient knowledge), physical activity counseling, and resources/references.</td>
<td>Monthly visits should be tailored to patient and family, based on family's readiness to change. Advance to more-intensive level of intervention depending on responses to treatment, age, health risks, and motivation.</td>
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<td>3. Comprehensive multidisciplinary intervention</td>
<td>Distinguished from stage 2 by more-frequent patient/provider contact, more-active use of behavioral strategies, more-formal monitoring, and feedback regarding progress to improve adherence. Multidisciplinary approach is essential. Components of multidisciplinary behavioral weight control programs include (1) moderate/strong parental involvement for children &lt;12 y of age; parental involvement should decrease gradually as adolescents increase in age; (2) assessment of diet, physical activity, and weight (body fat) before treatment and at specified intervals thereafter to evaluate progress; (3) structured behavioral program that includes at least food monitoring, short-term diet and activity goal setting, and contingency management; (4) parent/caregiver training to improve home food and activity environments; and (5) structured dietary and physical activity interventions that improve dietary quality and result in negative energy balance.</td>
<td>Primary care office can coordinate multidisciplinary care, weight management program (community), pediatric weight management center, or commercial programs with the following components: age-appropriate and culturally appropriate treatments; nutrition, exercise, and behavioral counseling provided by trained professionals; and weight loss goals of ≤2 lb/wk. Use primer 1 to evaluate commercial programs.</td>
<td>Multidisciplinary team with expertise in childhood obesity, including behavioral counselor (eg, social worker, psychologist, trained nurse practitioner, or other mental health care provider), registered dietitian, and exercise specialist. Alternative could bedietitian and behavioral counselor-based in primary care office, along with outside, structured, physical activity program (eg, team sports, YMCA, or Boy's and Girls Club program). For areas without services, consider innovative programs (eg, telemedicine).</td>
<td>Frequent follow-up visits (weekly for a minimum of 8–12 wk is most efficacious) and then monthly follow-up visits. If not feasible, then telephone or other modalities could be used, with weigh check no less than once per month in local health care provider office (eg, primary care provider or health department). Advance to more-intensive level of intervention depending on responses to treatment, age, health risks, and motivation.</td>
</tr>
<tr>
<td>4. Tertiary care intervention</td>
<td>Continued diet and activity counseling plus consideration of meal replacement, very-low-energy diet, medication, and surgery.</td>
<td>Pediatric weight management center operating under established protocols (eg, clinical or research) to assess and to monitor risks and outcomes; residential settings (camps or boarding facilities with appropriate medical supervision). Use primer 2 to evaluate centers.</td>
<td>Multidisciplinary team with expertise in childhood obesity, including behavioral counselor (eg, social worker, psychologist, trained nurse practitioner, or other mental health care provider), registered dietitian, and exercise specialist. For areas without services, consider innovative programs (eg, telemedicine).</td>
<td>According to protocol.</td>
</tr>
</tbody>
</table>
the evidence, so that readers can appreciate the limitations of these recommendations and watch for new studies that will refine them. The rating categories were as follows: (1) recommends with consistent evidence (CE), that is, multiple studies generally show a consistent association between the recommended behavior and either obesity risk or energy balance; (2) recommends with mixed evidence (ME), that is, some studies demonstrated evidence for weight or energy balance benefit but others did not show significant associations, or studies were few in number or small in sample size; (3) suggests, that is, studies have not examined the association of the recommendation with weight or energy balance, or studies are few, small in number, and/or without clear findings; however, the expert committee thinks that these recommendations could support the achievement of healthy weight and, if future studies disprove such an effect, then these recommendations are likely to have other benefits and are unlikely to cause harm. The rating categories for the treatment recommendations may differ from those for the prevention recommendations because of limited research in certain areas of treatment of childhood obesity.

Table 1 is designed to acquaint providers with the dietary, physical activity, and behavioral interventions that correspond to each of the 4 stages of the staged weight management process. Table 1 also identifies the appropriate setting, caregivers, and frequency of follow-up evaluation corresponding to each stage of treatment. It should be noted that patients who require stages 3 and 4 may benefit from referral to a community-based program or a pediatric weight management center for additional evaluation and treatment, to access a multidisciplinary health care team.

Table 2 provides a treatment algorithm to help physicians determine the appropriate weight management stage for each patient, on the basis of his or her age, BMI percentile, and, if applicable, weight-related disease sta-
tus and former obesity treatment history. Age-appropriate, BMI-dependent, weight goals are also provided for treatment stages 1 to 3. Figures 1, 2, and 3 present this information in a flow algorithm. New data indicate that extreme obesity in children is increasing in prevalence, and these children are at high risk for multiple cardiovascular disease risk factors. Because of this, the expert committee proposes recognition of the 99th percentile BMI. The marked increase in risk factor prevalence at this percentile provides clinical justification for this additional cutoff point. Although more research is needed, the committee recommends that providers use this BMI cutoff point in providing treatment with the staged approach. Table 3 provides 99th percentile cutoff points according to age and gender.

**Choosing and Advancing Treatment Intensity**

The Prevention Plus stage may be an appropriate initial treatment intervention for all overweight and obese children 2 to 18 years of age. Obese children and adolescents with significant comorbidities and those with severe obesity may be immediately enrolled in a more-advanced stage of treatment if such services are readily available and if the child demonstrates appropriate motivation and readiness to change. It may take 3 to 6 months for the lifestyle changes to produce a notable decrease in BMI. In most circumstances, the general goal for all ages is for BMI to deflect downward until it is <85th percentile. Although long-term monitoring of BMI is ideal, short-term (<3-month) weight changes may be easier to measure. However,
Stage 1: Prevention Plus
To foster development of a healthful lifestyle, all children 2 to 18 years of age with a BMI percentile in the normal range (5th to 84th percentile) should follow the recommendations for food consumption, activity, and screen time, as described in the accompanying prevention report. Children with BMIs in the 50th to 85th percentile may become overweight during adolescence, underscoring the need for providers to address weight management and lifestyle issues with all patients regardless of their presenting weight.

For children 2 to 18 years of age with BMI of >85th percentile, it is recommended that the Prevention Plus stage be introduced. This differs from the prevention stage in that providers need to spend more time and intensity on the recommendations and provide closer follow-up monitoring (3–6 months). However, children in this stage who have BMI values between the 85th and 95th percentiles, whose BMI values have tracked in the same percentile over time, and who have no medical risks may have a low risk for excess body fat. Clinicians may continue obesity prevention strategies and not advance the treatment stage. These recommendations can be implemented by primary care physicians or allied health care providers who have some training in pediatric weight management or behavioral counseling.

Stage 1 interventions should be based on the family’s readiness to change and include the following (level of evidence is identified in parentheses): (1) consumption of ≥5 servings of fruits and vegetables per day (ME), (2) minimization or elimination of sugar-sweetened beverages (ME), (3) limits of ≤2 hours of screen time per day, no television in the room where the child sleeps, and no television viewing if the child is <2 years of age (CE), and (4) ≥1 hour of physical activity per day (ME). Physical activity can be increased gradually for sedentary children. Children may be unable to achieve 1 hour of activity per day initially but can gradually increase activity to reach ≥1 hour/day. If musculoskeletal pain prevents patients from engaging in activity, then referral to a physical therapist may be warranted.
Patients and family members should be counseled to facilitate the following eating behaviors: (1) eating breakfast daily (ME); (2) limiting meals outside the home, including at fast food venues and other restaurants (ME); (3) eating family meals at least 5 or 6 times per week (ME); and (4) allowing the child to self-regulate his or her meals and avoiding overly restrictive behaviors (CE for children <12 years of age and suggested for those >12 years of age). Providers should acknowledge cultural differences and help families adapt recommendations to address these differences (suggest).

Within this category, the goal should be weight maintenance with growth that results in decreasing BMI as age increases. Monthly follow-up assessments should be performed. If no improvement in BMI/weight status has been noted after 3 to 6 months, then advancement to stage 2 is indicated, on the basis of patient/family readiness to change. Prevention Plus can be implemented by primary care providers or allied health professionals (registered nurses or registered dietitians) with additional training in pediatric weight management.

Stage 2: Structured Weight Management
This stage targets the same behaviors as the Prevention Plus stage (food consumption, activity, and screen time) and offers additional support and structure to help the child achieve healthy behaviors. This stage requires additional training in behavioral counseling for primary care providers or other providers. It is characterized by closer follow-up monitoring, more structure, and inclusion of monitoring activities. Eating and activity goals specific to this stage of treatment are described below.

Stage 2 recommendations include the following (level of evidence is identified in parentheses): (1) development of a plan for use of a balanced-macronutrient diet, emphasizing small amounts of energy-dense foods (suggest); (2) provision of structured daily meals and snacks (breakfast, lunch, dinner, and 1 or 2 snacks per day) (suggest); (3) ≥60 minutes of supervised active play per day, to ensure activity (ME); (4) ≤1 hour of screen time per day (suggest; CE for ≤2 hours); (5) increased behavioral monitoring (eg, screen time, physical activity, dietary intake, and restaurant logs) by provider, patient,

FIGURE 3
Staged treatment for 12- to 18-year-old youths. The order of the stages and the time in each stage should be tailored to the child’s physical and emotional development and the readiness of the child and family to change. SWM indicates structured weight management; Cont, continue; CMI, comprehensive multidisciplinary intervention; TCI, tertiary care intervention.
and/or family (CE); and (6) reinforcement for achieving targeted behavior goals (not weight goals) (suggest).

Within this category, the goal should be weight maintenance that results in decreasing BMI as age and height increase; however, weight loss should not exceed 1 lb/month for children 2 to 11 years of age or an average of 2 lb/week for older overweight/obese children and adolescents. If no improvement in BMI/weight status is observed after 3 to 6 months, then the patient should be advanced to stage 3.

Ideally, a dietitian with expertise in childhood obesity could provide the nutrition and physical activity counseling in conjunction with the primary care provider. Additional training in motivational interviewing/behavioral counseling, monitoring and reinforcement, family conflict resolution, meal planning, and physical activity counseling could help primary care providers implement treatment.

Parents should be involved in behavioral modification for children <12 years of age, with gradual decreases in parental involvement as the child ages. Referral to a physical activity program may be necessary to help some families develop an active lifestyle. Monthly follow-up assessment is recommended for most patients in this stage of treatment.

### Stage 3: Comprehensive Multidisciplinary Intervention

The eating and activity goals associated with this stage of treatment are generally the same as those of the preceding treatment stage, that is, structured weight management. The distinguishing characteristics of comprehensive multidisciplinary intervention are increased intensity of behavioral change strategies, greater frequency of patient-provider contact, and the specialists involved in the treatment. At this level of intervention, ideally the patient should be referred to a multidisciplinary obesity care team. The need for formalized behavioral therapy and a multidisciplinary treatment team exceeds the capacity of the services most primary care providers can supply. An individual provider, or several providers, can coordinate and supervise a multidisciplinary care program.

For stage 3, the eating and activity goals are the same as in stage 2 (level of evidence is identified in parentheses). Activities within this category should also include the following: (1) planned negative energy balance achieved through structured diet and physical activity (ME); (2) structured behavioral modification program, including food and activity monitoring and development of short-term diet and physical activity goals (CE); (3) involvement of primary caregivers/families for behavioral modification for children <12 years of age (CE); (4) provision of training for all families to improve the home environment (suggest); and (5) frequent office visits. Weekly visits for a minimum of 8 to 12 weeks seem to be most efficacious (CE), and subsequent monthly visits help maintain new behaviors. Group visits may be more cost-effective and have therapeutic benefit (ME).

Systematic evaluation of body measurements, dietary intake, and physical activity should be conducted at baseline and at specific intervals throughout the program. Within this category, the goal should be weight maintenance or gradual weight loss until BMI is <85th percentile. Weight loss should not exceed 1 lb/month for children 2 to 5 years of age or 2 lb/week for older obese children and adolescents.

For implementation of the comprehensive multidisciplinary intervention, comprehensive treatment should be provided by a multidisciplinary obesity care team, including a behavioral counselor (for example, social worker, psychologist, other mental health care provider, or trained nurse practitioner), registered dietitian, and exercise specialist (physical activity specialist or other team member with training or a community program prepared to assist obese children). The primary care provider should continue to monitor medical issues and maintain a supportive alliance with the family. Referral to a commercial weight loss program that meets the criteria outlined in primer 1 should be considered.

### Stage 4: Tertiary Care Intervention

The intensive interventions in this category have been used to only a limited extent in the pediatric population but may be appropriate for some severely obese youths who have been unable to improve their degree of adiposity and morbidity risks through lifestyle interventions. Candidates should have attempted weight loss at the level of stage 3 (comprehensive multidisciplinary intervention), should have the maturity to understand possible risks associated with stage 4 interventions, and should be willing to maintain physical activity, to follow a prescribed diet, and to participate in behavior moni-

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**TABLE 3** Cutoff Points for 99th Percentile of BMI According to Age and Gender

<table>
<thead>
<tr>
<th>Age, y</th>
<th>99th Percentile BMI Cutoff Point, kg/m²</th>
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<tbody>
<tr>
<td></td>
<td>Boys</td>
</tr>
<tr>
<td>5</td>
<td>20.1</td>
</tr>
<tr>
<td>6</td>
<td>21.6</td>
</tr>
<tr>
<td>7</td>
<td>23.6</td>
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<tr>
<td>8</td>
<td>25.6</td>
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<tr>
<td>9</td>
<td>27.6</td>
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<td>10</td>
<td>29.3</td>
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<tr>
<td>11</td>
<td>30.7</td>
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<tr>
<td>12</td>
<td>31.8</td>
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<tr>
<td>13</td>
<td>32.6</td>
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<tr>
<td>14</td>
<td>33.2</td>
</tr>
<tr>
<td>15</td>
<td>33.6</td>
</tr>
<tr>
<td>16</td>
<td>33.9</td>
</tr>
<tr>
<td>17</td>
<td>34.4</td>
</tr>
</tbody>
</table>

Results were adapted from the report by Freedman et al, with permission. The data were for ~500 children in each year from 5 through 11 years of age and ~850 children in each year from 12 through 17 years of age. Cutoff points are at the midpoint of the child’s year (eg, 5.5 y).
toring. Lack of success with stage 3 treatment is not by itself a qualification for stage 4 treatment. It is recommended that programs that provide these intensive treatments operate under established protocols to evaluate patients, to implement the program, and to monitor patients.

The components of stage 4 include referral to a pediatric tertiary weight management center that has access to a multidisciplinary team with expertise in childhood obesity and that operates with a designed protocol. This protocol should include continued diet and activity counseling and consideration of additions such as meal replacement, a very-low-energy diet, medication, and surgery (suggest).

There are few reports on the use of highly restrictive diets for children or adolescents. A restrictive diet has been used as the first step in a childhood weight management program, followed by a mildly restrictive diet.

Two medications have been approved by the FDA for use in adolescents, that is, sibutramine, a serotonin reuptake inhibitor that increases weight loss by decreasing appetite, and orlistat, which causes fat malabsorption through inhibition of enteric lipase. To be effective, these medications must be used in conjunction with diet and exercise. The FDA has approved sibutramine for patients ≥16 years of age and orlistat for patients ≥12 years of age.

Generally, gastric bypass has been used to treat severely obese adolescents who have not improved their weight or health with behavioral interventions. Inge et al proposed stringent patient selection and facility qualification criteria, that is, BMI of ≥40 kg/m² with a medical condition or ≥50 kg/m², physical maturity (generally 13 years of age for girls and ≥15 years for boys), emotional and cognitive maturity, and ≥6 months of participation in a behavior-based treatment program. Surgery should be performed only by experienced surgeons associated with a pediatric obesity center. Adolescents who undergo this procedure require careful medical, psychological, and emotional evaluation before surgery and prolonged nutritional and psychological support after surgery; many youths who might otherwise qualify live too far from an adolescent bariatric center.

For implementation of stage 4, the multidisciplinary team should have expertise in childhood obesity and its comorbidities, with patient care being provided by a physician, nurse practitioner, a registered dietitian, a behavioral counselor, and an exercise specialist. Standard clinical protocols for patient selection should evaluate patient age, degree of obesity, motivation and emotional readiness, previous efforts to control weight, and family support. Standardized clinical protocols for evaluation before, during, and after the intervention should be followed. These evaluations should focus on the physical and emotional effects of the treatment. These protocols should be established by physicians, dietitians, physical activity specialists, and behaviorists familiar with weight management and pediatric care.

Weight Loss Goals
In most circumstances, the general goal for all ages is for BMI to deflect downward until it is <85th percentile. With the realization that some children are healthy with BMI values between the 85th and 95th percentiles, however, clinical judgment plays a critical role in weight recommendations. Although long-term monitoring of BMI is ideal, short-term (<3-month) weight changes may be easier to measure. Resolution of comorbidities is also a goal.

The expert committee recommends that the weight loss recommendations indicated in Table 4 be considered when the staged treatment plan is implemented. The recommendations are based on clinical recommendations and judgment because of the limited amount of evidence. Children whose BMI is between the 85th and 94th percentiles, whose BMI has tracked in the same percentile over time, and who have no medical risks may have a low risk for excess body fat. Clinicians can continue obesity prevention strategies and not advance to the next treatment stage.

Because the Youth Risk Behavior Surveillance Survey indicates that 15% of teens practice some unhealthy eating behaviors, all teens should be evaluated for these symptoms. If the average weight loss is ≥2 lb/week in any age group, then it is important to evaluate for excessive energy restrictions by the parent or the child/teen or unhealthy forms of weight loss, such as meal skipping, purging, fasting, excessive exercise, and/or use of laxatives, diet pills, or weight loss supplements.

Primers

Use of Primers
Two primers, one for commercial weight loss programs and one for bariatric surgery centers, have been developed to help primary care physicians identify, by using a question-and-answer format, facilities capable of treating adolescent patients.

Primer 1: Primary Care Physicians’ Primer for Assessing Commercial Weight Loss Programs
1. Do you have a program for adolescents? The program should have options specific for children and adolescents or should be targeted specifically for the child’s age group.
2. What type of counseling/behavior modification models do you follow? The program should provide behavior modification that (a) emphasizes positive efforts and rewards success, (b) is sensitive to child/
TABLE 4  Weight Recommendations According to Age and BMI Percentile

<table>
<thead>
<tr>
<th>Age</th>
<th>Target</th>
<th>BMI of 85th to 94th percentile</th>
<th>BMI of ≥95th percentile</th>
<th>BMI of &gt;21 kg/m² (rare, very high)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–5 y</td>
<td>Weight maintenance until BMI of &lt;85th percentile or slowing of weight gain, as indicated by downward deflection in BMI curve.</td>
<td>Weight maintenance until BMI of &lt;85th percentile; however, if weight loss occurs with healthy, adequate-energy diet, then it should not exceed 1 lb/mo. If greater loss is noted, then patient should be monitored for causes of excessive weight loss.</td>
<td>Gradual weight loss, not to exceed 1 lb/mo. If greater loss occurs, then patient should be monitored for causes of excessive weight loss.</td>
<td></td>
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<tr>
<td>6–11 y</td>
<td>Weight maintenance until BMI of &lt;85th percentile or slowing of weight gain, as indicated by downward deflection in BMI curve.</td>
<td>Weight maintenance until BMI of &lt;85th percentile or gradual weight loss of ~1 lb/mo. If greater loss is noted, then patient should be monitored for causes of excessive weight loss.</td>
<td>Weight loss not to exceed average of 2 lb/wk. If greater loss is noted, then patient should be monitored for causes of excessive weight loss.</td>
<td></td>
</tr>
<tr>
<td>12–18 y</td>
<td>Weight maintenance until BMI of &lt;85th percentile or slowing of weight gain, as indicated by downward deflection in BMI curve.</td>
<td>Weight loss until BMI of &lt;85th percentile, no more than average of 2 lb/wk. If greater loss is noted, then patient should be monitored for causes of excessive weight loss.</td>
<td>Weight loss not to exceed average of 2 lb/wk. If greater loss is noted, then patient should be monitored for causes of excessive weight loss.</td>
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adolescent body image issues, (c) is culturally appropriate, (d) incorporates family members both to change the environment and to reinforce progress, (e) incorporates all 3 elements of weight loss/management (behavior, eating, and activity), and (f) meets frequently enough to support the child’s efforts and to monitor progress toward established goals.

3. Do you offer nutrition and exercise counseling/education? Programs should provide nutrition and exercise counseling/education tailored to the needs of the adolescent or child. Programs should have trained professionals conducting the sessions.

4. Must participants purchase proprietary meals? What are the initial and long-term costs? Initial fees, proprietary meals, and recurring costs, and how they will affect the patient’s participation, should be factored into the costs of the program. Proprietary meals can be costly, and no studies have examined their effect for children or adolescents.

5. Do you offer culturally appropriate services? The program should offer culturally appropriate services.

6. What are your immediate and long-term weight loss results? Immediate weight loss should not be more than 2 lb/week. The percentage of clients who are able to maintain adequate weight loss should be determined.

7. What is your attrition rate? The likelihood of patient success in program can be gauged by inquiring about the program’s attrition rate.

8. Do you advocate complementary/alternative weight loss methods? Programs that advocate complementary/alternative weight loss methods should use researched or reasonably approved methods, without the use of over-the-counter medications or products.

Primer 2: Primary Care Physicians’ Primer for Assessing Bariatric Surgery Services

1. Are you affiliated with a tertiary care center or pediatric hospital? Bariatric centers should be affiliated with a pediatric tertiary hospital.

2. Do you have specific guidelines for adolescents? There should be specific guidelines for adolescents.

3. What are your enrollment criteria? The enrollment criteria should include the following: (a) patients who have been unable to achieve significant reduction in BMI (<99th percentile) through nonsurgical means, including the use of medications, over a period of ≥6 months; (b) patients with BMI of >99th percentile or BMI of ≥40 kg/m² who are demonstrating the complications of diabetes, cardiovascular disease, or other comorbidities of obesity or patients with BMI of ≥50 kg/m² without complications, and (c) patients and families that demonstrate the ability to follow the behavior modifications and adapt to the psychological burdens associated with the child’s condition and expected outcomes.

4. Do you have a multidisciplinary team (with mental health care workers, dietitians, exercise specialists, and case managers)? The center should have a multidisciplinary team (with mental health care workers, nutritionists/dietitians, exercise specialists, and case managers) with specific training to address pediatric concerns.

5. Do you offer preoperative and postoperative weight loss/behavior modification, with diet/exercise and/
or medication? There should be both preoperative and postoperative weight loss/behavior modification, with diet/exercise and/or medication.

6. What surgical options do you provide? The surgical options should be approved for use in adolescents. Currently, Roux-en-Y gastric bypass is the only bariatric surgical procedure approved by the FDA for use in adolescents. However, other methods are currently in clinical trials.

7. What are the long-term potential complications? What are your long-term results? Long-term complications include delayed healing, multiple operations (including skin revision), and malnourishment. Immediate weight loss results should be within accepted guidelines, and long-term weight loss should be considered with respect to continued development.

8. What is the postoperative follow-up care, including duration? Postoperative follow-up care should include intensive nutritional guidance with attention to micronutrient balance and monitoring and psychological support for a minimum of 6 months to 1 year; this can be in an individual or group setting.

9. How are primary care/pediatric health concerns integrated? The primary care pediatrician should be integrated into the process so that ongoing pediatric health issues can be addressed and monitored after weight maintenance has been achieved.

10. What is the financial burden? The bariatric center should help in securing adequate financial support or facilitate minimization of the financial burden to the patient and family. It should be stated that the center will facilitate incorporation of the patient’s lifestyle changes (diet and special health needs) at the child’s school, to minimize the impact on the child’s psychosocial and educational environment.

Future Directions
With the realization that conventional treatment programs are not available to a large number of children in the United States, an emerging area of intervention involves the use of outreach clinics, distance education/counseling, or telemedicine. The University of Iowa hospitals and clinics outreach program confirmed the success of this approach by expanding the availability of tertiary care. The university established a network of outreach clinics throughout the state, and >75% of its tertiary care patients receive treatment outside the city and county where the university’s main hospital is located. Use of telemedicine and other electronic communication techniques can extend the reach of specialty care experts associated with tertiary care centers and allow them to partner with primary care providers in the management of very obese patients. Two research studies, with a combined enrollment of 289 adult subjects, demonstrated that patients participating in weight management programs who received counseling via e-mail or telephone lost as much weight as those who attended in-person counseling sessions. Little information is available on the use of remote weight loss counseling in the pediatric population. However, one small study by Saelens et al developed a weight management intervention that provided computer-based diet and activity education along with physician visits and counseling via telephone and mail. Adolescents who used this program lost slightly more weight than did those who received typical care, and they reported a higher level of satisfaction with the intervention.

A hospital-based, regional obesity center in South Dakota currently is studying how it can help primary care providers and adult patients living in remote rural communities participate in a medically monitored, multidisciplinary, weight management program. Primary care physicians received 3 hours of computer-based training in obesity assessment techniques and the medical monitoring procedures required to ensure the safety and efficacy of patients following an ~1000 kcal (4032 kJ)/day, full meal replacement diet regimen. Patients participated in a weekly group behavioral modification program via telephone or video conference. A therapist associated with the tertiary care center facilitated all behavioral change sessions. Patient medical records were reviewed weekly by a nurse practitioner and the supervising physician associated with the tertiary care center. Preliminary results indicate that weight loss, improvement in comorbid conditions, and patient satisfaction are comparable to those of patients participating in the same treatment at the tertiary care center. In addition to promoting preventive strategies, the public health system can support national weight management goals by providing community-based programs that meet some of the multidisciplinary treatment needs of patients enrolled in structured weight management programs (V. Mermel, PhD, unpublished data, 2006).

Larger-scale research programs are needed to validate the use of electronic counseling as a behavior management training tool for pediatric patients. In addition, investments in information technology infrastructure are required to enhance delivery of health care services, including obesity treatment, to rural areas.

Improving the Availability of Obesity Treatment
In 2006, the Institute of Medicine released a progress report on nationwide efforts to prevent childhood obesity. It concluded that obesity prevention requires the coordinated efforts of government agencies (federal, state, and local), industry representatives (involved in the manufacture and marketing of foods, beverages, leisure, and recreational products), communities, schools, and families. While acknowledging some progress, the
Institute of Medicine described current efforts to increase activity and to promote healthful eating as “generally fragmented.”

Special attention must be paid to ensuring that members of ethnic minorities and groups of low socioeconomic status have equal access to obesity prevention and treatment programs and to healthier foods and recreational opportunities within their communities. Black and Hispanic children and adolescents have higher rates of obesity, and such weight-driven diseases as type 2 diabetes and hypertension, than do their white peers, but they receive less care for these conditions. Fewer recreational facilities, fewer full-service grocery stores, and the relatively high cost of foods low in energy density have been identified as possible causes of the increased incidence of obesity in minority and low-socioeconomic status groups. A comprehensive policy is needed to address economic and cultural barriers to a more-healthful lifestyle. Health care professionals of different ethnic backgrounds must be involved in the development and implementation of culturally appropriate, weight management programs for children and adolescents with diverse ethnic, racial, and cultural backgrounds.

Developing a coordinated approach to the treatment of obesity is no less complex. Few primary care providers have the time or training needed to implement fully basic obesity treatment such as that described for the structured weight management stage. In addition, the number of tertiary care centers specializing in pediatric weight management is limited, and currently there is no registry of centers or programs. In fact, obesity treatment, even when available and medically necessary, is rarely reimbursed. Given the large number of obese children and adolescents in need of intensive intervention and the limited availability of specialty care, some experts suggest that the role of primary care providers must change. For pediatric providers to take on this role, pediatric primary care would need to be revised, because currently the system is geared toward treatment of acute conditions and not management of chronic diseases such as obesity.

Most primary care practitioners lack the training and time to assess, to modify, and to monitor obese patients’ diet, physical activity, and behavioral habits properly. A survey of >900 health care professionals (physicians, dietitians, and nurse practitioners) involved in pediatric care identified behavioral modification strategies, guidance in parenting techniques, and addressing of family conflicts as the 3 treatment techniques in which they felt least competent. Dietitians alone reported feeling confident in their ability to assess and to modify diets and activity. The American Medical Association is working with federal agencies, public health organizations, and medical societies to ensure that more physicians currently in practice, as well as those presently in medical school, are trained in the management of obesity in children and adults. In addition, the American Medical Association is encouraging primary care providers to identify community resources and referral services that can help them care for obese patients. Similar training must be made available to nurse practitioners, dietitians, behaviorists, and exercise specialists, because it is these health care professionals, together with physicians, who form the multidisciplinary treatment team required for tertiary obesity care. The American Dietetic Association has provided postgraduate certification in adult and childhood obesity management for several years. More dietitians must be encouraged to pursue this training, because their expertise is required in the early stages of obesity management. Training in obesity treatment for health care professionals also is limited. Recently, the American Dietetic Association sponsored a continuing education program to teach its members how to use Internet-based tools in pediatric weight management counseling. No formal research is available to validate the utility of these Internet-based resources for pediatric patients. However, clinical experience with the use of these resources has been positive.

Coaching patients in the process of behavioral change lengthens patient/provider encounters. The time constraints of the current primary care system represent a barrier to providing this aspect of treatment. Lack of reimbursement for weight management services is an additional obstacle. Generally, third-party payers do not reimburse physicians who provide such services themselves or who employ multidisciplinary teams within their practices to provide the services. Some efforts are being made to increase the number of physicians qualified to treat obesity and to improve reimbursement for those services. Because the National Institutes of Health and other health organizations recognize obesity as a disease, pressure is growing for third-party payers to reimburse health care providers for preventive counseling and management. Many organizations are lobbying actively for insurance coverage of obesity treatment. State and federal policymakers are evaluating which obesity treatments are effective and thus may qualify for Medicaid and Medicare reimbursement. More research is needed to identify successful weight management interventions and to secure reimbursement for obesity treatment from all third-party payers.

Increasing the number of health care practitioners with expertise in obesity treatment and securing reimbursement for a staged approach to obesity treatment services are necessary and eventually should foster development of additional tertiary care centers. Such centers cannot be developed soon enough to meet current and projected treatment needs, however, and, even when new tertiary care centers are created, people in rural areas are unlikely to have access to one. Some researchers have proposed that obesity treatment cen-
ters be regionalized in the way that pediatric cancer treatment centers are. Other approaches, such as development of satellite/outreach tertiary care clinics, use of telemedicine, and involvement of public health services, must also be explored. Obesity is a chronic condition. Therefore, individuals will need follow-up care after successful weight loss. Ultimately, a broad range of strategies must be developed to support maintenance of a healthy weight.

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