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Childhood Obesity: Assessment, Prevention, and Treatment

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Learning Objectives

After reading this *CME Bulletin*, you should be able to:

- Identify correct body mass index percentile categories for children and adolescents ages 2 to 19 years.
- Describe obesity-risk behaviors and the potential consequences of overweight and obesity in children.
- Discuss weight-management and obesity-prevention strategies with patients and their families; connect patients and their families to community resources for managing their weight; and motivate patients to make healthy lifestyle choices.
- Implement a practical, collaborative, stepwise approach to treating childhood overweight and obesity in the family medicine setting.

In 2008, 31.7% of US children and adolescents ages 2 to 19 years were either overweight or obese, and approximately 12.5 million (17%) children and adolescents ages 2 to 19 years were categorized as obese, a threefold increase since the 1980s.[1] Approximately 9.5% of children 2 years and younger are categorized as obese.[2]

Body mass index (BMI), defined as weight in kilograms divided by height in meters squared (kg/m^2) is used to determine an adult's weight category. Adult BMI cannot be used for children or adolescents. Instead, calculation of the BMI percentile for children older than 2 years is based on growth charts developed by the Centers for Disease Control and Prevention (CDC), which take into account age- and sex-based variations.[3] More information is available at http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html.

Because the CDC growth charts do not include robust data for children younger than 2 years, the CDC recommends use of the World Health Organization (WHO) growth standards for children up to age 2 years, then the CDC growth charts for children 2 years and older. The CDC charts and WHO standards, along with recommendations and instructions regarding their use, are available at http://www.cdc.gov/growthcharts.

Until 2005, use of the term *obese* to describe children with a BMI percentile of 95 or greater was discouraged, because it was thought to be stigmatizing. In 2007, an American Medical Association (AMA) Expert Committee proposed revising the terminology to be more consistent with that used for adults, as shown in *Table 1*. The committee suggested that a supportive attitude and language used by the physician can help reduce the negative connotation of the term *obesity*.[4,5]

A survey of 1,800 family physicians (FPs) showed that 45% compute children's BMI at most or every well-child visit, and that counseling is sporadic and incomplete. Of the FPs who provide counseling, 43% think their efforts are effective.[6] FPs are in an excellent position to assess obesity risk in their patients and to briefly counsel and motivate parents and children to prevent and manage childhood overweight and obesity.

Consequences of Childhood Overweight and Obesity

Obese children are more likely to be obese in adulthood than are healthy-weight children.[7] Obese children also are at higher risk of certain conditions in adulthood, including cardiovascular disease, components of the metabolic syndrome, and several types of cancer.[7] It is becoming increasingly apparent, however, that overweight and obese children are at high immediate risk of conditions previously not seen in children. For example, type 2 diabetes now accounts for almost half of all new diabetes cases among children.[7] Furthermore, overweight and obese children are at higher risk of hypertension,

Table 1. Childhood BMI Percentile Classifications

BMI Percentile Range	Previous Classification	Recommended Classification
<5th	Underweight	Underweight
5th to 84th	Healthy weight	Healthy weight
85th to 94th	At risk of overweight	Overweight
≥95th	Overweight	Obese

BMI = body mass index

Information from Barlow SE. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics.* 2007;120 Suppl 4:S164-S192.

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hyperlipidemia, asthma, nonalcoholic fatty liver disease, and perioperative respiratory distress under general anesthesia than are their healthy-weight counterparts.[8,9] Because of these increased risks, the Expert Committee recommendations include laboratory screening for overweight children older than 9 years with a lipid panel and, if risk factors are present, a fasting blood glucose test, alanine aminotransferase, and aspartate aminotransferase level every 2 years.[4] These tests are recommended every 2 years for obese children regardless of risk factors.[4]

The psychologic effects of obesity and overweight should not be underestimated. In a German study of self-reported health-related quality of life, overweight and obese children reported greater difficulty making friends than did healthy-weight children. Although 87.5% were overweight at the conclusion of the study, participants reported improvement in health, emotional well-being, and health-related quality of life during lifestyle interventions.[10] A Canadian study showed that overweight and obese children were more prone to low self-esteem than were healthy-weight counterparts.[11] This remained true 2 and 4 years from baseline. Children who participated in physical activity 5 to 7 times/week were less likely to have persistent low self-esteem than were those who participated rarely.[11] Some of the psychologic effects of childhood obesity, such as social isolation and low self-esteem, and the lifestyle habits that contribute to the development of obesity, are intertwined. Children with low self-esteem are less likely to participate in physical activity, making them more prone to obesity, which further compromises their self-esteem.[8]

Risk Factors

Risk factors (*Table 2*) for childhood overweight and obesity include environmental/socioeconomic, genetic/medical, and lifestyle factors. Lifestyle risk factors (ie, diet, physical activity) are most amenable to modification.[8,12]

Brief Counseling for Prevention and Management

As the US population becomes increasingly diverse, cultural competence takes on increasing significance. In the context of family medicine, cultural competence refers to using knowledge of another culture's norms to develop an effective counseling plan.[4,13] This includes understanding and respecting the roles of ethnicity, history, and socioeconomic circumstances in individuals' attitudes toward health, parenting, body image, meals, and physical activity. For example, a study of cross-cultural perspectives of obesity and body image among American Indian, black, and Mexican-American women in the United States showed that black women desired a body image that corresponded to a BMI of 27.7 kg/m^2, which is in the overweight category.[14] To achieve optimal outcomes, FPs should be familiar with the beliefs of the cultures that comprise their practices.

The etiology of childhood overweight and obesity is likely to be multifactorial, and, therefore, so is the optimal approach to prevention and management.[8] A recent meta-analysis showed that multifactorial interventions can be effective.[15] Because risk factors often occur in combination, it can be difficult to distinguish the nature or degree of their specific contributions to childhood overweight and obesity. When counseling parents and children about prevention and management strategies, consider and attempt to address the risk factors in each of the following categories.

Environmental/Socioeconomic

Environmental/socioeconomic and lifestyle risk factors often overlap, in that environmental factors can result in unhealthy diets and insufficient physical activity. Low-income families often live in neighborhoods in which it is not safe to walk to school (in 2009, only 13% of children walked or biked to school) and that might not have safe areas nearby for regular outdoor exercise.[16] Adtditionally, schools in low-income neighborhoods often do not offer full physical education programs or scheduled times and areas for physical activity, and budget constraints have led to cutbacks in physical education at schools across income levels.[16]

Families living in socioeconomically disadvantaged circumstances might not be in a position to prioritize weight control in the context of other problems[9]; nonetheless, information about community resources such as community parks and pools, and YMCA and other youth programs (see *Resources for Patients and Parents*) should be provided, and FPs should lobby for physical education programs in all US schools. Several organizations, states, and regions have instituted local programs to provide children with safe venues for physical activity,[16] and FPs should be aware of and make parents aware of local resources.

According to the US Department of Agriculture, approximately 23.5 million Americans live in *food deserts* — low-income neighborhoods with minimal access to affordable, healthy foods.[1] Additionally, low-income neighborhoods often contain an overabundance of fast-food restaurants and small convenience stores that do not typically stock high-quality, healthy food[16] and many low-income parents have minimal time after work to prepare healthful meals.

Genetic/Medical

Family physicians should consider genetic and medical risk factors for overweight and obesity. In addition to isolated gene effects, certain rare genetic disorders, such as Prader-Willi, Bardet-Biedl, and Alström syndromes, can lead to obesity in children. Polycystic ovary syndrome (PCOS), characterized by hirsutism, acne, and early menarche or dysmenorrhea in adolescents, is increasingly seen in overweight and obese girls.[17] Although there is no specific test for PCOS, laboratory testing should include measurements of free testosterone, dehydroepiandrosterone sulfate (DHEA-S), androstenedione, prolactin, thyroid-stimulating hormone, 17-hydroxyprogesterone (17-OHP), and fasting blood glucose levels, and a pregnancy test.[18]

Table 2. Risk Factors for Overweight and Obesity in Infants and Children

Environmental/Socioeconomic
Limited access to healthful foods
Limited time for healthful food preparation
Limited/no access to safe parks, community centers, or gyms
Unsafe to walk to school or recreation activities or play outside
Genetic/Medical
American Indian, Hispanic, or non-Hispanic black race
Large size for gestational age
Maternal diabetes
Weight of siblings and other family members
Lifestyle
Breastfeeding fewer than first 4 months
Fewer than 60 minutes of vigorous exercise per day
Frequent consumption of fast foods, sweetened drinks, high-fat snacks
More than 2 hours of television viewing and other screen time per day

Information from August GP, Caprio S, Fennoy I, et al. Prevention and treatment of pediatric obesity: an Endocrine Society clinical practice guideline based on expert opinion. *J Clin Endocrinol Metab.* 2008;93(12):4576-4599 [Review]; Persons RK. Sevdy TL, Nichols W. Does birth weight predict childhood obesity? *J Fam Pract.* 2008;57(6)409-410; Rao G. Childhood obesity: highlights of AMA Expert Committee recommendations. *Am Fam Physician.* 2008;78(1):56-63.

Ethnic origin, to the extent that it is distinguishable from socioeconomic circumstances, is another genetic risk factor for overweight and obesity. Hispanic, American Indian, and non-Hispanic black children are at greater risk of obesity than are non-Hispanic whites.[9]

Parents should be informed that even if their child has one or more nonmodifiable risk factors, overweight and obesity can be prevented.[16] A healthy lifestyle is at least as important for individuals with nonmodifiable risk factors as it is for those without such factors.

Lifestyle

Studies show that more than half of obese children were overweight at or before age 2 years, and the prevalence of overweight infants has nearly doubled in the past 30 years.[20] Excess gestational weight gain has been associated with early childhood obesity, and obesity in childhood is likely to persist into adulthood.[21] Additionally, infants born to obese mothers are more likely to be obese in later years.[12] Counseling to prevent obesity should begin during pregnancy or before conception. The Institute of Medicine's guidelines published in 2009 assume 0.5 to 2 kg (1.1 to 4.4 lb) gained in the first trimester of pregnancy and recommend a total weight gain of 12.7 to 18.1 kg (28 to 40 lb) for underweight women (0.5 kg [1 lb]/week in the second and third trimesters of pregnancy); 11.3 to 15.9 kg (25 to 35 lb) for normal-weight women (0.5 kg [1 lb]/week in the second and third trimesters of pregnancy); 6.8 to 11.3 kg (15 to 25 lb) for overweight women (0.3 kg [0.6 lb]/week in the second and third trimesters); and 4.99 to 9 kg (11 to 20 lb) for obese women (0.22 kg [0.5 lb]/week in the second and third trimesters of pregnancy).[22]

Not breastfeeding or breastfeeding only briefly can contribute to childhood overweight and obesity. The greatest protective effect of breastfeeding against overweight has been observed in adolescents, suggesting that the benefits extend well beyond the duration of breastfeeding. One study showed that the risk of becoming overweight was decreased by 4% for each month of breastfeeding in the first 9 months of life; this benefit plateaued after 9 months of breastfeeding.[23] One hypothesis explaining the protective effect is that infant formula stimulates insulin secretion to an extent beyond that of breast milk.[16] Another is that breastfed infants learn to self-regulate food intake more effectively than bottle-fed infants, who might be urged to continue drinking until the bottle is empty. Although there are no clear data regarding timing of introducing solid foods and its influence on childhood weight, mothers should be advised to breastfeed infants exclusively until age 4 months, and preferably until age 6 months.[21]

Excess consumption of empty calories, coupled with insufficient physical activity, creates an imbalance between energy intake and output. For prevention and management of childhood obesity, the entire family should be counseled regarding the importance of lifestyle modifications.[9]

Diet is one of the most influential lifestyle factors. This is not just a matter of overeating but also includes frequent consumption of foods high in energy density such as many convenience foods, infrequent consumption of vegetables and fruits, consumption of sweetened drinks such as soda and fruit juice, not eating breakfast, snacking often, and eating irregularly.[7] An evidence-based statement from the American Dietetic Association recommends using family-based lifestyle interventions for children and adolescents.[9] Parents should be encouraged to lead by example by providing a healthful food environment, discouraging the consumption of unhealthy foods outside the home.[7]

In addition to the environmental factors previously discussed, lifestyle factors can affect a child's level of physical activity.[16] The convergence of working parents' needs to keep children occupied and recent advances in technology has created a generation of sedentary children. Children of all ages, even those younger than 2 years, are watching more television than in past years and using computers for recreation.[16] Ninety percent of children between ages 4 and 6 years use screen media for an average of 2 hours/day. Older children accumulate even more screen time; many own handheld computer gaming devices or portable DVD players.[16] During screen time, children are likely to be exposed to advertising for fast food and junk food, which can fuel their desire for such foods. While watching television, children tend to snack, especially on the junk foods they see advertised. In parallel, physical activity is curtailed. Fewer than 1 in 5 US high school students get at least 60 minutes of exercise per day.[16]

The key to achieving a healthy lifestyle is to establish a combination of diet and physical activity that balances energy output and intake. Weight loss can be achieved when energy output exceeds intake. This can be accomplished with a calorie-restrictive diet or one that excludes certain foods or emphasizes others.[12] In addition to calorie restriction and consumption of regular meals, encouraging at least 1 hour of physical activity per day and limiting television and computer time to 2 hours or less, is advisable.[4] Additionally, parents should be advised to model appropriate lifestyle behaviors, eating healthfully and exercising regularly themselves to set an example for their children.[7] To some degree, all of the risk factors in this category are modifiable and, therefore, represent the best opportunity for prevention (*Table 3*).

Because lifestyle modification is the cornerstone of prevention and management of childhood overweight and obesity, the first step is to identify and overcome barriers to change. Parents might not be aware of a problem, or be reluctant to acknowledge one (eg, thinking it is *baby fat* that will resolve with age). Alternatively, they might acknowledge a problem but not be ready to institute changes. It is important to ascertain patient and family readiness to change behaviors, using a model/paradigm, such as Prochaska's stages of change (*Table 4*).[5]

Motivational Interviewing

Motivational interviewing takes into consideration an individual's or family's readiness to make lifestyle changes and uses nonjudgmental questions coupled with reflective listening to assess the beliefs and values of the parent or child. Using this technique, the FP can help motivate a family to develop a plan consistent with their own values and circumstances.[4] For example, after determining a child's BMI indicates overweight, an FP can attempt to elicit the parent's concerns by using neutral language and asking for feedback on the finding: "Your child's BMI is in the range which has been associated with health problems. What concerns, if any, do you have about your child's weight?" Once the parent acknowledges that changes should be made to improve the health of the child, an assessment of motivation to change can be made and a treatment plan developed.[4]

Table 3. Recommendations for Counseling for Lifestyle Risk Factors

- Breastfeed exclusively for first 4 months; 6 months if possible
- Consume a diet high in fruits and vegetables, low in fats
- Eat breakfast daily; regularly eat meals as a family
- Limit consumption of sweetened beverages, fast foods, and high-fat snacks
- Limit television and other screen time to no more than 2 hours/day; remove screens from child's bedroom
- Exercise vigorously 60 minutes or more per day

Information from Barlow SE; Expert Committee. Expert Committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics.* 2007;120 Suppl 4:S164-S192.

Table 4. Stages of Change

Stage	Characteristic
Precontemplation	Not yet considering change
Contemplation	Evaluation of pros and cons of change
Preparation	Planning for change
Action	Change is made
Maintenance	Sustained for more than 6 months

Information from Krebs NF, Himes JH, Jacobson et al. Assessment of child and adolescent overweight and obesity. *Pediatrics*. 2007;120 Suppl 4:S193-S228.

The AMA Expert Committee proposes a stepwise, multidisciplinary approach that divides management into 4 stages, each of which involves the addition of more personnel, more extreme measures, and more frequent monitoring (*Table 5*) than the previous stage. The stages should be attempted in order. If desired goals have not been reached after 3 to 6 months, the patient can move to the next stage.[4] The multidisciplinary team, coordinated by the FP, might comprise pediatric nurse practitioners, physician assistants, and more specialized members, including nutrition experts, exercise physiologists, and clinical psychologists.[4] The goal of every intervention is overall health, with sensible diet and sufficient physical activity as important components of a healthy lifestyle.

Other Treatment Options

The lipase inhibitor orlistat (Xenical) is the only drug approved by the Food and Drug Administration for treating obesity in individuals 12 years and older.[24] Treatment with orlistat has been observed to have modest additive effects (typically 2 to 3 kg [4.4 to 6.6 lb] additional weight loss) when combined with lifestyle intervention, but it has adverse gastrointestinal effects (eg, fatty or oily stools, diarrhea, fecal urgency, incontinence)[25] which limit its acceptability and usefulness.[8,12] There are no long-term studies of orlistat in children. Pharmacotherapy is not recommended for children with a BMI percentile less than 95, and should only be used for overweight children (BMI percentile greater than 85 but less than 95) who have severe comorbidities and who have not received benefit from lifestyle intervention.[9]

In October 2010, the manufacturer of the appetite suppressant sibutramine (Meridia), which had been approved for obesity management in adults and adolescents 16 years and older, voluntarily withdrew the drug from the market because of the risk of serious cardiovascular adverse events demonstrated in clinical trials.[26]

Several other drugs have been considered for off-label treatment of obesity, including the antidepressants fluoxetine, sertraline, and bupropion, and the antiepileptics topiramate, zonisamide, and lamotrigine.[27] These drugs should only be considered for use in obese children when there is an alternative indication present for treatment (eg, depression, seizure disorder); they should not be used solely to promote weight loss in children.[9] A review of 3 studies showed that the antidiabetic drug metformin decreased BMI in adolescents with risk factors for diabetes, but the overall effect did not show statistical significance in meta-analysis.[9] Like other drug trials enrolling children, these were small studies.[24]

Although adolescents are likely to be low-risk candidates for bariatric surgery because of a likely absence of serious comorbidities, concerns have been raised regarding high rates of surgical complications such as pulmonary embolism, shock, postoperative bleeding, hiatal hernia, infection, and pouch dilatation.[12] Additional concerns include adherence, informed consent, and durability of effect.[8] A recent small randomized trial of gastric banding versus

Table 5. Stages of Obesity Treatment

Stage	Description	Components
1	Prevention Plus	• Family physician • Guidance regarding healthy eating and physical activity to improve BMI for overweight or obese patients and maintain BMI for those within normal range
2	Structured Weight Management	• Family physician with additional support (eg, dietitian) • Specific plan for diet and physical activity, systematic monitoring, planned reinforcement
3	Comprehensive Multidisciplinary Intervention	• Family physician coordinates components, which might include weight-management center, commercial program, counselor, physical therapist, dietitian • Structured behavior-modification program (diet, physical activity), frequent monitoring
4	Tertiary Care Intervention	• For patients who have tried other methods without success: pediatric weight-management center, multidisciplinary team • Might involve drugs, very-low-calorie diet, bariatric surgery

BMI = body mass index.

Information from Barlow SE; Expert Committee. Expert Committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120 Suppl 4:S164-S192.

lifestyle program in adolescents (ages 14 to 18 years) found higher mean weight loss at 2 years (34.6 kg vs. 3 kg, respectively) and improved quality-of-life scores, but a higher rate of adverse events. However, absent larger long-term controlled clinical studies supporting a favorable benefit-to-risk ratio,[12] it is advisable to reserve surgery for only the most severely obese children (BMI percentile 50 or greater) in the context of a clinical trial.[28] Further, factors including pubertal development and growth, psychologic maturity, potential for chronic complications, and pregnancy or plans to become pregnant should be considered before recommending bariatric surgery in individuals ages 12 to 19 years.[29]

Resources for Patients and Parents

Diet and Exercise

- **4H Programs:** Health-promoting youth programs, available at http://www.4-h.org/
- **Big Brothers Big Sisters of America:** Mentoring program committed to promoting healthy lifestyles, available at http://www.bbbs.org/
- **Centers for Disease Prevention and Control Tips for Parents:** Information, resources, links, available at http://www.cdc.gov/nccdphp/dnpa/obesity/childhood/tips_for_parents.htm
- **Dietary Guidelines for Americans 2010:** Compendium of information on healthful diets, pitfalls, advice, and links to other resources, available at http://www.dietaryguidelines.gov/
- **Smart-Mouth.org:** Videos, games, information, links, available at http://www.cspinet.org/smartmouth
- **Text4Baby:** 3 free text messages/week to pregnant women or new mothers; actionable, evidence-based information relevant to stage of pregnancy or child's development; information available at http://www.text4baby.org/index.html

- **UCLA Fit for Healthy Weight Program:** Information, programs, tools, links to other resources, available at http://www.fitprogram.ucla.edu/
- **Weight-control Information Network:** Helping Your Child: Tips, information, links, available at http://win.niddk.nih.gov/publications/child.htm
- **YMCA:** Fitness programs for children (some at reduced fees), education to promote healthy choices, available at http://www.ymca.net

Food Assistance

- **National School Lunch and Breakfast Programs:** Free or reduced-cost balanced meals in public and nonprofit private schools, available at http://www.fns.usda.gov/cnd/lunch/ and http://www.fns.usda.gov/cnd/breakfast/
- **Supplemental Nutrition Assistance Program:** Assistance with grocery costs, available at http://www.fns.usda.gov/snap/

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Self-Assessment Quiz

1. Which of the following weight classifications for children based on body mass index percentile are recommended by the Centers for Disease Control and Prevention?
   A. Overweight (75 to 84); obese (85 or greater).
   B. At risk of obesity (75 to 84); obese (85 or greater).
   C. At risk of overweight (85 to 94); overweight (95 or greater).
   D. Overweight (85 to 94); obese (95 or greater).

2. Which of the following is true regarding overweight/obese children vs healthy-weigh children?
   A. They are at higher risk of cardiovascular disease, components of the metabolic syndrome, and certain types of cancer in adulthood.
   B. They are at higher risk of respiratory distress under general anesthesia in adulthood.
   C. They are at higher risk of type 2 diabetes, respiratory distress under general anesthesia, and cardiovascular conditions in childhood and adulthood.
   D. They are at higher risk of cardiovascular conditions in childhood but not at higher risk of type 2 diabetes.

3. Genetic/medical risk factors for childhood overweight and obesity include which of the following?
   A. Large or small size for gestational age; American Indian, Hispanic, or non-Hispanic black race.
   B. Large size for gestational age; American Indian, Hispanic, or non-Hispanic black race.
   C. Large or small size for gestational age; American Indian race.
   D. Small size for gestational age; American Indian, Hispanic, or non-Hispanic black race.

4. Lifestyle measures that help prevent childhood obesity include which of the following?
   A. Breastfeeding until the infant is at least age 4 months.
   B. Eating a diet high in fruits and vegetables and low in fats.
   C. Exercising vigorously for 60 minutes/day.
   D. All of the above.

5. Which of the following drugs is approved by the Food and Drug Administration to treat obesity in adolescents with a body mass index of 95 or greater?
   A. Sibutramine (Meridia).
   B. Orlistat (Xenical).
   C. Fluoxetine.
   D. Sertraline.

Answers: 1. D, 2. A, 3. B, 4. D, 5. B.

Members: To complete the quiz, see instructions for AAFP members at right.

CME Accreditation Information

This activity has been reviewed and is acceptable for up to 2 Prescribed credit(s) by the American Academy of Family Physicians. AAFP accreditation begins May 31, 2011. Term of approval is for 2 year(s) from this date with the option of yearly renewal.

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AAFP members who wish to obtain CME credit for completing this activity should read the *CME Bulletin* and complete the online self-assessment quiz and evaluation available at http://www.aafp.com/cmebulletin. Once you have completed the evaluation online, credit will be posted automatically to your CME record.

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