
In Brief

Treating obesity in the adult, and even more so in the pediatric, population can be a daunting and difficult task. Health care providers need to take a proactive role when treating children and focus on prevention of obesity rather than waiting until the condition exists. Obesity can lead to several complications and comorbidities; this article will address how to make an appropriate and thorough assessment of a child's lifestyle and behaviors and how to implement interventions that will result in improved health.

Childhood Obesity: Practical Considerations for Prevention and Management

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Childhood obesity is the greatest challenge to child health in the 21st century. In 2006, the prevalence of obesity in children reached 17% in the United States. If current trends remain unchanged, the prevalence of childhood obesity is expected to reach 20% by 2010.¹ Although obesity in children is multifaceted, little doubt remains that the factors

driving this phenomenon include rapid changes in the modern food and activity environment of children superimposed onto genetic and metabolic predispositions for weight gain.² Current evidence suggests that insulin resistance may be both a cause and an effect of childhood obesity and may even be induced by prenatal factors,³ race,⁴ poverty, geography,

Table 1. Complications and Comorbidities of Childhood Obesity

<ul style="list-style-type: none"> • Glucose tolerance Hyperinsulinemia Pre-diabetes Type 2 diabetes 	<ul style="list-style-type: none"> • Hepatic Cholestasis/cholelithiasis Steatosis Steatohepatitis
<ul style="list-style-type: none"> • Cardiovascular Systolic hypertension Systolic and diastolic hypertension Low HDL cholesterol Elevated LDL cholesterol Hypertriglyceridemia 	<ul style="list-style-type: none"> • Renal Microalbuminuria
<ul style="list-style-type: none"> • Mental health Low self-esteem Depression 	<ul style="list-style-type: none"> • Neurological Pseudotumor cerebri
<ul style="list-style-type: none"> • Orthopedic Coxa vara Slipped capital femoral epiphysis Blounts disease Legg-Calvé-Perthes disease 	<ul style="list-style-type: none"> • Dermatological Acanthosis nigricans Intertrigo Furunculosis
<ul style="list-style-type: none"> • Pulmonary Asthma Obstructive sleep apnea Pickwickian syndrome 	<ul style="list-style-type: none"> • Reproductive (girls) Polycystic ovary syndrome Hyperandrogenism Earlier menarche Dysmenorrhea • Reproductive (boys) Later pubertal onset Pseudo-micropenis Reduced circulating androgens

and lower access to health care, all of which add to increased risk of obesity for children affected by any of these variables.⁵

The child and family sit at the center of any effective prevention and treatment strategies, and their actions will ultimately determine success or failure. Because behavior and lifestyle change is the first intervention, deciding who will and will not benefit from actions to prevent or treat obesity becomes the first objective. In the health care environment, funding for weight-loss treatment may be limited. This includes costs associated with health care encounters and expenses related to making different food choices, purchasing exercise equipment, and other costs associated with access to these resources. For health care providers, cost reimbursement for obesity prevention and care remains limited. For families, barriers to care access may be distance-, work-, or school-related. For these reasons, it is most practical to incorporate as much of the assessment and intervention for obesity as possible into the health maintenance visit environment.⁶

Complications and Comorbidities of Childhood Obesity

Many diagnosable and treatable conditions arise from childhood obesity (Table 1). The existence of any of these conditions should be used to motivate change, because many patients will benefit from lifestyle modification.

Type 2 diabetes has received tremendous attention as one of the possible outcomes of childhood obesity.⁷ Because of the concern about the possibility of an underlying insulin-resistant state, some clinicians may order matching glucose and insulin levels during an oral glucose tolerance test (OGTT) or a random or fasting sample. An OGTT is done by having the patient fast for 8–12 hours and then drawing blood before and 2 hours after the patient drinks a glucose-containing solution. OGTTs may create concern or confusion when the insulin responses are reported as out of range yet glycemic response is within normal range. Diabetes is defined by glucose level, not insulin. For these reasons, questions regarding interpretation of OGTT data in children may need to be directed to a

pediatric endocrinologist.

Normoglycemia and accompanying hyperinsulinemia suggests that follow-up assessments for diabetes be performed at periodic intervals. These results may be used as another tool to encourage change by the child or family, because the onset of type 2 diabetes may be near. The American Diabetes Association recommends testing children at risk for type 2 diabetes starting at 10 years of age or at onset of puberty.⁸ Fasting plasma glucose is the preferred test and should be performed every 2 years.

Other silent elements of cardiometabolic risk not to be missed include dyslipidemia and hypertension. Periodic lipid profiles should accompany assessments for glucose intolerance in at-risk children. Blood pressure, taken with the appropriate size cuff, should be measured and compared to age- and sex-appropriate standards at each visit. If undiagnosed and left untreated, hypertension may increase the risk of retinopathy and microalbuminuria, even in the absence of overt glucose intolerance.

Insulin resistance is considered a significant contributor to an increased risk for obesity and later development of type 2 diabetes. Acanthosis nigricans is a painless dermatological condition often associated with insulin resistance. Affected skin typically appears hyper-pigmented and thickened. Parents often confuse acanthosis nigricans with dirt or poor hygiene. It is commonly found on areas of skin exposed to frequent flexion or friction, such as the neck or axilla. The presence of this condition may prompt referrals for assessment of type 2 diabetes and other comorbidities of insulin resistance. Fatty liver (hepatic steatosis) may be suggested by mild to large elevations in liver transaminases. The presence of such elevations is often associated with insulin resistance.⁹ Occasional cases may even progress to steatohepatitis and fulminant hepatic failure.

Other comorbidities of childhood obesity include depression, obstructive sleep apnea, and asthma. Depression is a complex disorder with numerous etiologies, which has been associated as both a potential cause and a result of obesity. Various forms of depression will inhibit efforts toward effective weight management. The use of atypical antipsychotics (i.e., olanzapine, risperidone, quetiap-

Table 2. Risk Factors Associated With Childhood Obesity

- **Family history**
Obesity
Heart disease
Hypertension
Dyslipidemia
Type 2 diabetes
Thyroid disease
- **Birth weight**
Low or high
- **Dietary**
Excessive fruit juice consumption
Sweetened beverages
Excessive whole milk intake
Frequency of eating outside home
Frequency of fast-food meals per week
- **Physical activity**
Screen time hours spent per day
Television in child's bedroom?
PE at school? How many times per week?
Participation in organized sports?
Parental exercise behaviors?
Access to safe outdoor locations?
- **Medications**
Glucocorticoids
Use of atypical antipsychotics
- **Reproductive (girls)**
Age of menarche
Oligomenorrhea
Hirsutism
- **Respiratory**
Snoring
Wheezing
Apnea
Daytime sleepiness
- **Dermatological**
Acanthosis nigricans
Furunculosis
- **Gastrointestinal**
Gallbladder disease
Gastroesophageal reflux
- **Musculoskeletal**
Joint pains
Limpness
- **Neurological**
Vision problems
Hyperactivity
Diplopia
Headache
- **Mental health**
Depression
Poor self-esteem
Isolation from peer group
Behavioral problems

ine, ziprasidone, and clozapine) with mood disorders has been associated with insulin resistance and increased type 2 diabetes risk in children.¹⁰ Screening overweight and obese children for mental health problems and providing treatment are essential to enabling effective lifestyle change to occur. Monitoring weight during therapy with atypical antipsychotic medications is essential.

Obstructive sleep apnea may often present as other problems, including depression, behavior disorders, or attention deficit disorder. Common signs and symptoms of this disorder include snoring, restless sleep, daytime napping, behavior problems, and headaches upon awakening. Parents may misinterpret these signs and symptoms as evidence of attention deficit disorder. Identification of any of these signs is sufficient for referral to a sleep disorder specialist

and consideration of a formal sleep study. Failure to identify and treat this problem will virtually assure lack of success in weight control efforts and will accelerate further weight gain and the onset of other disorders.

Childhood obesity and asthma are associated conditions.¹¹ Both are also associated with sleep-disordered breathing.¹² While asthma has the potential to limit physical activity, it has not been shown to predispose children to obesity and may actually precede its development. Furthermore, if oral glucocorticoids are required to treat asthma, this may aggravate weight gain and inhibit weight-loss efforts.

Assessment of Overweight or Obese Children

The first consideration is to assess obesity risk. Table 2 presents risk factors for obesity. Numerous his-

torical and observable patient risk factors can be identified before a child becomes overweight or obese. It is incumbent to be familiar with these risk factors, many of which are similar to those for diabetes and cardiovascular disease.

Proper measurement and accurate plotting of weight, length, head circumference, and BMI are the best tools to identify changes before they become severe. BMI is a descriptive measure of the degree of obesity in children and adults. BMI plotting is very useful in identifying trends associated with increased risk of childhood obesity. Families should become comfortable with what the BMI means and should have access to this information at every encounter. One of the limitations of BMI is the inability to distinguish the amount of fat mass compared to lean mass. Individuals with hypertrophied skeletal muscle, such as a very muscular athlete or an athletic child, would have a high BMI despite having a low percentage of body fat. When children are < 36 months of age, weight for length can be used to assess the child's growth. Weight for length is an indicator to classify infants and young children as over- or underweight.

The concept of adiposity rebound¹³ is a simple method to prospectively identify changes in BMI that signal an increased risk of future overweight or obesity.¹⁴ Adiposity rebound is the age at which a child's BMI nadir (lowest point) occurs. If the nadir occurs before 6 years of age and then starts to steadily increase, the child is at higher risk for abnormal weight gain and obesity. On the other hand, a BMI nadir after the age of 6 years tends to confer a lower risk of future overweight or obesity.¹⁵

Once the risk of obesity is recognized, there must be an assessment of the child's and family's readiness to change. The provider's familiarity with the child and family influences whether the subject is mentioned at all. If the reason for the visit is health maintenance, this is sufficient reason to explore this matter. Continuity of care is an asset to the provider and family if there is to be success in preventing excess weight gain or actual weight reduction. A separate visit may be needed to allow adequate time to discuss the problem and develop a plan with the child and family to imple-

ment changes. Also, the willingness of the child and family to return for a separate visit to discuss the problem of overweight and obesity should be interpreted as an encouraging indicator of willingness to change. Convincing the family that a lifestyle change is needed is often difficult when the need for change is not appreciated by the family or child.

Prevention of Obesity

Based on current societal culture and values, obesity is a difficult subject to raise even in clinical settings. Many providers may feel uncomfortable discussing the issue of overweight and obesity if that is not the primary reason for the encounter.¹⁶ Parents may become defensive when the issue is mentioned or view provider comments negatively. Some parents from lower income groups may possess different perceptions of weight than the health care provider.¹⁷ Currently, 60% of American adults and 35% of their children are overweight, and these numbers increase yearly. Clearly, this is a subject that must be addressed by health care professionals to their overweight and obese pediatric patients and their families. The provider's tone and approach to the subject of weight or its consequences should be informative and focused on the best interests of the child's short- and long-term health.

The best time to discuss weight is at the first well-child visit. New parents are usually most willing to make change for the sake of the infant. Since nutritional imprinting starts early, this is the ideal time to start discussing proper feeding practices. The need for early intervention is strongly reinforced by the fact that many U.S. parents are overfeeding their infants by > 200 kcal per day before the first birthday.¹⁸ Some children are having sugary soda drinks introduced in the first year of life. By age 2, the number one "vegetable" consumed by American toddlers is the French fry.¹⁹

Some parents feed their infants and toddlers large quantities of fruit juice under the mistaken impression that this is a healthy behavior, but the recommended amount is no more than 4–6 oz of 100% fruit juice per day for children ages 1–6 years. For children 7–18 years of age, fruit juice consumption should be no more than 8–12 oz daily. The American Academy of

Pediatrics states that juice should not be given to children under 6 months of age, and children 6–12 months of age should drink no more than 4–6 oz of juice per day, provided in a cup.²⁰

The television is also used as a convenient babysitting tool in the first years of life. Most children's programming is laced with advertisements for high-calorie foods and drinks.²¹ Billions of dollars have been spent to develop and perfect methods that attract the attention of children to televised food products to encourage them to convince parents to purchase these products in the grocery store (i.e., the "nag factor").

Even if time proves the clinician's concerns to be wrong, discussing the issue of obesity early would allow an easier path for revisiting the subject with the family if and when it presents later in childhood. Moreover, some advocate child obesity prevention counseling as part of the prenatal visit. Based on the author's experience, this is a sound strategy for those able and inclined to discuss the issue.

As children become older, their independence in food choices becomes greater. Assisting an overweight toddler or school-aged child is easier than a teenager because parents have a greater amount of control regarding food choices inside and outside the home. Treating obesity requires both a motivated patient and parent. Unless the child is motivated to lose weight and make changes, the chances are quite low that effective change can occur, and screening for comorbid problems may be the best that a clinician can do until a later age arrives. Even when adolescents are provided with proper nutritional information, their food-ordering preferences in a fast-food restaurant setting are more influenced by what peers are selecting.²² Most successful weight loss programs for adolescents require a maintenance component to keep excess weight from returning once it has been lost. Many families with obese adolescents lack access to these programs because of their expense, time, and often distance from the home. For these reasons, primary prevention of overweight and obesity should be the first goal of the health care provider for children at risk.

For children identified as overweight or obese, primary care providers should consider referral to an

experienced registered dietitian (RD) to obtain a full nutritional assessment for the child and family. The RD may be able to follow the child for several visits and will provide a written report and recommendations to the referring clinician. Limitations in reimbursement, distance, and additional time from work or school are significant limiting factors in getting patients and families to see an RD. It should be noted that this involves another visit and additional costs separate from the clinician visit. Not surprisingly, follow-up rates with RDs for weight counseling not associated with a physician visit are generally low. Therefore, clinicians should make a concerted effort to endorse the referral to an RD and to follow through on monitoring their recommendations.

Pharmaceutical and Surgical Interventions

Prescription and nonprescription medications to treat obesity are a multi-billion dollar industry worldwide. It is important when assessing patients to determine if any supplements or weight-loss medications are currently being taken. Recent controlled studies have shown significant weight reduction associated with sibutramine and lifestyle change.²³ Orlistat, an orally administered fat absorption blocker, has also been studied in adolescents with positive effects on weight reduction when combined with appropriate lifestyle change.²⁴ However, studies demonstrate that the weight-loss effects of these agents eventually plateau.²⁵ The explanation for these findings seems to be physiological changes within the individual to reduced energy intake, including a lowered metabolic rate and shunting of more calories into adipose tissue.

Because obesity is associated with hyperinsulinemia, it has been proposed that leptin resistance is induced by insulin resistance.²⁶ Because leptin acts to signal the degree of "body adiposity" to the hypothalamus, any reduction in leptin response would drive increased caloric intake and ultimately result in weight gain or obesity. This makes control of insulin resistance a prime target for pharmacological therapy of obesity. Currently, sibutramine is approved by the U.S. Food and Drug Administration for use in adolescents ≥ 16

years of age, and orlistat for children ≥ 12 years of age. Although approved only for treatment of type 2 diabetes in children > 12 years of age, metformin has been reported to consistently reduce weight in certain subgroups of children with obesity and documented insulin resistance.²⁷

Unless lifestyle change occurs, the same forces that created the excess weight gain would be expected to result in a return of the same problem. Therefore, the general consensus is that any pharmacological intervention must be accompanied by ongoing behavioral interventions to achieve lasting lifestyle change.²⁸

Laparoscopic adjustable gastric banding in morbidly obese adolescents has shown remarkable short-term success with relatively low mortality rates if performed by experienced surgeons.²⁹ Surgery may ultimately play a much larger role in weight management for a very select group of significantly obese adolescents. Questions remain regarding long-term effects and the need for ongoing behavioral maintenance considerations. Successful outcomes with bariatric surgery require sustainable lifestyle change before and after the procedure. For morbidly obese adolescents ($\text{BMI} \geq 40 \text{ kg/m}^2$), this may represent their best option for effective weight loss.

Provider Attitude: What You Can Do Health care providers can facilitate readiness to change by first deciding if they are willing to seriously address this problem. The management of childhood obesity does require a commitment by clinicians. When and how to best discuss the problem of weight may pose challenges for some health care professionals. For example, an infant cup containing soda pop makes for an ideal opportunity to discuss the significant relationship between consumption of regular soda and dental caries in toddlers.³⁰ A parent handing his toddler a French fry is a chance to discuss the caloric impact of these foods on rapid weight gain. A parent drinking a 12-oz soda can be reminded that drinking only one of these each day would add the caloric equivalent of 16 lb per year to their weight, regardless of age. Displaying educational tools around the clinic and exam room is an easy way to disperse health information and may foster questions from parents.

Reviewing height, weight, and BMI data with parents at each visit should help to focus them on the importance of these measures in the child's overall health. Most of all, clinicians make the most impact on the family when the message is delivered with concern and compassion, as opposed to a fleeting comment made at the end of the encounter. Conveying the message is a true test of a clinician's communication skills because patient outcomes are ultimately the result of behaviors that are being shaped by these messages.

Conclusion

Childhood obesity is a condition that is more cost-effective to prevent than to treat. Few medications are approved for treatment and then only for specific indications and with close follow-up. Accept that obesity is a family condition influenced equally by genetics and the food and activity environment. Many of the environmental forces at play that give rise to childhood obesity are correctable or modifiable. An emphasis should be placed on changing the person's behaviors through increased awareness and ongoing support of the family.

First, determine the family's willingness to change. This is often best done when the child is an infant and only at risk for obesity rather than already overweight or obese. Second, work to develop continuity with the family and child to maintain a productive dialogue regarding age-appropriate recommendations at scheduled health maintenance visits. The emphasis should be on identifying and discouraging poor food choices or feeding patterns and promoting regular physical activity habits. Third, use all available tools to anticipate the risk of obesity and to identify the first signs of its presence (e.g., BMI plotting and screening for adiposity rebound). Fourth, configure the clinic environment to convey positive health messages in passive and active ways. When possible, use practical, visual tools to educate and motivate families to change. Fifth, practitioners should reflect on their own attitudes about obesity and determine how passionate they wish to become in preventing it and how aggressive they wish to be in managing it. Changes on a societal and governmental scale will require greater degrees of advocacy by health care providers at the local, state, and national levels.

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