Author: Joseph A Skelton, MD, MS
Section Editors: Martin I Lorin, MD, Kathleen J Motil, MD, PhD, Melvin B Heyman, MD, MPH
Deputy Editor: Alison G Hoppin, MD

Contributor Disclosures

All topics are updated as new evidence becomes available and our peer review process is complete.
Literature review current through: Dec 2017. | **This topic last updated:** Dec 08, 2017.

INTRODUCTION — A variety of mechanisms participate in weight regulation and the development of obesity in children, including genetics, developmental influences ("metabolic programming," or epigenetics), and environmental factors. The relative importance of each of these mechanisms is the subject of ongoing research and probably varies considerably between individuals and populations. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Etiology' and "Obesity in adults: Etiology and natural history".)

Among these potential mechanisms, only environmental factors are potentially modifiable during infancy and childhood. Therefore, prevention and treatment of overweight and obesity in children in the primary care setting focuses on modifying behaviors that lead to excessive energy intake and insufficient energy expenditure. Experts who focus on cardiovascular health (rather than obesity per se) recommend very similar health behaviors, with a slightly different perspective. (See "Pediatric prevention of adult cardiovascular disease: Promoting a healthy lifestyle and identifying at-risk children".)

This topic review will address interventions to prevent and treat childhood obesity in the primary care setting. The definitions, epidemiology, and comorbidities of childhood obesity are discussed in separate topic reviews. Surgical treatment of severe obesity in adolescents also is discussed separately. (See "Definition; epidemiology; and etiology of obesity in children and adolescents" and "Comorbidities and complications of obesity in children and adolescents" and "Surgical management of severe obesity in adolescents".)

GUIDING PRINCIPLES — Few long-term randomized trials are available to determine which techniques to prevent or treat obesity are effective. Moreover, several of the techniques that have been addressed in clinical trials may not be practical for use in a clinical setting. Nonetheless, a number of approaches are recommended by expert consensus, based on clinical experience, inferences drawn from observing obesity-associated behaviors, and short-term evidence-based trials [1-9].

Recommendations for primary care providers center on:

- Universal measurement of body mass index (BMI) and plotting of results on a BMI chart to track changes over time
- Routine assessment of all children for obesity-related risk factors, to allow for early intervention
- Routine brief clinical interventions by the primary care provider, which include:
    - Messages of obesity-focused education to all children and families.
    - Family-centered communication and family-based interventions, rather than those focused on the child alone.
    - Emphasis on long-term changes in behaviors that are related to obesity risk, rather than relying on diets and exercise prescriptions, which tend to set short-term goals to elicit short-term weight loss.
- Implementing a staged approach to weight management, to address obesity at different ages and levels of severity

This review will briefly summarize the available evidence supporting the principles of obesity management, then outline practical approaches to incorporating them into a primary care practice, reflecting the authors' experience. These principles can be adapted and implemented to best fit your practice and office.

Staged approach to weight management — The American Academy of Pediatrics (AAP) suggests a staged approach to pediatric weight management [4]. A child's initial stage of treatment is determined by multiple factors, including the child's age, BMI percentile, and previous weight management history in other stages of treatment. The recommendations stipulate that all patients should receive counseling on obesity prevention, regardless of their BMI percentile, at each well-child visit. Additional intervention to address overweight or obesity is divided into stages representing escalating degrees of supervision, counseling, and intervention. An overview of care location, providers, and nutrition goals are provided in the table (table 1).

- Stage 1: Prevention plus
- Stage 2: Structured weight management
- Stage 3: Comprehensive multidisciplinary evaluation
- Stage 4: Tertiary care intervention

At each treatment stage the clinician confronts a variety of barriers, which may include a lack of clinician time, knowledge and treatment skills, or lack of support services or of funding to get support services. Nonetheless, we feel that involvement of the primary care provider in the first two stages of management is both practical and important. (See 'Brief clinical intervention' below.)

The third and fourth stages of the child's treatment typically require an intensive degree of care that is unlikely to be achieved in a primary care setting. For example, in adolescents with severe and refractory obesity, and particularly those with comorbidities, treatment options include weight loss surgery. (See "Surgical management of severe obesity in adolescents".)

RAISING THE SENSITIVE ISSUE OF WEIGHT — In most modern cultures of the developed world there is bias against individuals with obesity, which presumes that obesity is a character flaw. Despite progress in understanding the complex origins of obesity, which include genetic, epigenetic, cultural, and environmental factors, this bias remains widespread [10,11]. In one study, preadolescent children demonstrated significant implicit bias against overweight children, as measured by a standardized computer-based test [12]. Healthy weight children had stronger implicit weight bias compared with overweight or underweight children. Weight bias is also present within the medical community [10,13], where it often causes providers to take a blaming approach to individuals with obesity. Such an approach is rarely effective and often jeopardizes the therapeutic alliance [14]. Individuals with obesity have often absorbed the bias themselves, leading to self-criticism, low self-esteem, and hopelessness; these feelings are often barriers to behavior change.

Because of this widespread cultural bias, many families with obesity are sensitive about discussing the issue. To form a therapeutic alliance and engage the family in addressing weight-related behaviors, the provider must carefully avoid a blaming approach. For these reasons, it is important for providers to understand and acknowledge the role of genetics and epigenetics in the development of obesity, even though their assessment and intervention will emphasize modifiable environmental factors. The genetic and epigenetic mechanisms help to explain why families of similar education and capabilities may have very different predispositions to obesity and different success in weight management. This perspective helps the provider take a supportive rather than blaming approach and also reduces provider frustration in the challenging endeavor of weight management. Moreover, it is helpful to acknowledge the societal and environmental changes over the past several decades that promote unhealthy weight gain, such as readily available energy-dense foods, reliance on motorized transportation, and increases in sedentary leisure activities.

We suggest discussing weight in a "matter of fact" manner, but using language that avoids blame and focuses on health rather than weight or appearance. The use of sensitive language is not an attempt to avoid the issue, as children who are overweight or obese are usually generally aware of their weight status and may have been teased. Instead, the use of sensitive language demonstrates to the child and family that the doctor's office is a place of support, not judgment, which is essential to engaging them in behavior change [10]. As examples:

- We initiate the discussion of weight management by acknowledging that some individuals gain weight more easily than others, or are "easy gainers." We then move on to say that such people may have to "work extra-hard" to keep a healthy body weight. This dual message avoids blaming a patient or family with obesity, while still strongly encouraging them to invest in lifestyle change. We generally use the words "unhealthy weight" or "weight problem" because these terms are perceived by parents as more motivating and less stigmatizing than the terms "obese" or "fat" [10,15].

- We also choose terms that focus on health and function, rather than appearance. For children who are already overweight or obese, we discuss the goal of "growing into a healthy body weight," and being "strong and fast." At least in the initial encounter, we try to avoid discussing an "ideal weight" for the child, both because this is a moving target for a growing child, but also because choosing a target ideal weight is often unrealistic and leads to discouragement, which tends to reduce patient adherence and chances of success. Appropriate weight goals are discussed later in this topic review. (See 'Weight' below.)

Approaches will vary from child to child, and should take into account the child's age, maturity, and overall developmental status. The clinician may choose to discuss the topic initially with the parent, with the child not in the room, especially if there has been teasing, or if there is a concern the child could misinterpret the discussion. In our practice, for children 8 to 12 years of age, we often talk in general terms with the child about weight and health, linking the discussion to the importance of healthy habits. More frank discussions are typically held with the parent alone to prevent misunderstanding on the side of the child. For adolescents, having separate discussions with similar content with the patient and parent can support the adolescent's desire for autonomy while including the family for support.

Involvement of the parents as "agents of change" is important in pediatric weight management, and is supported by substantial clinical evidence [16-18]. However, it is also important to discuss and shape the parents' strategies, to avoid putting inappropriate pressure on the child or adolescent. In particular, the parents should be asked to avoid comments that focus on weight or weight-related appearance ("weight talk"), even if the comments are phrased as compliments or are focused on individuals other than the child, including the parents themselves. Similarly, family conversation about food should focus on healthy choices and healthy eating behaviors rather than dieting (which is distinguished by caloric restriction with a goal of weight loss). This is because "weight talk" by family members has been associated with subsequent weight gain, as well as development of eating disorders [19-21]. By contrast, family conversation that focuses on healthful eating behaviors rather than dieting is not associated with eating disorders [22].

THEORETICAL BACKGROUND — Recommendations for weight management counseling draw from framework of behavioral psychology that is outlined here. These ideas have been translated into a format that can be used for a brief clinical intervention, as described below. (See 'Brief clinical intervention' below.)

Behavioral strategies — Simply providing patients with education on obesity related health risks, nutrition, and physical activity is insufficient to induce behavior change. Instead, nutrition and physical activity should be thought of as habitual behaviors. The best-established counseling techniques used for pediatric obesity treatment use a behavioral change model, which includes the following elements [6,23-28]:

- **Self-monitoring** of target behaviors (logs of food, activity, or other behaviors, recorded by patient or family). This process allows the patient and family to recognize which behaviors may be contributing to their weight gain. Clinician feedback throughout the self-monitoring process is essential to behavior

change. A patient's food log may also identify other contributors to eating behaviors, such as meal-time environment, boredom, and level of hunger, all of which can be valuable in the evaluation of stimulus control.

- **Stimulus control** to reduce environmental cues that contribute to unhealthy behaviors. This includes reducing access to unhealthy behaviors (eg, removing some categories of food from the house or removing a television from the bedroom) and also efforts to establish new, healthier daily routines (such as making fruits and vegetables more accessible).

- **Goal-setting** for healthy behaviors rather than weight goals. Goal-setting is widely used for prompting behavior change. However, the process can be detrimental if goals are not realistic and maintainable. Appropriate goals are identified by the acronym "SMART," where goals should be should **S**pecific, **M**easurable, **A**ttainable, **R**ealistic, and **T**imely.

- **Contracting** for selected nutrition or activity goals. Contracting is the explicit agreement to give a reward for the achievement of a specific goal. This helps children focus on specific behaviors and provides structure and incentives to their goal-setting process.

- **Positive reinforcement** of target behaviors. Positive reinforcement can be in the form of praise for healthy behaviors or in the form of rewards for achieving specific goals. The reward should be negotiated by the parent and the child, ideally facilitated by the provider to ensure that the rewards are appropriate. Rewards should be small activities or privileges that the child can participate in frequently, rather than monetary incentives or toys; food should not be used as a reward.

Family involvement — We suggest family-based behavioral approaches to pediatric obesity treatment that incorporate at least one of a child's primary parents or caregivers, consistent with guidelines from the American Academy of Pediatrics (AAP) [1,19]. Studies have shown that targeting a parent as an important agent of behavior change, either with or without the child, is more effective for long-term weight management than targeting only the referred child without parental participation [16,17,23,24,29]. As an example, in a randomized trial in preschool-aged children, family-based behavioral therapy resulted in substantial improvement in weight status for both children and their parents, compared with a control intervention that counseled on healthy habits but not parenting or behavioral techniques [30]. Both interventions consisted of 13 group sessions and 10 phone calls over 12 months, followed by 12 months of low-intensity follow-up. No published studies have yet investigated or demonstrated whether treatments incorporating multiple members of the child's family are superior to those that include only one parent. Nonetheless, because of the overwhelming amount of evidence implicating the home environment as a contributor to obesity, we suggest that the counseling intervention include as many members of the family or household as possible. This approach may assist clinicians in identifying key practices and behaviors related to obesity that are not exclusive to parent-child relationships, help to reinforce treatment recommendations, improve program adherence, and create a healthier home environment with greater social support and fewer barriers to success. These suggestions for family involvement are also consistent with well-established theoretical perspectives of family function, such as Bioecological and Family Systems Theories [31]. These theories suggest that a child's most proximal relationships with caregivers, family members, and close friends that have the most profound impact on their behaviors [32], and the behaviors of one family member cannot be fully understood without also examining the behaviors of the entire family unit [33].

Client-centered communication — Effective approaches to behavior change are usually patient- and family-centered. In practice, this means that the process of behavior change should be collaborative rather than prescriptive. As an example, instead of dictating goals to the family, the clinician should engage the family in a conversation to select specific behaviors to change [1]. The child should be directly involved in decision-making, as appropriate to his or her age. This process ensures that the family and patient have confidence that they can change a behavior and are invested in the process, which greatly enhances the chance of success.

The process of meal planning provides a good example and opportunity to teach healthy communication patterns, including reinforcing the parent role, while including the child and permitting increasing autonomy for adolescents. Thus, we teach and model that the child should be included in the planning of meals, but with proper limits. For example, the child should be allowed to choose meals or recipes, but within healthy bounds (eg, child can choose a favorite vegetable or fruit as a side dish, but not candy). This process ensures that the child is included in the change process, but with reasonable limits and expectations.

Motivational interviewing — Motivational interviewing is a patient-centered counseling technique that is increasingly used for obesity treatment [1,4,6,19,34-36]. Initially used for the treatment of addictions, this technique addresses a patient's ambivalence to change and focuses on his or her values as a means to resolve that ambivalence [37]. The clinician employs reflective listening to encourage patients to identify their own reasons for making a behavior change, as well as their own solutions. The tone of motivational interviewing is nonjudgmental, empathetic, and encouraging [34,37]. Clinicians should help the family focus on specific and achievable behavioral goals; which usually means selecting a few specific behaviors related to weight management and overall health, and not goals for weight loss itself.

The efficacy of a motivational interviewing intervention was demonstrated in a randomized trial of more than 600 overweight children (two to eight years of age) in 42 primary care practices [38]. Motivational interviewing was delivered by the primary care provider in four sessions over two years, in some cases supplemented by an additional six sessions of motivational interviewing delivered by a dietitian. At the two-year follow-up, weight status was significantly lower for children who received the combined intervention, as compared with those treated with usual care (mean body mass index [BMI] percentile 87.1 versus 90.3, respectively). A separate study demonstrated that motivational interviewing is well-accepted by parents and also suggested that it is effective for many patients [34], and can be adapted clinically for use with parent-child dyads and families [35].

Formal assessment of a patient and family's motivation and self-efficacy has been successfully applied to a variety of health-related behaviors. Several approaches can be used to evaluate a patient's readiness to change (or stage of change) [39], including global assessment through interviewing questions, or use of a numerical or visual analog scale (eg, "on a scale of 1 to 10, how ready are you to consider making this change [to diet or exercise]"). This assessment may help a patient and clinician to recognize ambivalence, which is an important step in changing behaviors.

Scare tactics — The clinician has a role in educating the family about the health risks associated with obesity. As an example, families may not accurately assess their child's weight status. In this case, it is appropriate to provide information to the family, such as reviewing the growth chart to show that the child's weight is in an unhealthy range and describing some of the health implications of overweight and obesity. However, the use of scare tactics (ie, conversation that emphasizes specific dire long-term risks) is not recommended. Scare tactics may garner short-term attention but are rarely effective in achieving long-term change, perhaps because most people do not think probabilistically or respond consistently to risk-based thinking [40]. Instead, it is more effective to focus the discussion on health consequences that are less dire but more certain, such as persistence of obesity into adulthood, reduced mobility or athletic ability, and any personalized health concerns experienced by the patient and family.

CLINICAL ASSESSMENT

Body mass index — Measurement of body mass index (BMI) percentile for age and gender is the most practical tool for clinicians to identify and track overweight and obesity [41-43]. A rapid increase in weight-for-height or BMI is an important predictor of future obesity even in children who are currently within a healthy weight category. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Definitions'.)

BMI percentiles are grouped into the following categories:

- Overweight: BMI 85th to 95th percentile.

- Obese: BMI ≥95th percentile.
- Severe obesity: BMI ≥120 percent of the 95th percentile values, **or** a BMI ≥35 kg/m^2 (whichever is lower) (figure 1A-B) [44,45]. This corresponds to approximately the 99th percentile [46].

  Some authors distinguish an additional subgroup with more severe obesity with BMI ≥140 percent of the 95th percentile values **or** a BMI ≥40 kg/m^2, which corresponds to class III obesity in adults [45].

Other methods for measuring adiposity include dual energy x-ray absorptiometry (DEXA) and air displacement plethysmography. These techniques measure fat mass directly but are too cumbersome and expensive for clinical use. Use of waist circumference and skin-fold thickness measurements is limited by discrepancies in normative data, and they are not accurate indices of body fat in many patients [47-49]. (See "Measurement of body composition in children".)

Assessment of comorbidities — Assessment of the patient for comorbidities and for genetic causes of obesity is detailed in separate topic reviews. (See "Comorbidities and complications of obesity in children and adolescents" and "Clinical evaluation of the obese child and adolescent".)

Following are several tables highlighting key aspects of evaluating the obese child:

- Physical findings to note in children with obesity, including review of linear growth (height velocity) and blood pressure (table 2).
- Medical screening by weight category. Periodic measurement of a fasting lipid profile, hemoglobin A1c or fasting glucose level, and aminotransferase levels are suggested for children and adolescents with obesity (BMI ≥95th percentile), as outlined in the table (table 3).
- Review of systems (table 4).
- Additional assessment may be required in selected children with symptoms or signs of weight-related comorbidities (table 5). (See "Comorbidities and complications of obesity in children and adolescents".)

Nutritional assessment — A detailed assessment of caloric intake is often impractical in the primary care setting, has low accuracy, and is not usually necessary to support a brief counseling intervention. Therefore, we suggest a problem-oriented approach, using a brief dietary assessment to identify a few key dietary habits which are most likely to be associated with obesity.

Child's eating habits — The child's eating habits can be briefly assessed by asking about the following issues:

- Frequency of eating meals in restaurants (fast food, take-out, or service).
- Intake of calorie containing beverages (including juice and soft drinks).
- Frequency and portion size of energy-dense foods (such as cookies and other baked goods, chips, or ice cream).
- Servings of vegetables and fruits, and which of these are regularly offered and accepted. One serving equals one whole fruit, or ½ cup of vegetables.
- Number of meals each day, and frequency of skipping meals.
- Typical snacking patterns (timing and foods consumed).
- School lunch (purchased or brought from home).

The rationale and suggested approaches for making these inquiries are listed in the table (table 6) [1,2,4,6,47]. Although this assessment is not comprehensive, it generally yields one or more appropriate

targets for intervention, and is an efficient way to initiate counseling to improve nutritional status when the time available for clinical interaction is limited.

Parent feeding styles — Extensive research has shown that authoritarian parenting and feeding styles are associated with childhood obesity [50]. An authoritarian feeding style is likely if the parent insists on children finishing all food on their plate, negotiates vegetable intake (must finish for dessert, no seconds until vegetables eaten), or strictly limits portion sizes and servings. A few probing questions on how parents handle common mealtime situations can identify high levels of parent control over feeding, and provide opportunities for further discussion and education.

Family factors — Obesity in a child's parents is an important predictor of the child's risk of persistent obesity; if both parents are obese the child's risk of being obese as an adult is increased 6- to 15-fold as compared with a child without obese parents [51,52]. This is probably primarily due to genetic factors, but shared social and nutritional factors may also play a role. Therefore, we record the biological parents' heights and weights, and calculate their body mass index (BMI).

It is important to understand the child's nutrition patterns within the context of the family's nutritional patterns and finances. In our clinical evaluations, we evaluate the following aspects of family eating habits:

- Shopping habits, including coupon use, meal planning, use of grocery list, food label reading, and purchasing habits for dairy (full-fat versus reduced-fat milk) and grains (white, wheat, whole grain)
- Frequency of family meals and who is present at meals
- Whether foods are served "family style" (self-serve) or served by parent or caregiver before bringing to the table
- Caregiver duties and communication regarding food (eg, who does shopping and who does cooking, whether food selection is discussed among family members, and whether meals are eaten together as a family)
- How child spends time after school, and who supervises this time
- Work schedules of parents or other caregivers
- Meal location (eg, at dining table, in bedroom, or on couch/ in living room) and emotional climate (especially arguments about food)
- Whether television or other media is used during meals

Other considerations — In some cases, economic or cultural factors may limit a family's ability or willingness to make changes in diet or physical activity [6]. These obstacles can be addressed using a family-centered approach to counseling, in which families decide when to begin the change process and the intensity with which they are willing to pursue weight management. To initiate the discussion, the following factors should be assessed in selected patients:

- Economic challenges – Ask about food insecurity (do you sometimes run out of money for food?), about the family's living conditions (whether there is a working stove and/or refrigerator), and the availability of income assistance such as food stamps.
- Cultural factors – Ask the parents and child what they think of the child's weight. Misperception of the child's weight status, such as a cultural preference for overweight in children, may affect a family's ability to effectively address the problem. Conversely, excessive anxiety about the child's weight status also can interfere with effective management. To address this issue, it is important to explore reasons for the anxiety in the parent or child. Reasons for excessive anxiety may include an overestimate of the child's risk for future obesity or a personal history of disordered eating in the parent.

Activity assessment — Similar to the nutritional assessment of children, we suggest that clinicians do a brief qualitative assessment of physical activity and sedentary activity patterns in children. Both sedentary and active behaviors (structured and unstructured) should be assessed as outlined in the table (table 7). Similarly, assessing the time that the family spends together in sedentary and active pursuits can provide an opportunity for family-centered intervention.

In addition, assessment of the following social and environmental factors often helps to identify barriers to activity and opportunities for increasing physical activity [6,47]:

- Home – Television in bedroom [53]; family physical activity routines [54]; access to and frequency of free play [55,56]; access to and frequency of organized sports [55-57].
- School – Physical education classes [57,58]; affordability of activities [55,56]; safety concerns [55,56].
- Lifestyle activity – Current habits that require walking or use of stairs [57].

Combining a clinical assessment of baseline activity levels with the barriers to increased activity will provide the clinician with a basis with which to begin behavior changes. Reducing sedentary activities is a particularly important target for intervention and should be incorporated into any clinical approaches to obesity treatment and prevention. (See 'Sedentary activity' below.)

GOALS FOR WEIGHT MANAGEMENT

Weight — We find that discussion of specific weight loss targets with the patient and family is not usually helpful and sometimes causes the patient to become discouraged and to withdraw from weight control efforts. Instead of weight loss goals, we prefer to emphasize behavior goals for specific dietary habits and activities during discussions with the patient and family. Nonetheless, it is appropriate for the provider to keep weight targets in mind to ensure that a patient's weight trend is safe and realistic.

Weight loss goals are a function of a patient's age and degree of overweight or obesity [1,4,5].

- For children and adolescents who are overweight or mildly obese, the goal of maintaining current body weight is appropriate, because this will lead to a decrease in BMI as the child grows taller. If the child is in a phase of rapid linear growth, merely slowing weight gain is more realistic and often improves weight status.
- At higher degrees of obesity (BMI substantially above the 95th percentile, ie, at the 99th percentile), gradual weight loss is safe and appropriate, depending on the child's age and degree of obesity.
    - For children between two and eleven years old with obesity and comorbidities, a weight loss of up to one pound per month is safe and beneficial but may be difficult to achieve.
    - For adolescents with obesity and comorbidities, it is safe to lose up to two pounds per week, although a weight loss of one to two pounds per month usually is more realistic.

Diet — We and others suggest that health care providers use semi-structured dietary goals, seeking long-term improvement in the quality and quantity of the fats and carbohydrates their patients consume. These goals are most likely to be achieved by focusing on eating behaviors, rather than by prescribing a specific structured diet. The following table outlines our approaches to common diet-related problems encountered in children (table 8). A dietitian can be helpful in providing this type of counseling, particularly if the emphasis and content are coordinated with and consistent with that of the primary care provider. When implemented in a supportive fashion, with a focus on healthy eating behaviors rather than rigid or highly restrictive dieting, this type of intervention does not predispose to eating disorders [19]. Indeed, there is some evidence that well-conceived interventions help to reduce unhealthy dieting behaviors [59].

Given the limited time available in clinical interactions, it is helpful to use one or more of the available counseling tools, which are widely available and easily understood. As an example, the "balanced plate" or

"My Plate" was developed and distributed by the United States Department of Agriculture (USDA) as a simple tool to teach balanced nutrition [60]. While based on the Dietary guidelines for Americans, it is not a comprehensive guide. The ChooseMyPlate website is an interactive tool that uses effective visual cues to teach healthy dietary patterns, including major food groups, that can help patients better understand portion sizes and the goal of including more fruits and vegetables. Using this plate as a starting point, the clinician can then guide the patient in discussions of nutrient quality within each food group. Examples include: skim or 1 percent milk instead of whole; whole grains instead of simple carbohydrates; and lean proteins instead of higher fat choices.

There is limited clinical evidence to guide the choice of dietary interventions, including semi-structured or structured approaches. Our general preference for a semi-structured approach is based upon several studies using a variety of semi-structured diets. Most had promising results, particularly those studies that focused on encouraging families to select food groups of higher nutrient quality and lower energy-density [6,23,61]. As an example, clinicians can use the "traffic light" format as a teaching tool, grouping foods based on their nutrient quality and calorie density, and then explaining which foods should be eaten most often (red: eat rarely; yellow: eat less often; green: eat more often).

More structured diets may also be appropriate for some patients, provided that they are implemented with counseling and monitoring to avoid unhealthy dieting behaviors. Few studies have evaluated structured dietary interventions for children with obesity, and even fewer have attempted to control for complex nutritional behaviors and the family/home environment. A few well-designed clinical trials have shown modest efficacy of a low glycemic index diet, which focuses on reducing those specific types of carbohydrates which produce a strong glycemic response (rise in blood sugar) [62,63]. However, overall findings from glycemic index research have been mixed [64,65]. In addition, this type of highly structured diet is usually difficult to implement and sustain, so the results of a clinical study may not be generalizable to general clinical practice or to long-term outcomes. Diets that are low in carbohydrates are usually relatively low in glycemic index and may be simpler to teach and easier for patients to sustain [66-68]. Unfortunately, these and other highly structured diets have poor adherence rates over long periods of time.

Activity — Counseling to improve physical activity should focus on reducing sedentary activities as well as increasing physical activity [5,6].

Sedentary activity — Substantial evidence supports the importance of reducing sedentary activity as a means of preventing and treating obesity in children [3,7,69-72]. Indeed, reducing sedentary activity may be more effective than increasing structured physical activity, perhaps because reducing sedentary activity has the secondary benefit of reducing caloric intake [70,73].

In developed countries, sedentary activity is usually in the form of "screen time": television, video games, internet and computer, and other media. According to national surveys in the United States, children between 8 and 18 years spend an average of 7-1/2 hours daily viewing media, and those under age six spent nearly two hours daily [74]. Television viewing is perhaps the best established environmental influence on the development of obesity during childhood. The association between obesity and use of other media is somewhat weaker. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Environmental factors'.)

We and others recommend that television viewing and other "screen time" (other than homework) to be limited to about one hour a day, and that children younger than two years be exposed to even more limited and selected media [75,76]. For children who are viewing substantially more than this target, the first step should be in decreasing their present amount. School-wide campaigns and messages [69], and behavioral interventions using reinforcement and reward strategies have been effective in reducing television use [70].

Behavioral treatment strategies, detailed above, such as self-monitoring, can be useful. Children and families should first monitor their present amount of media use and then set goals to decrease it. We ask families to set firm and consistent media limits for all family members including parents. Consistent with the

policy statement from the American Academy of Pediatrics, we strongly encourage families to include all or most of the following components in their media rules [75,76]:

- No television set in child's bedroom
- No television viewing during meals
- Maximum time for television and media viewing (eg, no more than one hours daily, or some strategy that approximates that limit)
- Minimal media viewing for children under two years of age (only selected high-quality media, while interacting with parents)

Substituting healthier behaviors and entertainment is helpful in achieving these goals. For younger children, this is through the use of "active games" such as tag, hula hooping, and obstacle courses. Quiet non-media activities such as reading aloud or playing board games are also acceptable substitutes, because they avoid television advertising and establish patterns of family interaction that may ultimately lead to active play. Taking activity breaks during television commercials both reduces exposure to advertising and establishes specific windows for activity; the average hour of television features approximately 20 minutes of commercials, and half of the advertisements are for food.

Strategies to reduce media use for older children are more variable and are best addressed through a combination of self-monitoring, establishment of family media limits, and negotiation to identify substitute activities. Because both media and homework are often accessed through the computer, it can be difficult for a parent to monitor a child's actual media use. For these and other reasons, engagement of the child in the behavior-change process is essential, using the behavioral strategies outlined above. (See 'Theoretical background' above.)

Physical activity — Despite some discrepancy in study outcomes of increasing physical activity as a means to lower BMI, increasing child and family levels of physical activity is a key focus in obesity treatment [71]. It is generally recommended that children and adolescents participate in 60 minutes or more of physical activity a day [58,77,78]. To accomplish this goal, the American Academy of Pediatrics recommends that schools provide at least 30 minutes of structured physical activity during the school day [77].

As with nutrition goals, strategies for increasing physical activity are individualized. Clinicians should take into account the developmental stage of the child, family schedule, and personal preferences for activity, while being mindful of sedentary activity. Clinicians can support the change process by consistently advising patients and families to be physically active, suggesting options and encouraging goal-setting. In addition, clinicians can provide support for physical activity in the community by forming partnerships with local fitness centers and schools.

To increase physical activity in children it is often helpful to consider a variety of options. Structured physical activity (organized sports or performance arts) may be team-based or individual, and competitive or non-competitive. Less structured activity includes recreational sports with peers or family, self-directed physical training, and lifestyle activity. Although these categories overlap, consideration of each allows for an expanded and diverse view of a child and family's opportunities for physical activity.

For preschool-aged children, most physical activity will be unstructured; outdoor play is particularly helpful [79]. Providers can encourage physical activity in this age group by "prescribing" playground time and providing a list of local resources (playgrounds or other opportunities for active play), in addition to discouraging sedentary time (television use). The provider can also encourage parents to consider physical activity levels when they make choices among options for daycare and after-school programs.

For older children, we prefer to encourage structured physical activity when possible (ie, participation in team or individual sports, or supervised exercise sessions). Patients are more likely to participate

consistently in these activities because they are accountable to a coach or leader. However, whether a child is willing to engage in structured activities varies, particularly for adolescents. Some adolescents will enjoy engaging in sports or fitness centers, while others may not, due to lack of self-confidence or self-esteem. Directly engaging adolescents in choosing activities to replace sedentary time is helpful. We have found that a persistent trial-and-error approach often results in discovering activities that they enjoy.

Non-competitive active games and lifestyle activities may be more appealing to some children, particularly those with more severe obesity. These activities provide moderate levels of physical activity, while also replacing sedentary time. Activities to consider are: a walking program (boosted by use of a pedometer, smartphone application, or walking partner), trial memberships at local gyms (we find local fitness centers often provide trial memberships or passes to interested children and families), home fitness videos, and nontraditional sports such as yoga, tai chi, fencing, and martial arts.

If a patient chooses to focus his or her activity on walking, we encourage them to use a pedometer to measure the number of steps that they take; we find that this improves motivation (at least initially) and accountability, and allows the patient to track progress. Typical goals in adults are to walk more than 10,000 steps a day to improve health. Step counts vary markedly among children, so the best strategy is to measure current step counts using the pedometer and then set a goal of increasing the number of steps by approximately 10 percent. Subsequent goal setting can be modified based on the patient's weight and other activities. A variety of devices are available.

Electronic gaming systems are now programmed to increase physical activity through interactive control devices, such as the Nintendo Wii, or through exercise videos available on the internet (YouTube) or television. There is scant research but great interest in these systems to increase the physical activity level in children, and some have been used in school-based approaches. In general, the activity levels achieved while playing these games is modest, but certainly higher than sedentary activities. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Video games'.)

Sleep — Increasingly, sleep is seen as being intricately linked to child health and especially weight status. While its role in weight management is not entirely clear, addressing inadequate or interrupted sleep is important in addressing child weight. Initially, sleep apnea as a potential comorbidity was the primary focus of research, but it has become increasingly clear that shortened sleep duration is associated with obesity [80]. Aside from physiologic and hormonal disruptions linked to body weight, inadequate sleep can affect children in numerous ways. Appropriate goals include good sleep hygiene (table 9) and or aiming for adequate amounts of sleep. Guidelines can be shared with families to assure and educate on how much sleep their child needs, from preschool ages (10 to 13 hours a night) to teens (8 to 10 hours) (table 10) [81,82]. The evidence linking inadequate sleep to childhood obesity, and strategies for improving sleep, are outlined in separate topic reviews. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Sleep' and "Behavioral sleep problems in children", section on 'Young children with behavioral insomnia'.)

BRIEF CLINICAL INTERVENTION — For patients in the initial stages of obesity treatment (stages 1 and 2 above), we suggest that the provider of primary care perform a brief clinical intervention, using the behavioral strategies, nutritional goals, and exercise goals outlined above and summarized in the table (table 1).

Problems identified during the brief assessment are addressed in a brief problem-solving discussion. Even if many problems of lifestyle habits are identified, we suggest limiting the counseling to two or three problems, setting goals that the family can agree are achievable. Other issues can be addressed in future sessions as needed. Consistent with the theoretical principles outlined above, the intervention should be focused on modifying lifestyle habits of the entire family, rather than focused exclusively on the identified child [23,28]. In addition, the intervention should be tailored to the family's level of readiness (stage of change), and the tone of the interview should be nonjudgmental, empathetic, and encouraging [34]. A guide to using these

concepts for a brief clinical intervention is available from the Maine Youth Overweight Collaborative [83]. (See 'Theoretical background' above.)

The counseling session can be very brief (eg, three to five minutes) and use preprinted handouts. This brief format recognizes the time constraints that are usually present in the primary care setting, particularly because a substantial fraction of patients in most practices are overweight or obese and will require this intervention. Additional contact time is valuable if time permits or if an allied health care provider (eg, dietitian or nurse) is available to provide counseling. (See 'Intensity of intervention' below.)

These brief counseling sessions are repeated at each subsequent follow-up visit. To provide continuity and reinforce the message, the provider should review the same concerns at a follow-up session. If progress has been made the provider should praise the family and encourage additional work; if no progress has been made the provider should engage in further problem-solving and/or work with the family to identify other goals that seem more achievable.

Early intervention — Emerging evidence suggests that intervention during early- or mid-childhood can be effective. Although it is very difficult to directly compare the efficacy of interventions across different age groups through clinical studies, indirect comparisons suggest that early intervention may be more effective than intervention during adolescence [84-86]. If so, this advantage may be attributable to increased involvement of the family with younger age groups or to metabolic programming. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Metabolic programming'.)

The following studies illustrate the efficacy of early intervention to treat or prevent obesity:

- A randomized trial in overweight or obese preschool aged children in the United States consisted of 10 hours of group meetings over six months, supplemented by eight phone calls from a health "coach" [87]. At the end of the intervention, significant effects were seen on child and parent body mass index (BMI).

- A randomized trial in overweight or obese preschool aged children in the Netherlands consisted of 27 hours of provider contact over four months, including nutritional advice, supervised physical activity, and parent training [88]. At the end of the four-month program, there were significant decreases in child BMI and in other anthropometric measures as compared with baseline and a "usual care" control group. Most of the improvements were sustained at 12 months follow-up.

- An observational study in Sweden evaluated predictors of success for a behaviorally based three-year treatment program for 643 children 6 to 16 years of age [89,90]. Among participants with severe obesity, 58 percent of the younger children (six to nine years) experienced a clinically significant reduction in BMI Z-score (-0.5 kg/m^2), as compared with only 2 percent of adolescents (14 to 16 years). Among participants with moderate obesity, younger children also were more likely to be successful than older children.

- A randomized trial involving overweight children two to eight years of age evaluated the effect of a motivational interviewing intervention delivered by a primary care provider and dietitian [38]. Although the intervention was low-intensity, it had significant effects at two years of follow-up. A similar trial from Italy also found a beneficial effect of a low-intensity motivational interviewing intervention [91]. (See 'Motivational interviewing' above.)

- A randomized trial in three- to five-year-old children at risk for behavioral issues assessed the effect of an intervention to promote effective parenting [92]. Although the intervention focused on parenting rather than nutrition or physical health, the children in the intervention group had lower rates of obesity compared with controls (24 percent versus 54 percent), after three to five years follow-up.

- Several studies of lower-intensity interventions in infants and young children report improvements in weight-related habits, such as television viewing, but did not achieve statistically significant

improvements in BMI outcomes [93-95].

The evidence base in this age group is still small, and the optimal type and timing of intervention remain unclear. Nonetheless, these findings call for further exploration of early interventions to prevent and treat obesity [71,96]. Research has not determined optimal intervention approaches based on child age groups, though it is believed that children should be increasingly included in the counseling dialogue and should be given autonomy in treatment decisions as they mature [4].

Intensity of intervention — Most available data suggest that substantial hours of provider contact are necessary to improve a child's weight status. As an example, systematic reviews concluded that behavioral interventions of moderate or high intensity (defined as 26 to 75 hours or >75 hours of provider contact, respectively) are effective in achieving short-term (up to 12 months) weight improvements in children [36,97,98]. Unfortunately, interventions at this level of intensity are usually impractical for use in a primary care setting, unless ample services from dietitians or other specialized counselors are readily available and funded.

Low-intensity interventions (less than 25 hours of provider contact, typically spread over three to six months) are feasible in a primary care setting, although there is a limited evidence base to support their efficacy. Clinical trials suggest that these low-intensity interventions for treatment of childhood obesity generally have weak or inconsistent effects [3,98-100]. It is likely that low-intensity interventions may have important effects on obesity and health behaviors in individual patients, even if they have little or no measureable effect on the study population as a whole. Moreover, meta-analyses suggest that lifestyle interventions to prevent and treat obesity in children are generally effective, even if some of the included studies are too small to show statistically significant changes in weight status [71,101]. (See "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Environmental factors'.)

Therefore, we and others recommend that providers of primary care consistently provide counseling to all patients to support healthy eating and activity behaviors in an effort to prevent obesity [2]. In addition, we recommend that providers engage in brief counseling interventions for their patients with obesity or those with significant risk factors for developing obesity (such as parental obesity) [1].

For patients who do not respond to a brief clinical intervention or for those with severe obesity, higher-intensity approaches are needed. These interventions are implemented in stages, and usually require referral to a dietitian or behavioral counselor, and/or to specialized weight management programs or tertiary care centers. (See 'Staged approach to weight management' above.)

Example and materials — Several groups have developed messaging to support this type of brief clinical intervention as outlined above. Materials to support patient education and practice process improvement are available at each of the following websites:

- 5210 Let's go (Maine Youth Overweight Collaborative)
- National Initiative for Children's Healthcare quality (NICHQ)
- Eat smart move more (North Carolina)
- American Academy of Pediatrics, Institute for Healthy Childhood Weight

These models have much in common and have not been directly compared. It is reasonable for providers to select materials with messaging that is best suited to their community.

The Maine Youth Overweight Collaborative provides an example of a coordinated intervention that has been implemented in primary care practices across the state of Maine, using common approaches and messaging. The Healthcare toolkit includes extensive materials for patient education and improvement of practice processes, and is available to download free of charge or can be ordered in hard copy from the website. Some of these materials are translated into different languages. The program specifically seeks to

evaluate outcomes using both qualitative and quantitative data. Analyses suggest substantial increases in clinician support for several obesity-related interventions and improvements in adherence to healthy behaviors as reported by parents, although mean BMI Z-score was not affected [102-104]. The office-based initiative is closely integrated with initiatives in schools, after-school programs, and communities, and supported by community partners.

OFFICE SYSTEMS — Establishing an effective and efficient approach to prevention and management of obesity in the primary care setting generally requires systems-level changes, including practice processes, training of staff and colleagues, and negotiating insurance reimbursement [2,47].

Practice processes — The most important practice process is to establish regular, accurate, and efficient BMI screening for all patients during routine health management visits. Despite the introduction of BMI growth charts over 10 years ago, many practices are not routinely calculating and plotting BMI [105,106]. The first step is to identify the personnel responsible for measuring heights and weights, calculating BMI, and plotting the result. The calculation and plotting can be accomplished automatically by many electronic health records. Important steps in the practice improvement process are to set a clear goal for BMI charting and to objectively assess the practice's performance against the goal through chart audits.

It is also important to integrate the results of BMI screening into the clinical and educational process of the health maintenance visit. Discussion of overweight and obesity with a patient and family can be challenging but is usually well accepted if approached in a nonjudgmental way (see 'Raising the sensitive issue of weight' above). The following office systems may facilitate a positive and efficient discussion:

- Educational materials – Having educational materials readily available in the office improves efficiency and communication. In our practice we have posters with health related messages on the wall of each clinic room alongside related educational handouts. The clinician can use the poster as a talking point in screening health behaviors. The proximity of the materials and displayed poster allow for efficient and focused discussion and also allows families to select materials that capture their interest.

- Community resources – To assist families in developing an action plan, the practice can collect and distribute information about resources in the local community, including options for physical activity, active after-school programs, nutrition counseling services, and sources of healthy food (eg, local sources of fresh produce). Policies and strategies to promote physical activity in schools and communities in the United States are outlined in a National Physical Activity Plan, released in 2016 [107].

Equipment — Whenever possible, practices should have appropriate equipment to provide medical care to patients with obesity. This includes a wide range of blood pressure cuffs (including a "large adult" size) to ensure accurate measurements, and high-capacity scales (ideally up to 500 or 1000 lbs). In addition, it is helpful to have office furniture that is appropriate for large patients and their families, including sturdy armless chairs and lower examination tables.

PREVENTION — Preventing obesity in children should be a focus of every child healthcare provider. Prevention efforts are best focused on key behaviors associated with the development of obesity (table 6 and table 7) [6], although other factors including genetics undoubtedly also contribute to the risk for obesity [4].

There is modest evidence to suggest that modification of the following factors may help to prevent the development of obesity. These issues are discussed in more detail in the linked topic reviews.

Maternal factors:

- Maternal weight prior to conception and weight gain during pregnancy. (See "Weight gain and loss in pregnancy" and "Definition; epidemiology; and etiology of obesity in children and adolescents", section on 'Metabolic programming'.)

- Breastfeeding – Breastfeeding may have a weak protective effect on the development of obesity, but probably is not a major determinant of obesity risk. (See "Infant benefits of breastfeeding", section on 'Obesity'.)

Psychosocial factors:

- Establishing a healthy feeding relationship early in life (avoiding overly restrictive and overly permissive feeding patterns). (See "Introducing solid foods and vitamin and mineral supplementation during infancy", section on 'Feeding environment'.)
- Encouraging a family to eat meals together. (See "Dietary recommendations for toddlers, preschool, and school-age children", section on 'Eating environment'.)

Dietary goals (see "Dietary recommendations for toddlers, preschool, and school-age children", section on 'Dietary guidelines'):

- Limiting consumption of sugar-sweetened beverages, including juice
- Encouraging a diet with ample servings of vegetables and fruits
- Limiting eating at restaurants, particularly fast-food restaurants
- Limiting portion size (which for young children often is less than a "serving size" as listed on a food label)

Activity goals (see "Physical activity and strength training in children and adolescents: An overview", section on 'Physical activity')**:**

- Encouraging moderate to vigorous physical activity for one or more hours daily [4].
- Limiting television and other screen time – Minimal screen time for children under two years of age; maximum of about one hour daily after age two years [2,6].

SOCIETY GUIDELINE LINKS — Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Obesity in children".)

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see "Patient education: My child is overweight (The Basics)")

SUMMARY AND RECOMMENDATIONS — Obesity during childhood is associated with long-term health consequences and is influenced by genetic, epigenetic, behavioral, and environmental factors. Among these, only behavioral and environmental factors are modifiable during childhood, so these are the focus of clinical interventions.

We suggest the following practices among providers of primary care to children. These suggestions are based primarily on expert opinion; some are supported by clinical studies, usually with short-term outcomes.

- Universal measurement of body mass index (BMI) and plotting of results on a BMI chart to track changes over time. (See 'Body mass index' above.)

- Routine assessment of all children for obesity-related risk factors, to allow for early intervention. This includes recording the obesity status (BMI) of the biological parents and assessing key nutritional and physical activity habits (table 6 and table 7). (See 'Nutritional assessment' above and 'Activity assessment' above.)

- For children with obesity, weight-related comorbidities should be assessed through a focused review of systems (table 4), physical examination (table 2), and laboratory screening (table 3). (See 'Assessment of comorbidities' above.)

- For all children and their families, routine health care should include obesity-focused education. Key goals to address are the common diet-related problems encountered in children (table 8), set firm limits on television and other media early in the child's life, and establish habits of frequent physical activity. (See 'Diet' above and 'Sedentary activity' above and 'Physical activity' above.)

- For children who are overweight or obese, we suggest a series of clinical counseling interventions in the primary care setting (**Grade 2C**). Each session can be brief (3 to 15 minutes); this brief format is most practical for the primary care setting and is supported by limited clinical evidence. Additional contact time is valuable if time permits or if an allied health care provider (eg, dietitian or registered nurse) is available to provide counseling. (See 'Brief clinical intervention' above and 'Intensity of intervention' above.)

- Educational materials are available from a variety of sources to facilitate the counseling. These materials have much in common and have not been directly compared; it is reasonable for providers to select materials with messaging that is best suited to their community. Options include a Healthcare toolkit and an outline for a brief clinical intervention, which is based on the principles of motivational interviewing. (See 'Example and materials' above.)

- For patients who do not respond to a brief clinical intervention or for those with severe obesity, higher-intensity approaches are needed. These interventions are implemented in stages (table 1) and usually require referral to specialized weight management programs or tertiary care centers. (See 'Staged approach to weight management' above.)

- To establish a therapeutic relationship and enhance effectiveness, the communication and interventions should be supportive rather than blaming, and focused on the entire family, rather than on the child alone. Long-term changes in behaviors that are related to obesity risk should be emphasized, rather than diets and exercise prescriptions, which tend to set short-term goals. When implemented in a supportive fashion, with a focus on healthy eating behaviors rather than rigid or highly restrictive dieting, interventions to support weight loss do not predispose to eating disorders. (See 'Theoretical background' above.)

- To be effective in managing populations with obesity, primary care offices should develop an efficient office system for calculating and tracking BMI at each visit and have a wide range of blood pressure cuffs (including a "large adult" size) and high-capacity scales (ideally up to 500 or 1000 lbs). It is also helpful to have office furniture that is appropriate for large patients and their families, including sturdy armless chairs and low examination tables. (See 'Office systems' above.)

REFERENCES

1. 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.
2. Davis MM, Gance-Cleveland B, Hassink S, et al. Recommendations for prevention of childhood obesity. Pediatrics 2007; 120 Suppl 4:S229.
3. Oude Luttikhuis H, Baur L, Jansen H, et al. Interventions for treating obesity in children. Cochrane Database Syst Rev 2009; :CD001872.
4. Spear BA, Barlow SE, Ervin C, et al. Recommendations for treatment of child and adolescent overweight and obesity. Pediatrics 2007; 120 Suppl 4:S254.
5. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents, National Heart, Lung, and Blood Institute. Expert panel on integrated guidelines for cardiovascular health and risk reduction in children and adolescents: summary report. Pediatrics 2011; 128 Suppl 5:S213.
6. Daniels SR, Hassink SG, COMMITTEE ON NUTRITION. The Role of the Pediatrician in Primary Prevention of Obesity. Pediatrics 2015; 136:e275.
7. Colquitt JL, Loveman E, O'Malley C, et al. Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years. Cochrane Database Syst Rev 2016; 3:CD012105.
8. Society for Adolescent Health and Medicine. Preventing and Treating Adolescent Obesity: A Position Paper of the Society for Adolescent Health and Medicine. J Adolesc Health 2016; 59:602.
9. US Preventive Services Task Force, Grossman DC, Bibbins-Domingo K, et al. Screening for Obesity in Children and Adolescents: US Preventive Services Task Force Recommendation Statement. JAMA 2017; 317:2417.
10. Pont SJ, Puhl R, Cook SR, et al. Stigma Experienced by Children and Adolescents With Obesity. Pediatrics 2017; 140.
11. Howard JB, Skinner AC, Ravanbakht SN, et al. Obesogenic Behavior and Weight-Based Stigma in Popular Children's Movies, 2012 to 2015. Pediatrics 2017; 140.
12. Skinner AC, Payne K, Perrin AJ, et al. Implicit Weight Bias in Children Age 9 to 11 Years. Pediatrics 2017; 140.
13. Majdan JF. Memoirs of an obese physician. Ann Intern Med 2010; 153:686.
14. Puhl RM, Heuer CA. Obesity stigma: important considerations for public health. Am J Public Health 2010; 100:1019.
15. Puhl RM, Peterson JL, Luedicke J. Parental perceptions of weight terminology that providers use with youth. Pediatrics 2011; 128:e786.
16. Golan M, Crow S. Targeting parents exclusively in the treatment of childhood obesity: long-term results. Obes Res 2004; 12:357.
17. Janicke DM, Sallinen BJ, Perri MG, et al. Comparison of parent-only vs family-based interventions for overweight children in underserved rural settings: outcomes from project STORY. Arch Pediatr Adolesc Med 2008; 162:1119.
18. Boutelle KN, Cafri G, Crow SJ. Parent-only treatment for childhood obesity: a randomized controlled trial. Obesity (Silver Spring) 2011; 19:574.
19. Golden NH, Schneider M, Wood C, et al. Preventing Obesity and Eating Disorders in Adolescents. Pediatrics 2016; 138.
20. Loth KA, Neumark-Sztainer D, Croll JK. Informing family approaches to eating disorder prevention: perspectives of those who have been there. Int J Eat Disord 2009; 42:146.

21. Neumark-Sztainer DR, Wall MM, Haines JI, et al. Shared risk and protective factors for overweight and disordered eating in adolescents. Am J Prev Med 2007; 33:359.
22. Berge JM, Maclehose R, Loth KA, et al. Parent conversations about healthful eating and weight: associations with adolescent disordered eating behaviors. JAMA Pediatr 2013; 167:746.
23. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. Health Psychol 1994; 13:373.
24. Epstein LH, Myers MD, Raynor HA, Saelens BE. Treatment of pediatric obesity. Pediatrics 1998; 101:554.
25. Ross MM, Kolbash S, Cohen GM, Skelton JA. Multidisciplinary treatment of pediatric obesity: nutrition evaluation and management. Nutr Clin Pract 2010; 25:327.
26. De Santis-Moniaci D, Altshuler L. Comprehensive behavioral treatment of overweight and the pediatric practice. Pediatr Ann 2007; 36:102.
27. Robinson TN. Behavioural treatment of childhood and adolescent obesity. Int J Obes Relat Metab Disord 1999; 23 Suppl 2:S52.
28. Faith MS, Van Horn L, Appel LJ, et al. Evaluating parents and adult caregivers as "agents of change" for treating obese children: evidence for parent behavior change strategies and research gaps: a scientific statement from the American Heart Association. Circulation 2012; 125:1186.
29. Boutelle KN, Rhee KE, Liang J, et al. Effect of Attendance of the Child on Body Weight, Energy Intake, and Physical Activity in Childhood Obesity Treatment: A Randomized Clinical Trial. JAMA Pediatr 2017; 171:622.
30. Quattrin T, Cao Y, Paluch RA, et al. Cost-effectiveness of Family-Based Obesity Treatment. Pediatrics 2017; 140.
31. Skelton JA, Buehler C, Irby MB, Grzywacz JG. Where are family theories in family-based obesity treatment?: conceptualizing the study of families in pediatric weight management. Int J Obes (Lond) 2012; 36:891.
32. Bronfenbrenner U, Ceci SJ. Nature-nurture reconceptualized in developmental perspective: a bioecological model. Psychol Rev 1994; 101:568.
33. Fox LA. Bowen Family Systems Theory: a theoretical framework for organizational change agents. J AHIMA 1994; 65:49.
34. Schwartz RP, Hamre R, Dietz WH, et al. Office-based motivational interviewing to prevent childhood obesity: a feasibility study. Arch Pediatr Adolesc Med 2007; 161:495.
35. Irby M, Kaplan S, Garner-Edwards D, et al. Motivational interviewing in a family-based pediatric obesity program: a case study. Fam Syst Health 2010; 28:236.
36. Huang JS, Barlow SE, Quiros-Tejeira RE, et al. Childhood obesity for pediatric gastroenterologists. J Pediatr Gastroenterol Nutr 2013; 56:99.
37. Suarez M, Mullins S. Motivational interviewing and pediatric health behavior interventions. J Dev Behav Pediatr 2008; 29:417.
38. Resnicow K, McMaster F, Bocian A, et al. Motivational interviewing and dietary counseling for obesity in primary care: an RCT. Pediatrics 2015; 135:649.
39. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. J Consult Clin Psychol 1983; 51:390.
40. Hill D, Chapman S, Donovan R. The return of scare tactics. Tob Control 1998; 7:5.
41. Freedman DS, Wang J, Ogden CL, et al. The prediction of body fatness by BMI and skinfold thicknesses among children and adolescents. Ann Hum Biol 2007; 34:183.

42. Freedman DS, Wang J, Thornton JC, et al. Classification of body fatness by body mass index-for-age categories among children. Arch Pediatr Adolesc Med 2009; 163:805.
43. Reilly JJ. Descriptive epidemiology and health consequences of childhood obesity. Best Pract Res Clin Endocrinol Metab 2005; 19:327.
44. Kelly AS, Barlow SE, Rao G, et al. Severe obesity in children and adolescents: identification, associated health risks, and treatment approaches: a scientific statement from the American Heart Association. Circulation 2013; 128:1689.
45. Skinner AC, Skelton JA. Prevalence and trends in obesity and severe obesity among children in the United States, 1999-2012. JAMA Pediatr 2014; 168:561.
46. Flegal KM, Wei R, Ogden CL, et al. Characterizing extreme values of body mass index-for-age by using the 2000 Centers for Disease Control and Prevention growth charts. Am J Clin Nutr 2009; 90:1314.
47. Krebs NF, Himes JH, Jacobson D, et al. Assessment of child and adolescent overweight and obesity. Pediatrics 2007; 120 Suppl 4:S193.
48. Lohman TG. Anthropometric assessment of fat-free body mass. Wile-Liss, 1991.
49. Sarría A, Moreno LA, García-Llop LA, et al. Body mass index, triceps skinfold and waist circumference in screening for adiposity in male children and adolescents. Acta Paediatr 2001; 90:387.
50. Rollins BY, Savage JS, Fisher JO, Birch LL. Alternatives to restrictive feeding practices to promote self-regulation in childhood: a developmental perspective. Pediatr Obes 2016; 11:326.
51. Whitaker RC, Wright JA, Pepe MS, et al. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med 1997; 337:869.
52. Rudolf M. Predicting babies' risk of obesity. Arch Dis Child 2011; 96:995.
53. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. Pediatrics 2002; 109:1028.
54. Kalakanis LE, Goldfield GS, Paluch RA, Epstein LH. Parental activity as a determinant of activity level and patterns of activity in obese children. Res Q Exerc Sport 2001; 72:202.
55. Fulton JE, Garg M, Galuska DA, et al. Public health and clinical recommendations for physical activity and physical fitness: special focus on overweight youth. Sports Med 2004; 34:581.
56. Kohl HW 3rd, Hobbs KE. Development of physical activity behaviors among children and adolescents. Pediatrics 1998; 101:549.
57. Dietz WH, Robinson TN. Clinical practice. Overweight children and adolescents. N Engl J Med 2005; 352:2100.
58. Centers for Disease Control and Prevention (CDC). School health guidelines to promote healthy eating and physical activity. MMWR Recomm Rep 2011; 60:1.
59. Austin SB, Field AE, Wiecha J, et al. The impact of a school-based obesity prevention trial on disordered weight-control behaviors in early adolescent girls. Arch Pediatr Adolesc Med 2005; 159:225.
60. United States Department of Agriculture, "Choose my plate." Available at: www.choosemyplate.gov (A ccessed on October 09, 2015).
61. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioral, family-based treatment for obese children. JAMA 1990; 264:2519.
62. Ludwig DS. Clinical update: the low-glycaemic-index diet. Lancet 2007; 369:890.
63. Ebbeling CB, Leidig MM, Sinclair KB, et al. A reduced-glycemic load diet in the treatment of adolescent obesity. Arch Pediatr Adolesc Med 2003; 157:773.

64. Lean ME, Han TS, Prvan T, et al. Weight loss with high and low carbohydrate 1200 kcal diets in free living women. Eur J Clin Nutr 1997; 51:243.
65. Ebbeling CB, Leidig MM, Sinclair KB, et al. Effects of an ad libitum low-glycemic load diet on cardiovascular disease risk factors in obese young adults. Am J Clin Nutr 2005; 81:976.
66. Due A, Larsen TM, Mu H, et al. Comparison of 3 ad libitum diets for weight-loss maintenance, risk of cardiovascular disease, and diabetes: a 6-mo randomized, controlled trial. Am J Clin Nutr 2008; 88:1232.
67. Sondike SB, Copperman N, Jacobson MS. Effects of a low-carbohydrate diet on weight loss and cardiovascular risk factor in overweight adolescents. J Pediatr 2003; 142:253.
68. Demol S, Yackobovitch-Gavan M, Shalitin S, et al. Low-carbohydrate (low & high-fat) versus high-carbohydrate low-fat diets in the treatment of obesity in adolescents. Acta Paediatr 2009; 98:346.
69. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. JAMA 1999; 282:1561.
70. Epstein LH, Valoski AM, Vara LS, et al. Effects of decreasing sedentary behavior and increasing activity on weight change in obese children. Health Psychol 1995; 14:109.
71. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev 2011; :CD001871.
72. Guide to Community Preventive Services. Obesity prevention and control: behavioral interventions tha t aim to reduce recreational sedentary screen time among children. Available at: http://www.thecommu nityguide.org/obesity/behavioral.html (Accessed on January 09, 2015).
73. Epstein LH, Roemmich JN, Paluch RA, Raynor HA. Influence of changes in sedentary behavior on energy and macronutrient intake in youth. Am J Clin Nutr 2005; 81:361.
74. Generation M2: Media in the lives of 8- to 18-year olds. The Kaiser Family Foundation. Available at: htt p://www.kff.org/entmedia/mh012010pkg.cfm. (Accessed on January 19, 2011).
75. COUNCIL ON COMMUNICATIONS AND MEDIA. Media and Young Minds. Pediatrics 2016; 138.
76. COUNCIL ON COMMUNICATIONS AND MEDIA. Media Use in School-Aged Children and Adolescents. Pediatrics 2016; 138.
77. Physical fitness and activity in schools. American Academy of Pediatrics. Pediatrics 2000; 105:1156.
78. U.S. Department of Health and Human Services and U.S. Department of Agriculture. 2015 – 2020 Diet ary Guidelines for Americans. 8th Edition. December 2015. Available at: http://health.gov/dietaryguideli nes/2015/guidelines/ (Accessed on January 09, 2016).
79. Burdette HL, Whitaker RC, Daniels SR. Parental report of outdoor playtime as a measure of physical activity in preschool-aged children. Arch Pediatr Adolesc Med 2004; 158:353.
80. Anderson SE, Whitaker RC. Household routines and obesity in US preschool-aged children. Pediatrics 2010; 125:420.
81. Paruthi S, Brooks LJ, D'Ambrosio C, et al. Recommended Amount of Sleep for Pediatric Populations: A Consensus Statement of the American Academy of Sleep Medicine. J Clin Sleep Med 2016; 12:785.
82. Recommended Amount of Sleep for Pediatric Populations. Pediatrics 2016; 138.
83. Maine Youth Overweight Collaborative "5210 Let's Go" website. Available at: http://www.letsgo.org/res ources/Healthcare_Professionals_Toolkit.php?id=greenHealth&vid=v8 (Accessed on October 20, 201 1).
84. Reinehr T, Kleber M, Lass N, Toschke AM. Body mass index patterns over 5 y in obese children motivated to participate in a 1-y lifestyle intervention: age as a predictor of long-term success. Am J Clin Nutr 2010; 91:1165.

85. de Silva-Sanigorski AM, Bell AC, Kremer P, et al. Reducing obesity in early childhood: results from Romp & Chomp, an Australian community-wide intervention program. Am J Clin Nutr 2010; 91:831.
86. Baidal JA, Taveras EM. Childhood obesity: shifting the focus to early prevention. Arch Pediatr Adolesc Med 2012; 166:1179.
87. Quattrin T, Roemmich JN, Paluch R, et al. Efficacy of family-based weight control program for preschool children in primary care. Pediatrics 2012; 130:660.
88. Bocca G, Corpeleijn E, Stolk RP, Sauer PJ. Results of a multidisciplinary treatment program in 3-year-old to 5-year-old overweight or obese children: a randomized controlled clinical trial. Arch Pediatr Adolesc Med 2012; 166:1109.
89. Danielsson P, Kowalski J, Ekblom Ö, Marcus C. Response of severely obese children and adolescents to behavioral treatment. Arch Pediatr Adolesc Med 2012; 166:1103.
90. Danielsson P, Svensson V, Kowalski J, et al. Importance of age for 3-year continuous behavioral obesity treatment success and dropout rate. Obes Facts 2012; 5:34.
91. Davoli AM, Broccoli S, Bonvicini L, et al. Pediatrician-led motivational interviewing to treat overweight children: an RCT. Pediatrics 2013; 132:e1236.
92. Brotman LM, Dawson-McClure S, Huang KY, et al. Early childhood family intervention and long-term obesity prevention among high-risk minority youth. Pediatrics 2012; 129:e621.
93. McCallum Z, Wake M, Gerner B, et al. Outcome data from the LEAP (Live, Eat and Play) trial: a randomized controlled trial of a primary care intervention for childhood overweight/mild obesity. Int J Obes (Lond) 2007; 31:630.
94. Taveras EM, Gortmaker SL, Hohman KH, et al. Randomized controlled trial to improve primary care to prevent and manage childhood obesity: the High Five for Kids study. Arch Pediatr Adolesc Med 2011; 165:714.
95. Campbell KJ, Lioret S, McNaughton SA, et al. A parent-focused intervention to reduce infant obesity risk behaviors: a randomized trial. Pediatrics 2013; 131:652.
96. McGuire S. Institute of Medicine (IOM) Early Childhood Obesity Prevention Policies. Washington, DC: The National Academies Press; 2011. Adv Nutr 2012; 3:56.
97. DeBar LL, Stevens VJ, Perrin N, et al. A primary care-based, multicomponent lifestyle intervention for overweight adolescent females. Pediatrics 2012; 129:e611.
98. O'Connor EA, Evans CV, Burda BU, et al. Screening for Obesity and Intervention for Weight Management in Children and Adolescents: Evidence Report and Systematic Review for the US Preventive Services Task Force. JAMA 2017; 317:2427.
99. Saelens BE, Sallis JF, Wilfley DE, et al. Behavioral weight control for overweight adolescents initiated in primary care. Obes Res 2002; 10:22.
100. Sim LA, Lebow J, Wang Z, et al. Brief Primary Care Obesity Interventions: A Meta-analysis. Pediatrics 2016; 138.
101. Ho M, Garnett SP, Baur L, et al. Effectiveness of lifestyle interventions in child obesity: systematic review with meta-analysis. Pediatrics 2012; 130:e1647.
102. Centers for Disease Control and Prevention (CDC). CDC grand rounds: childhood obesity in the United States. MMWR Morb Mortal Wkly Rep 2011; 60:42.
103. Gortmaker SL, Polacsek M, Letourneau L, et al. Evaluation of a primary care intervention on body mass index: the Maine Youth Overweight Collaborative. Child Obes 2015; 11:187.
104. Rogers VW, Hart PH, Motyka E, et al. Impact of Let's Go! 5-2-1-0: a community-based, multisetting childhood obesity prevention program. J Pediatr Psychol 2013; 38:1010.
105. Klein JD, Sesselberg TS, Johnson MS, et al. Adoption of body mass index guidelines for screening and counseling in pediatric practice. Pediatrics 2010; 125:265.

106. Sesselberg TS, Klein JD, O'Connor KG, Johnson MS. Screening and counseling for childhood obesity: results from a national survey. J Am Board Fam Med 2010; 23:334.

107. National Physical Activity Plan, 2016. Available at: http://www.physicalactivityplan.org/index.html (Accessed on May 06, 2016).

Topic 15848 Version 42.0