



# The Role of the Pediatrician in Primary Prevention of Obesity

Stephen R. Daniels, MD, PhD, FAAP, Sandra G. Hassink, MD, FAAP, COMMITTEE ON NUTRITION

The adoption of healthful lifestyles by individuals and families can result in a reduction in many chronic diseases and conditions of which obesity is the most prevalent. Obesity prevention, in addition to treatment, is an important public health priority. This clinical report describes the rationale for pediatricians to be an integral part of the obesity-prevention effort. In addition, the 2012 Institute of Medicine report “Accelerating Progress in Obesity Prevention” includes health care providers as a crucial component of successful weight control. Research on obesity prevention in the pediatric care setting as well as evidence-informed practical approaches and targets for prevention are reviewed. Pediatricians should use a longitudinal, developmentally appropriate life-course approach to help identify children early on the path to obesity and base prevention efforts on family dynamics and reduction in high-risk dietary and activity behaviors. They should promote a diet free of sugar-sweetened beverages, of fewer foods with high caloric density, and of increased intake of fruits and vegetables. It is also important to promote a lifestyle with reduced sedentary behavior and with 60 minutes of daily moderate to vigorous physical activity. This report also identifies important gaps in evidence that need to be filled by future research.

## abstract

FREE

*The American Academy of Pediatrics Committee on Nutrition used review of the literature, including reports from other groups, but did not conduct a formal systematic review of the literature. Comments also were solicited from committees, sections, and councils of the American Academy of Pediatrics; 18 entities responded. Additional comments were sought from the Centers for Disease Control and Prevention, the National Institutes of Health, the US Department of Agriculture, and the US Food and Drug Administration, because these governmental agencies have official liaisons to the Committee on Nutrition who served the on the committee during the development of the statement. Comments also were solicited from various professional societies and other entities interested in childhood obesity; 4 entities responded. For recommendations for which high levels of evidence are absent, the expert opinions and suggestions of the members of the Committee on Nutrition and other groups and authorities consulted were taken into consideration in developing this clinical report.*

*This document is copyrighted and is property of the American Academy of Pediatrics and its Board of Directors. All authors have filed conflict of interest statements with the American Academy of Pediatrics. Any conflicts have been resolved through a process approved by the Board of Directors. The American Academy of Pediatrics has neither solicited nor accepted any commercial involvement in the development of the content of this publication.*

*Clinical reports from the American Academy of Pediatrics benefit from expertise and resources of liaisons and internal (American Academy of Pediatrics) and external reviewers. However, clinical reports from the American Academy of Pediatrics may not reflect the views of the liaisons or the organizations or government agencies that they represent.*

*The guidance in this report does not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.*

*All clinical reports from the American Academy of Pediatrics automatically expire 5 years after publication unless reaffirmed, revised, or retired at or before that time.*

[www.pediatrics.org/cgi/doi/10.1542/peds.2015-1558](http://www.pediatrics.org/cgi/doi/10.1542/peds.2015-1558)

DOI: 10.1542/peds.2015-1558

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2015 by the American Academy of Pediatrics

## INTRODUCTION AND RATIONALE FOR OBESITY PREVENTION

This clinical report updates and replaces the 2003 American Academy of Pediatrics (AAP) policy statement “Prevention of Pediatric Overweight and Obesity”<sup>1</sup> and complements the AAP-endorsed 2007 expert committee “Recommendations for Prevention of Childhood Obesity”<sup>2</sup> and the chapter “Promoting Healthy Weight” in the 2008 third edition of *Bright Futures: Prevention and Health Promotion for Infants, Children, Adolescents, and Their Families*.<sup>3</sup> Since 2003, much has been written in the scientific literature and the lay press regarding childhood obesity. The prevalence of pediatric obesity has increased significantly (two- to threefold, depending on the age group) in the past few decades in the United States and in other countries.<sup>4–6</sup> Because of the numerous medical and psychosocial complications of childhood obesity and the burden of pediatric obesity on current and future health care costs, this condition is now recognized as

a public health priority by many groups and experts.<sup>7-13</sup> Although treatment of obesity in the pediatric age group, as well as secondary and tertiary prevention, will remain a key component of a comprehensive strategy to address this public health problem, the results of treatment remain modest, and primary prevention is recognized as a critical part of a sustainable solution.<sup>8,9,12</sup> It is also increasingly recognized that both clinical interventions and supportive institutional and community environments are required to adopt more healthful lifestyles for the prevention of obesity and other noncommunicable diseases.<sup>9,14-19</sup> For example, a comprehensive review of strategies for obesity prevention in the United Kingdom concluded that “the deceptively simple issue of encouraging physical activity and modifying dietary habits, in reality, raises complex social and economic questions about the need to reshape public policy in food production, food manufacturing, healthcare, retail, education, culture and trade.”<sup>14</sup>

Pediatricians can and should play an important role in obesity prevention because they are in a unique position to partner with families and patients and to influence key components of the broader strategy of developing community support. Prevention of obesity is clearly not only the responsibility of pediatricians but of all elements of society, including the public and the private sectors. Unlike most schools, community-based organizations, or governmental programs, pediatricians often follow children over a long period of time, sometimes from fetal life through college, giving them a unique long-term perspective in preventing chronic conditions such as obesity. Furthermore, pediatricians, in the context of the medical home, have a family-centered perspective and are seen by families as a reliable source of health advice and as experts in developmentally appropriate

approaches to prevention. This clinical report reviews the role of the pediatrician in practice and in the community as a behavior-change agent and advocate for healthful lifestyles for the prevention of childhood obesity. It is not a systematic review of evidence but rather an assessment of the best-available evidence that weighs the potential benefits of possible interventions. This report also focuses on clinical practice. However, the role that a pediatrician can play in the community is also critical. Although the role of pediatricians as advocates for community and policy changes is not reviewed in detail here, resources to assist pediatricians in this role can be found on the AAP Institute for Healthy Childhood Weight Web site (<http://ihcw.aap.org>).<sup>20</sup>

#### **INDIVIDUAL/CLINICAL APPROACHES TO OBESITY PREVENTION**

The prevention of childhood obesity has been the subject of many research studies, reviews, and guidelines, primarily in the school or community setting, and these studies were taken into consideration for this report.<sup>2,9,21-25</sup> However, little is known about the feasibility, effectiveness, and cost of childhood obesity prevention in the primary care setting. Because research on pediatric obesity treatment began earlier than the research on pediatric obesity prevention, and because more data are available on treatment, many of the tools and behavior targets used for prevention derive from our knowledge of treatment. Because the motivation for prevention differs from that for treatment, and because an individual with obesity frequently differs metabolically from a person of healthy weight, this approach may have limitations that further increase the challenges of obesity prevention in a clinical setting designed for treatment. Despite these limitations, obesity-prevention strategies in the

pediatric clinical setting can be informed by findings about obesity treatment, obesity prevention in other settings, and obesity prevention among adults.

Several studies have examined the efficacy of obesity prevention in pediatric primary care settings. Patrick et al<sup>26</sup> used a randomized controlled design to compare a control intervention unrelated to obesity to a 12-month, theory-based intervention aimed at reducing sedentary behavior, promoting physical activity, and promoting healthier nutrition. The intervention was initiated in primary care but, after the initial primary care visit, was delivered by research staff by phone and mail. The intervention improved self-reported sedentary behavior, improved fruit and vegetable intake, and increased objectively measured physical activity among boys only. In a pilot study that used a natural experiment design, Kubik et al<sup>27</sup> showed that another practice-based intervention successfully increased parental intent to give their children 5 or more servings of fruits and vegetables per day. In a 6-month nonrandomized feasibility study, Schwartz et al<sup>28</sup> used primary care-based motivational interviewing to improve eating and sedentary behaviors. The intervention was found to be feasible; parents reported that it helped them change family eating habits, but no significant effect on BMI was observed. Furthermore, the drop-out rate was much higher in the more intensive intervention than in the minimal intervention or the control group. Ford et al<sup>29</sup> showed in a randomized controlled pilot and feasibility trial that a primary care-based behavioral intervention was successful not only at decreasing television watching but also at increasing organized physical activity.

A brief review of obesity treatment in the pediatric primary care literature showed mixed but promising results.

Two randomized trials found promising results with group differences in BMI.<sup>30,31</sup> Two other uncontrolled feasibility treatment studies also had promising results.<sup>32,33</sup> In contrast, 2 large Australian primary care-based obesity-treatment interventions proved ineffective at improving BMI and were costly to both the health system and families.<sup>34–36</sup> However, a more recent randomized controlled trial in 41 pediatric practices participating in Pediatric Research in Office Settings revealed significant reductions in BMI using motivational interviewing delivered by pediatricians, with a larger reduction when motivational interviewing was delivered to the patient by both the pediatrician and the dietitian.<sup>37</sup>

These studies have suggested that obesity-prevention or -treatment interventions in primary care are feasible and may result in behavioral change, but their effect on excessive weight gain is uncertain. The lack of feasible and effective obesity-prevention strategies in primary care constitutes an important research gap.<sup>38</sup> One reason for this gap is the lack of reimbursement for obesity-prevention efforts in the primary care setting. Additional gaps include studies to assess whether successful prevention strategies implemented in other settings (including interventions aimed at changing the food and activity environment) can be translated to the pediatric primary care setting. Areas of needed research include behavioral approaches for prevention in the pediatric primary care setting and the optimal format for obesity prevention in this setting (group versus individual, intervention by primary care staff versus outside staff), the length and intensity of effective interventions, and the level of resources required for effective interventions. Although research is still ongoing, it is important to emphasize that there is enough evidence to show that prevention in primary care has been successful in

increasing healthy nutrition and activity behavior, which is sufficient justification for pediatricians to develop the necessary skills to perform these activities as part of their practice.

### **PRACTICAL APPROACHES TO PREVENTION: STRATEGIES TO IMPLEMENT PREVENTION**

Most of the approaches and targets described in this section are derived from research on obesity prevention in other settings and age groups, on obesity treatment, or on the prevention of other conditions in pediatric and other primary care settings. They represent the best-available evidence informing clinical practice.

Regardless of the strategy used for prevention, it cannot be overemphasized that prevention should be tailored to the child's developmental stage, as well as to family characteristics.<sup>39</sup> Because pediatric primary care providers follow children longitudinally, they often know families for a long time and are aware of the families' characteristics that are relevant to the tailoring of prevention interventions. They are also well positioned to deliver developmentally appropriate preventive interventions.

Pediatric practitioners should be familiar with the specifics of the racial/ethnic, cultural, and socioeconomic groups to which their patients belong. Getting involved with the community and studying the characteristics, strengths, and challenges different cultural groups face will help develop greater cultural competence and improve tailoring of prevention interventions for patients and their families.

#### **Identification of Children at Risk**

To prevent obesity, pediatricians should identify children at risk of developing obesity.<sup>40</sup> From birth through 23 months of age, weight-for-

age and weight-for-length should be monitored by using the new World Health Organization normative growth charts based on healthy breastfed infants ([http://www.cdc.gov/growthcharts/who\\_charts.htm](http://www.cdc.gov/growthcharts/who_charts.htm)).<sup>41</sup> For children aged 2 years and older, BMI changes should be monitored by calculating and plotting BMI on the Centers for Disease Control and Prevention growth charts ([www.cdc.gov/growthcharts](http://www.cdc.gov/growthcharts)) at every health care visit so that obesity-prevention interventions can be implemented when a child starts to cross BMI percentiles upward, even before they approach the 85th or the 95th percentile.<sup>1,2,42</sup> A study found that only 46% of pediatricians surveyed routinely calculated and plotted BMI.<sup>43</sup> However, more recent evidence shows substantial improvement among pediatricians in primary care practice.<sup>44</sup>

Prenatal risk factors for obesity include parental obesity, maternal gestational diabetes, and maternal smoking during pregnancy. Child risk factors include never being breastfed, rapid infant weight gain, short sleep duration, depression, and having a disability.<sup>45–50</sup> Additional behavioral risks can be identified through the nutrition, sedentary behaviors, and physical activities questions that are part of the *Bright Futures* templates.<sup>51–53</sup>

#### **The Role of Education**

Although most of the population recognizes the benefit of healthy nutrition, physical activity, and reduced sedentary behavior, few follow public health recommendations, which suggests that more education is unlikely to result in significant improvement for most people. Most obesity-treatment studies use education as the control or placebo intervention, assuming that education alone will have little or no effect on obesity-related behaviors. However, education and counseling may have important roles in primary prevention, especially if

**TABLE 1** Feeding Guide for Children

Food	Age						Comments
	2 to 3 Years (1000–1400 kcal)		4 to 6 Years (1200–1800 kcal)		7 to 12 Years (1400–2000 kcal)		
	Portion Size	Daily Amounts	Portion Size	Daily Amounts	Portion Size	Daily Amounts	
Low-fat milk and dairy	1/2 cup (4 oz)	2-1/2 cups	1/2-3/4 cup (4-6 oz)	2-1/2-3 cups	1/2-1 cup (4-8 oz)	2-1/2-3 cups	The following may be substituted for 1/2 cup fluid milk: 1/2 oz natural cheese, 1 oz processed cheese, 1/2 cup low-fat yogurt, 2-1/2 T nonfat dry milk.
Meat, fish, poultry, or equivalent	1-2 oz (2-3 T)	2-4 oz	1-2 oz (4-6 T)	3-5 oz	2 oz	4-5-1/2 oz	The following may be substituted for 1 oz meat, fish, or poultry: 1 egg, 1 T peanut butter, 1/4 cup cooked beans or peas.
Vegetables and fruits							
Vegetables							
Cooked	2-3 T	1-1/2 cups	4-6 T	1-1/2-2-1/2 cups	1/4-1/2 cup	1-1/2-2-1/2 cups	Include dark-green (1 cup/week) and orange vegetables (3 cups/week) for vitamin A, such as carrots, spinach, broccoli, winter squash, or greens.
Raw <sup>a</sup>	Few pieces	Few pieces			Several pieces		Limit starchy vegetables (potatoes) to 3-1/2 cups weekly.
Fruits							
Raw	1/2-1 small fruit	1-1/2 cups	1/2-1 small fruit	1-1-1/2 cups	1 medium fruit	1-1/2-2 cups	Include 1 vitamin C-rich fruit, vegetable, or juice, such as citrus juices, orange, grapefruit, strawberries, melon, tomato, or broccoli.
Canned	2-3 T		4-6 T		1/4-1/2 cup		
Juice	3-4 oz		4 oz		4 oz		
Grain products							
Whole-grain or enriched bread	1/2-1 slice	3-5 oz	1 slice	4-6 oz	1 slice	5-6 oz	The following may be substituted for 1 slice of bread: 1/2 cup spaghetti, macaroni, noodles, or rice; 5 saltines; 1/2 English muffin or bagel; 1 tortilla; corn grits; or <i>posole</i> . Make one-half of grain intake whole grains.
Cooked cereal	1/4-1/2 cup	1-1/2-2-1/2 oz	1/2 cup		1/2-1 cup		
Dry cereal	1/2-1 cup	Whole-grain	1 cup		1 cup		
Oils		4 tsp		4-5 tsp		4-6 tsp	Choose soft margarines. Avoid <i>trans</i> fats. Use liquid vegetable oils rather than solid fats.

Reproduced with permission from American Academy of Pediatrics Committee on Nutrition. Feeding the child and adolescent. In: Kleinman RE, Greer FR, eds. *Pediatric Nutrition*. 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2014:153. Adapted from ChooseMyPlate at <http://www.choosemyplate.gov> and the 2010 Dietary Guidelines for Americans. T, tablespoons; tsp, teaspoons.

<sup>a</sup> Do not give to young children until they can chew well.

pediatricians provide information in the context of the child's growth and health and the family's health history. Reiteration of core messages from early in life may foster parenting that promotes a healthy lifestyle and strengthens prevention. The pediatrician's advocacy within the community for environmental supports of healthful behaviors can be an important adjunct to education.

A few simple screening questions about breastfeeding knowledge, healthy food choices, appropriate portion sizes, food label reading, nutrients of concern, energy balance, the benefit of physical activity, and the negative effect of sedentary entertainment can identify appropriate targets for counseling (see the Appendix for practical tools; also see the 15-minute obesity-prevention protocol in the Appendix of the Expert Committee report<sup>2</sup>). Health education, including use of handouts, can address these gaps. Physician and family resource materials may be found at <http://ihc.aap.org>.

Even when families have sufficient knowledge of healthy behaviors, they may need help from pediatricians to develop the motivation to change, to provide encouragement through setbacks, and to identify and support appropriate community resources that will help them successfully implement behavior changes. For example, in communities where access to fresh vegetables and fruits is limited, informing families about farmers' markets or local grocery stores that have a good supply of frozen or canned vegetables and fruits or online grocery shopping may improve availability.

Pediatricians should also become familiar with federal food assistance programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and the Supplemental Nutrition Assistance Program (SNAP) to understand how the educational

programs, nutritional counseling, and food packages affect a family's ability to implement prevention strategies discussed in the clinical setting. Particularly important may be information about cost-effective shopping for healthy foods. Workshops can be found online on the US Department of Agriculture Web site ChooseMyPlate.gov (<http://www.choosemyplate.gov/downloads/EatHealthyBeActiveCommunityWorkshops.pdf>). If local restaurants or grocery stores offer healthier take-out options, such information might be useful to families who consume a large amount of fast food or unhealthy take-out meals. When access to opportunities for physical activity is limited, providers may want to help families find local opportunities that are safe and sustainable, such as sports clubs, basketball courts, parks with walking or bicycle trails, skate parks, or playgrounds. Schools often have joint-use agreements that allow community-member usage of school facilities for physical activity.

### **The Role of Theory-Based Behavior-Modification Techniques**

Behavior-modification programs built on strong theoretical models have long been shown to be the best option for obesity treatment, both in adults and children.<sup>54-58</sup> Behavioral theories that have been used effectively for obesity treatment include the learning theory/operant conditioning, social learning/social cognitive theory, the behavioral economics theory, and the social-ecological model. More in-depth information on these theories is available for clinicians who are interested.<sup>19,59-63</sup> Most of these behavioral models have been investigated for the treatment of obesity. They are often also used for prevention as an extension of their use in treatment. However, less evidence exists to support their use in primary prevention. Most behavior-modification programs include a component of environmental

change, also known as "stimulus control," which eliminates food triggers and has been effective in obesity prevention in the school setting.<sup>64-66</sup> Changing the food that is available at home may help children make healthier choices and limit arguments about food. It may be useful to review with families what is available in the house and help them replace the less healthy choices with more nutritious options. To assist such reviews, it may be helpful to ask families to bring grocery store receipts, prepare a list of food items easily available to the child in the house, or e-mail or text pictures of the refrigerator, the kitchen counter, and pantry that can be reviewed together on the office computer. This can be a good arena for partnership with a dietitian and/or a role for other office professionals or group visits.

### **Managing the Food and Activity Environment**

After an assessment of the current food environment has been performed, the family should be encouraged to buy fewer of the foods that are associated with the development of obesity, such as sweetened beverages (including fruit-flavored drinks), high-caloric-density snacks, or sweets. If these items are present in the house for special occasions or other purposes, they should be purchased immediately before the event and removed immediately afterward to decrease the temptation to snack on these items. In contrast, healthy alternatives, such as water pitchers, fruits, vegetable snacks, and other low-calorie snacks should be readily available at all times and placed in plain sight; for example, in front of the refrigerator or in large bowls on the kitchen counter or table. Practically, the cookie jar should be replaced by a fruit bowl. If high-calorie foods remain in the home, they should be packaged in foil to make them less visible and more

forgettable. Healthier, low-calorie items should be placed in front of the refrigerator and pantry, and high-calorie items should be placed in the back.<sup>66</sup> Such environmental manipulations help children and adolescents make healthier choices, because visible and easily available foods are more likely to be chosen than are foods that require an effort to find.<sup>66</sup> Larger serving sizes increase intake, because they influence consumption norms and decrease the accuracy of consumption monitoring.<sup>67-69</sup> Therefore, pediatricians should recommend to families that they decrease the size of the main dish, serving dishes, serving spoons, plates, bowls, and glasses for calorie-dense foods and increase these for lower-calorie foods.<sup>67</sup> Parents should also be warned that many prepackaged food items and portion sizes at most restaurants contain more than 1 serving size and that these are often not appropriate for children.<sup>70</sup> Eating directly from the package should be discouraged, and high-calorie snacks should be repackaged at home in smaller containers.<sup>67</sup> It may also be helpful to recommend healthy snacks that are prepackaged in a size that is an age-appropriate portion size. In addition to convenience and decreasing caloric intake, this approach may help families learn the size of an age-appropriate serving (see Table 1). Another way to change the child's environment is to decrease opportunities for sedentary entertainment by reducing the number of television sets and especially removing the television and other media from the child's bedroom and where meals are consumed. The availability of other forms of sedentary entertainment, such as video games, computers, and other screen electronic devices, should also be limited. More practical tips for changing the home environment are provided on the Web sites listed in the Appendix. Pediatricians should be involved in

their local communities, working with their local public health departments on policies to effect system change and environmental change to prevent obesity by increasing the availability of public parks for recreational activity and enhanced bicycle paths as well as with schools to advocate for improved availability of fresh fruits and vegetables and improved environments for activity. Families and adolescent patients should also be encouraged to advocate for improvement in the food and physical activity environment in their communities, schools, child care facilities,<sup>71</sup> and work sites.

### Encouraging Self-Monitoring

Most behavior-modification techniques also involve self-monitoring, because it provides feedback on the frequency at which a target behavior occurs, raises awareness of the contextual cues that relate to the target behavior, and facilitates analysis of the target behavior, goal setting, and feedback from the goals' achievements.<sup>12</sup> Several diaries, forms, logs, and other formats have been developed, some of which can be found on the Web sites listed in the Appendix. To successfully implement self-monitoring, families should be instructed to partner with their children on maintaining a diary of food, physical activity, and/or sedentary activities on a daily basis, starting with only 1 or 2 target behaviors and increasing to more behaviors after the monitoring routine has been established. To maintain monitoring, parents need to encourage their children in a nonjudgmental way by reminding them to write the target behavior on several occasions during the day and by reviewing the diary with them at the end of the day. Goals for behavior change should be made in a small-step manner. They should also be unambiguous, attainable, and routinely reexamined. Positive feedback from the parent, such as

pointing out and praising positive behaviors while ignoring or positively addressing behaviors that should be changed, is critical for success. Parents should be discouraged from using food as a reward (ie, celebrating with ice cream, going out to eat) or a punishment (restricting food for bad behavior).

### Focus on Family-Based Interventions

The obesity-treatment literature emphasizes that family-based interventions are more effective than interventions focused on the child only.<sup>55</sup> It is reasonable to expect that the same applies to primary prevention. A family-based intervention fits well within the paradigm of primary care practice, because usually at least 1 parent is present for visits, at least for younger children. For adolescents, it may be important to involve parents in obesity-prevention interventions more closely than for other adolescent health problems, because even at that age, parents are still the main role models for eating and physical activity behaviors and have a direct effect on the adolescent's food and activity environment. Parents and other family members should be strongly encouraged to implement the same changes as the child and model healthier behaviors as a family. Parents and families should be encouraged to be supportive, and pediatricians are often in a good position to help families find ways to do this together. Another frequent problem for young children is that many adults other than the parents are involved in the care of the children. For example, grandparents may be involved in child care and can have a large influence on child-rearing practices. In these situations, communication regarding eating and physical activities should be encouraged between parents and other caregivers. It may sometimes be helpful for the pediatrician to communicate directly with other

caregivers to emphasize the health message.

### **Help Parents Develop Parenting and Communication Skills**

Although few empirical data exist, it often is the experience of clinicians that improving parenting skills and intrafamilial communications can facilitate the implementation of behavior changes for obesity prevention.<sup>72</sup> Clinicians can assist families in finding better ways to communicate, set limits, reward rather than punish, provide positive feedback, and role-model in the context of obesity prevention, as they already do in the context of other risk behaviors. Role modeling by parents cannot be overemphasized, and pediatricians should encourage the entire family, not just patients, to engage in healthy changes. Families can find useful resources under “Communication & Discipline” on the AAP Web site [www.healthychildren.org](http://www.healthychildren.org).

Parents who are obese are more likely to have children who are obese. In the United States, approximately 60% of adults are overweight or obese and, as parents, may have already established unhealthy lifestyles for themselves and their families. Parents who are overweight or obese may also have tried and failed at their own attempts to change their lifestyle. Their experiences can create nihilism or a defense of lifestyle for which pediatricians must be prepared. Pediatricians must address the health beliefs and contributors to adverse lifestyles across the family to have the best chance for success.

### **Motivational Interviewing**

Motivational interviewing is a technique that has shown promising results in terms of self-reported behavior changes for obesity prevention and is recommended by the AAP for treatment but has not yet shown an effect on weight status.<sup>28</sup> A recent randomized controlled trial

comparing an intervention with and without motivational interviewing in primary care revealed that using motivational interviewing was associated with significant reductions in BMI when compared with a standard approach.<sup>37</sup> An interactive, responsive dialog between pediatricians and families and children is important to help families move toward lifestyle change. The AAP Change Talk Web site (<http://www.kognito.com/changetalk/>), which includes training in motivational interviewing, may be used for primary care providers.

### **PRACTICE-BASED SKILLS AND WORKFLOW**

#### **Role of Nonphysician Providers**

Counseling on obesity prevention is time consuming. Pediatric practices with nonphysician staff may decide to train and delegate these activities to practice-based or community-based, culturally competent nonphysician providers. As awareness of the obesity epidemic increases, training opportunities and reimbursement for preventive care should become more widely available, making this approach more realistic for primary care practices. Although referral to dietitians or other local professionals is mostly indicated for obesity treatment, referral can be considered in some situations for obesity prevention.

#### **Payment**

Obesity prevention and treatment constitute “incremental work” for pediatricians and pediatric health care providers. Securing appropriate payment for obesity-related services includes the following: (1) reporting appropriate diagnostic and procedural codes related to obesity; (2) ability to manage workflow to include counseling for obesity prevention at well visits; (3) ability to schedule more frequent visits for children who are overweight, crossing percentiles, have high-risk

behaviors or risk factors, or who are already diagnosed with obesity; (4) ability to advocate on behalf of patients for proper payment; (5) ability to work with pediatric councils in each state as obesity-prevention and -management services are discussed with payers.

The AAP advocates that benefit plan design include coverage and payment for pediatric obesity assessment, evaluation, and treatment. As a result of focused advocacy by the AAP and child health partners, the Patient Protection and Affordable Care Act now includes a rule that essential preventive care services (as recommended by *Bright Futures*) are provided with no cost sharing for families with new health insurance plans. It is hoped that this rule will increase opportunities for families to access preventive services, including those for obesity.

The Affordable Care Act also includes provisions for an enhanced federal match for states that cover all US Preventive Services Task Force grade A- and B-recommended preventive services. Obesity screening and counseling for children, adolescents, and adults is a US Preventive Services Task Force-recommended service, as are breastfeeding counseling and gestational diabetes mellitus screening, all of which enhance obesity-related clinical services.

### **FOOD AND ACTIVITY TARGETS FOR PREVENTION**

A number of potential food and activity targets for prevention have been described. Most of these have not been widely investigated. Targets that have been implemented in other settings, age groups, or for treatment are highlighted in this section. Some of these targets have combined benefits, such as the associations of decreased intake of sweetened beverages with dental health benefits, or the effect of increased sleep duration with improved learning. Therefore, promoting a healthy

lifestyle and obesity prevention can be integrated into other aspects of prevention. Furthermore, these benefits may be more relevant as motivators to families who do not yet perceive the risk of obesity as important.

## **Beverages**

### *Sugar-Sweetened Beverages*

There is indirect or preliminary evidence that intake of sugar-sweetened beverages may lead to excess weight gain in children.<sup>73-76</sup> There is also evidence that these beverages are associated with tooth decay.<sup>76</sup> Because there is no evidence for health benefits of sugar-sweetened beverages, health-promotion efforts in pediatric practice should aim at removing all sugar-sweetened beverages from children's diets. Although many beverages are easily identified as sugar-sweetened beverages (soda, ice teas), some families may need education on other sugar-sweetened beverages that are less easily identified (sports drinks, energy drinks, and juice drinks).

### *Water*

The ideal beverages for children at all meals and during the day are low-fat milk and plain tap water. In the unusual situation in which tap water is unsafe, filtered or bottled water should be considered. Sparkling water and unsweetened flavored waters can be considered in transitioning from sodas to plain water. Low-fat or fat-free milk (preferably unflavored milk) also has an important place in children's diets, because milk contains important nutrients that are often deficient in the diets of children. There is no evidence of benefit from vitamin or protein waters, because the nutrients contained in these products are not typically deficient in children's diets. Replacing sweetened beverages with tap water should also be presented to families as a cost-saving change. Costs may be particularly motivating to

low-income families who struggle to provide a healthy, balanced, and inexpensive diet to children. For higher-income families, savings from this change could be set aside for fun, family-based activities.

### *Juice*

Another alternative is to consider providing small amounts of "naturally" flavored drinks without added sweeteners, such as 100% fruit juices, but these can also be high in calories. The portion size of fruit juice is important. The consumption of 100% fruit juices should be limited to 4 to 6 ounces/day for children 1 to 6 years of age and 8 to 12 ounces/day for children 7 to 18 years.<sup>77</sup>

### *Artificially Sweetened Drinks*

The use of beverages sweetened with no- or low-calorie artificial sweeteners remains controversial, because they may perpetuate the habit of drinking sweetened beverages and may lead to a disconnect between perception and actual energy intake or to the displacement of nutrient-rich beverages. However, they can provide an alternative to full-calorie sodas.<sup>78,79</sup> Because there is no evidence of benefits of these products over plain water, artificially sweetened beverages currently have a limited place in a child's diet. An example would be advising their use during a limited period of time to transition between full-calorie sodas and plain water, or when water is not available. The role of no- or low-calorie artificial sweeteners in children's beverages remains an area of ongoing research and debate. There is emerging evidence that nonnutritive sweeteners alter gut microbiota and increase glucose intolerance in humans.<sup>80</sup>

### **Energy-Dense Foods**

Increased caloric density of food (calories/g) has been associated with excessive caloric intake in laboratory studies in adults and children.<sup>81</sup>

Therefore, even without strong direct evidence for obesity-prevention benefits, a healthy diet should be rich in foods with low caloric density (vegetables, fruits, whole grains, low-fat dairy products, lean meats, lean fish, legumes) and limited in foods with high caloric density (fat-rich meats, fried foods, baked goods, sweets, cheeses, oil-based sauces). Furthermore, these choices have been shown to improve the cardiovascular risk profile, independent of obesity.<sup>82</sup> Because such healthy diets are often time-consuming to prepare and sometimes more expensive than unhealthy food choices, families can benefit from consultation with a dietitian on food shopping, meal planning, and food preparation as well as advice on making healthy choices while eating outside the home.

### **Eating Habits, Context, and Schedule**

Because of evidence that family meals eaten while sitting at a table and without distraction, such as television, are associated with improved nutrition- and obesity-related behaviors, such habits should be encouraged.<sup>47,83</sup> Skipping meals, especially breakfast, has been associated with obesity. Therefore, pediatricians should encourage daily breakfast consumption and assist families in identifying ways for children to consume breakfast despite limited time or appetite.<sup>84,85</sup> Because breakfast consumption has other benefits, particularly in academic achievement, this effort is indicated despite a lack of strong experimental evidence for obesity prevention.<sup>85</sup> Families should be encouraged to review school menus and provide alternatives if healthy choices are difficult for their children at school. Eating out, fast food, and take-out are becoming more frequent in the habits of most American families, but these meals are often higher in calories and associated with a poor diet quality.<sup>86,87</sup> The recognition that appropriate child



portions are considerably smaller than those for adults is important in light of increases in standard marketplace food portions that have occurred in recent decades (see Table 1). Federal legislation (as part of the Affordable Care Act) to label the caloric content of food items on menus of chain restaurants should help families make lower calorie choices when eating out.

Pediatricians should also assist families in understanding what is an age-appropriate daily caloric intake (see the MyPyramid Web site listed in the Appendix) so that they can make choices in restaurants within an appropriate information context. Pediatricians can also encourage parents to choose healthful kids' meal side items (eg, apple slices, oranges) and beverages (eg, water, low-fat unflavored milk) when eating out.

### Screen Time

Some of the strongest scientific evidence of behaviors related to the development of obesity is related to the duration of television viewing.<sup>88,89</sup> Because of rapid changes in available forms of sedentary entertainment, there is still limited evidence regarding these other forms of screen entertainment. It is reasonable to assume that the association of other screens with obesity is similar to what has been shown for television. It is thought that television viewing is associated with obesity because it is sedentary and involves exposure to food advertising that promotes foods of high energy density. Additional factors that may promote weight gain are mindless eating or snacking while viewing television. Therefore, limiting commercial television viewing and promoting media literacy may also be important approaches to preventing obesity. The AAP recommends limiting screen time to 2 hours or less per day.<sup>3</sup> It may be challenging for parents to implement such a limit, because children increasingly do more than 1 thing at a time

(homework and texting) and because the limits between entertainment and education are often blurred, especially when using a computer.

Therefore, pediatricians should remain informed about new forms of sedentary entertainment to assist families with information on parenting skills to limit these to 2 hours/day. It should also be clearly understood that promoting a decrease in screen time is a different message than promoting physical activity; both should be targeted. Limiting television viewing may be more effective than promoting physical activity to control weight.<sup>90</sup>

### Leisure and Lifestyle Physical Activity

Pediatricians should encourage families to meet the national physical activity guideline of at least 60 minutes of moderate to vigorous physical activity daily.<sup>91,92</sup> They should help families identify opportunities for physical activity available in the community, including sport clubs, basketball courts, parks with walking or bicycle trails, skate parks, or playgrounds. Pediatricians should also be strong advocates for the availability of these resources in the community. Physical activity does not necessarily mean sports but can also be obtained through family activities and active play (family walks and hikes, bicycle trips, outdoor games and activities, bowling, roller skating, and dog walking) and through daily lifestyle choices (using the stairs rather than elevators, walking or biking to a nearby destination, participating in chores). The AAP Let's Move! physical activity prescription can serve as a reminder to families and patients about goals that have been developed during the visit (see Appendix). As for all children and adolescents, physical activity should be performed in a safe environment with appropriate safety equipment to avoid injuries.<sup>93,94</sup> This advice may be particularly important to remember for obesity treatment,

because obese children are at increased risk of injuries of the extremities.<sup>95</sup>

### Sleep Duration

Health and education professionals should be trained in how to counsel parents about their children's age-appropriate sleep durations. There is emerging evidence that obesity is associated with shorter sleep duration.<sup>46,96</sup> A study in preschool-aged children found an increased rate of obesity in children who slept less than 11 hours/night, and the risk of obesity increased as sleep time decreased. Children who received less than 9 hours of sleep had 1.5 times the risk of being obese compared with those who received >11 hours of sleep/night. A longitudinal study in more than 7000 children aged 3 years found that sleep duration of less than 10.5 hours was associated with obesity at 7 years of age.<sup>97</sup> A meta-analysis of studies on the relationship of sleep and obesity found that for each hour increase in sleep, the risk of overweight/obesity was reduced, on average, by 9% for children younger than 10 years.<sup>98</sup>

Including a sleep history is important in any assessment of obesity risk. Pediatricians should identify sleep issues and should help parents to improve sleep patterns. This recommendation includes removing media from the bedroom, focusing on bedtime, and emphasizing appropriate targets for sleep duration.

## A DEVELOPMENTAL APPROACH TO OBESITY PREVENTION

### Rationale for Prevention Early in Life

There are 2 main reasons to address obesity prevention before 2 years of age, although only limited information on intervention models exists in this age group. Observational studies suggest that fetal life and the first 2 years of life may be critical periods for the programming of

obesity and related behaviors.<sup>48,99–102</sup> Furthermore, experimental studies suggest that tastes experienced by infants through maternal food choices during pregnancy and breastfeeding or through infant formula can affect long-term taste preferences.<sup>103,104</sup> Epidemiologic data suggest that infants are larger for their length now than in the past, at least for female infants, even though these trends appear to have stabilized in the past few years.

A recent report from the Institute of Medicine, “Early Childhood Obesity Prevention Policies,”<sup>105</sup> made specific recommendations for health care providers as follows.

### **General Principles**

#### *Assess, Monitor, and Track Growth From Birth to Age 5*

Pediatricians and primary care physicians should measure weight and length or height in a standardized way and should plot them on World Health Organization growth charts (ages 0–23 months) or on Centers for Disease Control and Prevention growth charts (ages 24–59 months), as part of every well-child visit. It is recommended to use weight-for-length for children younger than 24 months. In this age range, overweight is defined as weight-for-length >95th percentile.

Pediatricians should consider the following: (1) children’s rate of weight gain, especially as their BMI reaches the 85th and 95th percentiles, and (2) parental weight status as risk factors in assessing which young children are at highest risk of later obesity and its adverse consequences.

#### *Help Adults Increase Physical Activity and Decrease Sedentary Behavior in Young Children*

Pediatricians and other health and education professionals providing guidance to parents of young children and those working with young

children should be trained in ways to increase children’s physical activity and decrease their sedentary behavior as well as how to counsel parents about their children’s physical activity. Pediatricians should counsel parents and children’s caregivers not to permit televisions, computers, or other digital media devices in children’s bedrooms or other sleeping areas.

#### *Help Adults Increase Children’s Healthy Eating*

Pediatricians and other health and education professionals providing guidance to parents of young children and those working with young children should be trained and educated and have the right tools to increase children’s healthy eating and counsel parents about their children’s diet.

#### *Encourage and Support Breastfeeding During Infancy*

Pediatricians and other health and education professionals who work with infants and their families should promote and support exclusive breastfeeding for 6 months and continuation of breastfeeding in conjunction with complementary foods for 1 year or more.

### **Specific Age Groups**

#### *Prenatal Period*

The genetic predisposition toward obesity may account for 40% to 70% of observed obesity.<sup>106</sup> Maternal obesity is one of the strongest and most consistent predictors of childhood obesity.<sup>107</sup> Excessive weight gain during pregnancy is associated with obesity in the offspring.<sup>108</sup> It is, therefore, important for pediatricians to collaborate with their obstetrician colleagues to promote optimal gestational weight gain, as defined by the most recent Institute of Medicine guidelines, in mothers of their patients when they become pregnant again.<sup>109</sup>

Maternal smoking during pregnancy is also a risk factor for early childhood obesity. The promotion of smoking cessation for mothers of pediatric patients who are or plan to become pregnant through education or referral in collaboration with the obstetrician would be of great public health benefit.

The prevention of obesity in women of childbearing age and pregnant women is also important because of the well-known obstetric, fetal, and neonatal complications related to maternal obesity.<sup>107</sup> Because pediatricians often treat several children in a family and interact with women who are or plan to become pregnant, they are in a good position to assist in obesity-prevention and -treatment efforts. In this context, pediatric practitioners can contribute to maternal obesity prevention by working together with their obstetric colleagues, in the context of the medical home, to provide education and referrals, shape beliefs and attitudes, or assist families in modifying their home environment and habits using some of the points identified previously or through other expert recommendations. For example, breastfeeding promotion can contribute to maternal obesity prevention for the next pregnancy, because breastfeeding has been associated with decreased postpartum weight retention.<sup>109,110</sup>

Because of the association of fetal and infant taste exposure with later taste preferences, a healthy and balanced diet should be encouraged in pregnant and lactating women.<sup>103,104</sup> Imprinting taste preferences during fetal life and infancy could indirectly affect the development of obesity through future food choices and diet quality.

#### *Early Infancy*

Almost all observational studies suggest an increased risk of obesity in children who have been formula fed compared with those who were

breastfed.<sup>100,111-114</sup> At least 3 studies of siblings who were discordant for breastfeeding status have been performed.<sup>115-117</sup> Two of them concluded that formula feeding increased the risk of obesity, but the third failed to show an association after taking into consideration these familial factors. The only randomized trial of breastfeeding promotion that assessed weight status during later childhood showed no difference in weight status between groups, despite an increased rate of breastfeeding and demonstration of other benefits of breastfeeding.<sup>118</sup> That said, breastfeeding has so many other health benefits for the mother and children that its promotion is strongly encouraged and should be part of any obesity-prevention program.

Rapid weight gain during infancy has also been associated with an increased risk of obesity later in life in several observational studies. Because of the potential risks associated with restricting weight gain or protein intake during infancy, more research on safety and efficacy is necessary before translating these findings into recommendations. Therefore, close monitoring of infant weight gain and evaluation of dietary intake, food literacy, and misconceptions regarding infant feeding among families of infants who gain excessive weight are warranted. In particular, the introduction of foods other than human milk or formula before approximately 6 months of age should be discouraged.

#### *Weaning Period and Preschool Age*

The period of transition from breastfeeding or formula feeding to a more adult-type diet is potentially important in long-term obesity development. This transition generally occurs between the ages of 9 and 24 months. At the end of this period, young children have often begun patterns of eating that will continue for the rest of their lives. Foods of high calorie and low nutrient

density begin to be consumed in greater quantities and begin to displace foods of low calorie and high nutrient density. Pediatricians are in an excellent position to help families establish a healthful diet during the first 2 years of the child's life. Initially, the focus should be on maintaining exclusive breastfeeding, preferably for 6 months, then maintaining partial breastfeeding until 1 year of age or as long as mutually desired by the mother and child. Formula can be used as a substitute for human milk, if needed. Cow milk should not be introduced until after the first birthday. At that point, it is important for the pediatrician to have a discussion with the parents about the fat content of milk. Low-fat milk is acceptable in the context of an overall healthful diet, especially when there is concern about risk of obesity or the development of cardiovascular disease, on the basis of family history and other risk factors.<sup>119</sup> Earlier concerns, on the basis of case reports of extreme fat restriction, have been diminished by more recent data on the safety of lower-fat diets before the age of 2 years.<sup>120,121</sup> The introduction of other beverages should be considered carefully, because this is a time when sugar-sweetened beverages (including flavored drink mixes and fruit drinks) are often introduced and sometimes become major components of the child's diet. One-hundred percent fruit juice is acceptable in small portions, but fruit is almost always preferable to fruit juice. Water is also an acceptable drink but is not necessary in large quantities for this age group. Other sugar-sweetened beverages should not be consumed by children in this age range.

A healthy pattern of eating includes fruits, vegetables, whole-grain products, low-fat meats, low-fat dairy, and fish. This pattern should be the target as an infant becomes a toddler because of several major benefits. First, it does not require alteration later in life. Second, it provides higher

nutrient density with lower calories. Third, it channels parents into making better decisions regarding the home food environment. This pattern also provides an excellent opportunity for parents to rethink their food and beverage purchases and their own diets. Pediatricians can use the frequency of health maintenance visits during the first 2 years of life as well as their knowledge about diet to have an important effect on obesity prevention for the entire family. The parent as a role model for eating behaviors and improved approaches to parenting with respect to diet should be emphasized. Parents should also be educated that during the preschool years, a new food may need to be offered as often as 15 to 20 times before it is accepted and that they should not conclude too rapidly that the child does not like a food.<sup>122</sup> Parents should be empowered to create a healthy home food environment in the same way they approach poison- and accident-proofing the home for a toddler. Parents should also be encouraged to consider the food and physical activity standards and practices in selecting child care facilities that their children attend.

In the first 2 years of life, overly controlling feeding practices (monitoring, concern, restriction, or pressure to eat) should be discouraged. Observational studies have shown that these practices are associated with obesity and related eating disorders.<sup>123</sup> It should be emphasized that parents should control the food environment but that children should be encouraged to make choices within that healthful environment.

Very little is known regarding physical activity and exposure to sedentary behaviors before age 2, but it is reasonable to assume that parental modeling of physical activity and sedentary behaviors as well as the development of activity-related habits during this early period of life

might have long-term consequences on later activity choices and obesity development. Because of the low likelihood of risk and the substantial potential benefits, the promotion of family physical activity and prevention of sedentary behaviors is warranted even in this early period. The AAP recommends no television watching before 2 years of age and discourages the presence of a television set in children's bedrooms at any age.

### *School Age*

Most of what was discussed in the previous section on individual/clinical approaches to obesity prevention will also benefit school-aged children. However, some aspects are particularly relevant in this age group. Although school lunches and breakfasts have improved and will continue to improve, their quality remains heterogeneous among school districts. Therefore, as suggested previously, families should be encouraged to review school menus and provide alternatives if healthy choices at school are lacking. Parents and health care professionals, such as pediatricians, should be encouraged to join school wellness committees and limit the use of unhealthy foods at school parties and celebrations. School age is also a period when many eating, physical activity, and sedentary habits are established or reinforced and when the effect of parental behavior on child behavior remains large. Therefore, it is important for parents to continue to make efforts to be good role models by having structured meals and family-based physical activities and by limiting their own sedentary activities. School age is also a time when children may interact more with peers and start to make their own decisions about eating and activities without direct parental supervision. The timing of eating periods during the school day may not match the physiologic signals for hunger and mealtimes. This problem

with timing of meals may influence the choice of food and may ultimately influence food habits. It is, therefore, important for parents to monitor and guide children in these choices by discussing on a regular basis the eating and activity choices made by the child outside the home and by praising healthful choices. The pediatrician, again, plays a major role in helping parents develop and maintain good parenting skills.

### *Adolescence and Young Adulthood*

During adolescence, individual/clinical approaches to obesity discussed previously are still pertinent. A few topics, however, require special attention for this age group. The characteristics of adolescent behaviors, such as affirmation of independence, risk taking, and rebellion against authority, all apply to behaviors related to obesity prevention. During adolescence, parents continue to be responsible for supplying a healthy food environment while adolescents make specific choices at any given time/day. Sports and activities that were favorites during childhood may no longer be of interest and are replaced by sedentary activities or electronic social networking. A significant drop in physical activity has been described among girls during this period.<sup>124</sup> Although it is difficult to prevent changes that may be part of normal adolescence, the pediatrician may be able to provide suggestions for healthier alternatives or to minimize the consequences of these changes.

Adolescence is also a period of concern for the development of eating disorders, and this concern can be a barrier for pediatricians and parents to promote healthy lifestyles. Dieting can lead both to eating disorders and to obesity. Although not all adolescents who diet develop an eating disorder, eating disorders often begin with abnormal perception of body shape and dieting.<sup>125,126</sup> The

emphasis should be on the promotion of a healthy lifestyle, not on dieting.

The transition to adulthood may also be a difficult period for obesity prevention.<sup>127</sup> Some young adults who have been involved in athletic activities in high school often drop these activities when entering college or the workforce, without a corresponding decrease in caloric intake. Food availability and eating habits on college campuses are notoriously bad, and alcohol intake contributes to an increase in discretionary calorie intake.<sup>128</sup> For other young adults leaving home to enter the workforce or to start a family, lower income and poor cooking skills are challenges. Pediatricians can assist teenagers who are at risk of excessive weight gain to prepare a plan to remain active and maintain a healthy nutrition while transitioning to adult life.

### **SUMMARY**

The currently available evidence supports the following points:

1. The adoption and maintenance of healthful lifestyles must be emphasized as the basis for the prevention of obesity and other chronic health conditions.
2. Prevention of childhood obesity remains a public health priority, because obesity is the most prevalent chronic health condition in the pediatric population. Although many social sectors need to be mobilized to completely address this problem, pediatric primary care has a unique role to play, should be a resource for the community, and can be an integral part of the solution.
3. To address obesity prevention effectively in clinical practice, pediatricians should become familiar with the complex and interconnected factors that lead to excessive weight gain. They should understand how these

factors play out in a developmental fashion and create important periods for preventive intervention. By better understanding the environmental determinants of obesity, including those that they cannot control, pediatric practitioners can improve their ability to provide recommendations that are relevant to patients and their families.

4. Most prevention strategies that can be used in pediatric practice have not been rigorously tested through scientific research. However, preliminary evidence, indirect evidence, and inferences from other settings provide clues to recommend evidence-informed approaches, especially those with low risk of a negative health effect or with other known health benefits.
5. Although the prevention messages are similar for all pediatric patients, counseling should be tailored to the child's developmental stage and the socioeconomic, cultural, and psychological characteristics of families.
6. Pediatric practice has a critical role in identifying children who are on the path to becoming obese by calculating BMI and plotting it on percentile charts at every health care visit. At-risk children can also be identified through the nutrition, sedentary behavior, and physical activities questions that are part of the *Bright Futures* templates as well as family history.
7. Education and advice alone are unlikely to be effective in most cases for obesity prevention. Pediatricians should, therefore, become familiar with other forms of interventions as they apply to obesity prevention, such as behavior-modification techniques, environment control approaches, or the promotion of

improved parenting skills. They should also become familiar with the resources available in the areas they serve so that they are better suited to help each individual family.

8. There is no evidence for health benefits and some evidence for negative health effects of sweetened beverages (sodas, iced teas, sports drinks, juice drinks). Therefore, health-promotion efforts should aim at removing all sweetened beverages from the diets of children. The ideal beverage for children at all meals and during the day is water. Low-fat or fat-free, preferably unflavored, milk also has an important place in the diet of children beginning at 12 months of age. One hundred percent fruit juice should not be used before 1 year of age and should be limited thereafter. Fruits should be encouraged over fruit juice.
9. Promotion of a diet rich in foods with low caloric density (vegetables, fruits, whole grains, low-fat dairy products, lean meats, lean fishes, legumes) and poor in foods with high caloric density (fat-rich meats, fried foods, baked goods, sweets, cheeses, oil-based sauces) will likely contribute to the prevention of obesity.
10. All forms of sedentary entertainment, including television and newer forms of electronic entertainment or communication, should be excluded for infants and children up to 2 years of age and limited to 2 hours per day for children 2 years and older.
11. Promotion of active play and lifestyle and family- or sports-based moderate to vigorous physical activity for a total of 60 minutes/day is likely to contribute to the prevention of obesity and has multiple additional health benefits.

12. Prevention of childhood obesity should start before 2 years of age by promoting healthy maternal weight beginning in the prenatal period, smoking cessation before pregnancy, appropriate gestational weight gain and diet, breastfeeding and appropriate weight gain in infancy, transition to healthier foods with weaning, elimination of sedentary entertainment, active play for physical activity, and parental role modeling of healthy dietary and physical activity behaviors.

#### LEAD AUTHORS

Stephen R. Daniels, MD, PhD, FAAP  
Sandra G. Hassink, MD, FAAP

#### COMMITTEE ON NUTRITION, 2014–2015

Stephen R. Daniels, MD, PhD, FAAP, Chairperson  
Steven A. Abrams, MD, FAAP  
Mark R. Corkins, MD, FAAP  
Sarah D. de Ferranti, MD, FAAP  
Neville H. Golden, MD, FAAP  
Sheela N. Magge, MD, FAAP  
Sarah Jane Schwarzenberg, MD, FAAP

#### ADDITIONAL CONTRIBUTORS

Jatinder J.S. Bhatia, MD, FAAP, Past Chairperson  
Frank R. Greer, MD, FAAP, Past Chairperson  
Marcie Beth Schneider, MD, FAAP, Former Committee Member  
Janet Silverstein, MD, FAAP, Former Committee Member  
Nicolas Stettler, MD, FAAP, Former Committee Member  
Dan W. Thomas, MD, FAAP, Former Committee Member

#### LIAISONS

Jeff Critch, MD — *Canadian Pediatric Society*  
Laurence Grummer-Strawn, PhD — *Centers for Disease Control and Prevention*  
Rear Admiral Van S. Hubbard, MD, PhD, FAAP — *National Institutes of Health*  
Benson M. Silverman, MD<sup>†</sup> — *Food and Drug Administration*  
Valery Soto, MS, RD, LD — *US Department of Agriculture*

#### STAFF

Debra L. Burrowes, MHA

<sup>†</sup>Deceased.

## APPENDIX: PRACTICAL RESOURCES

- We Can! (contains dietary recommendations, physical activity recommendations, monitoring tools): <http://wecan.nhlbi.nih.gov/>
- Dietary Guidelines for Americans (provides dietary recommendations for children older than 2 years and adults): <http://www.cnpp.usda.gov/dietaryguidelines.htm>
- Choose My Plate (contains dietary recommendations to the public based on the Dietary Guidelines for Americans): <http://www.choosemyplate.gov/>
- BAM! (Contains dietary recommendations, physical activity recommendations, monitoring tools): <http://www.bam.gov/>
- Let's Move! and AAP (contains dietary recommendations, physical activity recommendations and prescription, tips to change home environment): <http://www.letsmove.gov/>
- AAP Institute for Healthy Childhood Weight (provides obesity prevention, management and treatment resources for health professionals, communities, and parents): <http://ihcw.aap.org>
- Exercise Is Medicine (contains recommendations for physicians to include physical activity prescription as part of their practice): <http://www.exerciseismedicine.org/physicians.htm>
- Healthychildren.org (contains dietary recommendations, physical activity recommendations, tips to change home environment, parenting skills advice): <http://www.healthychildren.org/>
- Bright Futures (guidelines for health supervision of infants, children, and adolescents): <http://brightfutures.aap.org/>
- WebMD (contains interactive content for children, teenagers, and parents): [www.fit.webmd.com](http://www.fit.webmd.com)
- Mindless Eating (contains tips to change home environment): <http://www.mindlesseating.org/>
- Calorie King (online and book to calculate calorie-content of foods): <http://www.calorieking.com/>
- Which Helmet for Which Activity? <http://www.cpsc.gov/CPSPUB/PUBS/349.pdf>
- Protect the Ones You Love: Child Injuries Are Preventable: [http://www.cdc.gov/safchild/Sports\\_Injuries/index.html](http://www.cdc.gov/safchild/Sports_Injuries/index.html)

### ABBREVIATION

AAP: American Academy of Pediatrics

## REFERENCES

1. Krebs NF, Jacobson MS; American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112(2):424–430
2. Davis MM, Gance-Cleveland B, Hassink S, Johnson R, Paradis G, Resnicow K. Recommendations for prevention of childhood obesity. *Pediatrics*. 2007;120(suppl 4):S229–S253
3. American Academy of Pediatrics. Promoting healthy weight. In: Hagan JF, Shaw JS, Duncan PM, eds. *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents*. 3rd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2008:109–119
4. Ogden CL, Carroll MD, Curtin LR, Lamb MM, Flegal KM. Prevalence of high body mass index in US children and adolescents, 2007–2008. *JAMA*. 2010;303(3):242–249
5. Obama M. Michelle on a mission [cover story]. *Newsweek*. 2010;155(12):40–41
6. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes*. 2006;1(1):11–25
7. Daniels SR. The consequences of childhood overweight and obesity. *Future Child*. 2006;16(1):47–67
8. US Public Health Service; Office of the Surgeon General; Office of Disease Prevention and Health Promotion; Centers for Disease Control and Prevention; National Institutes of Health. *The Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity*. Rockville, MD: US Department of Health and Human Services, Public Health Service; 2001
9. Institute of Medicine, Committee on Prevention of Obesity in Children and Youth. In: Koplan J, Liverman CT, Kraak VI, eds. *Preventing Childhood Obesity: Health in the Balance*. Washington, DC: National Academies Press; 2005
10. US Department of Health and Human Services. *Healthy People 2010*. Washington, DC: US Department of Health and Human Services; 2000
11. Kumanyika SK, Obarzanek E, Stettler N, et al; American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention. Population-based prevention of obesity: the need for comprehensive promotion of healthful eating, physical activity, and energy balance: a scientific statement from American Heart Association Council on Epidemiology and Prevention, Interdisciplinary Committee for Prevention (formerly the Expert Panel on Population and Prevention Science). *Circulation*. 2008;118(4):428–464
12. Barlow SE; Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(suppl 4):S164–S192
13. Reeves GM, Postolache TT, Snitker S. Childhood obesity and depression: connection between these growing problems in growing children. *Int J Child Health Hum Dev*. 2008;1(2):103–114
14. Kopelman P, Jebb SA, Butland B. Executive Summary: Foresight 'Tackling

- Obesities: Future Choices' project. *Obesity Review*. 2007;3(Suppl 1):vi–ix
15. Institute of Medicine, Committee on Childhood Obesity Prevention Actions for Local Governments. In: Parker L, Burns AC, Sanchez E, eds. *Local Government Actions to Prevent Childhood Obesity*. Washington, DC: National Academies Press; 2009
  16. Frieden TR, Dietz W, Collins J. Reducing childhood obesity through policy change: acting now to prevent obesity. *Health Aff (Millwood)*. 2010;29(3):357–363
  17. Khan LK, Sobush K, Keener D, et al; Centers for Disease Control and Prevention. Recommended community strategies and measurements to prevent obesity in the United States. *MMWR Recomm Rep*. 2009;58(RR-7):1–26
  18. Brownell KD, Kersh R, Ludwig DS, et al. Personal responsibility and obesity: a constructive approach to a controversial issue. *Health Aff (Millwood)*. 2010;29(3):379–387
  19. Kumanyika SK, Brownson RC. *Handbook of Obesity Prevention: A Resource for Health Professionals*. New York, NY: Springer; 2007
  20. American Academy of Pediatrics. Policy opportunities tool. Available at: [http://www2.aap.org/obesity/matrix\\_1.html](http://www2.aap.org/obesity/matrix_1.html). Accessed November 1, 2013
  21. Summerbell CD, Waters E, Edmunds LD, Kelly S, Brown T, Campbell KJ. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2005;3:CD001871
  22. Flynn MA, McNeil DA, Maloff B, et al. Reducing obesity and related chronic disease risk in children and youth: a synthesis of evidence with 'best practice' recommendations. *Obes Rev*. 2006;7(suppl 1):33–56
  23. Doak CM, Visscher TL, Renders CM, Seidell JC. The prevention of overweight and obesity in children and adolescents: a review of interventions and programmes. *Obes Rev*. 2006;7(1):111–136
  24. Council on Sports Medicine and Fitness; Council on School Health. Active healthy living: prevention of childhood obesity through increased physical activity. *Pediatrics*. 2006;117(5):1834–1842
  25. Gahagan S, Silverstein J; American Academy of Pediatrics Committee on Native American Child Health; American Academy of Pediatrics Section on Endocrinology. Prevention and treatment of type 2 diabetes mellitus in children, with special emphasis on American Indian and Alaska Native children. *Pediatrics*. 2003;112(4). Available at: [www.pediatrics.org/cgi/content/full/112/4/e328](http://www.pediatrics.org/cgi/content/full/112/4/e328)
  26. Patrick K, Calfas KJ, Norman GJ, et al. Randomized controlled trial of a primary care and home-based intervention for physical activity and nutrition behaviors: PACE+ for adolescents. *Arch Pediatr Adolesc Med*. 2006;160(2):128–136
  27. Kubik MY, Story M, Davey C, Dudovitz B, Zuehlke EU. Providing obesity prevention counseling to children during a primary care clinic visit: results from a pilot study. *J Am Diet Assoc*. 2008;108(11):1902–1906
  28. 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(5):495–501
  29. Ford BS, McDonald TE, Owens AS, Robinson TN. Primary care interventions to reduce television viewing in African-American children. *Am J Prev Med*. 2002;22(2):106–109
  30. 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(4):630–636
  31. Wake M, Gold L, McCallum Z, Gerner B, Waters E. Economic evaluation of a primary care trial to reduce weight gain in overweight/obese children: the LEAP trial. *Ambul Pediatr*. 2008;8(5):336–341
  32. Wake M, Baur LA, Gerner B, et al. Outcomes and costs of primary care surveillance and intervention for overweight or obese children: the LEAP 2 randomised controlled trial. *BMJ*. 2009;339:b3308
  33. Díaz RG, Esparza-Romero J, Moya-Camarena SY, Robles-Sardín AE, Valencia ME. Lifestyle intervention in primary care settings improves obesity parameters among Mexican youth. *J Am Diet Assoc*. 2010;110(2):285–290
  34. Saelens BE, Sallis JF, Wilfley DE, Patrick K, Cella JA, Buchta R. Behavioral weight control for overweight adolescents initiated in primary care. *Obes Res*. 2002;10(1):22–32
  35. Ewing LJ, Cluss P, Goldstrohm S, et al. Translating an evidence-based intervention for pediatric overweight to a primary care setting. *Clin Pediatr (Phila)*. 2009;48(4):397–403
  36. Siegel RM, Rich W, Joseph EC, et al. A 6-month, office-based, low-carbohydrate diet intervention in obese teens. *Clin Pediatr (Phila)*. 2009;48(7):745–749
  37. Resnicow K, McMaster F, Bocian A, et al. Motivational interviewing and dietary counseling for obesity in primary care: an RCT. *Pediatrics*. 2015;135(4):649–657
  38. Daniels SR, Jacobson MS, McCrindle BW, Eckel RH, Sanner BM. American Heart Association Childhood Obesity Research Summit Report. *Circulation*. 2009;119(15):e489–e517
  39. Kumanyika SK. Cultural differences as influences in obesity treatment. In: Bray GA, Bouchard C, eds. *Handbook of Obesity*. 3rd ed. New York, NY: Informa Healthcare; 2008:45–68
  40. Barton M; US Preventive Services Task Force. Screening for obesity in children and adolescents: US Preventive Services Task Force recommendation statement. *Pediatrics*. 2010;125(2):361–367
  41. de Onis M, Garza C, Onyango AW, Rolland-Cachera MF; Le Comité de Nutrition de la Société Française de Pédiatrie. WHO growth standards for infants and young children [in French]. *Arch Pediatr*. 2009;16(1):47–53
  42. Grummer-Strawn LM, Reinold C, Krebs NF; Centers for Disease Control and Prevention. Use of World Health Organization and CDC growth charts for children aged 0-59 months in the United States. *MMWR Recomm Rep*. 2010;59(RR-9):1–15
  43. Huang JS, Donohue M, Golnari G, et al. Pediatricians' weight assessment and obesity management practices. *BMC Pediatr*. 2009;9:19
  44. Perrin EM, Skinner AC, Steiner MJ. Parental recall of doctor communication of weight status:

- national trends from 1999 through 2008. *Arch Pediatr Adolesc Med.* 2012;166(4):317–322
45. Taveras EM, Rifas-Shiman SL, Belfort MB, Kleinman KP, Oken E, Gillman MW. Weight status in the first 6 months of life and obesity at 3 years of age. *Pediatrics.* 2009;123(4):1177–1183
  46. Taveras EM, Rifas-Shiman SL, Oken E, Gunderson EP, Gillman MW. Short sleep duration in infancy and risk of childhood overweight. *Arch Pediatr Adolesc Med.* 2008;162(4):305–311
  47. Anderson SE, Whitaker RC. Household routines and obesity in US preschool-aged children. *Pediatrics.* 2010;125(3):420–428
  48. Stettler N, Iotova V. Early growth patterns and long-term obesity risk. *Curr Opin Clin Nutr Metab Care.* 2010;13(3):294–299
  49. Dabelea D, Hanson RL, Lindsay RS, et al. Intrauterine exposure to diabetes conveys risks for type 2 diabetes and obesity: a study of discordant sibships. *Diabetes.* 2000;49(12):2208–2211
  50. Bandini LG, Curtin C, Hamad C, Tybor DJ, Must A. Prevalence of overweight in children with developmental disorders in the continuous national health and nutrition examination survey (NHANES) 1999-2002. *J Pediatr.* 2005;146(6):738–743
  51. American Academy of Pediatrics. *Bright Futures Preventive Services Manual.* Elk Grove Village, IL: American Academy of Pediatrics; 2008
  52. American Academy of Pediatrics. *Bright Futures Tool and Resource Kit* [CD-ROM]. Duncan PM, Shaw JS, Gottesman MM, Swanson J, Hagan JF, Pirretti AE, eds. Elk Grove Village, IL: American Academy of Pediatrics; 2010
  53. Li L, Law C, Lo Conte R, Power C. Intergenerational influences on childhood body mass index: the effect of parental body mass index trajectories. *Am J Clin Nutr.* 2009;89(2):551–557
  54. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year outcomes of behavioral family-based treatment for childhood obesity. *Health Psychol.* 1994;13(5):373–383
  55. Robinson TN. Behavioural treatment of childhood and adolescent obesity. *Int J Obes Relat Metab Disord.* 1999;23(suppl 2):S52–S57
  56. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation.* 2005;111(15):1999–2012
  57. Stunkard AJ, Wadden TA. *Obesity: Theory and Therapy.* 2nd ed. New York, NY: Raven Press; 1993
  58. Stuart RB. Behavioral control of overeating. 1967. *Obes Res.* 1996;4(4):411–417
  59. Bandura A. *Social Foundations of Thought and Action: A Social Cognitive Theory.* Englewood Cliffs, NJ: Prentice-Hall; 1986
  60. Epstein LH, Saelens BE. Behavioral economics of obesity: food intake and energy expenditure. In: Bickel WK, Vuchinich RE, eds. *Reframing Health Behavior Change With Behavioral Economics.* Mahwah, NJ: Lawrence Erlbaum; 2000:293–311
  61. Bronfenbrenner U. *The Ecology of Human Development: Experiments by Nature and Design.* Cambridge, MA: Harvard University Press; 1979
  62. Rogers EM. *Diffusion of Innovations.* 4th ed. New York, NY: Free Press; 1995
  63. Foster GD, Sherman S, Borradaile KE, et al. A policy-based school intervention to prevent overweight and obesity. *Pediatrics.* 2008;121(4). Available at: [www.pediatrics.org/cgi/content/full/121/4/e794](http://www.pediatrics.org/cgi/content/full/121/4/e794)
  64. Muckelbauer R, Libuda L, Clausen K, Toschke AM, Reinehr T, Kersting M. Promotion and provision of drinking water in schools for overweight prevention: randomized, controlled cluster trial. *Pediatrics.* 2009;123(4). Available at: [www.pediatrics.org/cgi/content/full/123/4/e661](http://www.pediatrics.org/cgi/content/full/123/4/e661)
  65. James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. *BMJ.* 2004;328(7450):1237
  66. Wansink B. From mindless eating to mindlessly eating better. *Physiol Behav.* 2010;100(5):454–463
  67. McConahy KL, Smiciklas-Wright H, Mitchell DC, Picciano MF. Portion size of common foods predicts energy intake among preschool-aged children. *J Am Diet Assoc.* 2004;104(6):975–979
  68. Rolls BJ, Morris EL, Roe LS. Portion size of food affects energy intake in normal-weight and overweight men and women. *Am J Clin Nutr.* 2002;76(6):1207–1213
  69. Young LR, Nestle M. Expanding portion sizes in the US marketplace: implications for nutrition counseling. *J Am Diet Assoc.* 2003;103(2):231–234
  70. Stettler N, Shelly S. *Living With Obesity.* New York, NY: Facts on File; 2009
  71. Barlow SE, Trowbridge FL, Klish WJ, Dietz WH. Treatment of child and adolescent obesity: reports from pediatricians, pediatric nurse practitioners, and registered dietitians. *Pediatrics.* 2002;110(1 pt 2):229–235
  72. White House Task Force on Childhood Obesity. *Solving the Problem of Childhood Obesity Within a Generation.* Washington, DC: White House Task Force on Childhood Obesity; 2010
  73. Lim S, Zoellner JM, Lee JM, et al. Obesity and sugar-sweetened beverages in African-American preschool children: a longitudinal study. *Obesity (Silver Spring).* 2009;17(6):1262–1268
  74. Ebbeling CB, Feldman HA, Osganian SK, Chomitz VR, Ellenbogen SJ, Ludwig DS. Effects of decreasing sugar-sweetened beverage consumption on body weight in adolescents: a randomized, controlled pilot study. *Pediatrics.* 2006;117(3):673–680
  75. Fiorito LM, Marini M, Francis LA, Smiciklas-Wright H, Birch LL. Beverage intake of girls at age 5 y predicts adiposity and weight status in childhood and adolescence. *Am J Clin Nutr.* 2009;90(4):935–942
  76. Section on Pediatric Dentistry and Oral Health. Preventive oral health intervention for pediatricians. *Pediatrics.* 2008;122(6):1387–1394
  77. American Academy of Pediatrics, Committee on Nutrition. Feeding the child. In: Kleinman RE, Greer FG, eds. *Pediatric Nutrition Handbook.* 7th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2013:143–173
  78. Ludwig DS. Artificially sweetened beverages: cause for concern. *JAMA.* 2009;302(22):2477–2478



79. Fiorito LM, Marini M, Mitchell DC, Smiciklas-Wright H, Birch LL. Girls' early sweetened carbonated beverage intake predicts different patterns of beverage and nutrient intake across childhood and adolescence. *J Am Diet Assoc.* 2010; 110(4):543–550
80. Suez J, Korem T, Zeevi D, et al. Artificial sweeteners induce glucose intolerance by altering the gut microbiota. *Nature.* 2014;514(7521):181–186
81. Kral TV, Rolls BJ. Energy density and portion size: their independent and combined effects on energy intake. *Physiol Behav.* 2004;82(1):131–138
82. Mente A, de Koning L, Shannon HS, Anand SS. A systematic review of the evidence supporting a causal link between dietary factors and coronary heart disease. *Arch Intern Med.* 2009; 169(7):659–669
83. Liang T, Kuhle S, Veugelers PJ. Nutrition and body weights of Canadian children watching television and eating while watching television. *Public Health Nutr.* 2009;12(12):2457–2463
84. Szajewska H, Ruszczynski M. Systematic review demonstrating that breakfast consumption influences body weight outcomes in children and adolescents in Europe. *Crit Rev Food Sci Nutr.* 2010; 50(2):113–119
85. Hoyland A, Dye L, Lawton CL. A systematic review of the effect of breakfast on the cognitive performance of children and adolescents. *Nutr Res Rev.* 2009;22(2):220–243
86. Nielsen SJ, Siega-Riz AM, Popkin BM. Trends in food locations and sources among adolescents and young adults. *Prev Med.* 2002;35(2):107–113
87. Sebastian RS, Wilkinson Enns C, Goldman JD. US adolescents and MyPyramid: associations between fast-food consumption and lower likelihood of meeting recommendations. *J Am Diet Assoc.* 2009;109(2):226–235
88. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA.* 1999;282(16):1561–1567
89. Strasburger VC, Jordan AB, Donnerstein E. Health effects of media on children and adolescents. *Pediatrics.* 2010; 125(4):756–767
90. 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(2):109–115
91. US Department of Health and Human Services; US Department of Agriculture, Dietary Guidelines Advisory Committee. *Dietary Guidelines for Americans, 2005.* 6th ed. Washington, DC: US Government Printing Office; 2005
92. US Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans: Be Active, Healthy, and Happy.* Washington, DC: US Department of Health and Human Services; 2008
93. Halstead ME, Walter KD; American Academy of Pediatrics, Council on Sports Medicine and Clinical report—sport-related concussion in children and adolescents. *Pediatrics.* 2010;126(3):597–615
94. Brenner JS; American Academy of Pediatrics Council on Sports Medicine and Fitness. Overuse injuries, overtraining, and burnout in child and adolescent athletes. *Pediatrics.* 2007; 119(6):1242–1245
95. Rana AR, Michalsky MP, Teich S, Groner JL, Caniano DA, Schuster DP. Childhood obesity: a risk factor for injuries observed at a level-1 trauma center. *J Pediatr Surg.* 2009;44(8):1601–1605
96. Pileggi C, Lotito F, Bianco A, Nobile CG, Pavia M. Relationship between chronic short sleep duration and childhood body mass index: a school-based cross-sectional study. *PLoS ONE.* 2013;8(6): e66680
97. Chen X, Beydoun MA, Wang Y. Is sleep duration associated with childhood obesity? A systematic review and meta-analysis. *Obesity (Silver Spring).* 2008; 16(2):265–274
98. Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. *Obesity (Silver Spring).* 2008;16(3): 643–653
99. Taveras EM, Rifas-Shiman SL, Scanlon KS, Grummer-Strawn LM, Sherry B, Gillman MW. To what extent is the protective effect of breastfeeding on future overweight explained by decreased maternal feeding restriction? *Pediatrics.* 2006;118(6): 2341–2348
100. Owen CG, Martin RM, Whincup PH, Smith GD, Cook DG. Effect of infant feeding on the risk of obesity across the life course: a quantitative review of published evidence. *Pediatrics.* 2005; 115(5):1367–1377
101. Oken E, Levitan EB, Gillman MW. Maternal smoking during pregnancy and child overweight: systematic review and meta-analysis. *Int J Obes (Lond).* 2008;32(2):201–210
102. Ong KK, Loos RJ. Rapid infancy weight gain and subsequent obesity: systematic reviews and hopeful suggestions. *Acta Paediatr.* 2006;95(8):904–908
103. Mennella JA, Forestell CA, Morgan LK, Beauchamp GK. Early milk feeding influences taste acceptance and liking during infancy. *Am J Clin Nutr.* 2009; 90(3):780S–788S
104. Mennella JA, Jagnow CP, Beauchamp GK. Prenatal and postnatal flavor learning by human infants. *Pediatrics.* 2001; 107(6). Available at: [www.pediatrics.org/cgi/content/full/107/6/E88](http://www.pediatrics.org/cgi/content/full/107/6/E88)
105. Institute of Medicine. *Early Childhood Obesity Prevention Policies.* Washington, DC: National Academies Press; 2011
106. Maes HH, Neale MC, Eaves LJ. Genetic and environmental factors in relative body weight and human adiposity. *Behav Genet.* 1997;27(4):325–351
107. Davies GA, Maxwell C, McLeod L, et al; Society of Obstetricians and Gynaecologists of Canada. Obesity in pregnancy. *J Obstet Gynaecol Can.* 2010; 32(2):165–173
108. Wrotniak BH, Shults J, Butts S, Stettler N. Gestational weight gain and risk of overweight in the offspring at age 7 y in a multicenter, multiethnic cohort study. *Am J Clin Nutr.* 2008;87(6):1818–1824
109. Institute of Medicine; National Research Council; Committee to Reexamine IOM Pregnancy Weight Guidelines. *Weight Gain During Pregnancy: Reexamining the Guidelines.* Washington, DC: National Academies Press; 2009
110. Baker JL, Gamborg M, Heitmann BL, Lissner L, Sørensen TI, Rasmussen KM. Breastfeeding reduces postpartum weight retention. *Am J Clin Nutr.* 2008; 88(6):1543–1551
111. Parsons TJ, Power C, Logan S, Summerbell CD. Childhood predictors

- of adult obesity: a systematic review. *Int J Obes Relat Metab Disord*. 1999;23 (suppl 8):S20–S21
112. Koletzko B, von Kries R, Closa R, et al; European Childhood Obesity Trial Study Group. Lower protein in infant formula is associated with lower weight up to age 2 y: a randomized clinical trial. *Am J Clin Nutr*. 2009;89(6):1836–1845
  113. Li R, Fein SB, Grummer-Strawn LM. Association of breastfeeding intensity and bottle-emptying behaviors at early infancy with infants' risk for excess weight at late infancy. *Pediatrics*. 2008; 122(suppl 2):S77–S84
  114. Li R, Fein SB, Grummer-Strawn LM. Do infants fed from bottles lack self-regulation of milk intake compared with directly breastfed infants? *Pediatrics*. 2010;125(6). Available at: [www.pediatrics.org/cgi/content/full/125/6/e1386](http://www.pediatrics.org/cgi/content/full/125/6/e1386)
  115. Nelson MC, Gordon-Larsen P, Adair LS. Are adolescents who were breast-fed less likely to be overweight? Analyses of sibling pairs to reduce confounding. *Epidemiology*. 2005;16(2):247–253
  116. Metzger MW, McDade TW. Breastfeeding as obesity prevention in the United States: a sibling difference model. *Am J Hum Biol*. 2010;22(3):291–296
  117. Gillman MW, Rifas-Shiman SL, Berkey CS, et al. Breast-feeding and overweight in adolescence: within-family analysis [erratum in *Epidemiology*. 2007;18(4): 506]. *Epidemiology*. 2006;17(1):112–114
  118. Kramer MS, Matush L, Vanilovich I, et al; PROBIT Study Group. Effects of prolonged and exclusive breastfeeding on child height, weight, adiposity, and blood pressure at age 6.5 y: evidence from a large randomized trial. *Am J Clin Nutr*. 2007;86(6):1717–1721
  119. Daniels SR, Greer FR; Committee on Nutrition. Lipid screening and cardiovascular health in childhood. *Pediatrics*. 2008;122(1):198–208
  120. Rask-Nissilä L, Jokinen E, Terho P, et al. Neurological development of 5-year-old children receiving a low-saturated fat, low-cholesterol diet since infancy: A randomized controlled trial. *JAMA*. 2000;284(8):993–1000
  121. Niinikoski H, Lapinleimu H, Viikari J, et al. Growth until 3 years of age in a prospective, randomized trial of a diet with reduced saturated fat and cholesterol. *Pediatrics*. 1997;99(5): 687–694
  122. Birch LL. Development of food preferences. *Annu Rev Nutr*. 1999;19: 41–62
  123. Faith MS, Scanlon KS, Birch LL, Francis LA, Sherry B. Parent-child feeding strategies and their relationships to child eating and weight status. *Obes Res*. 2004;12(11):1711–1722
  124. Kimm SY, Glynn NW, Kriska AM, et al. Decline in physical activity in black girls and white girls during adolescence. *N Engl J Med*. 2002;347(10):709–715
  125. Neumark-Sztainer DR, Wall MM, Haines JI, Story MT, Sherwood NE, van den Berg PA. Shared risk and protective factors for overweight and disordered eating in adolescents. *Am J Prev Med*. 2007;33(5): 359–369
  126. Neumark-Sztainer D, Wall M, Story M, Standish AR. Dieting and unhealthy weight control behaviors during adolescence: associations with 10-year changes in body mass index. *J Adolesc Health*. 2012;50(1): 80–86
  127. Gordon-Larsen P, The NS, Adair LS. Longitudinal trends in obesity in the United States from adolescence to the third decade of life. *Obesity (Silver Spring)*. 2010;18(9):1801–1804
  128. Nelson MC, Story M. Food environments in university dorms: 20,000 calories per dorm room and counting. *Am J Prev Med*. 2009;36(6):523–526

**The Role of the Pediatrician in Primary Prevention of Obesity**  
Stephen R. Daniels, Sandra G. Hassink and COMMITTEE ON NUTRITION  
*Pediatrics* 2015;136:e275  
DOI: 10.1542/peds.2015-1558 originally published online June 29, 2015;

**Updated Information & Services**

including high resolution figures, can be found at:  
<http://pediatrics.aappublications.org/content/136/1/e275>

**References**

This article cites 103 articles, 36 of which you can access for free at:  
<http://pediatrics.aappublications.org/content/136/1/e275#BIBL>

**Subspecialty Collections**

This article, along with others on similar topics, appears in the following collection(s):  
**Obesity**  
[http://www.aappublications.org/cgi/collection/obesity\\_new\\_sub](http://www.aappublications.org/cgi/collection/obesity_new_sub)

**Permissions & Licensing**

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:  
<http://www.aappublications.org/site/misc/Permissions.xhtml>

**Reprints**

Information about ordering reprints can be found online:  
<http://www.aappublications.org/site/misc/reprints.xhtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **The Role of the Pediatrician in Primary Prevention of Obesity**

Stephen R. Daniels, Sandra G. Hassink and COMMITTEE ON NUTRITION

*Pediatrics* 2015;136:e275

DOI: 10.1542/peds.2015-1558 originally published online June 29, 2015;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/136/1/e275>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2015 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

