

AMERICAN ACADEMY OF PEDIATRICS

POLICY STATEMENT

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of All Children

Committee on Nutrition

Prevention of Pediatric Overweight and Obesity

ABSTRACT. The dramatic increase in the prevalence of childhood overweight and its resultant comorbidities are associated with significant health and financial burdens, warranting strong and comprehensive prevention efforts. This statement proposes strategies for early identification of excessive weight gain by using body mass index, for dietary and physical activity interventions during health supervision encounters, and for advocacy and research.

ABBREVIATION. BMI, body mass index.

INTRODUCTION

Prevention is one of the hallmarks of pediatric practice and includes such diverse activities as newborn screenings, immunizations, and promotion of car safety seats and bicycle helmets. Documented trends in increasing prevalence of overweight and inactivity mean that pediatricians must focus preventive efforts on childhood obesity, with its associated comorbid conditions in childhood and likelihood of persistence into adulthood. These trends pose an unprecedented burden in terms of children's health as well as present and future health care costs. A number of statements have been published that address the scope of the problem and treatment strategies.¹⁻⁶

The intent of this statement is to propose strategies to foster prevention and early identification of overweight and obesity in children. Evidence to support the recommendations for prevention is presented when available, but unfortunately, too few studies on prevention have been performed. The enormity of the epidemic, however, necessitates this call to action for pediatricians using the best information available.

DEFINITIONS AND DESCRIPTION OF THE PROBLEM

Body mass index (BMI) is the ratio of weight in kilograms to the square of height in meters. BMI is widely used to define overweight and obesity, because it correlates well with more accurate measures of body fatness and is derived from commonly available data—weight and height.⁷ It has also been correlated with obesity-related comorbid conditions in

adults and children. Clinical judgment must be used in applying these criteria to a patient, because obesity refers to excess adiposity rather than excess weight, and BMI is a surrogate for adiposity. The pediatric growth charts for the US population now include BMI for age and gender, are readily available online (<http://www.cdc.gov/growthcharts>), and allow longitudinal tracking of BMI.⁸

BMI between 85th and 95th percentile for age and sex is considered at risk of overweight, and BMI at or above the 95th percentile is considered overweight or obese.^{9,10} The prevalence of childhood overweight and obesity is increasing at an alarming rate in the United States as well as in other developed and developing countries. Prevalence among children and adolescents has doubled in the past 2 decades in the United States. Currently, 15.3% of 6- to 11-year-olds and 15.5% of 12- to 19-year-olds are at or above the 95th percentile for BMI on standard growth charts based on reference data from the 1970s, with even higher rates among subpopulations of minority and economically disadvantaged children.^{10,11} Recent data from the Centers for Disease Control and Prevention also indicate that children younger than 5 years across all ethnic groups have had significant increases in the prevalence of overweight and obesity.^{12,13} American children and adolescents today are less physically active as a group than were previous generations, and less active children are more likely to be overweight and to have higher blood pressure, insulin and cholesterol concentrations and more abnormal lipid profiles.^{14,15}

Obesity is associated with significant health problems in the pediatric age group and is an important early risk factor for much of adult morbidity and mortality.^{15,16} Medical problems are common in obese children and adolescents and can affect cardiovascular health (hypercholesterolemia and dyslipidemia, hypertension),^{14,17-19} the endocrine system (hyperinsulinism, insulin resistance, impaired glucose tolerance, type 2 diabetes mellitus, menstrual irregularity),²⁰⁻²² and mental health (depression, low self-esteem).^{23,24} Because of the increasing incidence of type 2 diabetes mellitus among obese adolescents and because diabetes-related morbidities may worsen if diagnosis is delayed, the clinician should be alert to the possibility of type 2 diabetes mellitus in all obese adolescents, especially those with a fam-

PEDIATRICS (ISSN 0031 4005). Copyright © 2003 by the American Academy of Pediatrics.

ily history of early-onset (younger than 40 years) type 2 diabetes mellitus.²⁵ The psychological stress of social stigmatization imposed on obese children may be just as damaging as the medical morbidities. The negative images of obesity are so strong that growth failure and pubertal delay have been reported in children practicing self-imposed caloric restriction because of fears of becoming obese.²⁶ Other important complications and associations include pulmonary (asthma, obstructive sleep apnea syndrome, pickwickian syndrome),^{27–32} orthopedic (genu varum, slipped capital femoral epiphysis),^{33,34} and gastrointestinal/hepatic (nonalcoholic steatohepatitis)³⁵ complications. All these disturbances are seen at an increased rate in obese individuals and have become more common in the pediatric population. The probability of childhood obesity persisting into adulthood is estimated to increase from approximately 20% at 4 years of age to approximately 80% by adolescence.³⁶ In addition, it is probable that comorbidities will persist into adulthood.^{16,37} Thus, the potential future health care costs associated with pediatric obesity and its comorbidities are staggering, prompting the surgeon general to predict that preventable morbidity and mortality associated with obesity may exceed those associated with cigarette smoking.^{10,38}

Although treatment approaches for pediatric obesity may be effective in the short term,^{39–44} long-term outcome data for successful treatment approaches are limited.^{45,46} The intractable nature of adult obesity is well known. Therefore, it is incumbent on the pediatric community to take a leadership role in prevention and early recognition of pediatric obesity.

RISK FACTORS

Development of effective prevention strategies mandates that physicians recognize populations and individuals at risk. Interactions between genetic, biological, psychologic, sociocultural, and environmental factors clearly are evident in childhood obesity. Elucidation of hormonal and neurochemical mechanisms that promote the energy imbalance that generates obesity has come from molecular genetics and neurochemistry. Knowledge of the genetic basis of differences in the complex of hormones and neurotransmitters (including growth hormone, leptin, ghrelin, neuropeptide Y, melanocortin, and others) that are responsible for regulating satiety, hunger, lipogenesis, and lipolysis as well as growth and reproductive development will eventually refine our understanding of risk of childhood overweight and obesity and may lead to more effective therapies.^{47,48}

Genetic conditions known to be associated with propensity for obesity include Prader-Willi syndrome, Bardet-Biedl syndrome, and Cohen syndrome. In these conditions, early diagnosis allows collaboration with subspecialists, such as geneticists, endocrinologists, behavioralists, and nutritionists, to optimize growth and development while promoting healthy eating and activity patterns from a young age. For example, data suggest that growth hormone may improve some of the signs of Prader-Willi syndrome.^{49–51}

It has long been recognized that obesity “runs in

families”—high birth weight, maternal diabetes, and obesity in family members all are factors—but there are likely to be multiple genes and a strong interaction between genetics and environment that influence the degree of adiposity.^{47,48,52,53} For young children, if 1 parent is obese, the odds ratio is approximately 3 for obesity in adulthood, but if both parents are obese, the odds ratio increases to more than 10. Before 3 years of age, parental obesity is a stronger predictor of obesity in adulthood than the child’s weight status.⁵⁴ Such observations have important implications for recognition of risk and routine anticipatory guidance that is directed toward healthy eating and activity patterns in families.

There are critical periods of development for excessive weight gain. Extent and duration of breastfeeding have been found to be inversely associated with risk of obesity in later childhood, possibly mediated by physiologic factors in human milk as well as by the feeding and parenting patterns associated with nursing.^{55–58} Investigations of dietary factors in infancy, such as high protein intake or the timing of introduction of complementary foods, have not consistently revealed effects on childhood obesity. It has been known for decades that adolescence is another critical period for development of obesity.⁵⁹ The normal tendency during early puberty for insulin resistance may be a natural cofactor for excessive weight gain as well as various comorbidities of obesity.⁶⁰ Early menarche is clearly associated with degree of overweight, with a twofold increase in rate of early menarche associated with BMI greater than the 85th percentile.⁶¹ The risk of obesity persisting into adulthood is higher among obese adolescents than among younger children.⁵⁴ The roles of leptin, adiponectin, ghrelin, fat mass, and puberty on development of adolescent obesity are being actively investigated. Data suggest that adolescents who engage in high-risk behaviors, such as smoking, ethanol use, and early sexual experimentation also may be at greater risk of poor dietary and exercise habits.⁶²

Environmental risk factors for overweight and obesity, including family and parental dynamics, are numerous and complicated. Although clinical interventions cannot change these factors directly, they can influence patients’ adaptations to them, and the physician can advocate for change at the community level. Food insecurity may contribute to the inverse relation of obesity prevalence with socioeconomic status, but the relationship is a complex one.⁶³ Other barriers low-income families may face are lack of safe places for physical activity and lack of consistent access to healthful food choices, particularly fruits and vegetables. Low cognitive stimulation in the home, low socioeconomic status, and maternal obesity all predict development of obesity.⁶⁴ In research settings, there is accumulating evidence for the detrimental effects of overcontrolling parental behavior on children’s ability to self-regulate energy intake. For example, maternal-child feeding practices, maternal perception of daughter’s risk of overweight,⁶⁵ maternal restraint, verbal prompting to eat at mealtime, attentiveness to noneating behavior, and close parental monitoring⁶⁶ all may promote undesired

consequences for children's eating behaviors. Parental food choices influence child food preferences,⁶⁷ and degree of parental adiposity is a marker for children's fat preferences.⁶⁸ Children and adolescents of lower socioeconomic status have been reported to be less likely to eat fruits and vegetables and to have a higher intake of total and saturated fat.⁶⁹⁻⁷¹ Absence of family meals is associated with lower fruit and vegetable consumption as well as consumption of more fried food and carbonated beverages. Although our understanding of the development of eating behaviors is improving, there are not yet good trials to demonstrate effective translation of this knowledge base into clinical practices to prevent obesity. At a minimum, however, pediatricians need to proactively discuss and promote healthy eating behaviors for children at an early age and empower parents to promote children's ability to self-regulate energy intake while providing appropriate structure and boundaries around eating.

Widespread and profound societal changes during the last several decades have affected child rearing, which in turn has affected childhood patterns of physical activity as well as diet. National survey data indicate that children are currently less active than they have been in previous surveys. Leisure activity is increasingly sedentary, with wide availability of entertainment such as television, videos, and computer games. In addition, with increasing urbanization, there has been a decrease in frequency and duration of physical activities of daily living for children, such as walking to school and doing household chores. Changes in availability and requirements of school physical education programs have also generally decreased children's routine physical activity, with the possible exception of children specifically enrolled in athletic programs. All these factors play a potential part in the epidemic of overweight.⁷²

National survey data indicate that 20% of US children 8 to 16 years of age reported 2 or fewer bouts of vigorous physical activity per week, and more than 25% watched at least 4 hours of television per day.⁷³ Children who watched 4 or more hours of television per day had significantly greater BMI, compared with those watching fewer than 2 hours per day.⁷³ Furthermore, having a television in the bedroom has been reported to be a strong predictor of being overweight, even in preschool-aged children.⁷⁴ Some cross-sectional data have found significant correlation between obesity prevalence and television viewing,⁷⁵⁻⁷⁷ but others have not.^{78,79} The results of a randomized trial to decrease television viewing for school-aged children has provided the strongest evidence to support the role of limiting television in prevention of obesity. In this study, decreasing "media use" without specifically promoting more active behaviors in the intervention group resulted in a significantly lower increase in BMI at the 1-year follow-up, compared with the control group.⁸⁰ Additional support for the importance of decreasing television viewing comes from controlled investigations that demonstrated that obese children who were reinforced for decreasing sedentary activity (and following an energy-restricted diet) had significantly

greater weight loss than those who were reinforced for increasing physical activity.⁴² These findings have important implications for anticipatory guidance and provide additional support for recommendations to limit television exposure for young children.²

EARLY RECOGNITION

Routine assessments of eating and activity patterns in children and recognition of excessive weight gain relative to linear growth are essential throughout childhood. At any age, an excessive rate of weight gain relative to linear growth should be recognized, and underlying predisposing factors should be addressed with parents and other caregivers. The Centers for Disease Control and Prevention percentile grids for BMI are important tools for anticipatory guidance and discussion of longitudinal tracking of a child's BMI. Significant changes on growth patterns (eg, upward crossing of weight for age or BMI percentiles) can be recognized and addressed before children are severely overweight.⁸¹ An increase in BMI percentiles should be discussed with parents, some of whom may be overly concerned and some of whom may not recognize or accept potential risk.⁸²

Although data are extremely limited, it is likely that anticipatory guidance or treatment intervention before obesity has become severe will be more successful. Discussions to raise parental awareness should be conducted in a nonjudgmental, blame-free manner so that unintended negative impact on the child's self-concept is avoided.²⁴ Data from adult patient surveys indicate that those who were asked by their physician about diet were more likely to report positive changes.⁸³ Similarly, the efficacy of physicians discussing physical activity,⁸⁴ breastfeeding,⁸⁵ and smoking prevention⁸⁶ is well documented. Thus, pediatricians are strongly encouraged to incorporate assessment and anticipatory guidance about diet, weight, and physical activity into routine clinical practice, being careful to discuss habits rather than focusing on habitus to avoid stigmatizing the child, adolescent, or family.

ADVOCACY

Abundant opportunities exist for pediatricians to take a leadership role in this critical area of child health, including action in the following areas: opportunities for physical activity, the food supply, research, and third-party reimbursement. Change is desperately needed in opportunities for physical activity in child care centers, schools, after-school programs, and other community settings. As leaders in their communities, pediatricians can be effective advocates for health- and fitness-promoting programs and policies. Foods that are nutrient rich and palatable yet low in excess energy from added sugars and fat need to be readily available to parents, school and child care food services, and others responsible for feeding children. Potential affordable sources include community gardens and farmers' market projects. Advertising and promotion of energy-dense, nutrient-poor food products to children may need to be regulated or curtailed. The increase in

carbonated beverage intake has been linked to obesity⁸⁷; therefore, the sale of such beverages should not be promoted at school. Pediatricians are encouraged to work with school administrators and others in the community on ways to decrease the availability of foods and beverages with little nutritional value and to decrease the dependence on vending machines, snack bars, and school stores for school revenue. Regarding physical activity, advocacy is sorely needed for physical education programs that emphasize and model learning of daily activities for personal fitness (as opposed to physical education limited to a few team sports).

New initiatives for pilot projects to test prevention strategies have been funded by the National Institutes of Health and other organizations, but a long-term commitment of substantial funds from many sources and to many disciplines will be needed to attack this serious, widespread, and potentially intractable problem. Support for development and testing of primary prevention strategies for the primary care setting will be critical. Likewise, investment of substantial resources will be required for development of effective treatment approaches for normalizing or improving body weight and fitness and for determining long-term effects of weight loss on comorbidities of childhood obesity. Collaboration and coalitions with nutrition, behavioral health, physical therapy, and exercise physiology professionals will be needed. Working with communities and schools to develop needed counseling services, physical activity opportunities, and strategies to reinforce the gains made in clinical management is also important.

Pediatric referral centers will need to develop specialized programs for treatment of complex and difficult cases, and for research into etiology and new methods of prevention and treatment. Efforts are needed to ensure adequate health care coverage for preventive and treatment services. Even when serious comorbidities are documented, insurance reimbursement is limited.⁸⁸ Lack of reimbursement is a disincentive for physicians to develop prevention and treatment programs and presents a significant barrier to families seeking professional care.

SUMMARY/CONCLUSIONS

1. Prevalence of overweight and its significant comorbidities in pediatric populations has rapidly increased and reached epidemic proportions.
 2. Prevention of overweight is critical, because long-term outcome data for successful treatment approaches are limited.
 3. Genetic, environmental, or combinations of risk factors predisposing children to obesity can and should be identified.
 4. Early recognition of excessive weight gain relative to linear growth should become routine in pediatric ambulatory care settings. BMI (kg/m^2 [see <http://www.cdc.gov/growthcharts>]) should be calculated and plotted periodically.
 5. Families should be educated and empowered through anticipatory guidance to recognize the impact they have on their children's development of lifelong habits of physical activity and nutritious eating.
6. Dietary practices should be fostered that encourage moderation rather than overconsumption, emphasizing healthful choices rather than restrictive eating patterns.
 7. Regular physical activity should be consciously promoted, prioritized, and protected within families, schools, and communities.
 8. Optimal approaches to prevention need to combine dietary and physical activity interventions.
 9. Advocacy is needed in the areas of physical activity and food policy for children; research into pathophysiology, risk factors, and early recognition and management of overweight and obesity; and improved insurance coverage and third-party reimbursement for obesity care.

RECOMMENDATIONS

1. Health supervision
 - a. Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
 - b. Calculate and plot BMI once a year in all children and adolescents.
 - c. Use change in BMI to identify rate of excessive weight gain relative to linear growth.
 - d. Encourage, support, and protect breastfeeding.
 - e. Encourage parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains; encouraging children's autonomy in self-regulation of food intake and setting appropriate limits on choices; and modeling healthy food choices.
 - f. Routinely promote physical activity, including unstructured play at home, in school, in child care settings, and throughout the community.
 - g. Recommend limitation of television and video time to a maximum of 2 hours per day.
 - h. Recognize and monitor changes in obesity-associated risk factors for adult chronic disease, such as hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome.
2. Advocacy
 - a. Help parents, teachers, coaches, and others who influence youth to discuss health habits, not body habitus, as part of their efforts to control overweight and obesity.
 - b. Enlist policy makers from local, state, and national organizations and schools to support a healthful lifestyle for all children, including proper diet and adequate opportunity for regular physical activity.
 - c. Encourage organizations that are responsible for health care and health care financing to provide coverage for effective obesity prevention and treatment strategies.
 - d. Encourage public and private sources to direct funding toward research into effective strategies to prevent overweight and obesity and to maximize limited family and community re-

sources to achieve healthful outcomes for youth.

- e. Support and advocate for social marketing intended to promote healthful food choices and increased physical activity.

COMMITTEE ON NUTRITION, 2002–2003

*Nancy F. Krebs, MD, Chairperson

Robert D. Baker, Jr, MD, PhD

Frank R. Greer, MD

Melvin B. Heyman, MD

Tom Jaksic, MD, PhD

Fima Lifshitz, MD

*Marc S. Jacobson, MD

Past Committee Member

LIAISONS

Donna Blum-Kemelor, MS, RD

US Department of Agriculture

Margaret P. Boland, MD

Canadian Paediatric Society

William Dietz, MD, PhD

Centers for Disease Control and Prevention

Van S. Hubbard, MD, PhD

National Institute of Diabetes and Digestive and

Kidney Diseases

Elizabeth Yetley, PhD

US Food and Drug Administration

STAFF

Pamela Kanda, MPH

*Lead authors

REFERENCES

1. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Promotion of healthy weight-control practices in young athletes. *Pediatrics*. 1996;97:752–753
2. American Academy of Pediatrics, Committee on Public Education. Children, adolescents, and television. *Pediatrics*. 2001;107:423–426
3. American Dietetic Association. Position of the American Dietetic Association. Dietary guidance for healthy children aged 2 to 11 years. *J Am Diet Assoc*. 1999;99:93–101
4. Gidding SS, Leibel RL, Daniels S, Rosenbaum M, Van Horn L, Marx GR. Understanding obesity in youth. A statement for healthcare professionals from the Committee on Atherosclerosis and Hypertension in the Young of the Committee on Cardiovascular Disease in the Young and Nutrition Committee, American Heart Association. *Circulation*. 1996;94:3383–3387
5. American Medical Association, Council on Scientific Affairs. *Obesity as a Major Public Health Problem*. Chicago, IL: American Medical Association; 1999. Available at: <http://www.ama-assn.org/meetings/public/annual99/reports/csa/rtf/csa6.rtf>. Accessed September 4, 2002
6. Barlow SE, Dietz WH. Obesity evaluation and treatment: expert committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. *Pediatrics*. 1998;102(3). Available at: <http://www.pediatrics.org/cgi/content/full/102/3/e29>
7. Pietrobelli A, Faith MS, Allison DB, Gallagher D, Chiumello G, Heymsfield SB. Body mass index as a measure of adiposity among children and adolescents: a validation study. *J Pediatr*. 1998;132:204–210
8. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, et al. CDC growth charts: United States. *Adv Data*. 2000 Jun 8;(314):1–27
9. Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. *Am J Clin Nutr*. 1994;59:307–316
10. US Dept Health and Human Services. *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, Office of the Surgeon General; 2001
11. Ogden CL, Flegal KM, Carroll MD, Johnson CL. Prevalence and trends in overweight among US children and adolescents, 1999–2000. *JAMA*. 2002;288:1728–1732
12. Mei Z, Scanlon KS, Grummer-Strawn LM, Freedman DS, Yip R, Trowbridge FL. Increasing prevalence of overweight among US low-income preschool children: The Centers for Disease Control and Prevention Pediatric Nutrition Surveillance, 1983 to 1995. *Pediatrics*. 1998;101(1). Available at: <http://www.pediatrics.org/cgi/content/full/101/1/e12>
13. Ogden CL, Troiano RP, Briefel RR, Kuczmarski RJ, Flegal KM, Johnson CL. Prevalence of overweight among preschool children in the United States, 1971 through 1994. *Pediatrics*. 1997;99(4). Available at: <http://www.pediatrics.org/cgi/content/full/99/4/e1>
14. Gidding SS, Bao W, Srinivasan SR, Berenson GW. Effects of secular trends in obesity on coronary risk factors in children: the Bogalusa Heart Study. *J Pediatr*. 1995;127:868–874
15. Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa heart study. *Pediatrics*. 1999;103:1175–1182
16. Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med*. 1992;327:1350–1355
17. Clarke WR, Woolson RF, Lauer RM. Changes in ponderosity and blood pressure in childhood: the Muscatine Study. *Am J Epidemiol*. 1986;124:195–206
18. Johnson AL, Cornoni JC, Cassel JC, Tyroler HA, Heyden S, Hames CG. Influence of race, sex and weight on blood pressure behavior in young adults. *Am J Cardiol*. 1975;35:523–530
19. Morrison JA, Laskerzewski PM, Rauh JL, et al. Lipids, lipoproteins, and sexual maturation during adolescence: the Princeton Maturation Study. *Metabolism*. 1979;28:641–649
20. Shinha R, Fisch G, Teague B, et al. Prevalence of impaired glucose tolerance among children and adolescents with marked obesity. *N Engl J Med*. 2002;346:802–810
21. Pinhas-Hamiel O, Dolan LM, Daniels SR, Standiford D, Khoury PR, Zeitler P. Increased incidence of non-insulin-dependent diabetes mellitus among adolescents. *J Pediatr*. 1996;128:608–615
22. Richards GE, Cavallo A, Meyer WJ III, et al. Obesity, acanthosis nigricans, insulin resistance, and hyperandrogenemia: pediatric perspective and natural history. *J Pediatr*. 1985;107:893–897
23. Strauss RS. Childhood obesity and self-esteem. *Pediatrics*. 2000;105(1). Available at: <http://www.pediatrics.org/cgi/content/full/105/1/e15>
24. Davison KK, Birch LL. Weight status, parent reaction, and self-concept in five-year-old girls. *Pediatrics*. 2001;107:46–53
25. Mitchell BD, Kammerer CM, Reinhart LJ, Stern MP. NIDDM in Mexican-American families. Heterogeneity by age of onset. *Diabetes Care*. 1994;17:567–573
26. Pugliese MT, Lifshitz F, Grad G, Fort P, Marks-Katz M. Fear of obesity. A cause of short stature and delayed puberty. *N Engl J Med*. 1983;309:513–518
27. American Academy of Pediatrics, Section on Pediatric Pulmonology, Subcommittee on Obstructive Sleep Apnea Syndrome. Clinical practice guideline: diagnosis and management of childhood obstructive sleep apnea syndrome. *Pediatrics*. 2002;109:704–712
28. Rodriguez MA, Winkleby MA, Ahn D, Sundquist J, Kraemer HC. Identification of population subgroups of children and adolescents with high asthma prevalence: findings from the Third National Health and Nutrition Examination Survey. *Arch Pediatr Adolesc Med*. 2002;156:269–275
29. Riley DJ, Santiago TV, Edelman NH. Complications of obesity-hypoventilation syndrome in childhood. *Am J Dis Child*. 1976;130:671–674
30. Boxer GH, Bauer AM, Miller BD. Obesity-hypoventilation in childhood. *J Am Acad Child Adolesc Psychiatry*. 1988;27:552–558
31. Mallory GB Jr, Fiser DH, Jackson R. Sleep-associated breathing disorders in obese children and adolescents. *J Pediatr*. 1989;115:892–897
32. Silvestri JM, Weese-Mayer DE, Bass MT, Kenny AS, Hauptman SA, Pearsall SM. Polysomnography in obese children with a history of sleep-associated breathing disorders. *Pediatr Pulmonol*. 1993;16:124–129
33. Dietz WH, Gross WL, Kirkpatrick JA Jr. Blount disease (tibia vara): another skeletal disorder associated with childhood obesity. *J Pediatr*. 1982;101:735–737
34. Loder RT, Aronson DD, Greenfield ML. The epidemiology of bilateral slipped capital femoral epiphysis. A study of children in Michigan. *J Bone Joint Surg*. 1993;75:1141–1147
35. Rashid M, Roberts EA. Nonalcoholic steatohepatitis in children. *J Pediatr Gastroenterol Nutr*. 2000;30:48–53
36. Guo SS, Chumlea WC. Tracking of body mass index in children in relation to overweight in adulthood. *Am J Clin Nutr*. 1999;70(suppl):1455–1485
37. Wisemandle W, Maynard LM, Guo SS, Siervogel RM. Childhood

- weight, stature, and body mass index among never overweight, early-onset overweight and late-onset overweight groups. *Pediatrics*. 2000;106(1). Available at: <http://www.pediatrics.org/cgi/content/full/106/1/e14>
38. Wolf AM, Colditz GA. Current estimates of the economic cost of obesity in the United States. *Obes Res*. 1998;6:97-106
 39. Becque MD, Katch VL, Rocchini AP, Marks CR, Moorehead C. Coronary risk incidence of obese adolescents: reduction by exercise plus diet intervention. *Pediatrics*. 1988;81:605-612
 40. Sothorn MS, von Almen TK, Schumacher H, et al. An effective multidisciplinary approach to weight reduction in youth. *Ann N Y Acad Sci*. 1993;699:292-294
 41. Jacobson MS, Copperman N, Haas T, Shenker IR. Adolescent obesity and cardiovascular risk: a rational approach to management. *Ann N Y Acad Sci*. 1993;699:220-229
 42. Epstein LH, Myers MD, Raynor HA, Saelens BE. Treatment of pediatric obesity. *Pediatrics*. 1998;101(suppl):554-570
 43. Harrell JS, Gansky SA, McMurray RG, Bangdiwala SI, Frauman AC, Bradley CB. School-based interventions improve heart health in children with multiple cardiovascular disease risk factors. *Pediatrics*. 1998;102:371-380
 44. Willi SM, Oexamn MJ, Wright NM, Collup NA, Key LL Jr. The effects of a high protein, low-fat, ketogenic diet on adolescents with morbid obesity: body composition, blood chemistries, and sleep abnormalities. *Pediatrics*. 1998;101:61-67
 45. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioral family-based treatment for obese children. *JAMA*. 1990;264:2519-2523
 46. Wadden TA, Foster GD, Letizia KA. One-year behavioral treatment of obesity: comparison of moderate and severe caloric restriction and the effects of weight maintenance therapy. *J Consult Clin Psychol*. 1994;62:165-171
 47. Rosenbaum M, Leibel RL, Hirsch J. Obesity. *N Engl J Med*. 1997;337:396-407
 48. Rosenbaum M, Leibel RL. The physiology of body weight regulation: relevance to the etiology of obesity in children. *Pediatrics*. 1998;101(suppl):525-539
 49. Ritzen EM, Lindgren AC, Hagenas L, Marcus C, Muller J, Blichfeldt S. Growth hormone treatment of patients with Prader-Willi syndrome. Swedish Growth Hormone Advisory Group. *J Pediatr Endocrinol Metab*. 1999 Apr;12(suppl 1):345-349
 50. Whitman BY, Myers S, Carrel A, Allen D. The behavioral impact of growth hormone treatment for children and adolescents with Prader-Willi syndrome: a 2-year, controlled study. *Pediatrics*. 2002;109(2). Available at: <http://www.pediatrics.org/cgi/content/full/109/2/e35>
 51. Carrel AL, Myers SE, Whitman BY, Allen DB. Sustained benefits of growth hormone on body composition, fat utilization, physical strength and agility, and growth in Prader-Willi syndrome are dose-dependent. *J Pediatr Endocrinol Metab*. 2001;14:1097-1105
 52. Stunkard AJ, Harris JR, Pedersen NL, McClearn GE. The body mass index of twins who have been reared apart. *N Engl J Med*. 1990;322:1483-1487
 53. Bouchard C, Tremblay A, Despres JP, et al. The response to long-term overfeeding in identical twins. *N Engl J Med*. 1990;322:1477-1482
 54. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med*. 1997;337:869-873
 55. Agras SW, Kraemer HC, Berkowitz RI, Hammer LD. Influence of early feeding style on adiposity at 6 years of age. *J Pediatr*. 1990;116:805-809
 56. von Kries R, Koletzko B, Sauerwald T, et al. Breast feeding and obesity: cross sectional study. *BMJ*. 1999;319:147-150
 57. Gilman MW, Rifas-Shiman SL, Camargo CA Jr, et al. Risk of overweight among adolescents who were breastfed as infants. *JAMA*. 2001;285:2461-2467
 58. Hediger ML, Overpeck MD, Kuczmarski RJ, Ruan WJ. Association between infant breastfeeding and overweight in young children. *JAMA*. 2001;285:2453-2460
 59. Heald FP. Natural history and physiological basis of adolescent obesity. *Fed Proc*. 1966;25:1-3
 60. Travers SH, Jeffers BW, Bloch CA, Hill JO, Eckel RH. Gender and Tanner stage differences in body composition and insulin sensitivity in early pubertal children. *J Clin Endocrinol Metab*. 1995;80:172-178
 61. Adair LS, Gordon-Larsen P. Maturation timing and overweight prevalence in US adolescent girls. *Am J Public Health*. 2001;91:642-644
 62. Irwin CE Jr, Igra V, Eyre S, Millstein S. Risk-taking behavior in adolescents: the paradigm. *Ann N Y Acad Sci*. 1997;817:1-35
 63. Alaimo K, Olson CM, Frongillo EA Jr. Low family income and food insufficiency in relation to overweight in US children: is there a paradox? *Arch Pediatr Adolesc Med*. 2001;155:1161-1167
 64. Strauss RS, Knight J. Influence of the home environment on the development of obesity in children. *Pediatrics*. 1999;103(6). Available at: <http://www.pediatrics.org/cgi/content/full/103/6/e85>
 65. Birch LL, Fisher JO. Mothers' child-feeding practices influence daughters' eating and weight. *Am J Clin Nutr*. 2000;71:1054-1061
 66. Klesges RC, Stein RJ, Eck LH, Isbell TR, Klesges LM. Parental influence on food selection in young children and its relationships to childhood obesity. *Am J Clin Nutr*. 1991;53:859-864
 67. Ray JW, Klesges RC. Influences on the eating behavior of children. *Ann N Y Acad Sci*. 1993;699:57-69
 68. Fisher JO, Birch LL. Fat preferences and fat consumption of 3- to 5-year-old children are related to parental adiposity. *J Am Diet Assoc*. 1995;95:759-764
 69. Neumark-Sztainer D, Story M, Resnick MD, Blum RW. Correlates of inadequate fruit and vegetable consumption among adolescents. *Prev Med*. 1996;25:497-505
 70. Krebs-Smith SM, Cook A, Subar AF, Cleveland L, Friday J, Kahle LL. Fruit and vegetable intakes of children and adolescents in the United States. *Arch Pediatr Adolesc Med*. 1996;150:81-86
 71. Kennedy E, Powell R. Changing eating patterns of American children: a view from 1996. *J Am Coll Nutr*. 1997;16:524-529
 72. Berkey CS, Rockett HR, Field AE, et al. Activity dietary intake, and weight changes in a longitudinal study of preadolescent and adolescent boys and girls. *Pediatrics*. 2000;105(4). Available at: <http://www.pediatrics.org/cgi/content/full/105/4/e56>
 73. Anderson RE, Crespo CJ, Bartlett SJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fitness among children: results from the Third National Health and Nutrition Examination Survey. *JAMA*. 1998;279:938-942
 74. Dennison BA, Erb TA, Jenkins PL. Television viewing and television in bedroom associated with overweight risk among low-income preschool children. *Pediatrics*. 2002;109:1028-1035
 75. Pate RR, Ross JG. The National Children and Youth Fitness Study II: factors associated with health-related fitness. *J Physical Educ Recreation Dance*. 1987;58:93-96
 76. Dietz WH Jr, Gortmaker SL. Do we fatten our children at the TV set? Obesity and television viewing in children and adolescents. *Pediatrics*. 1995;75:807-812
 77. Gortmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. *Arch Pediatr Adolesc Med*. 1996;150:356-362
 78. Tucker LA. The relationship of television viewing to physical fitness and obesity. *Adolescence*. 1986;21:797-806
 79. Robinson TN, Hammer LD, Killen JD, et al. Does television viewing increase obesity and reduce physical activity? Cross-sectional and longitudinal analyses among adolescent girls. *Pediatrics*. 1993;91:273-280
 80. Robinson T. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA*. 1999;282:1561-1567
 81. Miller LA, Grunwald G, Johnson SL, Krebs NF. Disease severity at time of referral for pediatric failure to thrive and obesity: time for a paradigm shift? *J Pediatr*. 2002;141:121-124
 82. Jain A, Sherman SN, Chamberlin DL, Carter Y, Powers SW, Whitaker RC. Why don't low-income mothers worry about their preschoolers being overweight? *Pediatrics*. 2001;107:1138-1146
 83. Nawaz H, Adams ML, Katz DL. Physician-patient interactions regarding diet, exercise, and smoking. *Prev Med*. 2000;31:652-657
 84. Calfas KJ, Long BJ, Sallis JF, Wooten WJ, Pratt M, Patrick K. A controlled trial of physician counseling to promote the adoption of physical activity. *Prev Med*. 1996;25:225-233
 85. Lu MC, Lange L, Slusser W, Hamilton J, Halfon N. Provider encouragement of breast-feeding: evidence from a national survey. *Obstet Gynecol*. 2001;97:290-295
 86. Epps RP, Manley MW. The clinician's role in preventing smoking initiation. *Med Clin North Am*. 1992;76:439-449
 87. Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis. *Lancet*. 2001;357:505-508
 88. Tershakovec AM, Watson MH, Wenner WJ Jr, Marx AL. Insurance reimbursement for the treatment of obesity in children. *J Pediatr*. 1999;134:573-578

ADDITIONAL RESOURCES

American Academy of Pediatrics, Committee on Nutrition. Cholesterol in childhood. *Pediatrics*. 1998;101:141-147

American Academy of Pediatrics, Committee on Sports Medicine and Fit-

ness and Committee on School Health. Physical fitness and activity in schools. *Pediatrics*. 2000;105:1156–1157

Centers for Disease Control and Prevention. *2000 CDC Growth Charts: United States*. Atlanta, GA: Centers for Disease Control and Prevention; 2000. Available at: <http://www.cdc.gov/growthcharts>

Jacobson MS, Rees J, Golden NH, Irwin C. Adolescent nutritional disorders. *Ann N Y Acad Sci*. 1997;817

National Association for Sports and Physical Activity Web site. Available at: <http://www.aahperd.org>

National Institutes of Health, National Heart, Lung, and Blood Institute. *The Practical Guide: Identification, Evaluation, and Treatment of Overweight and Obesity in Adults*. Rockville, MD: National Heart, Lung, and Blood Institute; 2000. NIH Publ. No. 00-4084

Story M, Holt K, Sofka D, eds. *Bright Futures in Practice: Nutrition*. Arlington, VA: National Center for Education in Maternal and Child Health; 2000

US Department of Health and Human Services, Office of Public Health and Science, Office of Disease Prevention and Health Promotion, Public Health Foundation. *Healthy People 2010 Toolkit: A Field Guide to Health Planning*. Washington, DC: Public Health Foundation; 2002. Available at: <http://www.health.gov/healthypeople/state/toolkit> or by calling toll-free 877/252-1200 (Item RM-005)

Weight-control Information Network Web site. Available at: <http://www.niddk.nih.gov/health/nutrit/win.htm>

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

Prevention of Pediatric Overweight and Obesity

Committee on Nutrition

Pediatrics 2003;112;424

DOI: 10.1542/peds.112.2.424

Updated Information & Services

including high resolution figures, can be found at:
<http://pediatrics.aappublications.org/content/112/2/424>

References

This article cites 80 articles, 20 of which you can access for free at:
<http://pediatrics.aappublications.org/content/112/2/424#BIBL>

Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):
Committee on Nutrition
http://www.aappublications.org/cgi/collection/committee_on_nutrition
Endocrinology
http://www.aappublications.org/cgi/collection/endocrinology_sub
Obesity
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

Prevention of Pediatric Overweight and Obesity

Committee on Nutrition

Pediatrics 2003;112:424

DOI: 10.1542/peds.112.2.424

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/112/2/424>

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 © 2003 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

