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Addressing Childhood Overweight and Obesity in the Dental Office: Rationale and Practical Guidelines

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Abstract

The prevalence of childhood obesity has increased dramatically in the past 3 decades. The purposes of this paper were to: review health and dental implications; present guidelines for tracking body mass index (BMI) percentiles in children; and discuss reasonable “next steps” to take in communicating with parents and other health professionals. The health implications of childhood obesity warrant early monitoring, diagnosis, and treatment. Trends in visitation patterns of children offer dentists an unusual opportunity and an important role in addressing childhood obesity through regular monitoring of height, weight, and BMI percentiles. Dentists’ collaborations with pediatricians, registered dietitians, and parents have the potential to address the detrimental physical and psychosocial effects of childhood obesity. We encourage dentists to determine height, weight, and BMI percentiles for their patients at least annually. They should refer patients with unhealthy weight trajectories to pediatricians or family physicians and consider ancillary referrals to registered dietitians.

Keywords

OBESITY; OVERWEIGHT; BODY MASS INDEX REFERRAL AND CONSULTATION;
PEDIATRIC DENTISTRY; NUTRITION; CARIES

The prevalence of childhood overweight/obesity has increased to epidemic proportions in all age categories among children and adolescents in the United States. The most recent prevalence data estimate that childhood overweight has more than tripled since 1970¹ and currently affects nearly 32% of all children and adolescents. In addition to obesity-related medical challenges,¹ overweight/obese children may experience significant psychosocial distress² and a lower quality of life.³ They also are more likely to become obese adults.⁴

Despite these alarming findings, health professionals in both medicine and dentistry have been slow to implement clinical protocols to aid in the diagnosis and treatment of childhood overweight/obesity.⁵⁻¹⁰ This may be due in part to the sensitive nature of weight-related matters, but it has been shown that health professionals also may lack self-efficacy, knowledge, and information needed to properly diagnose and address the problem.⁸⁻¹³

Dental professionals and auxiliaries who care for children and adolescents have long been involved with in-office counseling for patient general health issues, including blood pressure

monitoring,¹⁴ smoking and alcohol cessation,^{15,16} and detection of child abuse or neglect.¹⁷ Many of these efforts have demonstrated significant positive outcomes.^{16,18,19} Additionally, dentists have a history of collaborating with pediatricians, resulting in joint professional guidelines on conscious sedation, referral for early childhood caries, and fluoride varnish application.²⁰⁻²² Accordingly, the dental team is well-positioned to engage in screening for overweight/obesity and to offer appropriate counseling and referral services.

The purposes of this paper were to: clarify the definitions and summarize the effects of childhood overweight/obesity; review the rationale for the dental team's involvement in the weight-related data collection; offer instructions for height and weight screening and body mass index calculation; and propose recommendations for "next steps."

Discussion

Assessment of childhood overweight and obesity via body-mass index (BMI)

The most convenient and commonly used tool to screen for overweight/obesity is the BMI (kg/m^2), a measure of body weight adjusted for height.²³ Although other measurement tools, such as waist circumference, may be more sensitive indicators of abdominal obesity, BMI is the most easily integrated into current clinical practice.²³ BMI is not a good measure of adiposity in muscular athletes and adults who have lost a significant amount of muscle mass,²⁴ but it has acceptable clinical validity and high sensitivity for prepubertal levels of adiposity.²³ Due to differential changes in height and weight during growth and development, BMI percentiles specific for age and sex are used to describe childhood weight status.

The Centers for Disease Control and Prevention (CDC) have published standardized BMI charts to determine BMI percentiles for children,²⁵ and free Internet-based BMI calculators are available. The current consensus regarding BMI percentiles and their corresponding categories is illustrated in Table 1. Any weight category other than "healthy weight" (fifth-84th percentile) as well as a rapidly rising BMI growth trajectory may be a cause for concern and discussion among the provider, parents, and patient.

Health consequences of overweight and obesity in children

"Overweight" and "obesity" are terms adopted to describe ranges of weight for a given height that are greater than what is generally considered healthy.²⁶ These categories are associated with an increased likelihood in health problems that have immediate consequences and long-term health implications that may occur well into adulthood.^{27,28} These include sleep apnea, high blood pressure (hypertension), increased blood cholesterol and triglyceride levels (hyperlipidemia), glucose intolerance, and elevated levels of liver enzymes associated with fatty liver.^{4,28}

One of the most common obesity-associated diseases of childhood is type II diabetes, now accounting for approximately 45% of newly diagnosed cases of diabetes mellitus, with the majority diagnosed in overweight/obese children.²⁹ Concurrent with the rise in childhood obesity and hypertension,³⁰⁻³² gallstones, previously seen predominantly in adults, have begun to increase in school-age children.^{29,33-36} Skeletal growth changes,³⁷ negative stigma,³⁸ anxiety, depression, and body size dissatisfaction are other problems found more in overweight children than in their normal-weight peers.³⁹ Finally, it is recognized that up to 63% of children who are overweight may develop into overweight/obese adults.⁴⁰ For the first time in recent history, children are expected to have a decreased life expectancy of between 5 to 20 years compared to their parents.⁴¹

Overweight/obesity also carries dental implications for children, including an acceleration in dental growth and development, increased incidence of smooth surface caries on permanent molars,^{42,43} and an increased risk of chronic periodontitis in late adolescence or early adulthood.⁴⁴ Studies examining the associations between childhood overweight/ obesity and caries reveal mixed results,⁴⁵⁻⁴⁸ suggesting that the association between weight and caries is multifactorial and complex.⁴⁹

Increased BMI and adiposity in children presents a significant challenge for sedation of pediatric dental patients, including respiratory complications, cardiovascular complications, increased likelihood for aspiration, and difficulty in achieving the level and duration of sedation desired.⁵⁰ Psychosocial changes also may influence interactions and compliance with health professionals, including the dentist.

The dental team's role in addressing childhood overweight/obesity

Historically, assessing and addressing childhood overweight/obesity has been the purview of the pediatrician or family physician. As the obesity epidemic escalates, it is apparent that screening solely during well child visits may no longer be a viable strategy for addressing the issue. Dentists likely will aid in diagnosing a small percentage of children compared to the percentage diagnosed by physicians. These small successes, however, make a significant difference on a population level.⁵¹

Considering that weight status and its dietary correlates are related to dental health, the dental team has a unique opportunity to collaborate with other health providers such as pediatricians, family physicians, and dietitians to address the epidemic. Leadership temperaments and current policy statements from the American Academy of Pediatrics, the American Academy of Pediatric Dentistry, and the American Dietetic Association support such collaborative efforts.⁵²⁻⁵⁴

A recent study by Braithwaite found that a majority of pediatric dentists in North Carolina said they understood the concept of BMI and the importance of addressing childhood overweight, yet only approximately 14% could correctly identify the data components for BMI assessment in children.⁹ Moreover, only 7% reported that they felt comfortable addressing weight issues with parents.⁹ Perrin et al found that NC pediatricians reported low self-confidence in their ability to address the obesity epidemic, stemming in part from a lack of training and experience.¹⁰ These studies highlight the fact that pediatric health professionals agree that childhood overweight/obesity is a significant health problem and are willing to help address it,^{9,10} but more training is needed. Importantly, it seems clear that clinicians need to enhance their knowledge and comfort level related to addressing issues.⁵⁵

The first step in addressing childhood overweight is likely timely screening for the condition. This requires longitudinal collection of height and body weight, collaboration among collection sites (in this case, among health professionals, including pediatricians and dentists), and an understanding of "next steps" in the diagnosis and treatment of childhood over-weight/obesity.

Dentists who care for children are in a unique position to help address the childhood obesity epidemic for several reasons. First, dentists may see children by 1 year old, providing an opportunity for longitudinal counseling and monitoring of weight status starting at an early age. Normative BMI percentiles are not available for children younger than 2 years-old. For these children, the dental team is encouraged to rely upon anticipatory guidance that includes a discussion of appropriate dietary habits, the importance of avoiding caloric-dense, low nutrition foods, and the consequences of nonideal growth trajectories that lead to development of overweight or obesity. Beginning at 2 years old or as soon as is reasonably

achievable, dental teams should measure and record height, weight, and BMI percentiles at regular intervals. This will facilitate the provision of longitudinal data regarding the child's growth and development.

Secondly, dentists have a higher likelihood than pediatricians of seeing older children on a regular basis for recall visits. At 3-years-old, the percentage of children with 1 or more visits to the dentist (55%)⁵⁶ surpasses that of children with 1 or more visits to the pediatrician (51%),¹³ a trend that continues with the greatest disparity occurring in the 6- to 12-year-old age range (55% for dental visits vs 34% for medical visits). By 6 years old, compliance with annual well-child visits to pediatricians and family physicians drops off from a peak of 81% during the first year of life to 64% (Table 2),¹³ with 6- to 12-year-olds visiting a dentist on average 4 times as often as a pediatrician (Table 3).^{13,56} The implication is not that dentists should replace pediatricians or family physicians in addressing childhood overweight or obesity, but that dentists can utilize dental visits to add additional screening and counseling that complements a physician's efforts in addressing overweight or obesity.

Third, dentists are credible sources for dietary counseling and already counsel about caries prevention. Most dentists who treat children feel that dietary counseling is an important component of oral health.⁵⁷ The main thrust of dietary counseling from dentists, however, focuses on the reduction of cariogenic foods and related consumption habits.⁵⁷ Dentists could easily expand their dietary counseling efforts to emphasize the implications of poor diet on oral and systemic health that extend well into adulthood. It is encouraging that initial studies exploring dental office-based dietary counseling have proven to be successful, feasible, well-accepted, and effective in changing the dietary habits of parents and children.^{58,59} Additionally, these efforts have been well-received by caregivers of pediatric patients. Tavares showed that greater than 94% of parents who participated in a dental office-based healthy weight intervention program felt that it was an appropriate place to address healthy eating and weight issues.⁵⁹

Fourth, some dentists currently measure children's weight and height for other purposes. Weight is essential to calculate safe dosages of local anesthesia for young children, and obtaining weight is important for most conscious sedation procedures or dental rehabilitation under general anesthesia. For these practitioners, calculation and longitudinal tracking of BMI percentiles requires only minor changes in routine protocols.

Fifth, minimal equipment is needed to collect weight/ height measurements, which can be collected with little disruption to patient flow. The equipment needed to institute BMI percentile measurements includes only a scale for measuring weight and a stadiometer for measuring height—both can be obtained for low start-up and maintenance costs.

Protocol for implementing BMI monitoring

The BMI percentile determination requires an accurate, reliable, and regularly calibrated scale for measurement of weight and a stadiometer for measurement of height. Measurement of BMI should occur at least annually. The dental team may want to monitor BMI data more frequently for patients who have an increasing BMI trajectory or who are consistently over the BMI 85th percentile for age/sex.

Height measurement

For height measurement, patients should remove their shoes and stand with their feet flat on the floor (heels on the ground). Their backs should be pressed flat against the wall-mounted stadiometer, and they should look straight ahead. The measurement bar should be pushed down until it sits flat and snugly against the most superior point of the head, with the child looking straight ahead and not up. An instructive module about correct positioning of the

child, clothing to be worn, and measurement procedure can be found at: “<http://depts.washington.edu/growth/index.htm>.”⁶⁰

Weight measurement

Digital scales are preferred and offer advantages because they can be reset prior to weight measurement of each patient. Modules to help train dental personnel on accurate weight measurements can be found at the aforementioned website.⁶⁰

Types of data generated

BMI and BMI Percentile. When the weight (in lbs or kg) and height (in inches or meters) have been measured, BMI is calculated using one of the following formulas: for English measurements, $BMI = \text{weight in lbs} / (\text{height in inches})^2 \times 703$; or for metric measurements, $BMI = \text{weight in kg} / (\text{height in meters})^2$. Internet-based calculators have proven extremely beneficial for BMI calculations. The CDC has one such calculator at: “<http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx>.”⁶¹ Either CDC growth charts or the CDC calculator then must be used to calculate the BMI percentile for age and sex.

BMI growth trajectory

Comparing BMI percentiles across several appointments may be useful in identifying trends or trajectories.⁶² Decreasing BMI percentiles at subsequent visits suggests a decreasing trajectory, while increasing percentiles correspond to an increasing trajectory. Several investigators have found that consistently increasing BMI trajectories in children as young as 2-years-old can be predictive for development of childhood overweight by 12-years-old.^{62,63} Consideration of the trajectories over 2 or more consecutive 6-month recalls may serve as a basis for discussion with the family and for determining when a referral should occur.

Recommendations

After a child’s BMI percentile and weight category has been determined (Table 1), the dental team should make recommendations that are consistent with the child’s weight and health status. The goals of these clinical recommendations are to: reinforce “universal” recommendations for healthy activity and nutrition, even for those in healthy weight categories; identify and refer individuals with an unhealthy BMI category for further assessment and confirmation of weight status; and inform parents of children in unhealthy weight categories of the serious effects of childhood overweight or obesity with appropriate urgency in a sensitive manner. It is important for the dental professional to also consider parental obesity, family health status, and current diet and physical activity behaviors.⁷

BMI status is a spectrum with cutoff points to aid the clinician in determining if counseling or referral may be appropriate. These cutoff points should not preclude counseling for a child who is nearing the 85th percentile, or who demonstrates a trajectory that is crossing percentiles at an unhealthy rate, even if this trajectory never exceeds the 85th percentile. After considering patient and familial factors and trajectories, the dental professional may offer the recommendations summarized in Table 4.

Underweight (BMI <5%)

Underweight health status during childhood may indicate: a failure to thrive, significant malnutrition, or a pathological condition that may result in poor absorption of nutrients,⁶⁴ deleterious effects on the development of teeth and other orofacial structures,⁶⁵⁻⁶⁸ and medical systemic effects with short- and long-term consequences.⁶⁴ The child should be

referred to a pediatrician or family physician for immediate further weight assessment and subsequent care, which may include nutritional and dietary counseling.

Healthy weight (BMI \geq 5-84%)

The dentist should take an active role in identifying, encouraging, and reinforcing healthy behaviors to maintain a healthy BMI trajectory. Similar to the praise given for good oral hygiene habits and their effects on the dentition and soft tissues, the dental team should also praise dietary habits, physical activity, and other factors that contribute to the maintenance of a healthy BMI percentile and trajectory. For children with a BMI percentile approaching the 85th percentile, or for those with an unhealthy BMI trajectory, dentists may choose to highlight the importance of healthy dietary and physical activity to prevent negative health consequences.

Overweight (BMI \geq 85-94%)

A BMI percentile equal or greater than 85% indicates an increased likelihood of obesity-associated health risks during childhood or adolescence and later in life.^{23,32} For increasing BMI trajectories that have some or all of their respective BMI percentiles between the 85th to 95th percentile, the dental team should explain the meaning of overweight status, the BMI trajectory, and the consequences of childhood overweight. Because of the increased risk for health consequences,^{24,26} the dental team should have meaningful conversations about the benefits of visiting a pediatrician or family physician and undergoing further weight assessment as well as the concerns of having a positive trajectory, especially for those approaching the 95th percentile. Dentists should identify unhealthy behaviors and encourage the adoption of healthier behaviors to improve BMI trajectory. A referral to a local pediatrician should be offered to the parent with documentation of any refusal of referrals in treatment notes.

Obese (BMI \geq 95%)

Children with BMI percentiles greater than 95% are likely to have obesity-related health risks presently and in the future²⁶ and should be strongly recommended to visit their pediatricians or family physicians for further assessment. Discussions with the parents should emphasize the child's weight status and the significant health consequences of childhood overweight. Patients with BMI percentiles over 95% are highly likely to require significant dietary modifications and to benefit from counseling from a registered dietitian (RD).²⁶ Dentists should have a list of local RDs available and discuss the benefits of visiting an RD who may offer dietary analysis and culturally sensitive diet recommendations for weight reduction and control. Obese children are likely to require a multifaceted treatment that will include more than lifestyle or diet modifications alone. The dental professional may act as a liaison and resource for parents of obese children who wish to seek more comprehensive care for this condition.

Communication of weight status with families

Perhaps the most difficult task and significant barrier for BMI screening among dental professionals is determining the manner in which a child's unhealthy weight status is to be communicated. This discussion may be met with a variety of emotions, such as anger, defensiveness, sadness, or fear. Discussions should be compassionate, culturally sensitive, and health focused. Dentists can initiate these conversations by explaining "because many of our patients may not have recently seen a physician, we are taking a greater role in addressing some health-related issues," which would entail discussions about prevention of childhood obesity.⁵⁵ Furthermore, dentists should say that "what the child eats, as well as how and when they eat, may cause dental caries, and other health issues, such as weight

problems.” In this way, dentists can emphasize that preventive dentistry is concerned with changes in diet because of the positive health effects on oral and general health and the wellbeing of growing children.

Parents should be told about their children’s weight status in a private and sensitive yet positive and optimistic manner (ie, “we’re catching this early,” “your child is still growing,” “this is the best time to change habits before they are entrenched”). Words like “obese” can be perceived as insensitive, and families may instead be told that the child’s weight is not healthy for his/her height. The topics and breadth of discussions vary, depending on the provider’s comfort level, and may include nutrition, dietary counseling, and discussions about physical and sedentary activity levels. Dental professionals should, at a minimum, have discussions with the caregivers of children regarding BMI percentiles and BMI growth trajectories that are at or above the 85th percentile cutoff denoting overweight. Three domains are very important: (1) what BMI and childhood overweight mean; (2) the health implications of overweight; and, (3) the clinician’s recommendations and rationale.

What to do once initial notification has been given to a pediatrician

The aforementioned recommendations apply primarily to patients who have not had prior intervention by a pediatrician. The dental team must ensure that the child and guardian are aware of BMI status and the significant health consequences that may afflict the child/adolescent, and that they have been provided with the opportunity to pursue further assessment with a medical professional. The dental professional should determine the best level of subsequent involvement. This may include sending annual reports with longitudinal BMI data to the child’s medical provider or offering dietary and physical activity counseling in synergistic collaboration with therapy offered by the patient’s primary care medical providers.

Conclusions

Childhood overweight/obesity is escalating at an alarming rate that begs for collaboration on the part of all health care professionals. It is important that continuing education programs and current dental and pediatric dental curricula are revised to include discussions about childhood obesity. Dental teams who care for children are encouraged to assess diet and sedentary and physical activity, weigh and measure children, calculate body mass index percentiles, and observe trajectories at regular intervals for children who are at least 2-years-old. Measures indicative of unhealthy weight statuses and behaviors should be explained to the parent or guardian in a positive and culturally sensitive manner. Pediatric dentists should be encouraged to not only advocate for the best interests of children, but to put obesity prevention into action in their practices.

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References

1. Dietz WH. Health consequences of obesity in youth: Childhood predictors of adult disease. *Pediatrics*. 1998; 101:518–25. [PubMed: 12224658]
2. Janicke DM, Harman JS, Kelleher KJ, et al. Psychiatric diagnosis in children and adolescents with obesity-related health conditions. *J Dev Behav Pediatr*. 2008; 29:276–84. [PubMed: 18562982]

3. Mitsnefes MM. Hypertension in children and adolescents. *Pediatr Clin North Am.* 2006; 53:493–512. viii. [PubMed: 16716793]
4. Denen ME, Hennessey JV, Markert RJ. Outpatient evaluation of obesity in adults and children: A review of the performance of internal medicine/pediatrics residents. *J Gen Intern Med.* 1993; 8:268–70. [PubMed: 8505688]
5. Barlow SE, Dietz WH, Klish WJ, et al. Medical evaluation of overweight children and adolescents: Reports from pediatricians, pediatric nurse practitioners, and registered dietitians. *Pediatrics.* 2002; 110:222–8. [PubMed: 12093999]
6. Perrin EM, Flower KB, Ammerman AS. Body mass index charts: Useful yet underused. *J Pediatr.* 2004; 144:455–60. [PubMed: 15069392]
7. Kolagotla L, Adams W. Ambulatory management of childhood obesity. *Obes Res.* 2004; 12:275–83. [PubMed: 14981220]
8. Dorsey KB, Wells C, Krumholz HM, et al. Diagnosis, evaluation, and treatment of childhood obesity in pediatric practice. *Arch Pediatr Adolesc Med.* 2005; 159:632–8. [PubMed: 15996996]
9. Braithwaite AS, Vann WF Jr, Switzer BR, et al. Nutritional counseling practices: How do North Carolina pediatric dentists weigh in? *Pediatr Dent.* 2008; 30:488–95. [PubMed: 19186774]
10. Perrin EM, Flower KB, Garrett J, et al. Preventing and treating obesity: Pediatricians' self-efficacy, barriers, resources, and advocacy. *Ambul Pediatr.* 2005; 5:150–6. [PubMed: 15913408]
11. Story MT, Neumark-Stzainer DR, Sherwood NE, et al. Management of child and adolescent obesity: Attitudes, barriers, skills, and training needs among health care professionals. *Pediatrics.* 2002; 110:210–4. [PubMed: 12093997]
12. Jelalian E, Boergers J, Alday CS, et al. Survey of physician attitudes and practices related to pediatric obesity. *Clin Pediatr.* 2003; 42:235–45.
13. Selden TM. Compliance with well-child visit recommendations: Evidence from the Medical Expenditure Panel Survey, 2000–2002. *Pediatrics.* 2006; 118:e1766–78. [PubMed: 17142499]
14. Little JW. The impact on dentistry of recent advances in the management of hypertension. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2000; 90:591–9. [PubMed: 11077382]
15. Petti S, Scully C. The role of the dental team in preventing and diagnosing cancer: Alcohol and the role of the dentist in alcohol cessation. *Dent Update.* 2005; 32:454–5. 458–60, 462. [PubMed: 16262033]
16. Dyer TA, Robinson PG. General health promotion in general dental practice: The involvement of the dental team. Part 2: A qualitative and quantitative investigation of the views of practice principals in South Yorkshire. *Br Dent J.* 2006; 201:45–51. discussion 31. [PubMed: 16829887]
17. Harris JC, Sidebotham PD, Welbury RR. Safeguarding children in dental practice. *Dent Update.* 2007; 34:508–10. 513–4, 517. [PubMed: 18019489]
18. Hanioka T, Ojima M, Hamajima N, et al. Patient feedback as a motivating force to quit smoking. *Community Dent Oral Epidemiol.* 2007; 35:310–7. [PubMed: 17615018]
19. Gordon JS, Severson HH. Tobacco cessation through dental office settings. *J Dent Educ.* 2001; 65:354–63. [PubMed: 11336121]
20. Rozier RG, Sutton BK, Bawden JW, et al. Prevention of early childhood caries in North Carolina medical practices: Implications for research and practice. *J Dent Educ.* 2003; 67:876–85. [PubMed: 12959161]
21. Cote CJ, Wilson S. Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: An update. *Pediatrics.* 2006; 118:2587–602. [PubMed: 17142550]
22. Hale KJ. Oral health risk assessment timing and establishment of the dental home. *Pediatrics.* 2003; 111:1113–6. [PubMed: 12728101]
23. Reilly JJ, Dorosty AR, Emmett PM. Identification of the obese child: Adequacy of the body mass index for clinical practice and epidemiology. *Int J Obes Relat Metab Disord.* 2000; 24:1623–7. [PubMed: 11126215]
24. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: The evidence report. National Institutes of Health. *Obes Res.* 1998; 6(suppl 2):51S–209S. [PubMed: 9813653]

25. Ogden CL, Kuczmarski RJ, Flegal KM, et al. Centers for Disease Control and Prevention 2000 growth charts for the United States: Improvements to the 1977 National Center for Health Statistics version. *Pediatrics*. 2002; 109:45–60. [PubMed: 11773541]
26. Barlow SE. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics*. 2007; 120(suppl 4):S164–92. [PubMed: 18055651]
27. Deckelbaum RJ, Williams CL. Childhood obesity: The health issue. *Obes Res*. 2001; 9(suppl 4): 239S–43S. [PubMed: 11707548]
28. Field AE, Cook NR, Gillman MW. Weight status in childhood as a predictor of becoming overweight or hypertensive in early adulthood. *Obes Res*. 2005; 13:163–9. [PubMed: 15761176]
29. Baker S, Barlow S, Cochran W, et al. Overweight children and adolescents: A clinical report of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *J Pediatr Gastroenterol Nutr*. 2005; 40:533–43. [PubMed: 15861011]
30. Hansen ML, Gunn PW, Kaelber DC. Underdiagnosis of hypertension in children and adolescents. *JAMA*. 2007; 298:874–9. [PubMed: 17712071]
31. Sorof JM, Lai D, Turner J, et al. Overweight, ethnicity, and the prevalence of hypertension in school-aged children. *Pediatrics*. 2004; 113:475–82. [PubMed: 14993537]
32. Moore WE, Stephens A, Wilson T, et al. Body mass index and blood pressure screening in a rural public school system: The Healthy Kids Project. *Prev Chronic Dis*. 2006; 3:A114. [PubMed: 16978489]
33. Honore LH. Cholesterol cholelithiasis in adolescent females: Its connection with obesity, parity, and oral contraceptive use: A retrospective study of 31 cases. *Arch Surg*. 1980; 115:62–4. [PubMed: 7350887]
34. Ford ES, Mokdad AH, Ajani UA. Trends in risk factors for cardiovascular disease among children and adolescents in the United States. *Pediatrics*. 2004; 114:1534–44. [PubMed: 15574612]
35. Luepker RV, Jacobs DR, Prineas RJ, et al. Secular trends of blood pressure and body size in a multi-ethnic adolescent population: 1986 to 1996. *J Pediatr*. 1999; 134:668–74. [PubMed: 10356132]
36. Morrison JA, James FW, Sprecher DL, et al. Sex and race differences in cardiovascular disease risk factor changes in schoolchildren, 1975-1990: The Princeton School Study. *Am J Public Health*. 1999; 89:1708–14. [PubMed: 10553393]
37. Wills M. Orthopedic complications of childhood obesity. *Pediatr Phys Ther*. 2004; 16:230–5. [PubMed: 17057553]
38. Latner JD, Stunkard AJ. Getting worse: The stigmatization of obese children. *Obes Res*. 2003; 11:452–6. [PubMed: 12634444]
39. Young-Hyman D, Tanofsky-Kraff M, Yanovski SZ, et al. Psychological status and weight-related distress in overweight or at-risk-for-overweight children. *Obesity (Silver Spring)*. 2006; 14:2249–58. [PubMed: 17189553]
40. Herman KM, Craig CL, Gauvin L, et al. Tracking of obesity and physical activity from childhood to adulthood: The physical activity longitudinal study. *Int J Pediatr Obes*. 2009; 4(4):281–8. [PubMed: 19922043]
41. Glick M. A concern that cannot weight. *J Am Dent Assoc*. 2005; 136:572, 574. [PubMed: 15966640]
42. Hilgers KK, Kinane DE, Scheetz JP. Association between childhood obesity and smooth-surface caries in posterior teeth: A preliminary study. *Pediatr Dent*. 2006; 28:23–8. [PubMed: 16615372]
43. Hilgers KK, Akridge M, Scheetz JP, et al. Childhood obesity and dental development. *Pediatr Dent*. 2006; 28:18–22. [PubMed: 16615371]
44. Reeves AF, Rees JM, Schiff M, et al. Total body weight and waist circumference associated with chronic periodontitis among adolescents in the United States. *Arch Pediatr Adolesc Med*. 2006; 160:894–9. [PubMed: 16953012]
45. Hong L, Ahmed A, McCunniff M, et al. Obesity and dental caries in children aged 2-6 years in the United States: National Health and Nutrition Examination Survey 1999-2002. *J Public Health Dent*. 2008; 68:227–33. [PubMed: 18384534]

46. Willershhausen B, Moschos D, Azrak B, et al. Correlation between oral health and body mass index (BMI) in 2,071 primary school pupils. *Eur J Med Res.* 2007; 12:295–9. [PubMed: 17933701]
47. Willershhausen B, Haas G, Krummenauer F, et al. Relationship between high weight and caries frequency in German elementary school children. *Eur J Med Res.* 2004; 9:400–4. [PubMed: 15337630]
48. Macek MD, Mitola DJ. Exploring the association between overweight and dental caries among US children. *Pediatr Dent.* 2006; 28:375–80. [PubMed: 16903449]
49. Kantovitz KR, Pascon FM, Rontani RM, et al. Obesity and dental caries: A systematic review. *Oral Health Prev Dent.* 2006; 4:137–44. [PubMed: 16813143]
50. Baker S, Yagiela JA. Obesity: A complicating factor for sedation in children. *Pediatr Dent.* 2006; 28:487–93. [PubMed: 17249428]
51. Cabana MD, Ebel BE, Cooper-Patrick L, et al. Barriers pediatricians face when using asthma practice guidelines. *Arch Pediatr Adolesc Med.* 2000; 154:685–93. [PubMed: 10891020]
52. Touger-Decker R, Mobley CC. Position of the American Dietetic Association: Oral health and nutrition. *J Am Diet Assoc.* 2003; 103:615–25. [PubMed: 12728223]
53. Krebs NF, Jacobson MS. Prevention of pediatric overweight and obesity. *Pediatrics.* 2003; 112:424–30. [PubMed: 12897303]
54. Policy on dietary recommendations for infants, children, and adolescents. *Pediatr Dent.* 2008; 30(suppl 7):47–8. [PubMed: 19216383]
55. Vann WF Jr, Bouwens TJ, Braithwaite AS, et al. The childhood obesity epidemic: A role for pediatric dentists? *Pediatr Dent.* 2005; 27:271–6. [PubMed: 16317966]
56. Brown, EJ. Children’s dental visits and expenses, United States, 2003. Quality AFHRA. , editor. AHRQ Publication; Rockville, Md: 2006. Statistical Brief no. 117
57. Sajjani-Oommen G, Perez-Spiess S, Julliard K. Comparison of nutritional counseling between provider types. *Pediatr Dent.* 2006; 28:369–74. [PubMed: 16903448]
58. More FG, Sasson LM, Godfrey EM, et al. Collaboration between dietetics and dentistry: Dietetic internship in pediatric dentistry. *Top Clin Nutr.* 2005; 20:259–68. [PubMed: 16639470]
59. Tavares M, Chomitz V. A healthy weight intervention for children in a dental setting: A pilot study. *J Am Dent Assoc.* 2009; 140:313–6. [PubMed: 19255175]
60. Department of Health and Human Services HRaSA. Maternal and Child Health Bureau. [Accessed October 1, 2008] Growth charts training. 2000. Available at: “<http://depts.washington.edu/growth/index.htm>”
61. Centers for Disease Control and Prevention. [Accessed October 1, 2008] BMI percentile calculator for child and teen: English version. Available at: “<http://apps.nccd.cdc.gov/dnpabmi/calculator.aspx>”
62. Li C, Goran MI, Kaur H, et al. Developmental trajectories of overweight during childhood: Role of early life factors. *Obesity (Silver Spring).* 2007; 15:760–71. [PubMed: 17372328]
63. Nader PR, O’Brien M, Houts R, et al. Identifying risk for obesity in early childhood. *Pediatrics.* 2006; 118:e594–601. [PubMed: 16950951]
64. Weaver LT. Rapid growth in infancy: Balancing the interests of the child. *J Pediatr Gastroenterol Nutr.* 2006; 43:428–32. [PubMed: 17033515]
65. Psoter W, Gebrian B, Prophete S, et al. Effect of early childhood malnutrition on tooth eruption in Haitian adolescents. *Community Dent Oral Epidemiol.* 2008; 36:179–89. [PubMed: 18333882]
66. Chaves AM, Rosenblatt A, Oliveira OF. Enamel defects and its relation to life course events in primary dentition of Brazilian children: A longitudinal study. *Community Dent Health.* 2007; 24:31–6. [PubMed: 17405468]
67. Rugg-Gunn AJ, Al-Mohammadi SM, Butler TJ. Malnutrition and developmental defects of enamel in 2- to 6-year-old Saudi boys. *Caries Res.* 1998; 32:181–92. [PubMed: 9577983]
68. Nishino M, Kamada K, Arita K, et al. Dentofacial manifestations in children with vitamin D-dependent Rickets type II. *Shoni Shikagaku Zasshi.* 1990; 28:346–58. [PubMed: 1966855]
69. Kuczmariski RJ, Ogden CL, Grummer-Strawn LM, et al. CDC growth charts: United States. *Adv Data.* Jun 8.2000 (314):1–27. [PubMed: 11183293]

Table 1
CURRENT BODY MASS INDEX (BMI) WEIGHT CATEGORY GUIDELINES

BMI categories for children and adolescents younger than 18 years old* (measurement=BMI percentile for age and sex)			
BMI percentile for age and sex	<5 th percentile	5 th -<85 th percentile	85 th -<95 th percentile >95 th percentile
Category	Underweight	Healthy weight	Overweight Obese

* Adapted from the Centers for Disease Control and Prevention. 23,69

Table 2

PERCENTAGE OF CHILDREN WITH ONE OR MORE VISITS TO PEDIATRICIANS VS DENTISTS BY AGE

Years	Pediatrician (2000-2002) ¹³ (%)	Dentist (2003) ⁵⁶ (%)
<1	82	N/A
1	88	N/A
2	66	
3-5	51	55
6-12	34	
13-18	35	60

Table 3

AVERAGE NUMBER OF VISITS TO PEDIATRICIANS VS DENTISTS BY AGE

Years	Pediatrician (2000-2002) ¹³ (N)	Dentist (2003) ⁵⁶ (N)
<1	2.64	N/A
1	2.64	N/A
2	1.13	
3-5	0.69	2.0
6-12	0.44	
13-18	0.49	3.4

SUMMARY OF RECOMMENDATIONS FOR BODY MASS INDEX (BMI) WEIGHT CATEGORIES FOR CHILDREN AND ADOLESCENTS

Table 4

BMI % for age and sex	BMI category	Recommendations
0-<5	Underweight	<ul style="list-style-type: none"> • Continue height/weight/BMI measurement at 6-month recall visits. • Formal letter of referral (including anthropometric values) to pediatrician for further evaluation and assessment of underweight.
5-<85	Healthy Weight	<ul style="list-style-type: none"> • Continue height/weight/BMI measurement at 6-month recall visits. • Encourage continuation of healthy habits. • Counseling focused on healthy recommendations for "at risk of overweight" patients.
85-<95	Overweight	<ul style="list-style-type: none"> • Continue height/weight/BMI measurement at 6-month recall visits. • Referral (including anthropometric values) to pediatrician for further evaluation and assessment of overweight within 6 months. • Identify unhealthy habits and make healthy recommendations.
95	Obese	<ul style="list-style-type: none"> • Continue height/weight/BMI measurement at 6-month recalls. • Referral (including anthropometric values) to pediatrician for immediate evaluation and assessment of overweight or obese status. • Referral to registered dietitian.