



Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity

Council on Sports Medicine and Fitness and Council on School Health

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

ABSTRACT

The current epidemic of inactivity and the associated epidemic of obesity are being driven by multiple factors (societal, technologic, industrial, commercial, financial) and must be addressed likewise on several fronts. Foremost among these are the expansion of school physical education, dissuading children from pursuing sedentary activities, providing suitable role models for physical activity, and making activity-promoting changes in the environment. This statement outlines ways that pediatric health care providers and public health officials can encourage, monitor, and advocate for increased physical activity for children and teenagers.

INTRODUCTION

IN 1997, THE World Health Organization declared obesity a global epidemic with major health implications.¹ According to the 1999–2000 National Health and Nutrition Examination Survey (www.cdc.gov/nchs/nhanes.htm), the prevalence of overweight or obesity in children and youth in the United States is over 15%, a value that has tripled since the 1960s.² The health implications of this epidemic are profound. Insulin resistance, type 2 diabetes mellitus, hypertension, obstructive sleep apnea, nonalcoholic steatohepatitis, poor self-esteem, and a lower health-related quality of life are among the comorbidities seen more commonly in affected children and youth than in their unaffected counterparts.^{3–7} In addition, up to 80% of obese youth continue this trend into adulthood.^{8,9} Adult obesity is associated with higher rates of hypertension, dyslipidemia, and insulin resistance, which are risk factors for coronary artery disease, the leading cause of death in North America.¹⁰

Assessment of Overweight

Ideally, methods of measuring body fat should be accurate, inexpensive, and easy to use; have small measurement error; and be well documented with published reference values. Direct measures of body composition, such as underwater weighing, magnetic resonance imaging, computed axial tomography, and dual-energy radiograph absorptiometry, provide an estimate of total body fat mass. These techniques, however, are used mainly in tertiary care centers for research purposes. Anthropometric measures of relative fatness may be inexpensive and easy to use but rely on the skill of the measurer, and their relative accuracy must be validated against a “gold-standard” measure of adiposity. Such indirect methods of

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Key Words

healthy living, physical activity, obesity, overweight, advocacy, children, youth

Abbreviations

PE—physical education

AAP—American Academy of Pediatrics

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estimating body composition include measuring weight and weight for height, body mass index (BMI), waist circumference, skinfold thickness, and ponderal index.¹¹ Of these, perhaps the most convenient is BMI, which can be calculated according to the following formulas (www.cdc.gov/growthcharts):

$$\text{BMI} = \text{weight (kg)} / (\text{height (m)})^2 \text{ or}$$

$$\text{BMI} = \text{weight (kg)} / \text{height (cm)} / \text{height (cm)} \times 10\,000$$

$$\text{BMI} = \text{weight (lb)} / \text{height (in)} / \text{height (in)} \times 703$$

BMI varies with age and gender. It typically increases during the first months of life, decreases after the first year, and increases again around 6 years of age.¹¹ A specific BMI value, therefore, should be evaluated against age- and gender-specific reference values. In the United States, such reference charts based on early 1970s survey data of children 2 to 20 years of age are readily available for clinical use.¹² Children and youth with a BMI greater than the 95th percentile are classified as overweight or obese, and those between the 85th and 95th percentiles are designated at risk of overweight.¹³ Although BMI tends to underestimate overweight in tall individuals and overestimate overweight in short individuals and those with high lean body mass (ie, athletes), it generally correlates well with more precise measures of adiposity in individuals with BMI in the 95th percentile or greater.¹⁴

Factors Contributing to Obesity

Some children have medical conditions associated with obesity and/or require pharmacologic treatments resulting in significant weight gain. Others (1%–2% of obese children) have underlying genetic conditions such as Down, Prader-Willi, or Bardet-Biedle syndrome, which can be associated with obesity. Rarely, single-gene disorders, including congenital leptin deficiency and defects in the melanocortin 4 receptor, cause morbid childhood obesity.

Observations in twin, sibling, and family studies suggest that children are more likely to be overweight if relatives are similarly affected and that heritability may play a role in as many as 25% to 85% of cases. However, to suggest that only genetic factors have caused the recent global epidemic of childhood obesity would not be realistic. It is more likely that most of the world's population carries a combination of genes that may have evolved to cope with food scarcity. In obesogenic environments in which calorie-dense foods are readily available and low-energy expenditure is commonplace, this genetic predisposition would be maladaptive and could lead to an obese population.¹¹

Nutritional factors contributing to the increase in obesity rates include, in no particular order, (1) insufficient infant breastfeeding, (2) a reduction in cereal fiber, fruit,

and vegetable intake by children and youth, and (3) the excessive consumption of oversized fast foods and soda, which are encouraged by fast-food advertising during children's television programming and a greater availability of fast foods and sugar-containing beverages in school vending machines.^{15,16} Although nutritional issues have a significant role to play, this statement focuses on factors associated with decreased energy expenditure, namely excessive sedentary behaviors and lack of adequate physical activity.

Children and youth are more sedentary than ever with the widespread availability of television, videos, computers, and video games. Data from the 1988–1994 National Health and Nutrition Examination Survey indicated that 26% of American children (up to 33% of Mexican American and 43% of non-Hispanic black children) watched at least 4 hours of television per day, and these children were less likely to participate in vigorous physical activity. They also had greater BMIs and skinfold measurements than those who watched <2 hours of television per day.¹⁷

Not only are the rates of sedentary activities rising, but participation in physical activity is not optimal. In a 2002 Youth Media Campaign Longitudinal Survey, 4500 children 9 to 13 years of age and their parents were polled about physical activity levels outside of school hours. The report indicated that 61.5% of 9- to 13-year-olds did not participate in any organized physical activities and 22.6% did not partake in nonorganized physical activity during nonschool hours.¹⁸

Youth at Risk of Decreased Physical Activity

Particular individuals at increased risk of having low levels of physical activity have been identified and include children who are from ethnic minorities (especially girls) in the preadolescent/adolescent age groups, children living in poverty, children with disabilities, children residing in apartments or public housing, and children living in neighborhoods where outdoor physical activity is restricted by climate, safety concerns, or lack of facilities.^{19,20} According to the Centers for Disease Control and Prevention (www.cdc.gov/nccdphp/sgr/adoles.htm), inactivity is twice as common among females (14%) as males (7%) and among black females (21%) as white females (12%). In a meta-analysis that evaluated physical activity and cardiorespiratory fitness, 6- to 7-year-olds were more active in moderate to vigorous physical activity (46 minutes/day) compared with 10- to 16-year-olds (16–45 minutes/day). Boys were approximately 20% more active than girls, and mean activity levels decreased with age by 2.7% per year in boys compared with 7.4% per year in girls.²¹ Many reasons are stated for the general lack of physical activity among children and youth. These reasons include inactive role models (eg, parents and other caregivers), competing demands/time pressures, unsafe environments, lack of

recreation facilities or insufficient funds to begin recreation programs, and inadequate access to quality daily physical education (PE).

Physical Activity in Schools

Children and youth spend most of their waking hours at school, so the availability of regular physical activity in that setting is critical. Although the *Healthy People 2010* report recommends increasing the amount of daily PE for all students in a larger proportion of US schools, such changes do not seem to be forthcoming.¹⁹ In 2000, a school health policies and program study²² looked at a nationally representative sample of private and public schools and found that only 8% of American elementary schools, 6.4% of middle schools, and 5.8% of high schools with existing PE requirements provided daily PE classes for all grades for the entire year. In addition, although approximately 80% of states have policies calling for students to participate in PE in all schools, 40% of elementary schools, 52% of middle schools, and 60% of high schools allow exemption from PE classes, particularly for students with permanent physical disabilities and those having religious reasons.²² The National Association of State Boards of Education recommends 150 minutes per week of PE for elementary students and 225 minutes per week for middle and high school students.²³ Unfortunately, these requirements are not being implemented. In a study of 814 third-grade students from 10 different US data-collection sites, the mean duration of PE was 33 minutes twice a week, with only 25 minutes per week at a moderate to vigorous intensity level.²⁴ In addition, 1991–2003 Youth Risk Behavior Surveillance data showed that although the percentage of high school students enrolled in PE class remained constant (48.9%–55.7%), the percentage of students with daily PE attendance decreased from 41.6% in 1991 to 25.4% in 1995 and remained stable thereafter (25.4%–28.4%).²⁵

Management of the Obese Child

The successful treatment of obesity in the pediatric age group has been somewhat obscure to date. Studies have shown that younger children seem to respond better to treatment than adolescents and adults.^{11,26} Reasons given for this include greater motivation, more influence of the family on behavioral change, and the ability to take advantage of longitudinal growth, which allows children to “grow into their weight.” Treatment programs that include nutritional intervention in combination with exercise have higher success rates than diet modification alone. Indeed, a research program that included dietary modification, exercise, and family-based behavioral modification demonstrated enhanced weight loss and better maintenance of lost weight over 5 years.²⁷ Successful activity-related interventions include a reduction in sedentary behavior and an increase in energy expenditure. Improvements in BMI have been shown to occur

when television viewing is restricted.²⁸ In this regard, the American Academy of Pediatrics (AAP) recommends no more than 2 hours of quality television programming per day for children older than 2 years.²⁹ Lifestyle-related physical activity, as opposed to calisthenics or programmed aerobic exercise, seems to be more important for sustained weight loss.³⁰ Such treatment programs should be individually tailored to each child, and their success should be measured not just in terms of weight loss but also in terms of the effects of the programs on associated morbidities.

Health Benefits of Physical Activity

Regular physical activity is important in weight reduction and improving insulin sensitivity in youth with type 2 diabetes.³¹ Aerobic exercise has been shown in a prospective randomized, controlled study of 64 children (9–11 years old) with hypertension to reduce systolic and diastolic blood pressure over 8 months.³² Resistance training (eg, weight lifting) after aerobic exercise seems to prevent the return of blood pressure to preintervention levels in hypertensive adolescents.³³ Weight loss through moderate aerobic exercise has been shown to reduce the hyperinsulinemia, hepatomegaly, and liver enzyme elevation seen in patients with steatohepatitis.^{6,34} Regular physical activity is also beneficial psychologically for all youth regardless of weight. It is associated with an increase in self-esteem and self-concept and a decrease in anxiety and depression.³⁵

Prevention of Overweight in Children and Youth

Given the challenges of reversing existing obesity in the pediatric population, preventive tactics are likely to be the key to success. Unfortunately, controlled prevention trials have been somewhat disappointing to date. In a systematic Cochrane Database review,³⁶ 3 of 4 long-term studies combining dietary education with physical activity showed no difference in overweight, and 1 long-term physical activity intervention study showed a slight reduction in overweight. However, the randomized control design may not be ideal for the study of most health-promotion interventions. This is because these are typically population-based programs, which tend to be complex, are delivered over long periods of time, and present some difficulties in controlling all variables.¹¹ Solution-oriented research, which evaluates promising interventions, often in a quasi-experimental manner, may be more appropriate in the long run.³⁷ It is unlikely, however, that any single strategy will be sufficient to reverse current trends in pediatric obesity. Success is more likely to be achieved by the implementation of sustainable, economically viable, culturally acceptable active-living policies that can be integrated into multiple sectors of society.

Increasing Physical Activity Levels in Children and Youth

Physical activity needs to be promoted at home, in the community, and at school, but school is perhaps the most encompassing way for all children to benefit. As of June 2005, there is a new opportunity for pediatricians to get involved with school districts. Section 204 of the Child Nutrition and WIC [Supplemental Nutrition Program for Women, Infants, and Children] Reauthorization Act of 2004 (Public Law 108–265) requires that every school receiving funding through the National School Lunch and/or Breakfast Program develop a local wellness policy that promotes the health of students, with a particular emphasis on addressing the problem of childhood obesity. By the 2006–2007 school year, each school or school district is required to set goals for healthy nutrition, physical activity, and other strategies to promote student wellness. Parents, students, school personnel, and members of the community are required to be involved in the policy development. Pediatricians can take advantage of this requirement to get involved. In light of the school wellness policy, many schools are looking to modify their present PE programs to improve their physical activity standards.

In past years, PE classes used calisthenics and sport-specific skill acquisition to promote fitness. This approach did not meet the needs of all students, such as those with obesity or physical disabilities. PE curricula and instruction should emphasize the knowledge, attitudes, and motor and behavioral skills required to adopt and maintain lifelong habits of physical activity.³⁸ Cross-sectional school-based studies have shown modest correlation between physical activity and lower BMI, although long-term follow-up data are lacking. In an observational study of 9751 kindergarten students, an increase in PE instruction time was associated with a significant reduction in BMI among overweight girls.³⁹ Project SPARK (Sports, Play, and Active Recreation for Kids Curriculum) looked at increasing physical activity through modified PE and classroom-based teaching on health and skill fitness. Physical activity levels increased during PE classes, and fitness levels in girls improved as a result.⁴⁰ It is interesting to note that, despite a significant increase in PE class time, there was no interference with academic attainment, and some achievement test results improved. A recent review of the literature suggests that school-based physical activity programs may modestly enhance academic performance in the short-term, but additional research is required to establish any long-term improvements. There does not seem to be sufficient evidence to suggest that daily physical activity detracts from academic success.⁴¹

An increase in school PE participation alone is not likely to be sufficient to reverse the childhood obesity epidemic. A 2-year study of elementary students showed that those who had enhanced physical activity education as well as modified PE classes to increase lifestyle aerobic

activity increased their physical activity inside the classroom, but lower levels were noted outside the classroom in their leisure time, and no improvements on fitness testing or body fat percentage were seen.⁴² The PLAY (Promoting Lifestyle Activity for Youth) program, which encourages the accumulation of 30 to 60 minutes of moderate to vigorous physical activity daily beyond school time and during regular school hours outside of PE classes, has been shown to increase the physical activity levels of children, especially girls.⁴³ Children can increase their physical activity levels in many other ways during school and nonschool hours, including active transportation, unorganized outdoor free play, personal fitness and recreational activities, and organized sports. Parents of children in organized sports should be encouraged to stimulate their children to be physically active on days when they are not participating in these sports and not rely solely on the sports to provide all their away-from-school physical activity. This should include participation in physical activities with the entire family. Communities designed with green spaces and biking trails help provide families the means to enjoy such active lifestyles.

During late childhood and adolescence, strength training may be additionally beneficial. Youth taking part in this type of exercise may gain strength, improve sport performance, and derive long-term health benefits.⁴⁴ Obese children often prefer strength training because it does not require agility or aerobic ability, and the benefits become apparent within as little as 2 to 3 weeks. Because of their added body mass, overweight participants also tend to be stronger than their peers, giving them a relative psychological advantage. Recent studies have shown that obese students are more compliant and increase their free fat mass when weight training is added to aerobic exercise or a standardized energy-reduction diet.^{45,46}

Recommended physical activity levels for children and youth vary somewhat in different countries. The Centers for Disease Control and Prevention and the United Kingdom Health Education Authority recommend that children and youth accumulate at least 60 minutes daily of moderate to vigorous physical activity in a variety of enjoyable individual and group activities.^{47,48} Health Canada guidelines recommend increasing physical activity above the current level by at least 30 minutes (10 minutes vigorous) and reducing sedentary activity by the same amount per day. Each month, physical activity should be increased and sedentary behavior should be decreased by 15 minutes until at least 90 minutes more active time and 90 minutes less inactive time are accumulated (www.paguide.com). The Canadian Paediatric Society has endorsed these recommendations and emphasizes a wide variety of activities as part of recreation, transportation, chores, work, and

planned exercise to encourage lifestyle changes that may last a lifetime.⁴⁹

Age-Appropriate Recommendations for Physical Activity

Clinicians should encourage parents to limit sedentary activity and make physical activity and sport recommendations to parents and caregivers that are consistent with the developmental level of the child.⁵⁰ The following are guidelines from the AAP for different age groups.

Infants and Toddlers

There is insufficient evidence to recommend exercise programs or classes for infants and toddlers as a means of promoting increased physical activity or preventing obesity in later years. The AAP has recommended that children younger than 2 years not watch any television. The AAP suggests that parents be encouraged to provide a safe, nurturing, and minimally structured play environment for their infant.⁵¹ Infants and toddlers should also be allowed to develop enjoyment of outdoor physical activity and unstructured exploration under the supervision of a responsible adult caregiver. Such activities include walking in the neighborhood, unorganized free play outdoors, and walking through a park or zoo.

Preschool-Aged Children (4–6 Years)

Free play should be encouraged with emphasis on fun, playfulness, exploration, and experimentation while being mindful of safety and proper supervision. Preschool-aged children should take part in unorganized play, preferably on flat surfaces with few variables and instruction limited to a show-and-tell format. Appropriate activities might include running, swimming, tumbling, throwing, and catching. Preschoolers should also begin walking tolerable distances with family members. In addition, parents should reduce sedentary transportation by car and stroller and, as applies to all age groups, limit screen time to <2 hours per day.

Elementary School-Aged Children (6–9 Years)

In this age group, children improve their motor skills, visual tracking, and balance. Parents should continue to encourage free play involving more sophisticated movement patterns with emphasis on fundamental skill acquisition. These children should be encouraged to walk, dance, or jump rope and may enjoy playing miniature golf. There is little difference between the sexes in weight, height, endurance, and motor skill development at this age; thus, co-ed participation is not contraindicated. Organized sports (soccer, baseball) may be initiated, but they should have flexible rules and short instruction time, allow free time in practices, and focus on enjoyment rather than competition. These children have a limited ability to learn team strategy.

Middle School-Aged Children (10–12 Years)

Preferred physical activities that focus on enjoyment with family members and friends should be encouraged as with previous groups. Emphasis on skill development and increasing focus on tactics and strategy as well as factors promoting continued participation are needed. Fully developed visual tracking, balance, and motor skills are typical in late childhood. Middle school-aged children are better able to process verbal instruction and integrate information from multiple sources so that participation in complex sports (football, basketball, ice hockey) is more feasible. Puberty may begin at different rates, making some individuals bigger and stronger than others. Basing placement in contact and collision sports on maturity rather than chronologic age may result in less risk of injury and enhanced chance of success, especially for those at lower Tanner stages. Weight training may be initiated, provided that the program is well supervised, that small free weights are used with high repetitions (15–20), that proper technique is demonstrated, and that shorter sets using heavier weights and maximum lifts (squat lifts, clean and jerk, dead lifts) are avoided.⁴⁴

Adolescents

Adolescents are highly social and influenced by their peers. Identifying activities that are of interest to the adolescent, especially those that are fun and include friends, is crucial for long-term participation. Physical activities may include personal fitness preferences (eg, dance, yoga, running), active transportation (walking, cycling), household chores, and competitive and non-competitive sports. Ideally, enrollment in competitive contact and collision sports should be based on size and ability instead of chronologic age. Weight training may continue, and as the individual reaches physical maturity (Tanner stage 5), longer sets using heavier weights and fewer repetitions may be safely pursued while continuing to stress the importance of proper technique.

Office-Based Physical Activity Assessment

An accurate assessment of an individual child's physical activity level by history or questionnaire is difficult and fraught with methodologic problems. It may be easier for parents to recall the number of times per week their child plays outside for at least 30 minutes than to estimate the average daily minutes spent in physical activity. In addition, asking parents about the number of hours per day their child spends in front of a television, video game, or computer screen may be simpler to quantify and track than time spent in active play. Pedometers may also be helpful, because they provide a simple and more objective method of measuring activity, are inexpensive, and have a "gadget appeal" among youngsters. It has been recommended that adults accumulate 10 000 steps per day to follow a healthy lifestyle.⁵² Require-

ments are less clearly defined in children, but guidelines range from 11 000 to 12 000 steps per day for girls and 13 000 to 15 000 steps per day for boys.^{53,54}

CONCLUSIONS

The prevalence of pediatric obesity has reached epidemic proportions. It is unlikely that the medical profession alone will be able to solve this serious health problem. The promotion of decreased caloric intake and increased energy expenditure will need to take place within all aspects of society. Among the most difficult but most important challenges for society are making exercise alternatives as attractive, exciting, and enjoyable as video games for children, convincing school boards that PE and other school-based physical activity opportunities are as important to long-term productivity as academics, changing both supplier and consumer attitudes about food selection and portion sizes, and reengineering living environments to promote physical activity.

RECOMMENDATIONS

Research has shown the importance of social, physical, and cultural environments in determining the extent to which people are able to be active in all facets of daily life, including work, education, family life, and leisure.⁵⁵ Creating active school communities is an ideal way to ensure that children and youth adopt active, healthy lifestyles. These communities require a collaborative framework between families, schools, community recreation leaders, and health care professionals. Physicians can be instrumental in the development of active school communities by advocating for policy changes at the community, state, and national levels that support healthy nutrition, reducing sedentary time, and increasing physical activity levels while providing education and health supervision about regular physical activity and reduced sedentary time to families in their practices.

ADVOCACY

In addition to promoting healthy nutrition recommendations suggested by the AAP Committee on Nutrition, physicians and health care professionals and their national organizations should advocate for:

- Social marketing that promotes increased physical activity.
- The appropriate allocation of funding for quality research in the prevention of childhood obesity.
- The development and implementation of a school wellness counsel on which local physician representation is encouraged.
- A school curriculum that teaches children and youth the health benefits of regular physical activity.

- Comprehensive community sport and recreation programs that allow for community and school facilities to be open after hours and make physical activities available to all children and youth at reasonable costs; access to recreation facilities should be equally available to both sexes.
- The reinstatement of compulsory, quality, daily PE classes in all schools (kindergarten through grade 12) taught by qualified, trained educators. The curricula should emphasize enjoyable participation in physical activity that helps students develop the knowledge, attitudes, motor skills, behavioral skills, and confidence required to adopt and maintain healthy active lifestyles. These classes should allow participation by all children regardless of ability, illness, injury, and developmental disability, including those with obesity and those who are disinterested in traditional competitive team sports. Commitment of adequate resources for program funding, trained PE personnel, safe equipment, and facilities is also recommended.
- The provision of a variety of physical activity opportunities in addition to PE, including the protection of children's recess time and the requirement of extracurricular physical activity programs and nonstructured physical activity before, during, and after school hours, that address the needs and interests of all students.
- The reduction of environmental barriers to an active lifestyle through the construction of safe recreational facilities, parks, playgrounds, bicycle paths, sidewalks, and crosswalks.

PROMOTING A HEALTHY LIFESTYLE

Physicians and health care professionals should promote active healthy living within each family unit by:

- Serving as role models through the adoption of an active lifestyle.
- Inquiring about nutritional intake, calculating and plotting BMI, identifying obesity-related comorbidities, and promoting healthy eating as suggested by the AAP Committee on Nutrition.
- Documenting the number of hours per day spent on sedentary activities and limiting screen (television, video game, and computer) time according to AAP guidelines.
- Determining physical activity levels of the child and family members at regular health care visits.
- Tabulating the amount of physical activity the child or youth does each day at home, school, or child care as part of transportation, work, recreation, and unorganized sports, which should include determining the actual minutes of PE and recess-related physical activity achieved at school each week. In addition, the

number of times per week spent in outdoor play for at least 30 minutes and/or the number of daily steps achieved (monitored by using a pedometer) should be documented. Specific involvement in organized sports and dance also should be noted.

- Encouraging children and adolescents to be physically active for at least 60 minutes per day, which does not need to be acquired in a continuous fashion but rather may be accumulated by using smaller increments. Events should be of moderate intensity and include a wide variety of activities as part of sports, recreation, transportation, chores, work, planned exercise, and school-based PE classes. These activities should be primarily unstructured and fun if they are to achieve best compliance.
- Identifying any barriers the child, youth, or parent might have against increasing physical activity, which might include lack of time, competing interests, perceived lack of motor skills, and fear of injury on the part of the child. Parents might be additionally concerned about financial and safety issues. Efforts must then be made to work with the family to educate them regarding the importance of lifelong physical activity and to identify potential strategies to overcome some of their barriers.
- Recommending that parents become good role models by increasing their own level of physical activity. Parents should also incorporate physical activities that family members of all ages and abilities can do together. They should encourage children to play outside as much as possible. Safety should be promoted by the use of appropriate protective equipment (bicycle helmets, life jackets, etc).
- Advising parents to support their children and youth in developmentally and age-appropriate sports and recreational activities. The child's favorite types of physical activity should be a priority. These might best occur in the school setting during extracurricular activities, in which parents/grandparents can take part as leaders and coaches.
- Suggesting that overweight children partake in activities that take advantage of their tall stature and muscle strength, such as water-based sports and strength training, rather than those that require weight bearing (eg, jumping, jogging).
- Recommending that parents of overweight children and youth play a supporting, accepting, and encouraging role in returning them to healthier lifestyles to increase self-esteem.
- Encouraging youth to promote physical activities for their peers and become role models and leaders for younger students.

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REFERENCES

1. World Health Organization. *Obesity: Preventing and Managing the Global Epidemic. Report of a WHO Consultation on Obesity, 3–5 June 1997, Geneva.* Geneva, Switzerland: World Health Organization; 2001. WHO/NUT/NCD 98.1
2. Ogden CL, Carroll MD, Flegal KM. Epidemiologic trends in overweight and obesity. *Endocrinol Metab Clin North Am.* 2003; 32:741–760, vii

3. Rosenbloom AL. Increasing incidence of type 2 diabetes in children and adolescents: treatment considerations. *Paediatr Drugs*. 2002;4:209–221
4. Sorof JM, Lai D, Turner J, Poffenbarger T, Portman RJ. Overweight, ethnicity, and the prevalence of hypertension in school-aged children. *Pediatrics*. 2004;113:475–482
5. Wing YK, Hui SH, Pak WM, et al. A controlled study of sleep related disordered breathing in obese children. *Arch Dis Child*. 2003;88:1043–1047
6. Rashid M, Roberts EA. Nonalcoholic steatohepatitis in children. *J Pediatr Gastroenterol Nutr*. 2000;30:48–53
7. Schwimmer JB, Burwinkle TM, Varni JW. Health-related quality of life of severely obese children and adolescents. *JAMA*. 2003;289:1813–1819
8. 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
9. Guo SS, Chumlea WC. Tracking of body mass index in children in relation to overweight in adulthood. *Am J Clin Nutr*. 1999;70(1 pt 2):145S–148S
10. Belay B, Belamarich P, Racine AD. Pediatric precursors of adult atherosclerosis. *Pediatr Rev*. 2004;25:4–16
11. Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obesity Rev*. 2004;5(suppl 1):4–104
12. Kuczmarski RJ, Ogden CL, Grummer-Strawn LM, et al. CDC growth charts: United States. *Adv Data*. 2000;(314):1–28
13. Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. *Am J Clin Nutr*. 1994;59:307–316
14. Sardinha LB, Going SB, Teixeira PJ, Lohman TG. Receiver operating characteristic analysis of body mass index, triceps skinfold thickness, and arm girth for obesity screening in children and adolescents. *Am J Clin Nutr*. 1999;70:1090–1095
15. Krebs NF, Jacobson MS; American Academy of Pediatrics, Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics*. 2003;112:424–430
16. American Academy of Pediatrics, Committee on School Health. Soft drinks in schools. *Pediatrics*. 2004;113:152–154
17. Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the Third National Health and Nutrition Examination Survey. *JAMA*. 1998;279:938–942
18. Centers for Disease Control and Prevention. Physical activity levels among children aged 9–13 years: United States, 2002. *MMWR Morb Mortal Wkly Rep*. 2003;52:785–788
19. US Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: US Department of Health and Human Services; 2001
20. Raine KD. *Overweights and Obesity in Canada: A Population Health Perspective*. Ottawa, Ontario, Canada: Canadian Institute for Health Information; 2004. Available at: <http://secure.cihi.ca/cihiweb/products/CPHIOverweightandObesityAugust2004.e.pdf>. Accessed March 30, 2005
21. Sallis JF. Epidemiology of physical activity and fitness in children and adolescents. *Crit Rev Food Sci Nutr*. 1993;33:403–408
22. Burgeson CR, Wechsler H, Brener ND, Young JC, Spain CG. Physical education and activity: results from the School Health Policies and Programs Study 2000. *J Sch Health*. 2001;71:279–293
23. National Association of State Boards of Education. *Fit, Healthy, and Ready to Learn: A School Health Policy Guide*. Alexandria, VA: National Association of State Boards of Education; 2000
24. Nader PR. Frequency and intensity of activity of third-grade children in physical education. National Institute of Child Health and Human Development Study of Early Child Care and Youth Development Network. *Arch Pediatr Adolesc Med*. 2003;157:185–190
25. Grunbaum JA, Kann L, Kinchen S, et al. Youth risk behavior surveillance: United States, 2003 [published corrections appear in *MMWR Morb Mortal Wkly Rep*. 2004;53(24):536 and *MMWR Morb Mortal Wkly Rep*. 2005;54(24):608]. *MMWR Surveill Summ*. 2004;53(2):1–96
26. Summerbell CD, Ashton V, Campbell KJ, Edmonds L, Kelly S, Waters E. Interventions for treating obesity in children. *Cochrane Database Syst Rev*. 2003;(3):CD001872
27. Epstein LH. Methodological issues and ten-year outcomes for obese children. *Ann N Y Acad Sci*. 1993;699:237–249
28. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. *JAMA*. 1999;282:1561–1567
29. American Academy of Pediatrics, Committee on Public Education. Children, adolescents, and television. *Pediatrics*. 2001;107:423–426
30. Epstein LH, Wing RR, Koeske R, Valoski A. A comparison of lifestyle exercise, aerobic exercise, and calisthenics on weight loss in obese children. *Behav Ther*. 1985;16:345–356
31. American Diabetes Association. Type 2 diabetes in children and adolescents. *Pediatrics*. 2000;105:671–680
32. Hansen HS, Froberg K, Hyldebrandt N, Nielsen JR. A controlled study of eight months of physical training and reduction of blood pressure in children: the Odense schoolchild study. *BMJ*. 1991;303:682–685
33. Hagberg JM, Ehsani AA, Goldring D, Hernandez A, Sinacore DR, Holloszy JO. Effect of weight training on blood pressure and hemodynamics in hypertensive adolescents. *J Pediatr*. 1984;104:147–151
34. Roberts EA. Nonalcoholic steatohepatitis in children. *Curr Gastroenterol Rep*. 2003;5:253–259
35. Calfas KJ, Taylor WC. Effects of physical activity on psychological variables in adolescents. *Pediatr Exerc Sci*. 1994;6:406–423
36. Campbell K, Waters E, O'Meara S, Kelly S, Summerbell C. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2002;(2):CD001871
37. Robinson TN, Sirard JR. Preventing childhood obesity: a solution-oriented research paradigm. *Am J Prev Med*. 2005;28(2 suppl 2):194–201
38. Centers for Disease Control and Prevention. Youth risk behavior surveillance: National College Health Risk Behavior Survey—United States, 1995. *MMWR CDC Surveill Summ*. 1997;46(6):1–56
39. Datar A, Sturm R. Physical education in elementary school and body mass index: evidence from the Early Childhood Longitudinal Study. *Am J Public Health*. 2004;94:1501–1506
40. Sallis JF, McKenzie TL, Kolody B, Lewis M, Marshall S, Rosen-gard P. Effects of health-related physical education on academic achievement: project SPARK. *Res Q Exerc Sport*. 1999;70:127–134
41. Taras H. Physical activity and student performance at school. *J Sch Health*. 2005;75:214–218
42. Donnelly JE, Jacobsen DJ, Whatley JE, et al. Nutrition and physical activity program to attenuate obesity and promote physical and metabolic fitness in elementary school children. *Obes Res*. 1996;4:229–243
43. Pangrazi RP, Beighle A, Vehige T, Vack C. Impact of Promoting Lifestyle Activity for Youth (PLAY) on children's physical activity. *J Sch Health*. 2003;73:317–321
44. Bernhardt DT, Gomez J, Johnson MD, et al. Strength training by children and adolescents. *Pediatrics*. 2001;107:1470–1472
45. Sothorn MS, Loftin JM, Udall JN, et al. Safety, feasibility, and

- efficacy of a resistance training program in preadolescent obese children. *Am J Med Sci*. 2000;319:370–375
46. Schwingshandl J, Sudi K, Eibl B, Wallner S, Borkenstein M. Effect of an individualised training programme during weight reduction on body composition: a randomised trial. *Arch Dis Child*. 1999;81:426–428
 47. Strong WB, Malina RM, Blimkie CJ, et al. Evidence based physical activity for school-age youth. *J Pediatr*. 2005;146:732–737
 48. Biddle S, Sallis J, Cavill N. Policy framework for young people and health-enhancing physical activity. In: Biddle S, Sallis J, Cavill N, eds. *Young and Active: Young People and Physical Activity*. London, England: Health Education Authority; 1998:3–16
 49. Canadian Paediatric Society, Healthy Active Living Committee. Healthy active living for children and youth. *Paediatr Child Health*. 2002;7:339–345
 50. Harris SS. Readiness to participate in sports. In: Sullivan JA, Anderson SJ, eds. *Care of the Young Athlete*. Rosemont, IL: American Academy of Orthopaedic Surgeons/American Academy of Pediatrics; 2000:19–24
 51. American Academy of Pediatrics, Committee on Sports Medicine and Fitness. Infant exercise programs. *Pediatrics*. 1988;82:800
 52. Hatano Y. Use of the pedometer for promoting daily walking exercise. *Int Council Health Phys Ed Rec*. 1993;29:4–8
 53. Vincent SD, Pangrazi RP. An examination of the activity patterns of elementary school children. *Pediatr Exerc Sci*. 2002;14:432–441
 54. Tudor-Locke C, Pangrazi RP, Corbin CB, et al. BMI-referenced standards for recommended pedometer-determined steps/day in children. *Prev Med*. 2004;38:857–864
 55. Health Canada, Population and Public Health Branch, Policy Directorate. *The Population Health Template: Key Elements and Actions That Define a Population Health Approach*. Ottawa, Ontario, Canada: Health Canada; 2001