



STANFORD
SCHOOL OF MEDICINE

Stanford University Medical Center

Building “Generation Play”:
Addressing the Crisis of Inactivity
Among America’s Children

A REPORT BY STANFORD UNIVERSITY

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STANFORD PREVENTION RESEARCH CENTER
STANFORD UNIVERSITY SCHOOL OF MEDICINE

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**Stanford Prevention Research Center
Stanford University School of Medicine**

Preface

Over the last several decades, technology and other advances that have benefited society in so many ways have created a host of social and environmental factors that have joined together to position this generation of youth to become the "Sedentary Generation."

Contributing factors include: unplanned urban sprawl; increased television viewing and computer use; concerns about safety and crime; a decrease in physical education, activity and recess in school; a loss of financial support and commitment to public venues for play; and a lack of knowledge about the importance of physical activity to health and wellbeing.

Today in many communities we find a lack of safe places and spaces to play, an inadequate number of voices to encourage and support play, and not enough opportunities for, or access to, quality play. In particular, opportunities for unstructured or self-structured play have diminished, even as such opportunities are recognized by developmental psychologists as being critical to the development of problem-solving skills of children.

More than one hundred years ago, the nation faced a similar dilemma. In response to the conditions of the Industrial Revolution, a broad spectrum of social and political institutions came together in a social movement to make life more tolerable for children; to help them develop socially and cognitively; and to recognize childhood as a significant part of a human being's developmental period.

Communities across the country fought for and established some of the first playgrounds and bound together to form local playground associations. Those local associations formally joined together as the Playground Association of America in 1906 and held its first meeting at the YMCA in Washington, D.C., where delegates from playground associations, public schools and municipal recreation departments, settlements, teachers' colleges and charitable organizations met for the first time.

A year later they held the first "Play Congress" and launched the Playground Movement that would be the catalyst to develop the places, spaces and voices for quality play centered on the themes of recreation and democracy, citizenship and character development.

In a letter to the Association, President Theodore Roosevelt - also the honorary President of the American Playground Association, wrote, "Through the whole of life, from childhood to old age, there should be opportunities for the practice of those forms of recreation which renew life, and which make for the joy of living. Therefore, I consider such work as that of our Association, in establishing the best forms of play and guiding the expressions of recreation among our people, to be an essential factor in our national life."

The Playground Movement benefited greatly from government involvement. Cities developed and managed parks and recreation programs. President Dwight D. Eisenhower created the President's Council on Youth Fitness and, shortly thereafter, a National Fitness Week was established.

President John F. Kennedy changed the name to the President's Council on Physical Fitness, today known as The President's Council on Physical Fitness and Sports. The Federal government passed legislation related to non-discrimination of Americans with disabilities and gender equity in sports. Companies built fitness facilities, developed league sports, and offered recreational opportunities to their employees.

The playground movement serves as a good example of change that influenced not only the physical fitness of youth, but also produced many positive lifelong benefits for youth and adults. The Playground Movement taught children self-improvement, social connectedness, community service, and a lifestyle directed toward health and vitality. The youth who benefited from this playground movement have come to be known in America as the "Greatest Generation."

Now, one hundred years later, the YMCA, National Recreation and Park Association and the National Association for Sport and Physical Education - whose organizations or their forbearers helped found the Playground Movement - have reconvened at the YMCA offices in Washington D.C. to activate and re-shape the movement in order to address physical inactivity among today's children.

The stakes are high. If we fail to take action, this generation may be the first in American history to have a shorter life expectancy than that of their parents. It is in this context that these three organizations commissioned this comprehensive review of the scientific literature to better understand the current barriers to physical activity and play, which contribute to childhood overweight.

The report makes it clear that science has sufficiently demonstrated the benefits of physical activity in preventing obesity among children and adolescents, and now we must decide to act upon these findings. Further, the report recommends a comprehensive approach to significantly change the current trend.

Certainly children make some of their own decisions about physical activity and play. However, children's attitudes, values and behaviors are influenced by parents and other caregivers as well as by "communities" in which children live. As a society, we need to take actions that are just as bold as those directed toward childhood immunization, use of protective restraints for children traveling in vehicles, and the prevention of smoking among teens.

We need to re-affirm our commitment to children's play. If we fail to act on these recommendations, we will have allowed this generation to become the most sedentary in our nation's history.

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Executive Summary

Childhood obesity is a serious national health problem. It is estimated that almost one in five children 2-19 years old in the United States were overweight in 2003-2004, as defined by gender- and age-specific body mass index (BMI) percentiles. Childhood obesity carries significant health risks not only for children but also for the adults they grow into. Childhood obesity is associated with an increased incidence of cardiovascular risk factors such as hypertension and type 2 diabetes. Obese children are also more likely to suffer from depression, low self-esteem and discrimination. If an overweight child becomes an overweight adult he or she will also have increased risks for cardiovascular disease, type 2 diabetes, sleep apnea, arthritis, and certain types of cancer.

Obesity is the result of an accumulated energy surplus, where energy intake exceeds energy expenditure over an extended period of time. There are considerable data on the impact of the energy intake part of the energy balance equation. The focus of this report is on the calorie expenditure side of the equation. Specifically, this report describes the lack of adequate physical activity of today's children and adolescents; summarizes factors contributing to this lack of activity; and suggests possible strategies for reversing this trend.

This report takes an ecological approach, in that it recognizes that for the trends to turn around, changes will have to be made on many levels, including individual behaviors; attitudes and beliefs about physical activity; the social and physical environments; policy decisions; and the roles parents, teachers, child and day care providers and the media play in support of children and youth in achieving greater levels of activity. These changes will need to be made at home, at school and after school sites; within communities, worksites, the media; and at local, state and national policy levels. The benefits of increased physical activity on improved physical and emotional health, as well as the economic gain, will be felt not only at the individual level but also at the societal level at large.

The current recommendation is for children to engage in at least 60 minutes of moderate to vigorous physical activity each day. It has been further recommended that half of the recommended amount of physical activity take place at school, both during daily physical education class and, for younger students, recess.

While it is difficult to gauge accurately physical activity levels of children and adolescents, the synthesis of existing data shows that today's youth are insufficiently physically active. One recent national survey has found that almost two-thirds of high school students are not meeting the recommended level of physical activity. Another study has found that 10-16 year olds are engaged in vigorous activity only 12.6 minutes per day. In contrast, they spend an average of 10.4 hours of their waking hours relatively motionless.

Another clear finding is that today's children spend much of their time engaged in sedentary activities. One recent study among 8-18 year olds found that they spend 6.5 hours per day with personal use media (including TV, DVDs, computers, radio and CDs), among which a daily average of 4 hours is spent watching TV, DVDs, or videos.

There are many factors that contribute to the lack of physical activity of today's children. This report focuses on four broad categories of contributory factors: (a) lack of opportunity/lack of access to venues for physical activity; (b) lack of psychosocial assets, such as self-efficacy and attitudes; (c) lack of knowledge about the importance of physical activity, the relationship between physical activity and childhood obesity, and numerous health implications of childhood obesity; and (d) existence of a sedentary culture and prevalence of appealing sedentary leisure-time activities.

The lack of opportunity to engage in physical activity is one of the factors thought to contribute to the overall low level of physical activity of today's youth. Examples include the lack of daily physical education class and recess at school. Even when children do have physical education class, they are not sufficiently active during the class. In addition, many children do not participate in organized sports, such as school-sponsored athletic teams, or after school intramural or club sports. Moreover, often for those who are not gifted athletes, little opportunity exists for other forms of physical activity. Another area of a "missed opportunity" for children to engage in physical activity is during their daily commute to and from school. Instead of walking or biking to school, as was done in the past, most children ride to school, either on buses, or in personal vehicles. Community design, or "the built environment," also has been implicated in the lack of physical activity among today's youth. Communities are being designed and built without sidewalks, bike paths and safe walking or biking routes to local stores, commercial businesses, schools, and recreation sites, thus encouraging transportation by car rather than by foot or bike. Additionally, many children and adolescents do not have access to recreational facilities, parks, playgrounds, or other safe areas in which to engage in physical activity.

Psychosocial variables have been shown to be linked to physical activity, and today's youth may need an improvement in important psychosocial assets. Specifically, parental support of physical activity is a powerful predictor of whether or not children will be physically active. Such support can consist of verbal encouragement, as well as facilitation of the physical activity by driving children to sports practices, or to bike or walking paths. Beliefs that one can overcome barriers to exercise (i.e., self-efficacy), as well as feelings that one is competent at sports, have been associated with higher levels of child and adolescent physical activity. Beliefs that physical activity is enjoyable, and the ability to self-regulate, also have been associated with an increased level of physical activity. Therefore, enhancing these psychosocial assets is likely to counteract a lack of physical activity among children.

An additional element that has been associated with childhood and adolescent physical activity is knowledge about physical activity. Specifically, youth need information about how to engage in physical activity throughout their lifetime; the wide range of benefits associated with physical activity (health and otherwise); and how to overcome barriers that may stand in the way of being physically active. As parental support is crucial in getting children physically active, parents also need this information. Effective mass media campaigns, which emphasize these points in culturally sensitive ways, can help increase levels of physical activity in youth. Another crucial venue through which physical activity knowledge can be improved is through regular, quality, physical education and health education taught by capable physical education and health education teachers. Physical education classes should provide instruction around physical activity skills, so as to increase students' perceptions of sports competence, a known correlate of physical activity. Students should learn about the physical, social, and mental health benefits of

exercise, and be exposed to a wide range of activities, so that students will encounter at least some activities that they enjoy. Students also need to learn skills about how to be physically active beyond team sports throughout their lifetime, including important self-regulation skills, such as goal-setting and self-monitoring.

Finally, in today's technologically-driven society, many day-to-day tasks that children used to do manually have been automated. Separately, such activities likely represent only a small amount of energy expenditure, but taken together, over the long-term, they could translate to excess energy and thus eventual weight gain. In addition, current culture exposes children and youth to extremely inviting sedentary media, and children spend a large portion of their time engaged in sedentary activities, especially television and DVD viewing, and computer use. Many studies have found a positive relationship between television viewing and weight gain. Time spent watching television is time not spent engaged in more active past-times, but it also impacts children's food choices and calorie intake as well. Interventions aimed at reducing the amount of time that children spend in sedentary activities have been found to result in weight loss.

Childhood obesity and lack of physical activity are problems that affect American youth from all segments of society. However, certain groups are at increased risk. Rates of physical activity differ by age, gender, ethnicity, socioeconomic status (SES) and disability status. Specifically, it has been found that: (a) older children are less active than younger children, which is especially true for females; (b) females are less active than males; (c) African American or Hispanic children and adolescents are less active than their white counterparts; (d) children of lower SES status (both at the individual and neighborhood levels) are less active than those of higher SES; and (e) children with disabilities face more barriers to being physically active than children without disabilities. The disparities in physical activity may be due to differential resources and support for physical activity, and access to safe venues in which to engage in physical activity.

Solutions for the childhood obesity epidemic will not be easy, and will necessitate changes in all the environments to which children are exposed, namely: home, school, after school, faith groups, youth groups, community organizations, community businesses, and the normative physical activity of the community at large. In order to make these changes, parents; teachers; school officials; elected officials at the local, state, and national levels; business leaders and community-based organizations that focus on youth, will need to collaborate and adopt similar goals for physical activity and healthy weight among children and youth.

Unfortunately, there has been no recent improvement in the level of physical activity of children, in general, to combat the alarming obesity epidemic. This fact demonstrates that current public policy has not been enough to encourage our youth to engage in more physical activity. While it is acknowledged that we need to continue to investigate the causes of the obesity epidemic, there is an urgent need for action. We cannot afford, nor can our children afford, to wait until all open questions are answered before taking action. It is clear that lack of physical activity among children plays a significant role in the childhood obesity epidemic, and thus changing this pattern holds the key to possible solutions. As such, lack of physical activity is a crisis that calls for immediate action based on what is currently known.

At the end of the current report, we summarize what we know about this crisis. Then, based on the available evidence, we describe possible strategies to increase physical activity, and thus reduce obesity, among children and adolescents. These recommendations impact parents, schools, mass media, healthcare, industry, communities, and government. Such recommendations include: (a) Encouraging parents to support and facilitate physical activity both in and outside the school environment; (b) Placing limits on sedentary leisure pursuits such as television viewing and other screen-time to no more than 2 hours per day; (c) Daily physical education classes taught by qualified teachers; (d) Community-based advertising campaigns to foster awareness of the benefits of physical activity and to encourage active lifestyles; (e) Routine healthcare monitoring of children's weight status and health behaviors including physical activity; (f) Products that promote physically active entertainment; (g) New development projects planned with designs for promoting physical activity (e.g., bike paths, sidewalks, mixed land use, no barricades between home and schools, and pedestrian promenades); and (h) Venues such as recreational facilities, community-based organizations, parks, and playgrounds that are accessible to all children to allow for safe play.

I. Introduction

The current obesity epidemic in America has evolved over the past three decades. Its consequences are being felt among individuals and families in terms of poor health, loss of vitality, and diminished quality of life. On a societal level, there are economic costs related to health care and lost productivity. If the obesity epidemic continues, such consequences are likely to become even more pronounced. On the one hand, the fundamental cause of obesity is straightforward: there is an imbalance between energy intake and energy expenditure—a surplus of energy over an extended period of time. On the other hand, multiple factors interplay in complex ways to contribute to overweight and obesity including environmental, social, economic, behavioral, and genetic factors, which require individual, societal, cultural, and environmental solutions.

Availability and choice about food and physical activity, prevailing normative values and behaviors, educational priorities within schools, decisions within governmental bodies about resource allocation, and environmental policies, are but a few of the important issues that contribute to the epidemic and which hold the potential for solution. To the extent that we focus our corrective actions only on what individuals can do about their own energy imbalance, we will not be successful in fighting this epidemic.

Obesity among children is of special concern. Childhood obesity has short-term negative physical, social, psychological, and economic consequences. In addition, as children develop attitudes, values, and lifestyle behaviors, they are painting a picture of their future. There is unanimous agreement among health experts from all segments of our society that youth obesity must be dealt with now or else it will create significant harm in the future (including failure in readiness of our workforce; increased disease, absenteeism, disability and health care costs; and compromised quality of life). There is no debate that youth are getting heavier. Unfortunately, efforts being directed toward the problem are neither coordinated nor sufficient. The solution does not lie within one course of action; rather, it will come from multiple actions taken by various segments of our community and directed toward all of the known causative agents. Now is the time for action.

This report gathers key information regarding youth physical inactivity—current status/trends and potential contributors—from various sources into one document for a clearer picture of the energy expenditure side of the energy balance equation of the current obesity epidemic. It presents an ecological view of the problem of physical inactivity among children and proposes collective solutions to address the problem, emphasizing that multiple causative factors require multiple solutions. The purpose of this report is to bring a sense of urgency to the public's awareness about this important health crisis and to call for a national coordinated plan of action.

II. Background

Childhood Obesity Epidemic

Childhood obesity is defined as being at or above the 95th percentile according to the Centers for Disease Control and Prevention (CDC) age- and gender-specific body mass index (BMI; weight (kg) /height (m)²) charts,¹ which were generated based on data from 1963-1994.² Children are considered at risk for overweight if they are at or above the 85th percentile of age- and gender-specific BMI charts.¹ For the purposes of this report, the terms “childhood overweight” and “childhood obesity” are sometimes used interchangeably. According to 2003-2004 National Health and Nutrition Examination Survey (NHANES) data, 13.9% of 2-5 year old, 18.8% of 6-11 year old, and 17.4% of 12-19 year old children, are overweight (17.1% overall among 2-19 year old children). These numbers reflect close to a tripling, and for 6-11 year old children more than a quadrupling of rates from the 1970s.³ The recent Institute of Medicine (IOM) report on preventing childhood obesity¹ states that policy makers must view the childhood obesity epidemic as a critical public health threat and asserts that the prevention of childhood obesity should become a national public health priority.

Consequences of Childhood Obesity

Childhood obesity is a serious public health problem, as there are important health, psychosocial, and economic costs associated with it. First, obese children and adolescents are more likely than their normal weight counterparts to experience a significant number of health risks, such as: hypertension, high cholesterol, glucose intolerance/insulin resistance, sleep apnea, menstrual abnormalities, impaired balance, and orthopedic problems. An increased prevalence of metabolic syndrome and type 2 diabetes in overweight, as compared to normal weight, children also has been found.^{1, 4-6} Obese children often feel stigmatized and discriminated against by peers, parents, teachers, and even healthcare professionals.⁷⁻⁹ Overweight children are more likely to suffer from depression and low self-esteem than their normal weight peers.^{1, 6, 8, 10}

Lifestyle habits (e.g., diet and physical activity) are often established in childhood and are likely to carry through to adulthood. Research has shown that 70-80% of obese adolescents will become overweight as adults.¹¹ As overweight children are likely to become overweight adults, they are at a higher risk for developing many health conditions associated with adult obesity, such as: type 2 diabetes, heart disease, arthritis, asthma, and certain types of cancer.¹²⁻¹⁴

Not only are there significant short- and long-term health and emotional costs associated with childhood obesity, but there are monetary costs as well. Obesity-related hospital costs for children and youth went from an annual average of \$35 million in 1979-1981 to \$127 million in 1997-1999.¹⁵ Added costs as obese children become obese adults are substantial^{16, 17} not only for the affected individuals and families in the form of increased medical expenses, lost work time, physical and mental disabilities, and premature death, but also for their employers and society at large in the form of loss of productivity among the workforce and increased health care costs including costs for government health programs.

Suggested Causes of Childhood Obesity

In simple terms, obesity is the result of an energy imbalance, where the number of calories expended is fewer than the number of calories taken in.^{1, 18} One recent study estimated that an excess energy of 110-165 kcal/day could be responsible for the increase in childhood obesity rates from the 1988-1994 NHANES data to the 1999-2002 NHANES data.¹⁹

Whereas the basic mechanism (“energy imbalance”) can be simply described, the causes of the energy imbalance that affect food intake and energy expenditure are complex and span across many contexts including genetic, physiological, psychological, behavioral, sociocultural and economic factors. Most researchers suggest that children today are living in an “obesogenic” environment, where it is effortless to consume too many calories, while physical activity is discouraged.^{20, 21}

There has already been much reported on the energy intake side of the energy balance equation. For example, researchers point to an increase in portion sizes, and the consumption of convenience foods and restaurant foods, with its excess fat and calories, as contributing to the obesity problem.²²⁻²⁶ This report will focus on the need to address the physical activity part of the equation among youth and children.

Benefits of Physical Activity in Children

Regular physical activity is crucial for health and well being.¹² Physical activity in children, structured or unstructured free play, is essential to maintaining an energy balance, promoting a healthy weight, and supporting cognitive, physical, social and emotional development and well-being.^{27, 28}

The 1996 Surgeon General’s report stated that regular participation in physical activity during childhood and adolescence helps control weight.¹³ Boreham and Riddoch²⁹ describe the three main health benefits that come from adequate childhood activity as: (a) the direct improvement of childhood health status and quality of life; (b) the direct improvement of future adult health status by preventing or delaying the onset of many chronic diseases, and (c) an increased likelihood of maintaining an active lifestyle as an adult. Because of the many benefits of physical activity, the Department of Health and Human Services (DHHS) has stated that making physical activity a part of our daily lives is crucial.¹²

Health benefits of physical activity in adults include: healthy weight; the prevention of high blood pressure, high cholesterol, type 2 diabetes, and heart disease; reduced risk of osteoporosis and certain types of cancers; increased muscle strength and endurance; and healthy joints. Physical activity also helps reduce feelings of depression and anxiety, and assists with mood management.^{12, 13, 30}

Since most of these physical health benefits are associated with the prevention of chronic conditions, one would not necessarily expect to see these benefits in children. Lack of large-scale longitudinal studies and difficulties in measuring activity level and health in children also may mask the relationship between physical activity and health. However, past research has indeed found some evidence for a direct relationship between physical activity and health and well-being in children and adolescents.

A review of the literature has found evidence that active children have healthier cardiovascular profiles than non-active children.²⁹ There is evidence of a relationship between physical activity and lipid and lipoprotein levels in adolescents.^{1, 29, 31} In addition, there is evidence to suggest that physical activity in childhood or adolescence can prevent or delay the development of high blood pressure later in life.^{13, 14} Physical activity may also lower blood pressure in hypertensive adolescents.^{13, 14, 32} A recent study found that physical activity was inversely associated with levels of fasting insulin, glucose, and triglycerides among children aged 9-10 and 15-16 years old.³³ It also has been found that physical activity in children and adolescents can help increase peak bone mass, and thus reduce the risk of adult osteoporosis.^{13, 29} Levels of physical activity also seem to be associated with physical fitness. In a representative sample of 12 to 19 year olds, cardiorespiratory fitness was likely to be lower among youth with low levels of physical activity and high levels of sedentary behavior.³⁴

In addition to these physical health benefits, physical activity in adolescents has been associated with increased psychological well-being and reduced anxiety and stress levels.¹³ Moreover, a relationship between sports participation and other positive health behaviors, such as increased fruit and vegetable consumption, and reduced likelihood of smoking and drug use, has been found among high school students.^{35, 36} Also, there is some evidence that increased physical activity is associated with improved academic performance.¹² For example, Grissom³⁷ found that among 5th, 7th, and 9th grade students in California, there was a positive correlation between physical fitness level and performance on standardized achievement tests. Fitness also has been associated with better neurocognitive function in children.³⁸ In addition, participation in organized sports programs facilitates children and adolescents learning sportsmanship, self-discipline, and teamwork.¹² It has been suggested that participation in organized sports reduces the impact of negative influences, such as gangs, drugs, and violence.^{12, 39} Social and emotional benefits are shown to be obtained from unstructured free play as well.^{27, 28}

In summary, despite the measurement challenges and lack of longitudinal data, studies to date indicate that a relationship between physical activity and childhood health and well-being does exist. The evidence is clear that physical activity is helpful in reducing obesity among children and adolescents. In addition, physical activity is shown to increase peak bone mass and to help improve components of cardiovascular health such as lipid and lipoprotein levels and blood pressure, and psychological well-being of children and adolescents. Physical activity also has been shown to be associated with other positive health behaviors, better academic performance, and cognitive, social and emotional development. Finally, lifestyle habits, including those around physical activity, may persist into adulthood, carrying the benefits throughout life.⁴⁰⁻⁴³ Considering the evidence of the substantial costs of physical inactivity and the tremendous benefits of physical activity, it is crucial that children and adolescents adopt a physically active lifestyle.²⁹

Recommendations for Physical Activity

Recommendations for the appropriate amount of physical activity among children and adolescents have evolved over time as scientific evidence adds knowledge about physical activity and health among youth. While the recommendations may vary slightly according to the source, there is no argument that youth need to be physically active. Currently, many governmental, scientific, and public health agencies recommend that school-age children and

adolescents engage in at least 60 minutes of moderate to vigorous physical activity that is developmentally appropriate, enjoyable, and which involves a variety of activities, on most, preferably all, days of the week.^{1, 44-46} This recommendation represents an increase from the previous guidelines which recommend that adolescents engage in moderate physical activity for at least 30 minutes on 5 or more days a week and/or engage in vigorous physical activity that promotes cardiovascular fitness on 3 or more days a week for 20 or more minutes per occasion.^{14, 47} These updates reflect the conclusions of an extensive review of the literature on the effect of physical activity on health and behavior.⁴⁶

In terms of BMI-referenced standards for recommended steps per day, studies using pedometers show that most girls between 6 and 12 years old need 12,000 steps per day and boys of the same age need 15,000 steps per day in order to prevent overweight/obesity.⁴⁸

For toddlers, the National Association for Sport and Physical Education (NASPE) recommends that they accumulate at least 30 minutes daily of structured physical activity and at least 60 minutes daily of unstructured physical activity. The recommendation for structured physical activity increases to at least 60 minutes daily for preschoolers.⁴⁹

Additional recommendations from the DHHS to be achieved by children and adolescents by the year 2010⁴⁷ include: decreasing the proportion of adolescents who watch more than 2 hours of television on a school day; increasing the proportion of trips of 1 mile or less made by walking to 50 percent of the trips; and increasing the proportion of trips to school of 2 miles or less made by biking to 5 percent of the trips.

There are additional recommendations around physical activity particularly in school. Specifically all students should have a daily physical education class and elementary school children should have recess that complements physical education class.^{14, 50-52} Furthermore, it is recommended that adolescents be active at least 50% of the physical education class period.⁴⁷ For schools, the DHHS also recommends increasing the proportion of the nations' public and private schools that provide access to their physical activity spaces and facilities for all persons outside of normal school hours (that is, before and after the school day, on weekends, and during summer and other holidays).⁴⁷

III. Data on Physical Activity in Children and Adolescents

Introduction to the Physical Activity Data

This section summarizes the available data on levels of physical activity among youth. Total physical activity is composed not only of intentional exercise, but also active commuting (i.e., walking or biking to school), and even low levels of physical activity derived from everyday activities, such as light housework, play and daily functioning. Data on sedentary behaviors are important as well, in that time spent in sedentary pursuits is necessarily time not spent engaging in physical activity.

When possible, we will report on trends in physical activity over time among youth and adolescents in order to document how our youth's activity and inactivity levels have changed over the past few decades. We will discuss: (a) general data on vigorous and moderate physical activity, (b) activity during school, including physical education class and unstructured play time at school (i.e., recess), (c) sports teams, and (d) active commuting. We will also examine available data with respect to sedentary behaviors, including television watching and computer use, as this piece of information is also important in understanding total physical activity levels.

In presenting the trends data, we note here some difficulties in assessing and comparing physical activity levels in children. First of all, data on physical activity among children are scarce. In the mid-80s, the National Children and Youth Fitness Study (NCYFS) I and II assessed physical activity and fitness among 10 to 18 year olds and 6 to 9 year olds respectively nationwide.^{53, 54} However, these efforts were discontinued. It is only since 1991 that the CDC began systematically tracking youth data with the creation of the Youth Risk Behavior Surveillance System (YRBSS), which includes assessment of physical activity on a nationally representative sample of high school students. Even with the advent of a national survey in the 1990s, getting accurate measures of child and adolescent physical activity is difficult.¹ As it is impossible for young children to report on their own activity, measurements of their activity usually depend on parents' report, which is prone to biases due to lack of information and/or inaccurate recall.^{1, 55} In other words, parents may not be able to accurately report on their children's daily activities. Older children are supposedly capable of self-reporting on their level of physical activity. However, studies show that such reports are not entirely accurate and are only moderately correlated with actual activity; in fact, physical activity is often over-reported. In one study, the correlation between an objective measure of children's physical activity (measured by accelerometer) and self-reported physical activity was only $r=.46$, with self reported activity being significantly higher than objectively measured physical activity.⁵⁶

Another difficulty in gaining a true picture of total energy expenditure in children is that it is very difficult to measure amounts of low level physical activity that takes place as a result of daily chores or low intensity play. For example, taking out the trash, clearing the dinner table, or tidying up one's room are daily tasks that may be part of the routine of children. If considered separately such activities do not require large energy expenditure. Together, however, these small activities can be important factors in youth and adolescent's total energy expenditure and thus their weight.⁵⁷ No survey has included sufficient detail to estimate and document trends in energy expenditure among children and adolescents as a result of such day-to-day functioning.

An additional challenge to gaining an accurate sense of the physical activity level of children and adolescents comes from trying to compare data across different sources, as physical activity is measured in different ways in the different studies.⁵⁸ Furthermore, it is also hard to compare collected physical activity data with national guidelines, as guidelines continue to change over time.⁵⁸ In some places in this report, it was necessary to make reference to past recommendations when we provide trend data, especially when we present trends in compliance with the recommendations.

While less than perfect, data on child and adolescent physical activity and sedentary behaviors can shed light on the overall activity patterns of today's youth. In addition, an examination of the physical activity data may reveal disparities in these activity patterns by subgroups of youth. Any disparities in physical activity will be summarized in a later section in more detail.

General Data on Vigorous and Moderate Physical Activity in Children and Adolescents

As discussed previously, data on vigorous or moderate physical activity for children and adolescents are scarce, and specific results vary according to the data source and definition of vigorous or moderate physical activity. In addition, survey data collected before 2005 compared physical activity levels against previous recommendations of moderate and vigorous physical activity.

Despite these limitations, one clear observation is that American children and adolescents lack sufficient amounts of physical activity. Starting from a decade and a half ago, the 1992 household-based Youth Risk Behavior Survey (NHIS-YRBS) showed that only about a half of American children aged 12 to 21 years old were engaging in regular vigorous activity; and only approximately one quarter of children and adolescents engaged in light to moderate physical activity on a daily basis. In addition, approximately 14% reported no recent physical activity at all.¹³

Looking at younger children, a national survey of 9-13 year olds in 2002 (Youth Media Campaign Longitudinal Survey) found that, although lacking reference to the intensity of physical activity, almost one-quarter (22.6%) of the children did not engage in any free time physical activity.⁵⁹

The Middle School YRBS, modeled on the high school YRBS and conducted in some states and cities among middle school students in 2003⁶⁰ showed that across cities, the median percentage of students in 6th, 7th, and 8th grades who did not participate in physical activities for 20 minutes or more on at least 3 of the 7 days preceding the survey that made them sweat and breathe hard ranged from 34.7% to 42.7%. This illustrates that a large percentage of middle school students are not engaging in vigorous physical activity.

A more recent study of physical activity in 10-16 year olds used an objective measure of physical activity (i.e., motion detectors), rather than the usual self- or parent-reported measures. Results showed that these children spent an average of only 12.6 minutes per day engaged in vigorous physical activity.⁶¹

The most current YRBSS (2005) among high school students revealed that 64.2 percent of students did not meet the current recommended levels of physical activity (doing any kind of physical activity that increased their heart rate and made them breathe hard some of the time for a total of at least 60 minutes/day on 5 or more of the 7 days preceding the survey).⁶² As is often found, girls were less active than boys; 56.2% of male high school students failed to meet these recommendations for physical activity, as compared with almost three-quarters (72.2%) of female students.⁶²

In order to examine the trends in the proportion of high school students not meeting the recommendations, we also present percentages who failed to meet the previously recommended levels; prior to 2005, the comparisons were made against the previous recommendations. The 1993 YRBSS shows that the percentage of high school students who did not participate in vigorous physical activity for at least 20 minutes at least three times the preceding week was 34.2%. The percentage has not shown substantial change since then.⁶³ Similarly, percentages around moderate physical activity have not changed over the last decade. The proportion of students who did not participate in moderate physical activity for 30 minutes or more at least five times in the preceding week was 79.6% in 1997 with not much change through 2005, when the percentage was 73.5%.⁶³ Finally, the percentage who did not participate in any vigorous or moderate physical activity during the 7 days preceding the survey has stayed around 10% since 1999.⁶²⁻⁶⁶

In summary, existing data show that there has been no significant change or improvement in vigorous or moderate physical activity among children or adolescents during the last decade and a half. Despite the deficiency of trend data over the past 15 years (and especially before) and the difficulty comparing data across years due to comparisons made against different recommendations, it is clear that a considerable proportion of youth today are not engaging in sufficient vigorous and/or moderate physical activity. From the most recent YRBSS data, about two-thirds of youth today are not sufficiently active to meet the recommendations of at least 60 minutes of moderate to vigorous physical activity each day. It is important to note that these percentages capture only some specific aspects of physical activity (e.g., vigorous physical activity at least three days a week), while total physical activity comprises the sum of all levels and types of physical activity throughout the day. For example, it is possible that youth are increasingly involved in sedentary behaviors, decreasing other less noticeable activity during lower intensity play or chores. Whereas it is impossible from these percentages to determine the changes in children's overall physical activity, what is clear is that sufficient moderate to vigorous physical activity occurs far too infrequently.

Physical Activity during School: Physical Education Class and Recess

As mentioned previously, daily physical education for all students, and recess for elementary school students in addition to physical education class, are recommended.^{14, 50-52} The numbers vary by source, but the available evidence shows that most students do not receive daily physical education. The 2000 School Health Policies and Programs Study (SHPPS), which assesses school programs and policies, found that among schools that require physical education, only 8% of elementary schools, 6.4% of junior high schools, and 5.8% of high schools provided

daily physical education for all students for the whole year. A larger percentage of schools offer less frequent physical education class.⁶⁷

In addition to the lack of daily physical education class offered at the school level, student level data from the 2005 YRBSS revealed that only about a half (54.2%) of high school students attended physical education class on one or more days in an average week. As is often the case in many other estimates of physical activity, attendance to physical education was higher among the younger students. Specifically, 72% of 9th grade students attended physical education class, but only 39% of 12th grade students attended physical education class in 2005.⁶² In terms of changes in physical education enrollment over time, the percentage of high school students who attended physical education classes (on one or more days in an average week when they were in school) did not show changes from 1991 to 2005, with percentages staying around 50%. Daily attendance in physical education class among high school students is even smaller; in 2005, only one third (33%) of high school students attended physical education class five days in an average week when they were in school. In 1991, daily attendance among high school students was 41.6%, but it decreased to 25.4% by 1995 and then has not changed significantly since then.^{62-66, 68-71} Among middle school students in 2003 (from YRBS), over half of the students (ranging from 55.8% to 62.1% across states among 6th through 8th graders) did not attend physical education class daily.⁶⁰

DHHS⁴⁷ also recommends that adolescents be active at least 50% of the physical education class period. However, this does not seem to be the case in our schools. An earlier study among elementary school students in Texas found that although the students were in physical education class an average of 140 minutes per week, they were active an average of only 10.4 minutes per week.⁷² That means the students were *inactive* for an average of 130 minutes out of 140 minutes per week they were in physical education class. Another study that looked at physical education class in several elementary and middle schools in Texas found that the percentage of time that students were engaged in moderate to vigorous activity varied widely from school to school. Averages for a randomly selected sample of elementary schools and middle schools were 8.6% and 16.1%, respectively.⁷³ These percentages are far below the recommended 50%. The estimates among high school students from YRBSS showed that 69.7% of those who attended physical education class exercised for more than 20 minutes during the average physical education class in 1995⁶⁹ and 84% in 2005.⁶² These numbers may seem higher, but it should be noted that the YRBSS data are self-reported, which tend to be over-reported,⁵⁶ whereas the studies mentioned previously^{72, 73} are from direct observation. In addition, it means very little when the majority of students are not enrolled in physical education class in the first place. For example, in 1995 YRBSS, when examined on a daily basis, only 19% of all high school students reported being physically active in physical education class for 20 minutes or more.¹³

Data on recess from SHPPS 2000 show that over 70% of elementary schools provided recess for all grades.⁶⁷ While impressive, this means that almost 30% of elementary schools are not providing regularly scheduled recess for all of their students. Also, it is important to ensure that recess is a supplement to physical education class, not a replacement.⁵⁰ Recess is often not available to students once they get beyond elementary school, leaving only a portion of the lunch break for unstructured play. A study of elementary, junior and high school students determined that opportunities for unstructured play were much more available to elementary students than

the older two groups. Elementary students were much more likely to make use of unstructured time for active play during school and also in their leisure time before and after school hours. The availability of such time was believed to be largely responsible for these younger children being consistently more active than their older counterparts.⁷⁴

In summary, a large proportion of students fail to meet recommendations for physical activity during school and the situation appears to worsen as children get older, due in part to changes in curriculum and structure of the school day. YRBSS data show that the percentage of students attending physical education classes daily has decreased since 1991. Across all age levels, most children do not receive daily physical education, as is recommended; even when children do receive physical education, often they are not sufficiently active. Also, over one-quarter of elementary schools fail to provide regularly scheduled recess and recess is removed in upper grade levels.

Sports Teams and Outdoor Recreation

Another important avenue by which students can get physical activity is by participating on school sports teams or in other organized physical activities and outdoor activities. The 2005 YRBSS data found that nationwide, 56% of high school students had played on one or more sports teams (run by their school or community groups) during the preceding year. This percentage shows little change since 1999 when the percentage was 55.1%. Data from earlier YRBSS are hard to compare, because sports team participation was assessed using different question sets.

Among children aged 3 to 12 years, time spent in organized sports and outdoor activities is shown to have increased from 1981 to 1997.^{1, 23, 75} However, more recent data on children 9-13 years old show that, in 2002, only 38% participated in any organized physical activity.⁵⁹ Data also suggest that participation rates in a variety of traditional outdoor recreation activities such as road bicycling, mountain biking, and canoeing have declined since 1998 among young people (aged 16 and 24).⁷⁶

These data provide important information. First, while a sizable portion of youth are engaged in organized sports and outdoor activities, many are not. In addition, those not on sports teams are generally those youth who may be less skilled at sports, those who have less positive attitudes toward sports, those who do not have access to these opportunities, or those who cannot afford to be on sports teams. Finally, it is important to consider that being a member of a sports team does not necessarily mean that a child is engaging in adequate physical activity. That is, less skilled athletes may spend most of the time “on the bench,” and thus, in actuality, may not be physically active. Research also has shown that as youth move toward age 16 and beyond, it becomes harder to secure places on competitive sports teams and that most will not consider switching into a new sport because they feel too far behind to acquire the requisite skills.⁷⁴

Active Commuting

Children can engage in physical activity during their commute to and from school by walking or biking. While data on general physical activity trends show that inadequate physical activity levels have remained unchanged and we have seen no improvement since 1991, it

appears clear that the percentage of students who walk or bike to and from school has declined substantially over the past 35 years. It has been reported that while 48% of students walked or biked to school in 1969, only 15% walked and 1% biked in 2001.⁷⁷

Percentages of walkers and bikers are higher for those who live within 1 to 2 miles of school,^{55,77} but the numbers still represent a significant decline from a few decades ago. According to a 1999 Healthy Styles Survey, among participating households, 25% of children aged 5 to 15 years who lived within a mile of school either walked or bicycled at least once during the previous month.⁷⁸ These numbers should be contrasted with numbers from 1969, where the figure was close to 90%.⁷⁹

Sedentary Activities

As stated, time spent in sedentary activity is time not spent engaged in more active pursuits, and therefore may reduce the opportunity for children to be outdoors and be physically active.⁸⁰ Estimates vary, but it appears that many children and adolescents exceed the recommended limit of 2 hours of television watching per day. Recent national data among high school students report that 38% of high school students watched three or more hours of television on a typical school day.⁶² This is a slight decrease from 42.8% in 1999.⁶⁴

Data on television viewing among children aged 3 to 12 years show a decline by approximately 4 hours/week between 1981 and 1997.⁷⁵ Among older children (8th, 10th, and 12th graders), heavy television watching (4 hours or more) in 2004 was slightly lower than what it was in 1991, with the rates fluctuating between those years.⁸¹ On the other hand, television viewing for one hour or less has increased.⁸¹

However, these trends in television viewing alone do not provide a complete picture of children's sedentary behaviors. Children today may substitute some time previously spent in television viewing with other sedentary activities such as personal computer use for doing emails or visiting websites and playing video games. In fact, data show that in addition to television viewing, other sedentary pursuits may contribute to physical inactivity of today's youth. For example, heavy computer use of 3 or more hours per day on an average school day, playing video or computer games, or using the computer for recreation was reported by 21.1% of high school students in 2005.⁶²

A more comprehensive look of the sedentary behaviors among children including various media use is available from a Kaiser Family Foundation survey released in 2005.⁸² Among 8-18 year olds, it was found that the amount of non-school related use of media (including TV, DVDs, videos, video games, computer use, movies, music and print) has increased by over an hour during the past five years, from about 7.5 hours to 8.5 hours a day. The increases were most evident in computer use and video games. However, since multi-tasking of media has increased as well, the actual number of media use hours has shown little change at about 6.5 hours a day (44.5 hours a week). This amount of time is interpreted as more than the equivalent of a full-time job across the seven days of the week. Among the 6.5 hours a day of media time, the average amount of time spent watching TV/DVDs/Videos in this group averaged almost four hours per day.⁸²

Even younger children aged 2-7 years were reported to spend close to 4.5 hours a day using media in 1999.⁸³ Considering uses of different media at the same time, the total amount of time actually spent on media use was about 3.5 hours a day.⁸³

Screen media use (mostly TV and videos) by children six and under, reported by their parents in 2003, indicate an average of about 2 hours a day, which was about the same amount of time that the children spent playing outside.⁸⁴ In spite of the recommendation by the American Academy of Pediatrics that children under two should not watch any television, 68% of children under two used screen media including TV, video or DVD, for an average of about 2 hours per day.

A study using objective measures of physical activity showed that 10-16 year olds spent an average of 10.4 hours a day relatively motionless. They spent an average of a little over five hours per day doing homework, sitting at the computer, or watching television. The remaining sedentary time was spent mainly at school.⁶¹

Sedentary behaviors resulting from the advancing engineering of everyday objects such as use of remote control devices and elevators/escalators must have reduced “insensible” exercise among children and adolescents. However, we do not have information concerning shifts in children’s energy expenditure as a result of changes in everyday functioning to document such trends.

In summary, data on media use demonstrate that children today are spending far too much time engaging in many sedentary activities, such as watching TV, playing video games and using computers. The rise in computers and other sedentary leisure pursuits over the past twenty years offers a list of attractive opportunities for spending time during which children and adolescents are sedentary, while similarly appealing outlets for physical activity have not been increasingly made available.

Summary and Implications

Sporadic data on child and adolescent physical activity and inactivity make it hard to get a clear picture of physical activity trends among youth. Despite the lack of data and challenges we face in trying to make comparisons across studies and over time, it is clear that many children and youth today do not engage in sufficient moderate to vigorous physical activity to meet current recommendations. There does seem to be substantial evidence for a decline in the percentage of students who bike or walk to school and moderate evidence that there has been a decline in physical education class enrollment. Children and adolescents also spend a substantial part of their day in sedentary activities, especially television viewing and computer use, and less time in outdoor activities.

The consistent pattern of low physical activity among our youth over the past decade and a half clearly demonstrates society’s inability to successfully respond to the ever increasing obesity epidemic. Despite the alarming increase in overweight and obesity among children, and the established fact that increasing physical activity is one of *the* two key factors to addressing the energy imbalance, current public policy has not been very successful in encouraging our youth to engage in more physical activity.

In the following section, we review possible causes for such lack of physical activity among youth. We emphasize that these factors, on the other hand, if altered, can provide valuable opportunities for increased physical activity.

IV. Factors Contributing to Lack of Physical Activity

There are many factors that may contribute to the lack of physical activity of today's children. In this report, we use the following four broad categories to describe contributory factors: (a) lack of opportunity/lack of venue for physical activity, (b) lack of psychosocial assets, such as self-efficacy and attitudes, (c) lack of knowledge about the importance of physical activity, the relationship between physical activity and childhood obesity, and numerous health implications of childhood obesity, and (d) prevalence of sedentary culture where modern engineering has reduced the need for insensible expenditure of energy and where sedentary competing activities dominate leisure time pursuits, especially screen time (such as television viewing and computer/video game use).

The following sections of the report will describe the influence of each of these factors on children's physical activity. In doing so, we will take an ecological perspective, in that we will attempt to illustrate how social, cultural, economic, environmental, and policy-related variables impact each of these broad categories and their effect on childhood physical activity. This approach is especially important because effective interventions will be those that occur across multiple levels and different settings,¹³ as the causes of lack of physical activity span across numerous levels.⁸⁵ Researchers have pointed out that understanding behaviors around physical activity is complex, requiring knowledge of many social, psychological and environmental variables and that partnerships among a variety of disciplines will be required to create useful strategies.⁸⁶ Other government reports also have emphasized that increasing physical activity will depend on the collaborative efforts of children, their families, teachers, school officials, youth groups, faith groups, government, and members of the community.^{12, 50}

Lack of Opportunity/Venue

One reason that is posited for the lack of physical activity among today's youth is that there are not enough opportunities in which to engage in physical activity. A review by Sallis et al⁸⁷ found that opportunities to be active, as well as program and facility access, are consistently related to physical activity levels in children and adolescents. That is, the more opportunities and access children have, the more likely they are to be active. Therefore it is important to examine possible opportunities/venues—or lack thereof—for children to be physically active. As stated earlier, the recommendation is that children get at least one hour of physical activity per day.⁴⁴ As children spend much of their waking hours at school, it is recommended that they get at least 30 minutes of physical activity during the school day¹ with additional physical activity occurring before and after school.

School Setting

As children spend much of their day at school, it represents an important environment for children to get physical activity.^{1, 51} School policies should promote lifelong physical activities among young people including those that are not gifted athletes. An example of such a policy is the requirement for daily physical education classes for all students.^{14, 50-52} In fact, one factor that has been widely cited as contributing to the lack of physical activity among today's youth is the lack of physical education classes and recess offered at school.¹

Data presented in the previous section showed that few schools provide daily physical education for all students for the whole year,⁶⁷ and the majority of students do not attend daily physical education classes.⁶² This may be because physical education in schools is often viewed as an extracurricular activity. As such, physical education programs are often cut in the current climate with its focus on academic achievement and tight fiscal resources.³⁷

The CDC⁵⁰ recommends that students be able to get a large percentage of their weekly physical activity from physical education class. However, simply offering physical education class does not guarantee that adequate physical activity actually occurs. Whereas DHHS⁴⁷ recommends that adolescents be active at least 50% of the physical education class period, students enrolled in physical education class do not seem to engage in enough physical activity in our schools. One study in Texas reported that elementary school students in physical education class were active only an average of 7.4% of physical education time (10.4 out of 140 minutes per week).⁷² A recent study also showed that increasing the physical education time by one unit resulted in an increase of only 7.6 minutes of actual exercising time per week for boys and 8.1 minutes per week for girls.⁸⁸

Another study that looked at physical education class in several elementary and middle schools in Texas⁷³ uncovered an important factor in determining what percentage of time students are active. That is, the percentage of time that students were engaged in moderate to vigorous activity varied widely from school to school, but it was higher among schools that were identified as having highly qualified physical education teachers. Specifically, students were active 20.6% of the physical education time in the elementary schools with qualified physical education teachers (in contrast to 8.6% among a random sample of schools) and 24.5% of the time in the middle schools with qualified physical education teachers (compared with 16.1% among a random sample).

In addition to the structured physical activity of physical education class, the CDC⁵⁰ also recommends that schools provide time for unstructured play during the school day (i.e., recess). Support from teachers and educated physical activity professionals during recess is also important so that this time can be safely and constructively used for active pursuits. However, the 2000 SHPPS results showed that over one-quarter of elementary schools do not provide daily recess for all of their students.⁶⁷

Thus, it seems clear that there is not enough opportunity for physical activity during the school day. Specifically, there do not seem to be enough physical education classes, children do not seem to engage in sufficient activity even when they are in physical education class, and daily recess is not provided in all elementary schools. As the recent IOM report¹ suggests, making improvements in the number and quality of physical education classes is no trivial matter. For example, school districts would need to believe that such changes are important enough to justify added expense. Recommendations by other groups^{50, 51} concur, stating that schools and communities must commit sufficient financial resources for physical education, health education, and other school physical activity programs in order to change the current state of physical inactivity among children.

Teachers would need to be persuaded to modify the physical education curriculum to allow students to be more active for a greater percentage of class time. Even during regular class

time, efforts can be made to increase physical activity by integrating grade-specific physical activity into the school academic core curriculum objectives. In fact, a classroom-based physical activity promotion program, TAKE 10!, has been shown to promote a meaningful amount of physical activity among elementary school children.⁸⁹ Furthermore, school staff should encourage students to be physically active during recess. Offering a variety of physical activities from which to choose would allow students of varying interests and skill levels to enjoy the experience of participating in a physical education class and recess.⁵⁰ Having physical education specialists, and training personnel to deliver quality physical education should increase the percentage of time of physical education during which students are active.^{14, 50}

Parents' attitudes might need to shift such that they appreciate the importance of physical activity being a part of the school day, in addition to academic pursuits. Ideally, they would even advocate for quality physical education instruction.⁵⁰ Importantly, research has found that more time spent in physical education class can actually improve academic performance.⁹⁰

After School Physical Activity

Sports Teams and Intramural Sports Programs. The IOM¹ asserts that just as there is room for improvement in terms of offering more physical activity during school hours, so could there be more opportunities for physical activity during after school hours. The CDC⁵⁰ also recommends that schools should offer a number of extracurricular physical activity programs that are varied enough to appeal to many different types of students. This is especially important for middle and high school students, as it has been found that children, especially girls, become less active as they get older.^{12, 13, 91, 92}

While elite athletes have the ability to participate on school sports teams, less skilled students do not have the equivalent outlet for physical activity.⁵⁰ The 2005 YRBSS data found that over half of high school students had participated on a sports team the previous year, with males being significantly more likely to have done so.⁶² While impressive, and many children do get significant amount of physical activity through sports, this still leaves a large percentage of high school students who are not on any sports teams. Ironically, while it is precisely the less active adolescents who are most in need of athletic opportunities, the more skilled athletes are the ones on the sports teams. For this reason, it is recommended that intramural sports programs and clubs be developed and implemented at schools.¹ In addition to providing alternative options for physical activity, unskilled youth would need to be taught skills so they too can participate in and benefit from sports programs.

Such an effort would require philosophical and tangible (i.e., financial) support from a variety of sources.¹ One of the Healthy People 2010⁴⁷ objectives includes increasing the proportion of the nation's public and private schools that provide access to their physical activity spaces and facilities for all persons outside of normal school hours (that is, before and after the school day, on weekends, and during summer and other holidays). Often, schools have the facilities but not the personnel to offer after school programs. School officials should work together with community officials and existing child care organizations to make better use of available resources. To make this effort most effective, parents would need to get involved and actively encourage their children to take part in such physical activity programs.⁵⁰

Daycare, Preschool and After School Programs. Changes should also be made to add physical activity to the curriculum at daycare, preschool, and after school programs.¹ The fact that nationally, 57% of children aged 3 to 5 were enrolled in center-based early childhood care and education programs in 2005 (e.g., preschool and nursery schools)⁹³ shows that effective changes to these programs will reach a large proportion of children. These changes will come about only after changes in policy, and with the support of parents and the community.¹ These changes might mean raising money to buy play equipment, or coordinating with neighborhood schools for use of their equipment before or after school hours. Unique opportunities also may exist through the creation of mutually beneficial collaborations between schools and child care providers such as the YMCA of the USA and the National Recreation and Park Association (NRPA), which represent the leading providers of non-profit and public after school programs respectively, many of which are located in the school setting. To the extent that children do not have adequate opportunities for physical activity during the school day, such after school programs become an even more important opportunity for children and youth to engage in physical activity.

Public Recreation Programs. Public recreation programs can be important in that they provide access to both the social networks and physical places necessary for physical activity.⁹⁴ A variety of programs for youth occur at community recreation centers in most cities around the country. These centers have the potential to increase activity among youth,⁹⁵ but there are barriers to participation in activities offered at the centers. A recent study conducted in San Diego County reported that an estimated 28,000 youth (7%) participated in programs at recreation centers. A positive and significant predictor of the number of youth involved in these programs was the number of paid staff. Center administrators indicated reductions in funding and staff as the primary barriers to increasing participation. Staff also pointed out that groups hardest to reach were girls and youth from lower income families.⁹⁶

Commuting to and from School

Another lost opportunity for children to participate in physical activity is during their commute to and from school. The trends data showed that the percentage of students who walk or bike to and from school has declined precipitously over the past 30 years.⁷⁷ Children commuting to and from school five days a week for most of the year represents a significant opportunity for physical activity. As such, it has the potential for increasing physical activity and therefore preventing or reducing weight gain in children.¹ Indeed, research has found children can get vigorous physical activity during their school commute.^{97, 98} In a sample of Filipino adolescents, inactive commuting to school resulted in an energy surplus that was equivalent to a weight gain of 2- to 3-pound per year.⁹⁸

It has been recognized that the decline of walking and biking to school needs to be considered within an ecological framework that takes into account the effects of the physical, social, political, and economic environments.¹ Some of the reasons given for not walking or biking to school include: long distance, traffic safety concerns, crime danger, and school policy.⁷⁸ From these reported barriers, it is obvious that the physical environment (i.e., the “built environment”) comes into play where school commute is concerned. For example, schools may be too far from children’s homes for walking or biking to be a feasible mode of commuting to school. Similarly, these reasons suggest that inadequacy of the physical environment such as a

lack of safe sidewalks, designated bike lanes, or clear traffic signals and/or the existence of on-off ramps to major highways near schools, could also contribute to the decline of students walking or biking to and from school.

Research suggests that efforts to change the built environment will favorably impact the extent to which students walk and bike to school. A study conducted by the Environmental Protection Agency (EPA)⁷⁷ found that students with shorter walk and bike times are more likely to walk and bike to and from school. Thus, location of schools, in relation to the student population it serves, has important consequences for the mode of the students' commute. In addition, the study found that students traveling through "higher quality" environments are more likely to bike and walk.

Addressing barriers in the built environment to improve walking/biking rates of students would necessitate changes on many levels.¹ New school construction decisions should be made with consideration of their proximity to the students they serve. Efforts could be made to improve sidewalks, bike paths, and traffic-control devices. Such changes will require the involvement of local governments and the allocation of funds for this purpose.¹ There is potential for increased activity through existing legislation that encourages this type of involvement and provides funding. In a study of Safe Routes to School (SRTS) projects in California, students who passed through/by SRTS projects walked and bicycled to school more often than students who did not (15% and 4% respectively).⁹⁹

Even before changes are made to the built environment, action can be taken to improve walking/biking rates.¹ For example, adults can accompany children as they walk to school as a way of ensuring children's safety. This intervention has the added benefit of increasing the physical activity level of the parents, as well as the children. Providing off-site dropoffs also provide opportunities for children to walk. Additionally, providing school crossing-guards at busy intersections and safe storage areas for bicycles can all promote active ways of commuting to and from schools. Furthermore, many activities are underway nationally to address safety concerns such as Walking School Buses.¹⁰⁰

Looking at the stated crime concern, it is apparent that changing the commuting habits of students would be no easy undertaking. As the IOM report¹ points out, tackling this concern has far-reaching implications in terms of local government, law enforcement agencies, and community members.

Finally, it is ironic that parents list school policy as a reason that their children do not bike or walk to school. Clearly, educators and policy makers at the school district level will need to be persuaded that promoting physical activity among their students will have benefits that far outweigh any costs that may be associated with changing school policies.

Community Design

It has been shown that the built environment can indeed influence the extent to which its inhabitants are physically active.⁵⁵ When the community is more sprawling, people are less likely to walk and more likely to be heavier.¹⁰¹ Young people today do not have the opportunities for walking provided to previous generations. Specifically, since the 1940s, urban development

has focused on increasing the efficiency of automobile use, and thus many communities were not designed to encourage walking. Land use zoning, the basis of planning in most American cities, has hampered active non-motorized travel by promoting subdivisions that are isolated from support services.^{55, 102} As such, communities built in the 1960s and later may not have adequate sidewalks, bike paths, or crosswalks to make biking or walking a feasible mode of transportation.¹⁴ Many times it is not feasible to run errands on foot or on a bike; safe routes do not exist and distances for obtaining services are too great. These active trips need to be better understood and taken into account as neighborhoods, parks and retail centers are arranged and connected within a community.

A review by Jackson emphasizes the strong evidence for a multidimensional relationship between human health and the urban environments in which most people live their daily lives. Aesthetically pleasing environments offered by nature based parks and open spaces, and access to them through sidewalks, pathways and trails, are seen as critical to creating communities that promote mental and physical health.¹⁰³ Frumkin offers a similar review through the lens of a health professional. He concludes that the designing of places (e.g., urban neighborhoods) for healthier living requires a healthful “sense of place.” Again, the evidence points to the need for environments to be both activity-promoting (sidewalks, trails, bike routes) and aesthetically pleasing (e.g., parks) so that people will want to use such facilities.¹⁰⁴ Research is currently examining how aesthetics, access, facilities, safety and management policy might be influencing the active use of such places.¹⁰⁵

The development of trails, distinct from sidewalks, can provide safe and enjoyable places for both transportation and recreational walking and bicycling leading to higher activity levels among residents. For example, research on three urban trails in Texas determined that users felt their trails contributed most to “community quality of life” through enhanced health and fitness and access to natural areas.¹⁰⁶ Gobster found that of more than 4000 trail users surveyed in a Chicago park, over 28% were under 18 and most of these (69%) were engaged at least in moderate levels of activity while on or near the trail. In a second study of Chicago trails, just over 25% of trail users who were under 18 years old indicated their primary reason for trail use was better health.¹⁰⁷

We are learning more about environmental correlates of walking and bicycling in and around places where people live and work. Research indicates that, given choices, people are more likely to walk on sidewalks in their neighborhoods and in local parks. However, among those who said their preferred place to walk was a public park or school track, less than 15% could reach this place in less than ten minutes.^{108, 109} Poor access to preferred places for walking is likely to contribute to lower rates of this activity. Research also has found that children are more likely to be physically active if they have access to convenient play spaces such as parks and recreation facilities; if they have sports equipment; and if they have transportation to sports programs.¹¹⁰⁻¹¹⁵ Research also has shown that the biggest correlate of physical activity in children is the amount of time spent outside.¹¹⁶⁻¹¹⁸ Unfortunately, many of today’s youth live in areas that are not conducive to safe outdoor play. As such, parents in high crime areas may prefer their children stay inside, engaged in more sedentary activities, where it is safer.

To the extent that local government and private developers can plan future development with walking/biking in mind, the more opportunities everyone, including children, will have for

engaging in everyday physical activity.¹ The current environment is the result of policies and decisions of a number of different people, such as elected officials, urban planners, and traffic engineers. However, there are constant opportunities for making the environment more encouraging to engage in physical activity, as existing structures are renovated and new developments are planned and built.⁵⁵ When planning future urban development, there are at least four important components that influence the potential for residents to be active: (a) the functionality (e.g., trail surface & width), (b) safety (e.g., street crossings, lighting), (c) destination quality/desirability (e.g., bike parking facilities, shops available), and (d) aesthetic quality (e.g., maintenance, trees).^{119, 120}

The CDC⁵⁰ recommends that communities provide access to facilities that allow for physical activity. These places need to be free from not only violence, but also environmental hazards. Unfortunately, many communities fail to invest in close-to-home physical activity facilities, such as parks and playgrounds. Community-based-organizations such as YMCA, community parks and recreation facilities or Scouts, with their existing infrastructure, are in an ideal position to provide children and youth with opportunities and facilities to engage in physical activity. Again, parents and other interested community members would need to advocate for increased community resources to be put towards promoting physical activity within the community. These actions would range from building more playgrounds and recreational facilities; to re-zoning neighborhoods to make them more conducive to physical activity; to having stores, restaurants, and living quarters within walking distance of one another.¹

Lack of Psychosocial Assets

In addition to the environmental factors described previously, some individual psychosocial factors also have been suggested as important influences for child and adolescent physical activity, which include: (a) self-efficacy to exercise; (b) perception of sport or physical competence; (c) perceived benefits of exercise; (d) perceived barriers to exercise; (e) self-regulation ability; (f) enjoyment of physical activity and physical education; (g) parental support, including verbal encouragement and facilitation for exercise; and (h) parent level of physical activity.^{13, 121-126}

In an extensive review of studies conducted between 1970 and 1998 to update information from the 1996 Surgeon's General Report¹³ and to more clearly identify correlates of child and adolescent physical activity, Sallis et al⁸⁷ summarized somewhat inconsistent findings and concluded that conflicting results do not necessarily mean that these variables are not associated with physical activity. Measurement error, different sample sizes, different analysis strategies, and varying sample characteristics, could all contribute to the lack of consistent results across studies. In addition, relatively few studies assessed psychosocial variables in children, probably because children would have difficulty reporting on constructs such as competence, and support from parents and friends.

Keeping these limitations in mind, we summarize studies that examined relationships between psychosocial variables and physical activity among children and adolescents.

Self-efficacy and Perception of Sport Competence

A psychosocial variable that consistently has been found to be associated with physical activity in children and adolescents is self-efficacy, usually with respect to having an ability to overcome barriers associated with exercise.^{61, 110, 121, 124-128} The related concept of perception of sport or physical competence also has been associated with increased physical activity.¹²³

In a study of 10-16 year olds, Strauss et al⁶¹ looked at the relationship between a host of variables and moderate and high levels of physical activity. Physical activity was objectively measured using motion detectors. While they did not find an association between self-efficacy and moderate activity, they did find that increased levels of vigorous activity were associated with greater self-efficacy. In a prospective study of fifth graders, Trost et al¹²⁹ similarly found that self-efficacy predicted physical activity. It has been found that overweight adolescents have lower self-efficacy with respect to physical activity than normal weight adolescents¹²⁴ and girls have lower self-efficacy than boys.¹²⁶

Physical Activity Beliefs and Attitudes

Attitudes and beliefs about physical activity also have been found to correlate with child and youth physical activity levels.^{125, 129-131} In a study by Trost et al, beliefs about physical activity were found to predict physical activity levels in fifth graders.¹²⁹ DiLorenzo et al¹²⁵ looked at determinants of self-reported physical activity levels of children in 5th and 6th grades, and then followed up with them three years later. Results revealed that the most important predictor of physical activity for 5th and 6th graders was enjoyment of physical activity. Sallis et al¹³² also found among children in grades 4 through 12 that enjoyment of physical education was associated with greater amounts of self- and parent-reported physical activity. De Bourdeaudhuij et al¹²⁴ found that positive attitudes about benefits of exercise were positively correlated with physical activity in both normal and overweight adolescents.

Self-regulation

Another variable that has been examined with respect to childhood and youth physical activity is self-regulation. Self-regulation refers to the ability to personally regulate a goal-directed behavior, and relies on five factors: goal setting, self-monitoring, gaining and maintaining social support, planning to overcome barriers, and securing reinforcements.¹²⁶ Research has found a link between the ability to self-regulate with respect to physical activity and actual physical activity levels in adolescents.^{121, 126}

Parental Physical Activity and Support

As stated, one hypothesized predictor of childhood physical activity is parental level of physical activity. Suggested mechanisms for the association between parental and youth physical activity levels include: (a) parents acting as role models, (b) parental encouragement and support, (c) genetic predisposition to physical activity, or (d) shared activities between parent and child.^{122, 133} Research on the link between parental level of physical activity and children's physical activity have yielded mixed results.^{122, 133-135}

One study among children aged 4 to 7 years old found a strong association between parental and child physical activity level.¹²² This study measured physical activity levels directly by using Caltrac accelerometers, rather than by relying on self-reports. Results showed that

children of active mothers were two times more likely to be active than were children of inactive mothers. Children of active fathers were 3.5 times more likely to be active than children of inactive fathers. Overall, children with two active parents were six times more likely to be active than children with no active parents. When both parents were active, sons were 7.2 times and daughters 4.5 times as likely to be active as children with no active parents.

Evidence suggests that boys receive more parental support for physical activity than do girls.^{134, 136} In addition, overweight adolescents may receive less support for physical activity from family and friends than do normal weight adolescents.¹²⁴ This may contribute to the lower levels of physical activity among girls and overweight adolescents.

Reviews conducted to clarify the relationship between parent and children's level of physical activity^{87, 136} concluded that there was a consistent strong positive relationship between parental support of physical activity, and encouragement of physical activity with children's physical activity. Findings also supported a direct correlation between parents' facilitation of physical activity behaviors (e.g., driving children to sports practice, providing sports equipment) and physical activity levels. Support has been found to have a direct effect on physical activity, as well as working indirectly by increasing children's feelings of self-efficacy or physical and sports competence.^{134, 137, 138} It seems that parental support is more of a predictor of younger children's physical activity, compared to older children.¹³⁶ One review of the literature concluded that any association between child and parent activity levels is probably due to support and encouragement, and less from modeling.¹³⁶

In sum, the relationship between different psychosocial variables and physical activity in children and adolescents often varies from sample to sample. As such it is difficult to make clear conclusions about many of these variables and physical activity levels in children and adolescents. However, studies that have found a relationship between various psychosocial variables and childhood and adolescent physical activity suggest that youth who believe that they can engage in physical activity (i.e., have self-efficacy, perceive having sports competence); have positive attitudes around physical activity; and find physical education enjoyable will be more likely to engage in physical activity. There is strong evidence that children who feel supported in the physical activity efforts, and receive help from parents and significant others, will be more physically active. Self-regulation ability also has been linked to physical activity in adolescents. Interventions aimed to increase physical activity in children and adolescents should focus on bolstering these variables.

Lack of Knowledge

As attitudes and beliefs about the benefits of physical activity; self-efficacy; perception of sport competence; and parental support have been linked to physical activity in children and adolescents, it is important that children, adolescents, and their families have access to information about the benefits of physical activity. In addition, they need information about how to overcome the barriers that may stand in the way of being physically active. Training in requisite sports skills is also important.

Results from one study of parents of children aged 2 to 17 years old revealed that few parents of overweight, or "at risk for overweight" children (as defined by BMI percentiles)

identified their child as being overweight. Nor were they concerned about their child's weight. In addition, less than one-quarter of parents of overweight children remembered their pediatrician voicing concerns over their child's weight. Parents of overweight children were less confident that they could influence their child's physical activity, and parents, in general, felt they were not successful in limiting television viewing for their children.¹³⁹ A study by Baughcum et al¹⁴⁰ of mothers of overweight children aged 2 to 6 years old similarly found that mothers had inaccurate perceptions of their children's weight. In that study, mothers with low education were less likely to correctly perceive their overweight child as overweight. Thus, parents need accessible information that conveys the importance of the relationship between obesity and health in children.

Media campaign

Increasing knowledge involves actions from many levels including federal support for programs that emphasize the importance of physical activity and nutrition in children, youth, and their families. A powerful tool to educate children and their families about the importance of physical activity in combating the obesity epidemic is mass media. Any effective media campaign will be one that is culturally sensitive and linguistically appropriate for individuals of different ethnicities and background.^{1, 14} Effective campaigns must communicate the social and physical benefits of physical activity to children. In addition, parents should be made aware that their beliefs about the importance of physical activity will impact their children's activity levels.¹³⁸

One recent mass media campaign that encouraged physical activity among youth was CDC's VERB campaign, launched in June 2002. VERB is based on a social marketing framework, using sophisticated commercial marketing techniques to increase physical activity among children. The primary audience of this campaign was multiethnic children aged nine to 13 years (known as "tweens"). In order to increase physical activity among tweens, the VERB campaign aimed to associate physical activity with other activities that tweens value, such as spending time with friends, having fun, gaining recognition, and exploring the world around them. The campaign aimed to convince tweens that these benefits of physical activity outweighed any costs associated with physical activity, such as sports fees, or time pressures. In order to make physical activity sound "cool," VERB urged tweens to discover new activities that they like to do, rather than simply telling them to engage in physical activity for at least 60 minutes each day.¹⁴¹

As support and verbal encouragement from parents, and facilitation of physical activity, have been found to be significant correlates of physical activity,¹³⁶ parents and other adult influences on tweens were also targeted by the VERB campaign. The campaign asked these adults to support, recognize, encourage, and praise children for being active. It recommended engaging in physical activity as a family. Adults also received tips for communicating with tweens about physical activity, including the risks of inactivity and benefits of physical activity. In addition, VERB has offered promotions in conjunction with schools and community-based organizations.¹⁴¹

A recent analysis of first year results of the VERB campaign was promising. Seventy-four percent of surveyed tweens were aware of the VERB campaign to some degree.

Furthermore, as VERB awareness increased, levels of physical activity increased. Among certain subgroups of the total sample, there were significant differences in physical activity levels of those aware of the VERB campaign vs. those unaware. Specifically, the VERB campaign resulted in 34% more free-time physical activity among 9-10 year old children who were aware of the campaign, as compared with those who were unaware of it. In addition, girls who were aware of the VERB campaign engaged in significantly more free time physical activity than did girls who were unaware of the campaign.¹⁴² Unfortunately, despite these promising results, the President's Budget does not include, and Congress did not support, continued funding for this program for fiscal year 2007; this action has been criticized.¹⁴³

Recent other examples of media campaigns include Cartoon Network's "Rescuing Recess"¹⁴⁴ and Nickelodeon's "Let's Just Play."¹⁴⁵ Rescuing Recess is a campaign developed by leaders and policymakers in children's health and education to recognize the benefits and importance of daily unstructured break time for children and to protect and enhance recess in schools. The campaign includes elements that encourage schools to support and celebrate recess, and empower parents, children and teachers to revitalize recess in their schools. "Let's Just Play," a long-term, grassroots campaign to empower children to engage in active, healthy and fun play aims to celebrate active, physical play; encourage and provide children with the opportunities to "just play"; promote the basic benefits and joys of play; lessen the pressures put on today's youth in their participation in sports and games; and to provide resources that will help achieve a more active lifestyle among children.

While the media can raise awareness about the importance of physical activity for children, children must have access to opportunities to engage in physical activities. As such, changes in policy or the "built environment" may need to happen concurrently with media campaigns.^{1, 141}

Physical Education

In a report to the President issued in Fall 2000,¹⁴ DHHS stated that engaging in physical activity is a voluntary behavior; as such, children and adolescents will not increase their current physical activity levels unless they find those experiences enjoyable. The report states that enjoyment of physical activity depends on meeting the following conditions: (a) having a variety of physical activities to choose from so as to be able to find one that matches their interests; (b) having the necessary skills to engage in physical activity; (c) having confidence in their ability to engage in physical activities; (d) having supportive and knowledgeable adults to encourage them; and (e) being in an environment with cultural norms that support being physically active. One important way to facilitate these conditions is by offering quality physical education and health education among children and adolescents.

The general consensus among knowledgeable sources is that quality physical education and health education are critical in getting children and adolescents to engage in more physical activity.^{1, 14, 50} In 1997, CDC⁵⁰ issued guidelines to help schools and community programs promote life-long physical activity among America's young people. Three years later, in the Fall of 2000, the Secretary of Health and Human Services and Secretary of Education issued a report¹⁴ to the President with similar recommendations on improving the health of young people

through physical activity. Parents need to recognize the importance of physical activity, rather than minimize its importance, with respect to academic pursuits.¹ Ideally, parents will facilitate participation by their children in school physical activity programs, as well as advocate for quality physical education programs in schools.⁹ It is encouraging because recent surveys show that parents exhibit strong support for physical education programs. For example, more than 80% of parents favored a requirement that students take physical education class everyday at every grade level.^{146, 147}

As previously discussed, one generally agreed upon recommendation is for daily physical education classes for students in kindergarten through 12th grade.^{1, 14, 50} Such classes provide an important opportunity for students to engage in moderate to vigorous physical activity. In addition, if conducted properly, physical education classes should provide instruction and experiences that increase students' confidence around engaging in physical activity (i.e., self-efficacy) and perception of competence, as research has shown that self-efficacy and competence are important correlates of physical activity.^{61, 123} Students should be exposed to a variety of physical activities, so that they will encounter at least some activities they enjoy. In this way, they will recognize that physical activity can be fun.⁵⁰ It is important that students enjoy physical education class, as research has found that enjoyment of physical education class and enjoyment of physical activity are important predictors of physical activity outside of school.¹²⁵

The School Health Policies and Programs Study (SHPPS), first conducted in 1994 and repeated in 2000, examines physical education and activity policies and programs in elementary, middle/junior high schools, and senior high schools at the state, district, school, and classroom levels. Data from the 2000 SHPPS show that, unfortunately, few schools provide daily physical education for all students for the whole year.⁶⁷ In terms of following physical education standards or guidelines, the 2000 SHPPS does show that over 80% of schools that completed the physical education interview follow national, state, or district physical education standards or guidelines with respect to their physical education program. Over 80% of those schools that completed the interview also provide their physical education teachers with goals, objectives, and expected outcomes for physical education, and over three-quarters provide a physical education curriculum.⁶⁷

As the hope is that children and adolescents will engage in lifelong physical activity, physical education classes should include instruction for children and adolescents about how they can develop an active lifestyle that will be maintained throughout their lifetime^{14, 50} Thus, in addition to learning the requisite motor skills associated with particular physical activities, students need to learn more generalizable self-regulation skills, such as goal-setting, communication, and self-monitoring, as these skills are associated with increased physical activity.^{121, 126}

The CDC recommends that physical education teachers instruct skills associated with physical activities more likely to be sustained throughout the lifetime, such as dancing, jogging, and swimming, rather than those solely associated with competitive sports. Physical education classes also should discuss injury prevention.⁵⁰ A quality physical education program will teach children and adolescents about the physical, social, and mental health benefits of physical activity, as this has been linked to participation in physical activity.^{50, 129} Fortunately, schools seem to recognize the importance of such lessons. Data from the 2000 SHPPS reveal that in

more than 90% of schools surveyed, physical education teachers taught about health-related fitness, injury prevention, phases of a workout, as well as physical, psychological, and social benefits of physical activity in at least one physical education course.

It is further recommended that teachers be discouraged from using physical activity as punishment, so as to prevent negative attitudes towards physical activity.⁵⁰ Unfortunately, SHPPS data show that while two-thirds of schools do not allow staff to use physical activity as punishment, only 18% of these schools actively discourage this practice through memoranda or guidelines.⁶⁷

Past research has suggested that knowledge about how to be physically active may be a more important influence on physical activity than knowledge about why it's important to be active. As such, it is recommended that students learn the components of health-related fitness, principles of exercise, and social influences on physical activity. Also, it is recommended that children and adolescents learn how to develop and implement a safe and effective physical activity program.⁵⁰ Unfortunately, 2000 SHPPS revealed that physical education teachers in only 23.1% of schools had students develop individualized activity plans.⁶⁷

To ensure that students get quality instruction, CDC⁵⁰ further recommends that physical education specialists be hired to teach these classes. It has been shown that the average percentage of time spent in moderate to vigorous activity in a given physical education class was higher among schools having highly qualified physical education teachers (8.6% vs. 20.6% in the elementary schools; 16.1% vs. 24.5% in middle schools).⁷³ Thus, knowledge and skills of the physical education teachers are important determinants of quality physical education programs. DHHS¹⁴ concurs and states that the most essential ingredient of a quality physical education program is having qualified and properly trained teachers. Data from the 2000 SHPPS, however, reveal this is not always the case in our schools. Specifically, only 70% of elementary schools that require physical education have these classes taught only by a physical education specialist. The percentage of middle/junior high schools in which physical education is taught only by a physical education specialist is just over 60%. More schools (80.6%) require newly hired physical education teachers to have undergraduate or graduate training in physical education or a related field. Almost three-quarters of schools require newly hired physical education teachers to be state-certified, licensed, or endorsed in physical education.⁶⁷

In addition, an acceptable teacher to student ratio is a necessary component of a quality physical education program. Data from 2000 SHPPS revealed that only approximately one-quarter of states have a policy on the maximum allowable student to teacher ratio for physical education classes in schools. Among states with a policy, the average maximum allowable ratio is 27:1 for elementary schools; 30:1 for middle/junior high schools, and 34:1 for senior high schools.⁶⁷ Thus, many physical education classes have so many students that teachers may not be able to give students individual attention.¹⁴ Further, recommendations for physical education teacher training (through undergraduate teacher training sessions or staff development programs)^{14, 148} do not seem to be followed. The 2000 SHPPS revealed that only one-third of physical education teachers received training on helping students develop individualized physical activity plans and one-half of physical education teachers received staff development on using technology in physical education.⁶⁷

Finally, school physical education programs also must be able to accommodate students with disabilities.¹⁴ Data from the 2000 SHPPS revealed that 62% of schools surveyed had students with permanent physical or cognitive disabilities. Of these schools, 94.5% have disabled students participate in required physical education. These students participated either in regular physical education classes, adapted physical education classes, or both.

Health Education

In addition to physical education classes, CDC⁵⁰ recommends complementary comprehensive health education for all students, from kindergarten through 12th grade. Such health education should help students develop the knowledge, attitudes, skills, and confidence to engage in a physically active lifestyle. To be most effective, CDC⁵⁰ encourages the use of active learning strategies in health education classes. Other recommendations for health education include encouraging family involvement in physical activity, and including parental involvement in physical activity instruction in schools.^{14, 50} Similarly, parents are encouraged to be physically active role models for their children. In these ways, children are more likely to perceive that their parents support them being physically active, a factor associated with physical activity in children.¹³⁶ On a related note, government organizations recommend offering onsite health promotion programs for school faculty and staff, so that they serve as role models for the students.^{14, 50}

Using the School Health Profiles survey, the CDC has assessed school health programs in secondary schools since 1994. As part of the 2004 School Health Profiles survey, lead health education teachers reported whether health education in their school covered each of 12 topics related to physical activity and fitness. On average, less than 45% of the states, and less than 49% of the school districts, covered all the topics. The topics least likely to be covered dealt with developing an individualized activity plan and monitoring progress toward reaching goals.¹⁴⁹ That is unfortunate, as self-regulation is an important skill shown to be associated with increased physical activity.^{121, 126}

Ideally, physical education and health education teachers would collaborate on activities and projects to reinforce positive attitudes toward, self-confidence in, and perceived benefits of, physical activity. Health education curricula also should reinforce behavioral skills (such as goal-setting and self-monitoring) taught in physical education classes. Unfortunately, data from the 2000 SHPPS revealed that in only approximately half the schools did physical education staff collaborate with school health education staff.⁶⁷

In keeping with the recommendation to hire only qualified health education teachers, it is further recommended that these teachers receive state-of-the-art training, either through their undergraduate teacher training sessions, or through staff development programs.^{14, 148} Despite these recommendations, many teachers do not seem to be taking advantage of professional development opportunities. The 2004 School Health Profile Survey revealed that, on average, the lead health education teacher received staff development on physical activity within the past two years in only 43% of the states and 44% of the school districts.¹⁴⁹

Sedentary Behaviors

Another factor that has been linked to children's inactivity is today's sedentary culture. In the current technologically-driven society, many day-to-day tasks that children used to do manually have been automated. In addition, children and adolescents spend a large proportion of their leisure time engaging in sedentary activities as these are often more easily available and appealing than more active alternatives.

Obese children are found to be more sedentary than non-obese children,¹⁵⁰ and obese children are more likely to choose sedentary, rather than active activities when given the choice.¹⁵¹ They are also more likely to decrease physical activity when sedentary activity is reinforced.¹⁵⁰

Gender differences have been observed with respect to engaging in sedentary behaviors. First, girls and boys have been found to have different preferences for sedentary activities. Adolescent girls prefer listening to music and talking on the phone, whereas adolescent boys prefer playing computer games.¹⁵² When reinforced for increasing targeted sedentary behaviors, girls lapse further into sedentary activities than do the boys.¹⁵⁰

It is important to note that physical activity and sedentary behaviors are two distinct behaviors that are not always inversely correlated each other.^{26, 95} That is, to examine the total level of physical activity within an individual, we need to look at both physical activities and sedentary behaviors. Either one of them alone does not necessarily reveal the true status of physical activity. One intervention study conducted with children and adolescents found that although increasing targeted sedentary behaviors resulted in a decrease of physical activities, decreasing targeted sedentary behaviors did not result in an increase of physical activities. The authors posit that children were probably substituting non-targeted sedentary behaviors.¹⁵⁰ Research has also shown that participation in physical activities versus sedentary alternatives has different determinants.^{95, 152}

Despite the fact that sedentary and physical activities are apparently influenced by different factors, researchers have found that the availability and reinforcing nature of sedentary versus active leisure time activities influences how active we are.^{14, 153} Epstein and his colleagues have conducted a series of studies to further understand how children and adolescents choose between active and more sedentary leisure-time alternatives.^{150, 151, 153-157} Research supports the idea that children will choose to be more active when access to sedentary alternatives is reduced.¹⁵¹

Technological Advances

In the past century or more, technological innovations have reduced the physical requirements of daily life substantially. Automation and the introduction of labor-saving devices in the home have led to a decline of physical activity.⁵⁵ It has been suggested that in general, Americans are expending less energy because of technological change,^{25, 158} and that the reduced physical demands for day-to-day functioning have caused a decline in physical activity over the past half-century. Children, as well as adults, should be affected by these technological advances.

Many day-to-day activities that expend small amounts of energy have been replaced by automated systems. For example, instead of getting up to change TV channels, most people use a

remote control. Elevators or escalators are a readily available alternative to using stairs. Instead of rolling up and down a car window manually, a push of a button does it all. Separately, such activities likely represent only a small amount of energy expenditure, but taken together, over the long-term, they could translate to an excess of energy and thus eventual weight gain. Some researchers believe that the reduction in these "insensible" physical activities may reflect a few hundred calories a day that are no longer expended, and this could account for significant weight gain in the long run.⁵⁷

Media Use/Screen Time

The sedentary behavior that has been most implicated in the rise of childhood obesity is screen time, including television viewing. Data on prevalence of television viewing suggest that a high percentage of children and adolescents watch more than the recommended limit of two hours a day.^{1, 47} A Kaiser Family Foundation survey of 8-18 year olds found that they spend 6.5 hours a day with media (including TV, DVDs, videos, computer use, radios, CDs). The average amount of time spent watching TV/DVDs/Videos in this group averaged almost four hours per day.⁸² Among younger children 2-7 years old, the average amount of media time was 3.5 hours.⁸³ Even among children under two years old, 68% of children used screen media including TV, video or DVD, for an average of about 2 hours.⁸⁴

Data from the 2005 YRBSS⁶² found that 37.2% of high school students watched three or more hours of television on a typical school day. Among middle school students, the estimates were close to 50%.⁶⁰ Some researchers hypothesize that on average, American children spend more than a quarter of their waking hours watching television.¹⁵⁹

Among Americans, television viewing time increased from 10.4 hours per week to 15.1 hours per week, from 1965 to 1985.¹⁶⁰ Nielson data suggest that Americans 12 and over watch an average of 28 hours per week.¹⁶⁰ The reason for the increase might be accessibility. In 1960, only 12% of US households had more than one television set; by the year 2000, 76% of U.S. households had more than one set.¹⁶⁰ As studies have shown that children are more likely to engage in sedentary behaviors to the extent that such alternatives are easily accessible,^{84, 153} the number of television sets in the house becomes an important determinant in the matter of time spent viewing television. Currently, 36% of children up to six years old⁸⁴ and 68% of 8-18 year olds, report having a TV in their room.⁸² Having a television in the bedroom has been related to a higher prevalence of childhood obesity.¹⁶¹

Television viewing can have a multiplying negative effect on the weight of children and adolescents. The use of electronic media, including TV, has been suggested as a likely source of change in participation rates in a variety of traditional outdoor recreation activities.⁷⁶ Not only is time spent watching television time that is not spent engaging in physical activity, but television viewing is associated with increased food intake as well.^{26, 159, 162, 163} This relationship was especially true when comparing children who watched less than one hour of television versus those who watched greater than five hours.¹⁶² Watching television during mealtime is associated with eating fewer vegetables and fruits, and consuming less nutritious food and drinks.^{162, 164}

In addition, an analysis of the types of commercials aired during children's television programming found that commercials often promoted sweetened breakfast cereals, snacks,

candy, soft drinks, and fast food restaurants. As advertising influences children's food choices, it is no wonder that television viewing is associated with less healthy eating habits.¹⁶⁴ As such, it is recommended that parents should monitor the amount of time children spend watching TV or playing video games and should encourage children instead to engage in physical activity.^{165, 166} However, a recent survey found that for 53% of 8-18 year olds, their families have no rules around television watching.⁸² This may have an important implication for TV viewing among youth. Among children under six, it has been shown that children whose parents enforce media rules are likely to spend more time reading and playing outdoors.⁸⁴

Many studies have found a positive association between television viewing and prevalence of childhood obesity. One study of children aged 10 to 15 years found that those children who watched five or more hours of television per day were 4.6 times more likely to be obese as compared to children watching two or fewer hours.¹⁶⁷ Another large study of children and adolescents aged 8 to 16 years found similar results, with the prevalence of obesity highest among those who watched four or more hours of television per day and lowest among those watching one hour or less.¹⁶² Parsons et al¹⁶⁸ also reported a positive association between television viewing and BMI in 11 year old girls. A similar association between television viewing and adiposity was also found among children aged 9-10 and 15-16 years old in a recent European study.³³

The fact that parents and children are not skilled at tracking how children spend their time, including the extent to which they watch television or engage in physical activity, makes it challenging to document the relationship between television viewing and physical activity among children.^{26, 159} However, some studies have found evidence of a negative association between physical activity and television viewing. One study by Santos et al¹⁶⁹ found that while physically active adolescents and their less active counterparts did not differ in weekday television watching, physically active adolescents were less likely to watch television on the weekends. In a study of preschoolers using direct observation of physical activity (rather than parent or child reporting), DuRant et al¹⁷⁰ found that physical activity was lowest among the children during the longest periods of television watching. Robinson et al¹⁷¹ also found a negative relationship between television viewing and reported physical activity among adolescent girls. On the other hand, a review by Sallis et al⁸⁷ reported that studies of children aged 4 to 12 years old found mixed results when looking for a relationship between television watching and playing video games and physical activity. They found no association between television viewing and physical activity among adolescents aged 13 to 18 years old. Similarly, a recent European study reported no association between television viewing and physical activity in children aged 9 to 10 years old and 15 to 16 years olds.³³

One review of the literature suggests that the association between overweight and sedentary behaviors is greatest among 8 to 12 year olds, which are the peak years for watching television.²⁶ Among four to six year olds, those who watch TV two or more hours a day were found to spend an average of 30 minutes less per day playing outside than did children who watched fewer than two hours of TV. Whether there is a causal relationship, and if so which direction the relationship is in (whether increased TV watching results in less playing or vice versa) could not be determined.⁸⁴

Interventions to Reduce Sedentary Behaviors

Given the hypothesized link between television viewing and obesity, there have been several interventions aimed at tackling the childhood obesity problem by targeting sedentary behaviors. Many of these interventions have been found to reduce weight gain and the prevalence of obesity among children and adolescents.^{154, 156, 172}

One such example is the Planet Health intervention.¹⁷² In this study, middle school students received information on how to reduce television viewing, along with information about healthy eating and the importance of engaging in physical activity. Lessons were incorporated into the curriculum of existing subjects throughout the school year. Students were followed over a two year period.

Results showed that obesity prevalence was significantly reduced among female students in the intervention schools as compared with their counterparts in control schools. Further analyses revealed that change in TV viewing mediated the intervention effect. Specifically, each hour reduction in television viewing was associated with a reduction in obesity prevalence. In this study, the effect of television viewing on weight seems to have occurred through improving the eating behaviors of the female participants, rather than in increasing physical activity.¹⁷²

Epstein and his colleagues¹⁵⁴⁻¹⁵⁷ have conducted several interventions aimed at reducing sedentary behaviors as a way to increase physical activity and reduce weight in both obese and non-obese children. Results are similar, though not identical, across studies. One study¹⁵⁴ involved obese children and their families, who received diet information, as well as information about the positive effects of increased physical activity and the negative effects of a sedentary lifestyle. Some participants were positively reinforced for increasing their physical activity, while other participants were reinforced for decreasing the amount of time spent in targeted sedentary activities. Other sedentary activities were not targeted as a way of examining whether children replaced the targeted sedentary activities with other sedentary activities or with more active pursuits. A third group was reinforced both for increasing physical activity and decreasing sedentary activities. Results showed that children who were reinforced for reducing sedentary behaviors showed better changes in percentage overweight and percentage body fat than did the group who were reinforced for exercising. The group that was reinforced for both had results midway between the other two groups. Interestingly, the group that was reinforced for exercising showed the greatest intake of calories. The authors posit that those in the exercise group still may have been watching television, which can act as a stimulus to eat.¹⁵⁴

Other intervention studies by Epstein and his colleagues have found that reducing access to sedentary activities resulted in decreases in percent overweight, increases in fitness, increases in physical activity, and decreases in calorie intake. Presumably, the reduction in sedentary behaviors (such as television viewing) resulted in a decrease in conditioned eating responses. The increase in physical activity was thought to result from youth reallocating time previously spent in sedentary activities, although some of the time previously spent in targeted sedentary activities was reallocated to non-targeted sedentary activities.^{150, 156}

Robinson¹⁷³ describes an intervention in which third and fourth grade students received six months of classroom instruction on how to reduce television viewing. Compared with controls, students who received the intervention significantly reduced the amount of television they watched, and had significantly greater decreases in BMI and other measures of body

fatness. The intervention also reduced the frequency of eating meals with the television turned on. The intervention did not, however, significantly increase moderate-to-vigorous physical activity or fitness of the children. The author posits that reductions in television watching could have resulted in increased energy expenditure through low intensity activities. This theory is supported by the finding that a reduction in television watching was not accompanied by an increase in other sedentary behaviors, such as using a computer, doing homework, listening to music, or playing quiet indoor games.

Other research describes that television viewing is one of the most valued sedentary activities among children. As such, reducing access to such an activity has the largest potential impact on children's obesity. However, as this is the most favored sedentary activity, it will be harder to persuade children to give that up in favor of a more active alternative. Instead, researchers believe that youth will be more likely to choose to be physically active when the sedentary alternative is less valued.¹⁵³

In summary, children and adolescents spend a large part of their days involved in sedentary activities. Time spent in sedentary activities is, by necessity, time not spent engaging in physical activity. Intervention studies have found that reducing access to sedentary behaviors, including television viewing, can effectively lower obesity prevalence among children and adolescents. This reduction in obesity seems to be the result of both healthier eating habits and increased physical activity. Thus, taken together, the evidence supports limiting children's television viewing.

V. Disparities in Obesity and Physical Activity

As is true with many other chronic conditions, certain subpopulations have an especially high prevalence of childhood obesity. Obesity rates have been found to differ by ethnicity and socioeconomic status (SES). It has been documented that rates of overweight (defined as BMI for age at 95th percentile or higher) are not only higher among Mexican American (e.g., 25.3% among 6-11 year old boys), non-Hispanic black (26.5% among 6-11 year old girls)³ and American Indian youth,^{174, 175} but are also rising at a higher rate.^{176, 177} In terms of SES disparities, non-Hispanic white adolescents from lower-income families are more likely to be overweight than their counterparts from higher-income families.¹⁷⁸

Disparities in childhood obesity are at least partly due to differences in physical activity. Indeed, studies have found that the following demographic variables are implicated in physical activity levels: race/ethnicity, age, gender, and socioeconomic status.^{91, 179} Children with physical disabilities have special barriers to physical activity.¹⁸⁰ Such disparities call for special intervention strategies that consider and focus on the most vulnerable groups of children. This section summarizes differences in the levels of physical activity and sedentary behaviors across subgroups of the population.

Age

It has been consistently shown that children's activity levels decline with age. One meta-analysis that evaluated physical activity and cardiorespiratory fitness showed that 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).⁹¹ There is also a complementary increase in inactivity with age. A national survey of high school students (YRBSS in 2005) revealed that the prevalence of failing to meet currently recommended levels of physical activity increased as grade level went up, from 63.1% in 9th grade to 67.1% in 12th grade.⁶²

Gender

Another consistent finding is that girls are less active than boys, and this difference becomes more pronounced through adolescence. Specifically, one study calculated that boys were approximately 20% more active than girls.⁹¹ In addition, decline in activity levels with age was greater among girls; while boys' activity levels declined 2.7% per year, girls' activity levels declined by 7.4% per year.⁹¹ Similarly, the 2005 YRBSS found that male students (43.8%) were significantly more likely to meet current recommended levels of physical activity than female students (27.8%).⁶² Data also found that male students (61.8%) were significantly more likely than female students (50.2%) to have played on a sports team.⁶² The CDC reports that inactivity is twice as prevalent among females (14%) than males (7%).¹⁷⁹

Ethnicities

Members of ethnic minority groups report less physical activity and more inactivity than their white counterparts. Data show that white high school students (38.7%) were more likely than their African American (29.5%) and Hispanic (32.9%) classmates to engage in regular

physical activity and meet current recommended levels of physical activity.⁶² White students (57.8%) were also more likely than African American (53.7%) and Hispanics (53.0%) students to play on sports teams in and out of school.⁶² Among 9-13 year old children, it was found that non-Hispanic black and Hispanic children reported significantly less involvement in organized physical activity than non-Hispanic white children.⁵⁹

The 2005 YRBSS⁶² also reported that African American high school students (14.4%) were more likely to report not engaging in moderate or vigorous physical activity during the preceding week than were white (8.1%) and Hispanic (10.6%) students. Also, the National Longitudinal Study of Adolescent Health (Add Health) data showed that in their teen years, Hispanic and non-Hispanic black young women had the lowest physical activity level of all racial/ethnic/gender groups and as they aged, their activity level decreased dramatically.¹⁸¹

Differences in physical activity levels also may be tied to differences in time spent in sedentary pursuits across ethnicities. The 2005 YRBSS⁶² results showed that African American (25.2%) students were more likely than Hispanic (19.8%) and white (19.6%) students to use computers for 3 hours or more each day. African American students (64.1%) also were most likely to watch at least 3 hours of television per day, compared to Hispanic (45.8%) or white students (29.2%).⁶²

When total media use (i.e., TV, video games, radios, cassette tape players, VCRs, compact disc players and computers) is examined among 2 to 18 year olds, ethnic differences also were apparent. Specifically, daily average amount of media use was reported 5.08 hours among white children, as compared with 6.03 hours among minority children.⁸³ In another study among 8-18 year old children, African American youth were shown to spend far more time than white youth watching TV (average daily amount of 4.08 vs. 2.75 hours) and playing video games (1.07 vs. 0.77 hours).⁸²

Differences in physical activity levels across ethnicities may be due to differences in opportunities to safely engage in physical activity. Residentially segregated areas such as communities with higher percentages of African American residents have been shown to have fewer available parks and green spaces, places to play sports, and public pools and beaches.¹⁸² When asked to identify barriers to their children's participating in physical activities, parents of all races, incomes and educational levels reported many of the same barriers. However, transportation difficulties, lack of area opportunities, and expense were reported significantly more often by non-Hispanic black and Hispanic parents than by non-Hispanic white parents.⁵⁹ Concerns about neighborhood safety were greater for Hispanic than for non-Hispanic white or African American parents.⁵⁹

Collectively, these ethnic differences represent a large risk differential between minority and white children. As such, it would be wise to develop culturally appropriate interventions geared specifically for minority children and their parents, highlighting the importance of physical activity. Such campaigns would need to emphasize the many physical, social and mental benefits of physical activity. Concurrent changes in the built environment, such as access to safe, convenient recreational facilities, also would need to take place for physical activity levels to increase among minority children.

Socioeconomic Status

Physical activity levels also differ according to socioeconomic status. Specifically, lower levels of regular non-school physical activity were observed among children whose parents had lower incomes and educational levels.⁵⁹ The disparities were observed in sedentary behaviors as well. Children whose parents had a high level of education were less likely to watch a lot of weekday television than are students whose parents had low levels of education.⁸¹ Sedentary behaviors also seem to be influenced by the neighborhood SES level. The average amount of media use among 2-18 year olds was about an hour less daily among children who live in or go to school in communities with a higher annual median income, as compared to children from communities with a lower median household income.⁸³

One proposed mechanism for socioeconomic disparities in physical activity is that lower SES children have fewer opportunities to engage in safe play. Studies that have looked at park use found that in particular, inner-city residents and the poor were much less likely to report participation in outdoor recreation activities than other metropolitan and non-metropolitan residents. For example, 13% of inner-city poor residents reported running or jogging, compared to 29% of metropolitan residents.¹⁸³ In fact, the inner-city poor were less likely than other residents to participate in any of the 23 outdoor recreation activities surveyed.

The above-described differential is likely because those individuals did not have a safe venue in which to engage in physical activity. In a study examining physical activity settings and SES, overall availability of outdoor places to play and engage in physical activity decreased as the area poverty level increased.¹⁸² A study of neighborhood physical environment also revealed that high socioeconomic status neighborhoods were more likely to have one or more recreational facilities, while low-SES and high-minority neighborhoods were less likely to have facilities. This difference was associated with decreased physical activity and increased overweight in these areas.¹⁸⁴ In addition, legislative bills that have reduced parks and recreation revenue resulted in fewer programs in lower-income areas.¹⁸⁵ Accordingly, recreation centers have begun to rely on user fees to subsidize programs. Expectedly, user fees were associated with reduced participation by low-income residents.¹⁸⁶ Children living in poverty or from low-income families might not be able to participate in such programs, as they are unable to pay for transportation, special sports equipment, or program fees.⁵⁰

Safety concerns, another reason often cited for lack of physical activity in children, seem to be more an issue in poorer, inner city neighborhoods. In these areas, children often play in the streets, as there are not areas dedicated to children's play. As a result, child pedestrian injuries occur at a higher rate.¹⁸⁷ The high crime, littered sidewalks, and poorly maintained environments that are present in poorer inner city areas discourage most discretionary outdoor physical activity.⁵⁵

Children with Disabilities

Children with disabilities often experience more barriers to physical activity than children without disabilities. Individuals with disabilities confront many challenges including limited mobility and accessibility.¹⁸⁰ Whereas children with disabilities have the same physical activity needs as children without disabilities,¹⁸⁸ these hurdles, in addition to social barriers, may

discourage children with disabilities from participating in various physical activities. There may be also less opportunity for children with disabilities to participate in physical activity programs. To serve all children including children with disabilities, parks, schools and other places for physical activity should be constructed with the needs of children with disabilities in mind.¹⁸⁰ In addition, children with disabilities should be encouraged to participate in school physical education, sport teams, and community physical activity programs, in the same way that children without disabilities are encouraged.

Summary

There seems to be clear evidence for age, gender, ethnicity, and SES differences in physical activity behaviors. Specifically, it has been found that: (a) older children (i.e., adolescents) are less active than younger children, which is especially true for females; (b) males are more active than females; (c) white children and adolescents are more active than their African American or Hispanic counterparts; and (d) children of lower SES status are less active. It also appears that children with disabilities are less active than children without disabilities. Differences across these groups may be due to differential access to venues in which to engage in physical activity. Combined with differential opportunities to make healthy food choices (such as poor neighborhoods having a fewer number of supermarkets than wealthy neighborhoods, and healthy foods costing more than calorie-dense unhealthy foods),^{189, 190} children in some racial/ethnic and socioeconomic groups may be at a higher risk of obesity. Increasing the availability of recreational facilities in underserved communities and especially for these at-risk groups may be an effective strategy for increasing physical activity and decreasing overweight at a population level.¹⁸⁴

VI. Summary and Recommendations

What We Do Know

From the evidence presented throughout this report, it is clear that we need to commit to additional research to develop effective strategies to combat the childhood obesity epidemic. At the same time, however, there is an urgent need for action. We cannot afford, nor can our children afford, to wait until all of our questions are answered before taking action. Lack of physical activity among children certainly plays a significant role in the childhood obesity epidemic. As such, it is a crisis that calls for immediate action based on what we do know. Here is what is known from the existing data:

- Almost one in seven children aged 2- to 5 years old and almost one in five children aged 6- to 19 years old is currently overweight. This represents more than a doubling of rates, and for some age groups a tripling or quadrupling of rates, from the 1970s.
- Childhood obesity is a serious public health problem with important health, psychosocial, and monetary implications.
- Childhood obesity is the result of an energy imbalance, where energy intake exceeds energy expenditure.
- Costs of obesity are very high in terms of physical, psychosocial, and economic consequences not only at the individual level, but also at the societal level:
 - Obese children and adolescents carry significant health risks such as hypertension, high cholesterol, glucose intolerance/insulin resistance, type 2 diabetes, sleep apnea, menstrual abnormalities, impaired balance, and orthopedic problems.
 - Obese children and adolescents are also more likely to suffer from depression or low self-esteem and to feel discriminated against.
 - Obese children and adolescents often become overweight adults, and thus are more likely to suffer from chronic conditions such as type 2 diabetes, heart disease, arthritis, asthma, and even cancer.
 - Childhood obesity is predictive of increased medical expenses, decreased quality of life, lost work time, physical and mental disabilities, premature death, and loss of productivity.
- Benefits of physical activity in children are many:
 - Physical activity helps maintaining a healthy weight and can reduce weight in obese children.
 - Physical activity improves childhood physical and psychological health and quality of life.
 - Physical activity helps cognitive, physical, social and emotional development.
 - Physical activity delays the onset of many chronic diseases.
 - Childhood physical activity increases the likelihood of maintaining an active lifestyle as an adult.
- To get benefits from physical activity, it has been recommended that children engage in a total of at least 60 minutes of moderate to vigorous physical activity each day (before, during, and after school).

- While data on childhood physical activity levels vary from source to source, it is clear that today's youth are not sufficiently physically active:
 - The majority of children do not meet the recommended levels of regular vigorous or moderate physical activity of at least 60 minutes per day.
 - Physical education classes receive less time in the curriculum or are eliminated altogether in favor of academic classes and the majority of children are not getting daily physical education.
 - Even when children are in physical education classes, they are often not sufficiently active.
 - Not all elementary school students are getting regularly scheduled recess.
 - Many children do not participate on sports teams.
 - The majority of children do not walk or bike to school.
- Obesity is increasing at an alarming rate, but data show little change in trends of our children's level of physical activity. That is, prevention has not caught up with obesity trends.
- Today's youth lack opportunity/venue to engage in safe physical activity:
 - The majority of children do not have daily physical education classes and some do not even have recess.
 - Even during physical education class, children are not physically active for a significant proportion of time.
 - Not all elementary schools provide daily recess for all their students.
 - The opportunity to participate in organized sports, such as school-sponsored athletic teams, or after school intramural or club sports, is not readily available to all children, especially to those of lower SES and those with low sports skills.
 - Many barriers exist for children walking or biking to school:
 - Schools are being built at further distances from neighborhoods, making active commuting (walking or biking to school) difficult.
 - Sidewalks, trails, and bike paths are not present in many communities.
 - Traffic safety issues at busy intersections and on-off ramps to major highways often prevent walking or biking to school.
 - Crime danger is a concern for parents so that children are not encouraged to walk or bike to school.
 - School policies often discourage active commuting.
 - Community design is not conducive to physical activity:
 - Many communities are built without sidewalks, bike paths, or crosswalks; there is a deficit of safe walking or biking routes to local stores, commercial business, schools and recreation sites, and also trails for jogging and walking.
 - Safety concerns such as crime and traffic danger prevent parents from encouraging children to play outside.
 - Communities lack close-to-home physical activity facilities such as neighborhood parks and playgrounds.
- Psychosocial factors such as self-efficacy or perception of sport competence, positive attitudes toward physical activity, self-regulation skills, and parental support for physical activity are associated with greater physical activity among children and adolescents.

- Today's youth do not receive adequate physical education and health education that can provide knowledge about the importance of childhood obesity, physical activity, and the relationship between the two.
 - As enjoyment of physical education is a predictor of childhood physical activity, it is important that children be exposed to a wide range of physical activities in physical education class so that they can find activities that they enjoy. This is especially true for the student of average athletic abilities.
 - Health education in schools often fails to fully cover topics related to physical activity and fitness, thereby missing opportunities to help children develop a physically active lifestyle early in life.
 - Topics least likely to be covered in health education in schools include developing an individualized activity plan and monitoring progress toward reaching goals, which are skills associated with maintaining a physically active lifestyle.
 - In only half of the schools do physical education staff collaborate with school health education staff.
 - In many schools, physical education is not taught by specialists. This has been shown to limit the amount of time students are physically active during physical education class.
 - Health education teachers in the schools often fail to receive recommended staff development on physical activity; as such they are less likely to be able to competently speak to the importance of physical activity
 - The majority of physical education teachers do not receive training on helping students develop individualized physical activity plans and staff development on using technology in physical education. This is unfortunate, as individualized physical activity plans are an important way in which students can get into the habit of maintaining a healthy lifestyle. Use of technology in physical education represents a unique training method that is more likely to keep students' interest.
 - Families and society in general lack knowledge about the importance of childhood obesity, physical activity, and the relationship between the two. Parents often fail to identify that their children are overweight, or that there is a health concern connected with childhood obesity.
- Today's youth are growing up within a sedentary culture:
 - Children are exposed to a wide variety of attractive sedentary activities such as television, videos, computers, DVDs, and sedentary electronic games.
 - Parents often do not set and enforce rules around sedentary leisure-time activities such as television viewing, use of computer for recreation, DVD viewing, and cellphone use.
 - Today's children spend a large portion of their time engaged in sedentary activities, and time spent in sedentary activities is, by necessity, time not spent in physical activity.
 - It is possible to increase children's physical activity by reducing access to sedentary alternatives.
- Certain subgroups of children are at increased risk for lack of physical activity and obesity:
 - Activity levels decline with age.
 - Girls are less active than boys.

- Ethnic minorities are less active and more sedentary.
- Children of low socioeconomic status are less active and more sedentary.
- Ethnic minority children and low income children face increased barriers to physical activity, such as lack of facilities and programs, restraining built environment (lack of safety and availability), and inability to pay for physical activity-related costs.
- Children with disabilities confront many challenges to physical activity including limited mobility and accessibility, and social barriers.
- Effective mass media campaigns can impact youth's decisions to engage in physical activity or more sedentary pursuits.
- In general, today's culture at home, school, and in the community at large often does not promote physical activity.
- Solutions for the childhood obesity epidemic will necessitate changes in all the environments to which children are exposed, namely: home, school, after school programs, faith groups, youth groups, community organizations, and the normative physical activity of parents and the community at large.
- In order to make necessary changes, parents; teachers; school officials; elected officials at the local, state, and national levels; business leaders; and community-based organizations that focus on youth, will need to collaborate and adopt similar goals for physical activity and healthy weight among children and youth.
- Physical activity needs to become a public health priority.

Recommendations

Recommended levels of physical activity for children and adolescents differ slightly by the source that is issuing the recommendation, but the lead federal health departments and agencies recommend at least 60 minutes of moderate to vigorous activity each day. Similarly, reports of actual levels of child and adolescent physical activity vary, as measurement techniques and definitions of physical activity are not consistent from study to study. That said, it is evident that today's children and adolescents do not engage in sufficient moderate or vigorous physical activity to maintain an energy balance that results in a healthy weight.

Solutions for the childhood obesity epidemic will not be easy, and will necessitate changes in all the environments to which children are exposed, namely: home, school, faith groups, youth groups, community agencies and organizations, and the normative physical activity of the community at large. In order to make these changes, parents; teachers; school officials; elected officials at the local, state, and national levels, and community-based organizations that focus on youth, will need to collaborate and adopt similar goals for physical activity and healthy weight among children and youth.

Often, recommendations focus on what the child or adolescent can do. While this is important, it is not sufficient to make an impact that will change the current pattern of physical inactivity. Strategies need to focus at the macro level, where changes impact whole groups of all children in a community, and all children who live in this country. Public health strategies impact large populations and help to shape attitudes, values, and normative behaviors. We need

to build strategies that have proven to be successful in other public health initiatives, such as promoting childhood immunizations, stopping smoking and preventing drunk driving. The problem is not the know how—rather it is inertia and lack of leadership. The time for action is NOW.

One way in which inertia can be overcome is for national community-based organizations to make the commitment to engage community-based partners, to coordinate actions, and to take a leadership role in preventing childhood obesity. Because the solutions to this inactivity crisis require change in multiple settings (home, school, media, healthcare, industry, community, government), it will take a collective of leaders and community-based organizations that influence those settings. Three such leaders—YMCA, NRPA (National Recreation and Park Association) and NASPE (National Association for Sport and Physical Education)—together with other experts and stakeholders, can make a dramatic impact on this crisis. These three groups, with a history of organizing a nationwide movement on a grand scale, have great potential to increase children's physical activity through the programs they provide at child care, after school programs and youth sports programs. These three organizations are composed of staff professionals from the fields of physical education, health education, and recreation. In addition, consider:

The YMCA of the USA

- Oldest and largest non-profit service organization in the country
- Serves 20.2 million Americans each year, half of whom are under the age of 18
- Largest non-profit provider of child care, after school programs, and youth sports

National Recreation and Park Association

- Represents all local, state and regional public parks and recreation entities in America
- Members operate 500,000 facilities in over 6,000 agencies
- Serves more than 200 million park visits each year
- The largest public providers of child care, after school programs and youth sports

National Association for Sport and Physical Education

- Non-profit professional membership association that sets standards for practice in physical education and sport
- 17,000 members including K-12 physical education teachers, coaches, athletic directors, athletic trainers, sport management professionals, researchers, and college/university faculty
- Mission is to enhance knowledge, improve professional practice, and increase support for high quality physical education, sport, and physical activities.

The following recommendations describe ways in which children can be encouraged to engage in physical activity now, and to maintain an active lifestyle for the rest of their lives. We have issued different recommendations, based on the many contexts and influences to which

children are exposed, namely: home, school, mass media, health care system, business, and the larger community. We have also included a section on the government, as many of the necessary changes that need to occur in these various contexts require legislative action to provide the incentive, and financial resources, to be put into action. As is evident upon reading the recommendations, many of the same suggested behavioral changes for children and adolescents can be promoted through several different contexts. In fact, only if children and adolescents hear consistent messages about the value of physical activity and a healthy lifestyle will there be any hope of reversing the current trends of childhood obesity.

As described, high prevalence of physical inactivity and obesity are present among boys and girls from all ethnic groups and SES levels. However, certain segments of the population are at increased risk. Specifically, girls, members from ethnic minority groups, and low-income and inner city residents, are more likely to be less physically active. At least some of these disparities are due to differential access to safe venues to engage in play. Thus, while the following recommendations will help all children increase their level of physical activity, special care should be taken to implement these recommendations with respect to members of these disadvantaged groups.

Many of these recommendations are based on previous suggestions put forth by other health authorities^{1, 12-14, 50}.

Home

- Parents should plan family activities that revolve around physical activity, such as family hikes, bike rides, swimming, and outdoor recreational games.
- Parents should encourage their children to walk or bike to school, when feasible. When appropriate, parents may need to accompany their children as they commute to school.
- Parents should encourage their children to take the stairs, to walk or bike to stores or to visit friends. Physical activity needs to become the option of choice and then the option of habit, similar to children who now buckle their safety belts because they always were buckled for safety.
- Parents should actively promote their children's physical activity efforts. Such support includes: verbal encouragement and praise; where appropriate watching children as they participate in sports or other types of physical activities; and facilitating physical activity by transporting children to the activity, providing necessary equipment, and arranging programs in which children and youth have the opportunity become physically active. If such costs are beyond parents' capabilities, they should actively seek support from local groups such as the YMCA or religious organizations that might be able to fill this financial gap.
- Parents should encourage physical activity among children through not only organized sports but also unstructured, free play.
- Parents should place limits on television viewing of their children to less than 2 hours per day. This recommendation can be extended to include leisure time screen activities such as video games, DVDs, and recreational use of computers, and the amount of time a child can spend on the phone talking with friends, instead of playing with friends.

- Children should be guided not only to decrease time spent in sedentary activities but also to replace that sedentary time with physically active time.
- Because children respond better when they are offered choices, parents should offer children several physical activities from which to choose, rather than forcing a particular activity on the child.
- Parents may be more successful in getting their children to be active if they find activities that the child already likes and increase the time spent in those activities, as well as to promote decreases in sedentary activity.
- Parents should help make physical activity enjoyable and part of every day. This would include helping children to develop skills in physical activities.

Schools

- Children should receive daily physical education class of 30-60 minutes in length (If schools use a “block scheduling” format, then it is recommended that children receive at least 150 minutes/week for elementary school and at least 225 minutes/week for middle school and high school).
- Qualified specialists should teach physical education class where possible, as these individuals will be more effective in getting children to be physically active and in teaching skills that will enable the child to enjoy the activity.
- Children should be engaged in moderate to vigorous physical activity for at least half of the physical education class period.
- Physical education class instruction should discuss the health, social, and mental benefits of physical activity as well as the potential risks of physical inactivity.
- Children should be exposed to a wide range of physical activities in physical education class, so that they are able to find ones that they enjoy, as enjoyment of physical activity and physical education are predictors of physical activity.
- Children should be taught the necessary skills and given adequate time to practice such skills so that they gain a sense of self-efficacy and competence around physical activity.
- The goal of physical education class should be to encourage all children regardless of athletic gifts to engage in lifelong physical activity. As such, children should be taught not only about team sports but also non-competitive physical activities such as walking, jogging, hiking, biking- activities that are more easily engaged in throughout the life cycle.
- Physical education instruction should include self-regulation skills, such as self-monitoring and goal setting. Likewise, children should be required to develop an individualized physical activity plan, with appropriate teacher feedback.
- Physical education instruction should include information about injury prevention.
- Elementary and middle schools should allow for an adequate time for daily recess that provides 30-60 minutes of unstructured physical activity during the school day.
- In addition to daily recess, other creative approaches to physical activity such as physical activity breaks in the classroom should be encouraged.
- School curricula should include health education that discusses topics which support physical activity and fitness.

- Physical education and health education teachers should collaborate to best educate students about physical activity and how to integrate fitness activities into their daily routine.
- School policies and facilities should be such that they encourage children to walk or bike to school. Schools should provide safe storage areas for bikes and crossing guards at major intersections to encourage safe walking.
- School administrators and city officials should work with municipal agencies like park and recreation departments and planning departments to plan, design and fund safe and attractive walking and bicycling facilities and paths that connect schools to surrounding neighborhoods.
- As many children do not see a physician on a regular basis, height and weight should be measured and recorded annually at school and these numbers, along with calculated body mass index, should be communicated in a private way to parents. A written communication also would describe body mass index, how it is used as a measure of health, and what can be done to improve body mass index through physical activity.
- Schools and daycare providers should encourage and support the physical activity behaviors of their staff, as they act as role models for the students. To support this, onsite health promotion options should be offered for teachers, as well as students.
- Programs should be directed toward ALL children and youth, including those who are chronically ill or who have disabilities, those who are living in poverty, those who don't thrive in academic areas of school, and those who are members of ethnic groups who may have cultural issues that need to be considered.
- Parents should be advocates for more physical education and health education in the schools.
- Daycare, preschool, and after school programs should include opportunities for children to engage in physical activity.
- Schools should offer a wide variety of after school physical activity programs that will meet the interests of a diverse student population. Scholarships and transportation options should be offered to lower-income students.
- School Boards need to stand firm in their commitment to teach the "whole child" including spirit, mind, and body.
- Schools should regularly evaluate the physical fitness of their students and their physical activity programs, and make the findings public, so that parents can be assured that their children are participating in and benefiting from physical education, sports, and recreational opportunities offered by the school. Also, if the results are published, school administrators and teachers may be more likely to respond to scores that do not meet a designated standard. In addition, parents will become more interested in the physical activities offered by the schools and may encourage their children to participate.
- Schools should provide physical education teachers with staff development courses on cutting-edge topics.
- Physical education teachers should be required to earn continuing education credits to maintain state certification or licensure.
- A standardized assessment tool should be developed in order to evaluate students' fitness levels, physical activity knowledge, motor skills, and self-management skills. The quality of physical education programs should be monitored using this assessment tool and also

evaluated against national and state standards and recommendations for a quality physical education program.

- Physical education and health education should be among the core subjects upon which students are tested as part of the state education assessments and the “No Child Left Behind” legislation. As policy and budgetary decisions are often made on the basis of standardized test scores, such a move might make it more likely that physical education receives greater attention and resources.
- Schools should assist collecting information for national databases that measure youth participation in physical activity and related health and social outcomes.
- Each state should have a physical education specialist to coordinate school physical activity programs throughout the state. This person would play an important role in implementing staff development, resource dissemination, student assessment, and evaluation of programs.
- Federal agencies and national organizations should disseminate tools to help schools improve their physical education programs.
- National, state, and local governments, along with school boards and parents, should require that schools and daycare programs provide opportunities and allocate time for physical activity programs.
- These same agencies should allocate appropriate financial resources to support quality physical education and health education, in terms of providing for qualified staff and necessary equipment.
- School facilities should be open to the community during non-school hours so that playgrounds and gymnasiums, cafeterias, and “all purpose rooms” can be used for open play or for organized sport programs.
- Local governments, private developers, and community groups should work together to improve the street, sidewalk, and street-crossing safety of routes to school.
- Community groups and school officials should work together to develop and implement programs that encourage students to walk or bike to school.
- Developers and communities should plan school construction in such a way that new schools are within walking or biking distance of the neighborhood they serve and whose location does not present significant barriers to these activities such as being located next to on/off ramps of major highways or roads.

Mass Media

- Conduct focus groups among children, adolescents, and parents from diverse backgrounds in order to identify the most important perceived mental, physical, and social benefits of physical activity.
- Conduct a national campaign to foster awareness of these benefits of regular moderate to vigorous physical activity of at least 60 minutes a day for all children and youth. Incorporate positive messages about physical activity in pre-existing youth-oriented programming.
- Train public health and exercise scientists in media advocacy skills so as to empower them to disseminate their knowledge to a broad audience.
- Encourage community-based advertising campaigns to balance messages so that there is less promotion of sedentary behaviors.

- Encourage media professionals to utilize actors' influences as positive role models demonstrating healthful behaviors.

Healthcare

- Pediatricians and family care physicians should routinely track height, weight, BMI, and physical activity habits; offer relevant evidence-based counseling and guidance; be more communicative with parents with a child who is overweight or obese of the effects of obesity; serve as role models; and provide leadership in their communities for advancing physical activity.
- Physicians or other healthcare professionals may need to go into the schools on an annual basis to measure and track BMI of those students who do not have regular access to health care professionals.
- BMI measurements and the risks associated with childhood overweight and obesity should be communicated in an age-appropriate manner to parents and the children themselves. This information will help families make informed decisions about physical activity and nutrition.
- Insurers and accrediting organizations should provide incentives or recommendations to health care providers for establishing a dialogue with families about the importance of maintaining a healthy body weight. Incentives and recommendations also may focus on screening and obesity preventive services being made a part of the routine clinical practice and quality assessment.

Industry

- Provide expertise in consumer research and market strategies for ongoing initiatives and interventions to enhance physical activities for kids.
- Leisure, entertainment, and recreation industries should develop products and opportunities that promote regular physical activity and reduce sedentary behaviors among children.
- Worksites can host family-day events with a focus on physical activities.
- Provide corporate sponsorship of child and adolescent intramural teams, clubs and sport leagues.
- Provide corporate support for playgrounds, trails, bike and walking paths, and fields and venues for sports, play and activity.
- Local businesses can promote safe routes to school, including the provision of staff as volunteers to walk with kids.

Communities

- Design community evaluation tools such as a "Community Play Index" that incorporate measures of the availability of opportunities for physical activity. Communities should be encouraged to use the index to assess and improve opportunities for physical activity in the community, and to build model communities of play.
- Promote programs that encourage regular physical activity, particularly for high-risk populations, such as inner city youth and members of ethnic minority groups.

- Because overweight and obese children are often embarrassed about their lack of skill at physically demanding activities or their appearance in sports clothing, they are less likely to voluntarily participate in physical activity. Special encouragement for these children to participate in sports activities by trained professionals is needed to overcome these self-imposed barriers.
- Train public health, recreation and exercise scientists to develop programs for children who are overweight or obese to minimize the tendency of these children to avoid sports-related activities.
- Prioritize capital improvement projects to increase opportunities for physical activity in existing areas and for walking or biking between areas.
- New development should be designed with the increased opportunities for physical activity as a high priority, encouraging biking and walking (rather than geared solely for automobile use). This would entail having adequate bike paths, sidewalks, multiple-use trails, pedestrian zones, and mixed use areas. When possible, similar modifications to existing areas should be made.
- The community should provide conveniently located facilities where children can safely engage in physical activity. These facilities may be indoor recreation centers, or outdoor parks and playgrounds.
- To serve all children including children with disabilities, parks and other places for physical activity (including schools) should be constructed with the needs of children with disabilities in mind.
- The community should work with the schools to make existing facilities available to the public during non-school hours. This may entail providing additional funding to staff the schools during off hours.
- The community should capitalize on the existence of not-for-profit organizations that are committed to healthy lifestyle and physical activity.
- The community should provide transportation when needed to recreation centers.
- New schools should be built such that they are conveniently located to encourage students to walk or bike to school.
- Communities should protect current open spaces and try to find opportunities for more of them and make them available for recreational activities.
- Improve the street, sidewalk, and street-crossing safety of routes to school, develop programs to encourage walking and bicycling to school, and build schools within walking and bicycling distance of the neighborhoods they serve.
- Institute and enforce “traffic calming” measures, such as lowering speed limits in residential areas and the use of traffic circles or speed bumps.
- Plan for transit-oriented development along transit routes and around transit stations.
- Target infrastructure development and the location of public facilities to encourage urban redevelopment and infill.
- Organize disenfranchised groups and advocate equity in health, such as demanding secure recreation sites.
- Encourage community-based youth organizations to:
 - Promote physical activity among youth.
 - Make physical activity a fun event within the organization.

- Encourage professional athletes (and professional teams and leagues) to take a more proactive role in promoting physical activity as a way of life for every child, regardless of skill in sporting events or athletic competition.
- Sponsor family events where the focus is on family physical activity.

Government

- Pass laws that will provide adequate incentives, and adequate funding, for schools, industry, and the community to promote multi-sectoral efforts to increase childhood physical activity.
- Issue recommendations/requirements to schools regarding the necessity of recess, physical education classes, and health education in schools.
- Allocate appropriate funds to schools so that they will be able to improve existing physical education and health education programs, which would include providing more staff development.
- Allocate resources for the restructuring of current urban design and for new development that would encourage walking and biking.
- Allocate funding for communities to set aside land for public open space and for the creation of safe playgrounds and recreation centers.
- Sponsor well-designed mass media campaigns that promote the full range of benefits derived from physical activity—not just improved health—to children and adolescents in a culturally sensitive way. Most children and adolescents are not motivated by “better health” messages.
- Sponsor well-designed mass media campaigns that emphasize to parents the importance of encouraging their children to be physically active.
- Hire marketing firms as consultants to use social marketing techniques that encourage physical activity and which present physical activity as fun.
- Develop/fund national databases that accurately measure various types and levels of physical activity in children and adolescents and systemically monitor their longitudinal changes, so that trends can be documented and the impact of youth physical activity can be demonstrated. Ideally, such a database also will include measurement and evaluation of health and social outcomes.
- Fund national studies that evaluate the efficacy of interventions designed to reduce inactivity and promote physical activity among children and adolescents.
- Sponsor the development of tools to evaluate the health-related benefits of participation in sports and recreation programs offered within the community and tools to document the use of parks for youth-oriented physical activities (both organized and ‘free play’). Separately, such tools can be used to evaluate the impact of media on participation levels.

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