

## Obesity in Young Children: Impact and Intervention

**This Brief highlights the importance of addressing obesity in children beginning at an early age. New research points the way toward effective, early intervention that can help stem the alarming rise in the prevalence of childhood obesity.**



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Childhood obesity is an epidemic in the U.S., and is threatening child health gains made over the past three decades. A study released in March 2004 by the Centers for Disease Control and Prevention (CDC) concluded that poor diet and inactivity are close to overtaking cigarette smoking as the leading cause of preventable death.<sup>1</sup> At this rate the current generation of children will not live as long as their parents.

The prevalence of childhood obesity in the United States is growing rapidly for children of all ages. Over 15% of children ages 6-19 were overweight in 2000 (almost 9 million children). For 6-11 year olds, the percentage is more than double the prevalence in 1980. The impact is even greater for 12-19 year olds, with the prevalence triple the rate. Even more alarming is the increase in overweight among young children 2-5 years old, from 7% ten years ago to 10% today.<sup>2</sup>

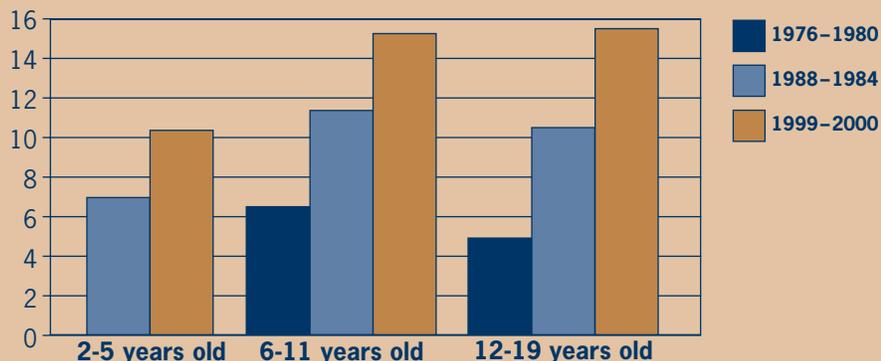
New research presented in this Brief on overweight in young children, sponsored by the NIHCM Foundation and conducted by RAND, finds that early intervention can be effective in reducing the incidence of childhood overweight and that schools can be influential partners in childhood healthy weight initiatives.

The research focuses on the impact of existing school physical education (PE) programs on childhood overweight and the relationship between childhood overweight and mental health and academic outcomes in school.

The research is based on data from the ongoing U.S. Department of Education Early Childhood Longitudinal Study (ECLS) of young children as they enter school — an environment in which large numbers of children can be studied and potentially receive interventions designed to address overweight. Using data from schools has the added benefit of identifying issues and interventions that may affect academic achievement. The research shows:

- School PE programs can be effective in reducing the incidence of childhood overweight.** Physical education programs can play a significant role in containing and even preventing overweight in elementary school students, particularly girls. Expanding existing PE programs 1-hour per week in 1st grade significantly reduced childhood Body Mass Index (BMI) for overweight and at-risk-for-overweight girls. Further, the study projects that expanding existing PE instruction time nationwide to at least 5 hours per week for kindergarteners could reduce the prevalence of overweight among girls by 43% and of at-risk-for-overweight by 60%. Smaller increases in PE instruction time could still have a significant impact on childhood overweight among girls.
- Childhood overweight is linked to behavior problems in girls.** Using teacher- and parent-reported data, a strong association exists for girls as they enter kindergarten between overweight and behavior problems, such as anxiety, loneliness, low self-esteem,

**FIGURE 1**  
*Trends in Prevalence of Overweight in U.S. Children*



Sources: Ogden CL, Flegal KM, Carroll MD, et al. Prevalence and Trends in Overweight Among US Children and Adolescents, 1999-2000. *JAMA* October 9, 2002; 288(14):1728-1732. Centers for Disease Control and Prevention. Health, United States, 2003, Table 69.

sadness, anger, arguing and fighting. This association, however, is not found for boys. Also, overweight children who did not exhibit behavior problems entering school did not develop them over the course of the study.

- **Overweight in boys may be a risk factor for lower academic performance.** Overweight children have significantly lower math and reading test scores compared to non-overweight children in kindergarten. Except for boys' math scores, however, these differences could be explained by other factors such as parental education. Although overweight and non-overweight children gained similarly on math and reading test scores, the findings indicate that the baseline gap in scores between the groups persists at the end of first grade.

## Findings from Individual Studies

The research presented from three separate studies uses data from the ECLS, the first large and nationally representative data set of young school children. It provides detailed information on children's health, early care and early school experiences. It contains specific data on: cognitive, social, emotional and physical development; home environment; home educational practices; school and classroom environment; classroom curricula; and teacher qualifications.

The studies use data from 11,192 children in approximately 1,000 schools who entered kindergarten in the 1998-1999 school year. Data are currently available from surveys administered in the

fall and spring of kindergarten and the spring of 1st grade. (Future surveys will be conducted in the Spring of 3rd and 5th grades.) The geographic diversity and size of the survey population allows the data to provide a nationally representative sample.

The longitudinal nature of these data enables examination of how overweight children's mental health condition and school performance change over time, and how traditional school PE programs can impact the prevalence and severity of childhood overweight. The results can be used as a baseline for further research on the impact of overweight throughout childhood, particularly through ECLS surveys of later grades.

### I. Childhood Overweight and School Physical Education Programs

No national study has evaluated the impact of PE classes – currently implemented in American schools – in reducing childhood overweight. This study examines the effect of existing elementary school PE programs on childhood overweight by measuring how changes in BMI are associated with changes in exposure to PE. The study also projects the effects of increasing PE instruction time on childhood overweight for girls.

The CDC recommends all schools require PE for all students from kindergarten through 12th grade on a daily basis, as do other organizations such as the American Heart Association and the National Association for Sport and Physical Education. While these guidelines recommend that students have daily classes, receive a substantial percentage of the weekly amount of physical activity in PE classes and be physically active for at least half of the PE class

FIGURE 2

## Impact of Weight Gain on Children's Overweight Status<sup>1</sup>

### 5-YEAR OLD BOY

Weight	Height	BMI	BMI Percentile	Weight status
42 lbs	3'8"	15.3	45 <sup>th</sup>	Healthy
48 lbs	3'8"	17.5	91 <sup>st</sup>	At-risk-for-overweight
53 lbs	3'8"	19.3	> 95 <sup>th</sup>	Overweight

### 6-YEAR OLD GIRL

Weight	Height	BMI	BMI Percentile	Weight status
50 lbs	4'	15.3	52 <sup>nd</sup>	Healthy
57 lbs	4'	17.4	87 <sup>th</sup>	At-risk-for-overweight
65 lbs	4'	19.9	> 95 <sup>th</sup>	Overweight

#### BMI Calculation

Metric formula:  $\text{Weight (kg)} / \text{Height (m)}^2 = \text{BMI}$   
 English formula:  $[\text{Weight (lbs)} / \text{Height (in)}^2] \times 703 = \text{BMI}$

#### Indicators of Status in Children

Underweight: BMI < 5<sup>th</sup> percentile for age  
 At-risk-for-overweight: BMI between 85<sup>th</sup>-95<sup>th</sup> percentile for age  
 Overweight: BMI > 95<sup>th</sup> percentile for age

<sup>1</sup> These figures were derived using the BMI calculator on the following website: [http://pediatrics.about.com/cs/usefultools/1/bl\\_bmi\\_calc.htm](http://pediatrics.about.com/cs/usefultools/1/bl_bmi_calc.htm)

time, past research has found only a small number of children have daily classes, and active class time is far below 50%.<sup>3</sup>

### Findings

Current PE programs can play an important role in reducing and even preventing overweight in elementary school students, particularly girls.

- Exposure to PE in kindergarten.** On average, kindergartners spend 57 minutes per week in PE. Most (59%) have PE 1-2 times per week; 16% receive PE instruction in school daily; and 13% receive PE instruction less than once a week or never. Schools with a high percentage of low-income students or minority students, and small schools are more likely to have no PE in kindergarten.

Duration of physical education also varies. Nearly two-thirds (64%) have PE class time between 16-30 minutes per day, and nearly 25% have PE class time between 31-60 minutes per day.

- Exposure to PE in 1st grade.** The frequency and duration of PE instruction increases in 1st grade to an average of 65 minutes per week. However, wide variations still exist: 37% of children experience an increase in PE instruction from kindergarten to 1st grade; 44% maintain their kindergarten levels; 8% go from no PE to some PE; 19% have less PE instruction in 1st grade; and 2% stop getting PE in 1st grade.

The median increase in PE instructional time shows a significant increase from kindergarten to 1st grade — from 35 minutes per week to 68 minutes per week, due to a shift toward longer PE sessions per day.

- Impact of increase in PE time.** Expanding PE may be an effective strategy for containing overweight among elementary school girls. Analyzing the change in BMI in kindergarten and 1st grade, a 1-hour increase in PE instruction per week leads to a .31 greater reduction in BMI among overweight and at-risk-for-overweight girls in 1st grade. The effect on overweight boys is much smaller and not statistically significant; no effect is observed for children with normal or low BMI.

Using findings from the impact of a change in PE from kindergarten to 1st grade, the study projects the influence increased PE instruction time can have in all schools. Expanding PE time to at least 5 hours per week could decrease the prevalence of overweight among girls by 4.2 percentage points and the prevalence of at-risk-for-overweight among girls by 9.2 percentage points. Given that the prevalence of overweight and at-risk-for-overweight among girls in this population is about 10% and 15% respectively, the additional PE time would lower the

FIGURE 3  
*Frequency of Physical Education Instruction During Kindergarten and 1<sup>st</sup> Grade*

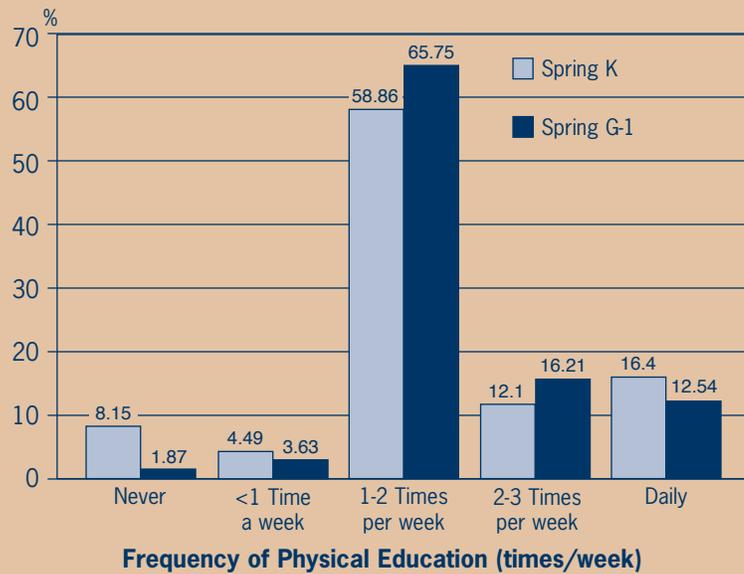
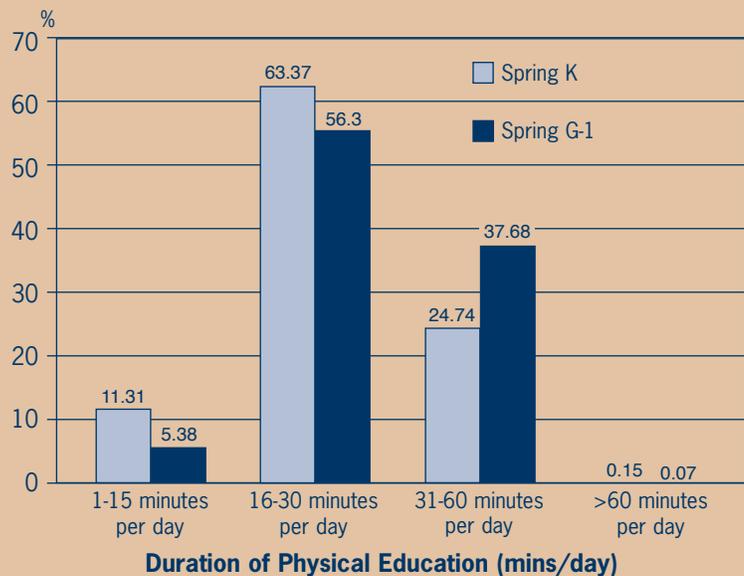


FIGURE 4  
*Duration of Physical Education Instruction During Kindergarten and 1<sup>st</sup> Grade*



Derived from: Datar A, Sturm R. Physical Education in Elementary School and Body Mass Index: Evidence from the Early Childhood Longitudinal Study. *American Journal of Public Health* 2004 (in press).

prevalence of overweight among girls by 43% and the prevalence of at-risk-for-overweight among girls by 60%, resulting in a rate of 5.8% for both.

Establishing a nationwide increase in PE instruction by 30 minutes per day, 5 days a week over current levels might decrease the prevalence of overweight among girls by 2.8 percentage points and the prevalence of at-risk-for-overweight among girls by 6.5 percentage points. Based on the prevalence of overweight for girls, these effects translate into a 28% reduction in overweight and a 43% reduction in at-risk-for-overweight among girls.

As further projections illustrate, even smaller increases in additional PE instruction time can have a significant impact:

- Adding one hour per week to PE instruction time could decrease the prevalence of overweight among girls by 10% and the prevalence of at-risk-for-overweight among girls by 21%.
- Adding 30 minutes per week to PE instruction time could decrease the prevalence of overweight among girls by 5% and the prevalence of at-risk-for-overweight among girls by 10%.

## II. Childhood Overweight and Mental Health

This study examines the relationship between overweight status and behavior problems during the first two years of school and whether behavior problems identified in kindergarten increase the risk for future weight gain. The study analyzes parent- and teacher-reported internalizing behavior problems, such as apparent presence of anxiety, loneliness, low self-esteem, sadness and problems being accepted or liked by others, and externalizing behaviors like arguing, fighting, anger, impulsive acts or disturbing ongoing activity.

While there is much concern about a possible relationship between overweight status and mental health problems — especially with respect to impact on school performance — there are few data on young children. A study published in 2000 reports a significant association between depressive symptoms and BMI among 3rd grade girls in Northern California, but not among boys.<sup>4</sup>

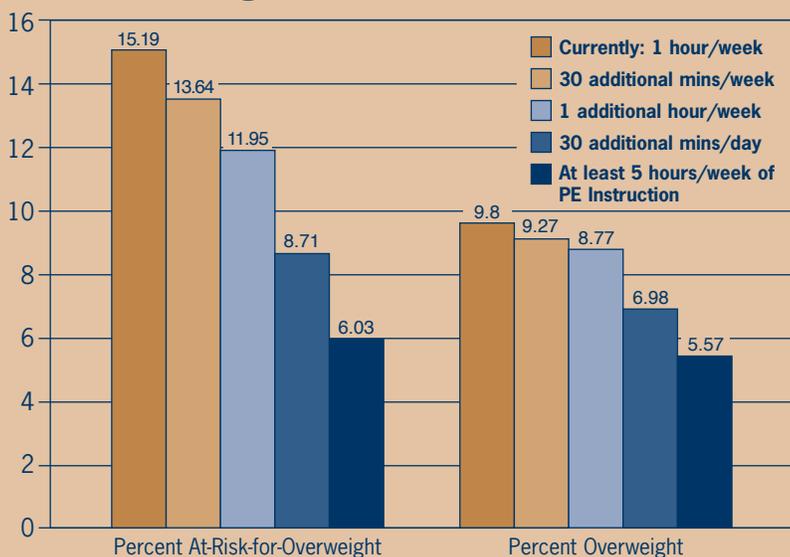
Few other studies have been conducted on the relationship between mental health and overweight for young children. One recent study showed that clinically meaningful behavior problems in 8-11 year-old children were independently associated with a high risk for becoming overweight.<sup>5</sup> Some studies have confirmed an inverse relationship between overweight and body esteem, including girls as young as five years old.<sup>6</sup> This new study thus shows the need for further research to understand how overweight status can impact children's mental health.

### Findings

- **Behavior problems associated with childhood overweight.** Overweight girls are significantly more likely to have behavior problems at the beginning of kindergarten as compared to non-overweight girls, even when adjusting for socioeconomic and other factors. Specifically, overweight girls are substantially more likely to have teacher-reported external behavior problems as well as teacher- and parent-reported internal behavior problems. There are no significant differences for boys. The data also indicated that internalizing behavior problems found in kindergarten are predictive of future weight gain for overweight girls.

- **Overweight and onset of behavior problems.** For girls and boys with no behavior problems at the start of kindergarten, overweight status is not a risk factor for the onset of new internalizing or externalizing behavior problems during the first two years of school. Low family income and maternal depression are stronger predictors for development of new behavior problems.

FIGURE 5  
*Simulations for Declines in Overweight Status Among Girls*



Derived from: Datar A, Sturm R. Physical Education in Elementary School and Body Mass Index: Evidence from the Early Childhood Longitudinal Study. *American Journal of Public Health* 2004 (in press).

### III. Childhood Overweight and School Performance

This study is the first to examine the relationship between childhood overweight and academic performance among young children in the U.S. The study analyzes the independent association of overweight status with children's math and reading standardized test scores in kindergarten and 1st grade, controlling for socioeconomic status, parent-child interaction, birth weight, physical activity, and television watching.

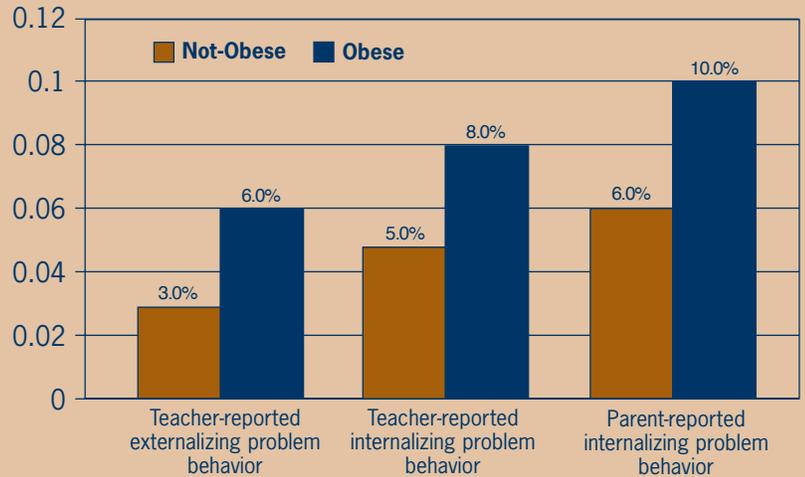
Past research has confirmed the relationship between lower educational achievement among adults and obesity. Less is known about whether this relationship exists among young children, although overweight has been shown to affect children's psychosocial outcomes, such as low self-esteem and depression — outcomes that may affect children's academic performance.<sup>7</sup> Other research also reported that overweight adolescents consider themselves worse students.<sup>8</sup>

#### Findings

- **Test scores in kindergarten.** Overweight children have significantly lower math and reading test scores as compared to non-overweight children in kindergarten. Except for boys' math scores at baseline, these differences can be explained by other factors such as race/ethnicity and the mother's education. For overweight boys, the effect on math scores is statistically equivalent to watching two extra hours of TV per day.

FIGURE 6

### Obese Girls Significantly More Likely to Exhibit Behavior Problems

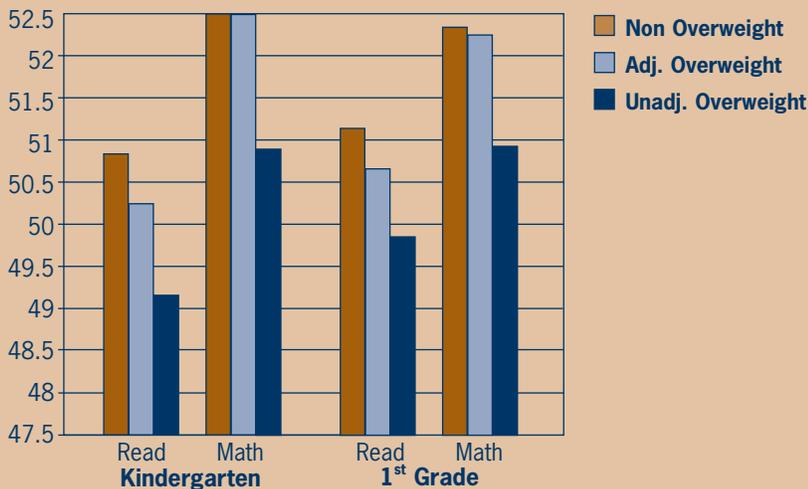


Derived from: Datar A, Sturm R. Childhood Overweight and Teacher- and Parent-Reported Behavior Problems: Evidence from a Prospective Study of Kindergartners. *Archives of Pediatrics and Adolescent Medicine* 2004 (in press).

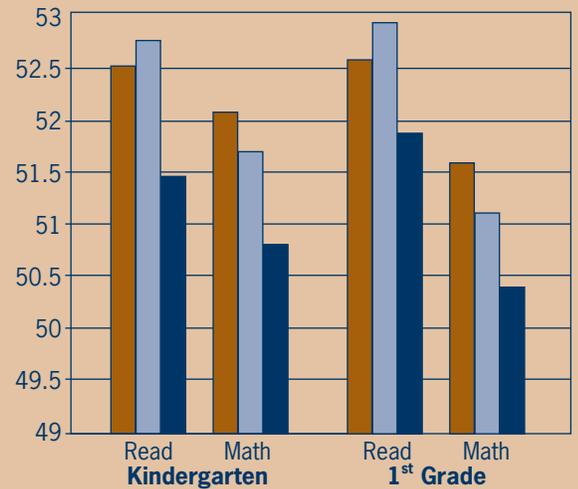
- **Gaps in test scores persist.** Although overweight and non-overweight children gained similarly on math and reading test scores, the baseline gap in scores between the groups persists at the end of 1st grade. In addition, even though the difference in test scores

FIGURE 7

### Boys' Test Scores



### Girls' Test Scores



Source: Datar A, Sturm R, Magnabosco JL. Childhood Obesity and Academic Achievement: Evidence from a Population-Based Sample of Kindergartners and First Graders. *Obesity Research* 2004; 12:58-68.

can be explained by other factors, overweight is an easily observable characteristic and its association with worse academic performance can contribute to the stigma of overweight.

These findings don't necessarily mean that overweight is inconsequential for academic performance because the effects of overweight may appear in later years. Future waves of the ECLS data may shed more light on this issue.

## Policy Implications

### Intervention should begin as early as possible

The new research presented provides evidence that early intervention could be effective in reducing the prevalence of overweight, particularly among girls. Other research also underscores the importance of changing behaviors contributing to obesity at a young age. A recent study of more than 3,000 infants and toddlers in the U.S. found that children as young as 4-6 months of age are consuming too many calories and eating inappropriate foods — including soda and french fries. Children between one and two years of age were consuming 1,220 calories per day — more than 30% higher than the 950 calories per day typically needed at that age.<sup>9</sup>

The serious health and economic consequences of obesity make addressing the increasing prevalence of overweight in children at the earliest age possible the highest priority.

### Health consequences

Obesity is associated with the development of chronic medical conditions including diabetes, heart disease, hypertension and some types of cancer. Children who are overweight or at-risk-for-overweight are at a dramatically increasing risk for many of these same conditions.<sup>10</sup> For example, the incidence of type 2 diabetes — the 7th leading cause of death in the U.S. — has increased from 4% in 1990 to approximately 20% in 2000 in children and adolescents.<sup>11</sup> That figure varies from 8% to 45%, depending on the age (type 2 diabetes is most frequent in the 10-19 year age group in pediatric practice) and the racial/ethnic mix of the group studied.

Research also is showing that overweight children are increasingly being diagnosed with liver disease.<sup>12</sup> In addition, many overweight children have high cholesterol and blood pressure, which are risk factors for heart disease and stroke.<sup>13</sup> In recognition of these growing health risks for children, new federal guidelines urge doctors to begin checking children for high blood pressure at age 3 during routine office visits.<sup>14</sup>

Past research has shown that about one-third of overweight preschool children and about half of overweight school-age children become overweight

adults.<sup>15</sup> This will have enormous implications on the health status of our nation. Obese individuals with similar social demographic characteristics to normal-weight individuals suffer from an increase in chronic conditions of about 67%.<sup>16</sup> Appendix 2 highlights the medical conditions associated with overweight and obesity in children. These conditions are only exacerbated when children remain overweight into adulthood.

### Economic consequences

Treatment of illnesses related to obesity costs America \$93 billion a year (9.1% of all health care spending), rivaling the financial toll of smoking-related disease. That figure does not include the additional \$56 billion in associated indirect costs, bringing the total to about \$149 billion.<sup>17</sup> Health care for obese individuals costs an average of 37% more than for people of normal weight, adding an average of \$732 to the annual medical bills of every American.<sup>18</sup>

Recent research indicates that poor diet and physical inactivity are poised to become the leading cause of mortality in the United States. Deaths due to poor diet and physical inactivity rose by 33% over the last decade, accounting for 400,000 deaths, just behind the 435,000 tobacco-related deaths.<sup>19</sup> The gravity and scope of these health and economic consequences highlight the need for early intervention to prevent overweight children from becoming overweight and obese adults.

FIGURE 8

## Costs of Select Medical Conditions Related to Overweight and Obesity in Children

Medical Condition	Costs
Type 2 Diabetes	\$98 billion
Coronary Heart Disease (CHD)	\$8.8 billion
Osteoarthritis	\$5.3 billion
Hypertension	\$4.1 billion
Gall Bladder Disease	\$3.2 billion
Colon Cancer	\$1.3 billion
Breast Cancer	\$1.1 billion
Endometrial Cancer	\$310 million

Note: Type 2 Diabetes is total cost in 2001 dollars, all other statistics are direct costs in 1995 updated to 2001 dollars.

Source: Weight-control Information Network, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health. Statistics Related to Overweight and Obesity. July 2003.

## Schools are important partners in the battle against childhood overweight

This new research underscores the importance of schools as partners in addressing childhood overweight. Clearly, there are multiple factors underlying the rapid rise in child overweight – including an increase in sedentary lifestyles, diets comprised of high calorie foods, and environment. Given these diverse contributors to childhood overweight, schools cannot, and should not, be expected to shoulder the entire responsibility for addressing this problem. Since most children are enrolled in school, however, schools have a unique opportunity to address two key behaviors that contribute to overweight: unhealthy eating and physical inactivity.

One of the key findings from the research – that current school PE programs can be effective in reducing the incidence of childhood overweight – is especially important when considering how few schools in this country provide daily PE. A study conducted by the CDC in 2000 found that “only 8.0% of elementary schools for grades 1 through 5, 6.4% of middle/junior high schools, and 5.8% of senior high schools provide daily physical education or its equivalent (150 minutes per week for elementary schools; 225 minutes per week for middle/ junior and senior high schools) for the entire school year for students in all grades in the school.”<sup>20</sup> Elementary school PE requirements vary widely (see Appendix 1).

Two national polls conducted by the Robert Wood Johnson Foundation in December 2003 found strong support from both teachers and parents for remedying this situation: 81% of teachers and 85% of parents favor requiring students to take physical education every day at every grade level. The same surveys found that 90% of teachers and 86% of parents believe that physical activity helps children behave better in the classroom and increases or improves learning.<sup>21</sup>

School-based interventions further illustrate how schools already play an important role in helping to reduce childhood overweight. Various models of behavior modification incorporate improved physical activity, expanded nutrition education and integrated physical and health education. Some programs are partnerships among sectors in the community, such as schools working with health plans and community-based groups. A few examples include:

- **Planet Health** is a school-based behavior intervention designed to reduce obesity in middle-school age children. Teachers integrate sessions into classroom curricula in four major academic subjects and PE. Lessons include reducing television viewing, improving nutrition and increasing physical activity.
- **The SPARK Programs (Sports, Play and Active Recreation in Kids)** incorporate increased physical activity time by exposure to a variety of sports/fitness

activities, a self-management program to teach children life-long behavior skills, including goal setting, decision making/problem solving and stimulus control, and a teacher-training program.

- **Pittsburgh school district partnership** with Highmark Blue Cross Blue Shield created a school-based program to reduce childhood overweight and inactivity. The program incorporates SPARK along with a nutrition program, Food Reeducation for Elementary School Health (FRESH).
- **Integrated PE in Spokane's Public Schools** combines fitness with health education in kindergarten through 10th grade. The program uses a progressive curriculum of standard fitness skills, noncompetitive games and “lifelong” physical activities, nutrition, heart health and healthy behaviors education. Heart-rate monitors and pedometers are used to show students their success.<sup>22</sup>
- **Philadelphia's Urban Nutrition Initiative** is a partnership of the city public schools and the University of Pennsylvania that develops curricula and activities for each school focusing on nutrition education. Program elements include having children tend their own garden plots and teaching science and nutrition through garden-related activities.

## Public Officials recognize the need for action

Federal and state governments recognize the need for more targeted interventions, with initiatives and proposals designed to reduce obesity and improve the state of Americans' health.

### *Federal initiatives*

At the federal level, several initiatives are underway to prevent and reduce the incidence of obesity. A few examples include:

- **CDC's State-based Program to Prevent Obesity and Other Chronic Diseases.** Beginning in FY 2000, the CDC has been sponsoring state programs to prevent obesity (and other chronic diseases) by improving nutrition and physical activity. Twenty state programs were selected for funding in FY 2003. In Massachusetts, the program supports 1,900 students in grades 6–7 in an overweight prevention initiative that uses the Planet Health curriculum. In Florida, it has supported a survey of middle school students' nutrition, physical activity, and sedentary lifestyle behaviors and a curriculum for parents on healthy child nutrition and physical activity.<sup>23</sup>
- **CDC's Campaign to Get Kids Physically Active.** In 2002, the CDC launched a national, multicultural, social marketing campaign to encourage young people ages 9-13 to be physically active every day. The “VERB: It's What You Do”

campaign combines paid advertising, marketing strategies, and partnership efforts to reach its audience. A survey released in February 2004 found that VERB resulted in “a 34% increase in weekly free-time physical activity sessions among 8.6 million children ages 9-10 in the U.S.”<sup>24</sup>

- **Steps to a HealthierUS.** In 2003, the U.S. Department of Health and Human Services (DHHS) launched this program with grant awards totaling \$13.7 million for community initiatives to promote better health and prevent disease. The grants direct money toward programs addressing diabetes, asthma, overweight and obesity because of the rapidly increasing prevalence of these conditions in the United States and the ability for individuals to control and even prevent these diseases through exercise, diet and other strategies. President Bush’s federal budget for FY 2005 requests \$125 million for this program.
- **Healthy Lifestyles and Disease Prevention.** On March 9, 2004, DHHS announced a new public awareness and educational campaign to encourage Americans to make small activity and dietary changes to ensure effective, long-term weight control. The Healthy Lifestyles and Disease Prevention initiative will include public service announcements and a new, interactive Web site, [www.smallsteps.com](http://www.smallsteps.com).
- **NIH Obesity Research.** Also on March 9, the National Institutes of Health (NIH) announced development of a strategic plan for research to improve understanding, prevention and treatment of obesity.
- **FDA Strategy: “Calories Count.”** Also in March 2004, the Food and Drug Administration’s (FDA) Obesity Working Group released a new report with recommendations that include: strengthening food labeling; encouraging restaurants to provide nutritional information to consumers; revising FDA guidance for developing drugs to combat obesity; and initiating a consumer education campaign focusing on the “calories count” message, to promote healthy eating choices.

#### *Federal legislation*

Congress passed the Physical Education for Progress (PEP) Act in 2000, authorizing federal grants to help start, expand, or improve physical education programs for students in grades K-12. Congress appropriated \$69 million to fund the program in FY 2004, up from \$60 million in 2003 and \$50 million in 2002.

Numerous bills have been introduced in the 108th Congress to improve and promote good nutrition and/or physical activity among children. Senator Bill Frist (R-TN) introduced bills that recognize the

importance of funding interventions and research to promote healthy eating behaviors and physical activity. The IMPACT Act (S. 1172) calls for providing community educational activities as well as age-appropriate school-based activities. The Childhood Obesity Reduction Act (S. 2551) establishes a Congressional council to develop model obesity prevention plans that can be used in schools. Strategies employed in other bills include funding for school-based grants or pilot programs, requiring improvements to school lunch programs, and funding for nutrition education. None of these bills have been enacted to date.

Other obesity-related programs have received increased funding in the past few years. For example, CDC funding for poor nutrition and physical inactivity increased from \$16.2 million in FY 2001 to \$34 million in FY 2003. NIH funding for obesity research increased to just over \$400 million in FY 2004.

#### *State legislation*

Bills have been introduced in many state legislatures to help improve children’s health through nutrition and/or level of physical activity. Approaches ranged from barring or restricting access to vending machines in schools, encouraging or requiring schools to provide more nutritious foods, promoting safe walking/biking to school, requiring or increasing requirements for PE, improving health education, and a range of committees, commissions, task forces or councils to study, set standards or make related recommendations. Only a few of these legislative efforts were successful, such as bills in California to ban sale of sodas in elementary and middle schools and a bill in Arkansas to develop school nutrition and physical activity standards, ban vending machines in elementary schools, and establish a student health report card that includes students’ BMIs.

## **Conclusion**

With childhood overweight rising to epidemic levels, the need for effective interventions has never been clearer. New research presented in this Brief shows that overweight affects children at a very young age. As early as kindergarten, being overweight can negatively impact school performance. The research also shows that physical activity through school PE programs can reduce childhood overweight. Programs emphasizing more activity can have a greater effect.

Despite the reported impact of school PE programs, schools are only one partner in stimulating children to be more physically active. Families can help their children be active every day and teach healthy behaviors at an early age. Parents of overweight children need to recognize social and health problems that can be associated with weight in order to address and prevent long-term

concerns. More work needs to be done to identify which interventions are most effective and in which environments, so that public health, educational and private initiatives can be appropriately designed for maximum impact. For example, additional research could clarify how best to improve eating behaviors among young children and how to increase and sustain higher levels of physical activity, whether through school PE or

other programs. Small, sustained changes in activity level can produce significant results. Burning more calories than consumed each day will reduce weight.

Overweight is a preventable health problem. Focusing attention on identifying and sharing information about effective interventions across the private-public spectrum is critical if we are to halt this precipitous decline in our children's health and well-being.

## Endnotes

- 1 National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention. Fact Sheet — Actual Causes of Death in the United States, 2000. March 2004. Available at [http://www.cdc.gov/nccdphp/factsheets/death\\_causes2000.htm](http://www.cdc.gov/nccdphp/factsheets/death_causes2000.htm)
- 2 National Center for Health Statistics, Centers for Disease Control and Prevention. Prevalence of Overweight Among Children and Adolescents: United States, 1999-2000. Available at <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overwght99.htm>
- 3 Nader PR. Frequency and Intensity of Activity of Third-grade Children in Physical Education. *Archives of Pediatrics and Adolescent Medicine* February 2003; 157(2):185-90. Simons-Morton BG, O'Hara NM, Parcel GS, et al. Children's Frequency of Participation in Moderate to Vigorous Physical Activities. *Research Quarterly for Exercise and Sport* December 1990; 61(4):307-14. Simons-Morton BG, Taylor WC, Snider SA, et al. Observed Levels of Elementary and Middle School Children's Physical Activity During Physical Education Classes. *Preventive Medicine* July 1994; 23(4):437-441. Parcel GS, Simons-Morton BG, O'Hara NM, et al. School Promotion of Healthful Diet and Exercise Behavior: An Integration of Organizational Change and Social Learning Theory Interventions. *Journal of School Health* April 1987; 57(4):150-156. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance System (YRBSS): United States, 2001. *Morbidity and Mortality Weekly Report* June 28, 2002; 51(SS04):1-62.
- 4 Erickson S, Robinson T, Haydel FL, et al. Are Overweight Children Unhappy? *Archives of Pediatrics and Adolescent Medicine* September 2000; 154(9):931-935.
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## APPENDIX 1

*State PE Requirements for Elementary School (K-8)*

State	Does State Require PE?	Time/Frequency Requirements	State	Does State Require PE?	Time/Frequency Requirements
<b>AL</b>	Yes	Determined by local school districts	<b>NE</b>	No	State Board of Education sets state guidelines
<b>AK</b>	No	Determined by local school districts	<b>NV</b>	Yes	Determined by local school districts
<b>AR</b>	Yes	No less than 1 hour per week	<b>NH</b>	No	Determined by local school districts
<b>AZ</b>	Yes	Determined by local school districts	<b>NJ</b>	No	Determined by local school districts
<b>CA</b>	Yes	200 minutes every 10 days	<b>NM</b>	No	Determined by local school districts
<b>CO</b>	No	Determined by local school districts but state Department of Education sets model content standards	<b>NY</b>	Yes	Determined by state regents
<b>CT</b>	Yes	Determined by local school districts	<b>NC</b>	Yes	By 2006-2007 school year, encourages elementary schools to provide 150 minutes per week
<b>DE</b>	Yes	Determined by local school districts	<b>ND</b>	No	Determined by local school districts
<b>FL</b>	No	Determined by local school districts	<b>OH</b>	Yes	Determined by local school districts
<b>GA</b>	Yes	State Board of Education to set standards for all grade levels	<b>OK</b>	No	Determined by local school districts
<b>HI</b>	Yes	Determined by local school districts	<b>OR</b>	No	Determined by local school districts
<b>ID</b>	Yes	Determined by local school districts	<b>PA</b>	Yes	Determined by local school districts
<b>IL</b>	Yes	Daily participation in PE classes must be as long as other subject areas	<b>RI</b>	Yes	Daily average of 20 minutes instruction on health and PE
<b>IN</b>	Yes	Determined by local school districts	<b>SC</b>	Yes	Determined by local school districts
<b>IA</b>	Yes	Determined by local school districts	<b>SD</b>	No	State PE standards serve as framework for programs designed by local school districts
<b>KS</b>	No	Determined by local school districts	<b>TN</b>	No	Guidelines and standards set by state Commissioner of Education
<b>KY</b>	No	Determined by local school districts	<b>TX</b>	Yes	State Board of Education may require up to 30 minutes per day of physical activity
<b>LA</b>	Yes	Grades K-6 must have 30 minutes of "quality physical activity" per day	<b>UT</b>	No	State Office of Education recommends 90 minutes per week
<b>ME</b>	Yes	Determined by local school districts	<b>VT</b>	Yes	Determined by local school districts
<b>MD</b>	Yes	Determined by local school districts	<b>VA</b>	Yes	Determined by local school districts
<b>MA</b>	Yes	Determined by local school districts	<b>WA</b>	Yes	Determined by state Board of Education
<b>MI</b>	Yes	Determined by local school districts	<b>WV</b>	Yes	Determined by local school districts
<b>MN</b>	Yes	Determined by local school districts	<b>WI</b>	No	Determined by local school districts
<b>MS</b>	No	State recommends schools offer 30 minutes per day K-6	<b>WY</b>	Yes	Determined by local school districts under standards set by state Board of Education
<b>MO</b>	No	State Board of Education sets state guidelines			
<b>MT</b>	No	Determined by local school districts			

Source: Adapted from NCSL State Health Policy Tracking Service, December 2003; updated by NIHCM Foundation, May 2004.

## APPENDIX 2

*Medical Conditions Associated with Overweight and Obesity in Children*

<b>Type 2 (non-insulin dependent) Diabetes</b>	<ul style="list-style-type: none"> <li>• An alarming increase in type 2 diabetes is seen in children and adolescents, a condition that used to only occur in adults<sup>1</sup> and is more strongly associated with obesity than any other condition<sup>2</sup>;</li> <li>• Risk increases approximately 25% after each additional BMI unit &gt;22<sup>3</sup>;</li> <li>• Hospital discharges for children with obesity-associated diabetes nearly doubled since 1979<sup>4</sup>;</li> <li>• Up to 85% of children with type 2 diabetes are overweight or obese<sup>5</sup>;</li> <li>• Total cost related to overweight and obesity is \$98 billion (2001 dollars).<sup>6</sup></li> </ul>
<b>Glucose Intolerance</b>	<ul style="list-style-type: none"> <li>• A precursor to diabetes, glucose intolerance (pre-diabetes) is increasingly prevalent in children and adolescents<sup>7</sup>;</li> <li>• Individuals with pre-diabetes are at an increased risk for heart disease and stroke.<sup>8</sup></li> </ul>
<b>High Cholesterol</b>	<ul style="list-style-type: none"> <li>• Poor diet, being overweight, and physical inactivity can increase blood cholesterol levels<sup>9</sup>;</li> <li>• High cholesterol is a major risk factor for heart disease, the number one killer in the United States<sup>9</sup>;</li> <li>• Overweight children are 2.4 times more likely than average-weight children to have an elevated total cholesterol level.<sup>10</sup></li> </ul>
<b>Hypertension (High Blood Pressure)</b>	<ul style="list-style-type: none"> <li>• Overweight children are 4.5 times more likely to have a higher systolic blood pressure and 2.4 times more likely to have a higher diastolic blood pressure<sup>10</sup>;</li> <li>• Obese men and women have a relative risk of 2.1 and 1.9, respectively, for developing high blood pressure<sup>3</sup>;</li> <li>• Direct cost related to overweight and obesity is \$4.1 billion (1995 updated to 2001 dollars).<sup>6</sup></li> </ul>
<b>Coronary Heart Disease (CHD)</b>	<ul style="list-style-type: none"> <li>• Individuals who are overweight or obese have an increased incidence of heart disease (heart attack, congestive heart failure, sudden cardiac death, angina or chest pain, and abnormal heart rhythm)<sup>11</sup>;</li> <li>• 58% of overweight children (5-17 years old) have one additional cardiovascular risk factor, and 20% have two or more additional risk factors<sup>10</sup>;</li> <li>• A sustained 10% reduction in weight could reduce the expected lifetime incidence of CHD by 12 to 38 cases per 1000<sup>11</sup>;</li> <li>• The direct cost related to overweight and obesity is \$8.8 billion (1995 updated to 2001 dollars).<sup>6</sup></li> </ul>
<b>Gall Bladder Disease</b>	<ul style="list-style-type: none"> <li>• Almost 50% of the cases of cholecystitis (inflammation of the bladder) in adolescents may be associated with overweight<sup>7</sup>;</li> <li>• Hospital discharges for obesity-associated gallbladder disease tripled for children since 1979<sup>4</sup>;</li> <li>• Total cost related to overweight and obesity is \$3.4 billion (1995 updated to 2001 dollars).<sup>6</sup></li> </ul>
<b>Osteoarthritis</b>	<ul style="list-style-type: none"> <li>• For every 2-pound weight-gain, the risk of developing arthritis increases by 9-13%<sup>1</sup>;</li> <li>• Overweight women and men have nearly 4 and 5 times the risk of developing knee osteoarthritis, respectively<sup>12</sup>;</li> <li>• The total cost of osteoarthritis related to overweight and obesity is \$21.2 billion (1995 updated to 2001 dollars).<sup>6</sup></li> </ul>
<b>Cancer</b>	<ul style="list-style-type: none"> <li>• Overweight and obesity are associated with an increased risk for certain types of cancer including endometrial, colon, gall bladder, prostate, kidney, and breast cancer<sup>1</sup>;</li> <li>• 14% of cancer deaths for men and 20% of cancer deaths for women in the U.S. may be attributable to overweight and obesity<sup>6</sup>;</li> <li>• Total cost related to overweight and obesity is \$2.9 billion for breast cancer, \$3.5 billion for colon cancer, and \$933 million for endometrial cancer (1995 updated to 2001 dollars).<sup>6</sup></li> </ul>
<b>Sleep Apnea &amp; Respiratory Problems</b>	<ul style="list-style-type: none"> <li>• Obesity is associated with a higher prevalence of asthma<sup>1</sup> and approximately 7% of obese children have sleep apnea<sup>7</sup>, one of the most severe conditions that can lead to learning and memory problems<sup>13</sup>;</li> <li>• Hospital discharges for obesity-associated sleep apnea have increased five-fold for children since 1979.<sup>4</sup></li> </ul>
<b>Liver Disease</b>	<ul style="list-style-type: none"> <li>• Studies have shown that 20%-60% of obese adults develop Nonalcoholic Steatohepatitis (NASH)<sup>14</sup>;</li> <li>• NASH is increasingly appearing in children<sup>14</sup> — 6% of overweight adolescents and 10% of obese adolescents presented with elevated alanine aminotransferases levels, an indicator of NASH<sup>15</sup>;</li> <li>• Children with NASH risk progressive liver damage, including cirrhosis.<sup>14</sup></li> </ul>
<b>Psychosocial Effects</b>	<ul style="list-style-type: none"> <li>• Overweight children are often socially marginalized and isolated,<sup>16</sup> and experience mental health problems such as depression, lack of self-confidence, low self-esteem<sup>13</sup>;</li> <li>• The likelihood of impaired quality of life for obese children is similar to that of a very sick child with cancer — 5.5 times greater than for a healthy child.<sup>17</sup></li> </ul>
<b>Women's Reproductive Health</b>	<ul style="list-style-type: none"> <li>• Increased risk for reproductive health problems (menstrual irregularities, infertility, irregular ovulation) is evident for children who remain overweight into adulthood.<sup>3</sup></li> </ul>
<b>Death</b>	<ul style="list-style-type: none"> <li>• Poor diet and physical inactivity caused 400,000 deaths in 2000<sup>18</sup>;</li> <li>• Compared with normal-weight individuals, obese individuals have a 50%-100% higher risk of death from all causes.<sup>6</sup></li> </ul>

**Endnotes (Appendix 2)**

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**NIHCM**  
FOUNDATION

1225 19th Street, NW  
Suite 710  
Washington, DC 20036  
tel 202.296.4426  
fax 202.296.4319  
web [www.nihcm.org](http://www.nihcm.org)

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The National Institute for Health Care Management Research and Educational Foundation is a non-profit organization whose mission is to promote improvement in health care access, management and quality.

### About This Issue Brief

The Brief includes a summary of research conducted by Roland Sturm and Ashlesha Datar at RAND for NIHCM Foundation. Three studies resulting from the research include:

Datar A, Sturm R. Physical Education in Elementary School and Body Mass Index: Evidence from the Early Childhood Longitudinal Study. *American Journal of Public Health* 2004 (in press).

Datar A, Sturm R. Childhood Overweight and Teacher- and Parent-Reported Behavior Problems: Evidence from a Prospective Study of Kindergartners. *Archives of Pediatrics and Adolescent Medicine* 2004 (in press).

Datar A, Sturm R, Magnabosco JL. Childhood Obesity and Academic Achievement: Evidence from a Population Based Sample of Kindergartners and First Graders. *Obesity Research* 2004;12:58-68.