



# ISSUE BRIEF

The Massachusetts Health Policy Forum



## Childhood Obesity in Massachusetts: *Costs, Consequences and Opportunities for Change*

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## Executive Summary

Like the rest of the nation, Massachusetts suffers from a childhood obesity epidemic. Childhood overweight and obesity has been trending steadily upward over the past 20 years in our state, with almost a third of children classified as overweight or obese. These numbers may still be on the rise, although some recent Massachusetts data have indicated a leveling off of the upward trend. Our state also suffers from socioeconomic and racial disparities in overweight and obesity: obesity rates are around 45 percent for both low-income and Hispanic children.

Both nutrition and physical activity play key roles in the obesity epidemic and Massachusetts data from both of these domains remains grim. Not only do our children not consume the recommended servings of fruits, vegetables, dairy and whole grains, but the percentages have been on a decline since 1999. Only 15 percent of students report consuming the recommended five servings of fruits and vegetables and three servings of dairy per day. Fourteen percent of high-school students report never eating breakfast. Data on physical activity paint a similar picture. Less than 50 percent of students report being physically active for the recommended 60 minutes per day and 10 percent report no daily moderate or vigorous activity. Physical education participation is also on the decline, with only eight percent of students attending classes daily. This is compounded by an increasing percentage of middle school (18 percent) and high school (50 percent) students who report daily screen time in excess of three hours.

Obese children suffer multiple health complications and have a shorter life expectancy. The prevalence of childhood diabetes has increased

in Massachusetts as demonstrated by a 35 percent increase in blood glucose testing and insulin pump care in our schools. The annual medical costs of an overweight child are approximately \$200 more than a healthy weight child. Obese children are more likely to become overweight or obese adults, and adult obesity has enormous health and economic consequences. In 2002, obesity cost \$15 billion statewide in medical care, workers compensation and lost productivity. In addition, the psychosocial impacts to children of overweight and obesity are very real: they are more likely to miss school, suffer from social discrimination and teasing, and are predisposed to sleep problems. Illness, school absenteeism and social stigma can lead to decreased academic performance and lower test scores. In a state where significant investment is made in school reform, many of our children are unable to take full advantage of this investment because of problems related to overweight and obesity.

Lack of recognition of the magnitude of the problem is a barrier to change. Nationally, more than half of parents of obese children between six and eleven years of age perceive that their children are about the right weight or are slightly underweight.

*So what can be done about the childhood obesity epidemic in our state?* The root causes of the epidemic are multi-factorial, and so must be the solution. Weight control, once thought to be an individual problem, is now understood to be the result of a complex of factors and environmental influences. Progress is being made both from a programmatic and policy level in our state, but coordinated strategies that enable individuals to make healthy lifestyle choices are still needed. The routine col-

lection of data on children's weight status, nutritional habits and physical activity is the first step to raising awareness and developing a strategic approach to solving the problem.

Changes in children's nutrition and physical activity are essential. Policy recommendations include efforts to increase schools' participation in breakfast programs, regulate marketing of foods to children, change zoning requirements in the built environment that improve access to healthy and affordable food, and improve school nutrition standards and limit access to junk foods. Children's participation in physical activity at school must be increased and annual fitness testing required. Public officials, planners and advocates need to come together and design communities, schoolyards, playgrounds and trails that are safe and accessible, and thus promote active living. Improved nutrition and increased physical activity form the basis for the solution, but a coordinated, community-wide strategy is needed to create change.

## **Introduction**

About a third of Massachusetts children are overweight or obese, as are more than half of our adults, evidence that the problem of overweight and obesity has reached epidemic proportions. Obese children are at increased risk for Type II diabetes, cardiovascular disease, hypertension, and obstructive sleep apnea, and experts predict a continued increase in the societal and economic costs of our state and nation's unhealthy weight problem.<sup>3,4</sup> The problem is significant, and we are much worse off than we were 20 to 30 years ago.<sup>5</sup> In the last 20 years, the percentage of young children who are overweight has more than doubled and

among adolescents, it has tripled. Childhood overweight is affecting children at increasingly younger ages, impacting children of all races, ethnicities and income levels. Proper nutrition and physical activity, the major factors implicated in the obesity trend, are worsening on a population level.

Prevention is crucial to addressing the obesity epidemic because it is so difficult for individuals, once overweight, to return to a healthy weight. An obese child has about an 80 percent chance of becoming an obese adult if at least one of his/her parents is also obese.<sup>3</sup> The need for early prevention underscores the importance of policies that promote children's healthy eating and physical activity. It is estimated that 30 to 50 percent of new pediatric cases of diabetes are Type II, which is closely related to obesity, when just a decade ago the majority of cases were Type I.<sup>6,7</sup> Importantly, if a child develops Type II diabetes they are shortening their life span by 10 to 20 years.<sup>8</sup> The problem has reached such a state that this may be the first generation in which parents outlive their children. This issue brief describes the problem, trends and contributors to childhood obesity in Massachusetts, presents the health and economic consequences of the problem, and finally highlights policies and programs that can play a key role in combating the epidemic.

## **Childhood Obesity Prevalence and Trends**

The United States has one of the highest rates of overweight and obesity in the world, ranking in the top three nations along with Malta and Wales.<sup>9</sup> Recent national data show that 16 percent of U.S. children are obese with a total of 32 percent classified as either overweight or

obese, with prevalence increasing with age from 2 to 19 years.<sup>10, 11</sup> While Massachusetts is not ranked as poorly as the rest of the nation (we have the 2<sup>nd</sup> lowest rates of adult obesity with Colorado being the lowest)<sup>5</sup>, 20 percent of adults are obese and this rate increased significantly from 2004 to 2006. The numbers get worse when looking at our children where we are ranked 27<sup>th</sup> with nearly 14 percent of our children classified as obese and a staggering 15 percent of children from low-income families are already obese by the age of 2 ½.<sup>5</sup>

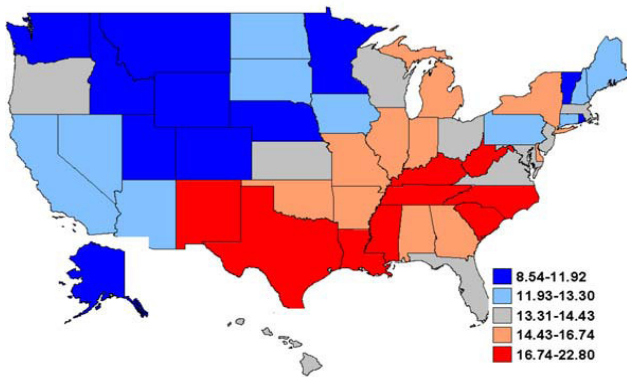


Figure 1. Obesity prevalence (percent) by state among US children aged 10 to 17 years (National Survey of Children’s Health, 2003)<sup>12</sup>

A 2008 report suggests a disturbing trend: while children’s overall health has improved in recent years, rising obesity rates remain a serious concern and impact children’s well-being.<sup>13</sup> U.S. children aged 2 to 5 are nearly three times as likely, and those aged 6 to 11 are nearly four times as likely to be obese compared to their 1960s counterparts. Data just released on measured body mass index (BMI) demonstrated no significant changes in overweight and obesity between 2003-2004 and 2005-2006 for U.S. children 2 to 19 years, possibly indicating a leveling off of the 20-year upward trend (Figure 2).<sup>10</sup> Another major

survey which only examines high school youth, also demonstrated a leveling off of this upward trend in both Massachusetts and the U.S. (Figure 2; see Appendix I for more information on surveys).

During 2006-2007, BMI was measured in Massachusetts students in the 1<sup>st</sup>, 4<sup>th</sup>, 7<sup>th</sup> and 10<sup>th</sup> grades of which almost 35 percent were overweight or obese.<sup>14</sup> Massachusetts boys have slightly higher rates of overweight and obesity than girls which is similar to national data.<sup>15</sup> Higher obesity prevalence is found among children living in poverty (44.8 percent; Figure 3), on public health insurance (42.6 percent), and among those who are Hispanic (45.2 percent; Figure 4).<sup>16</sup>

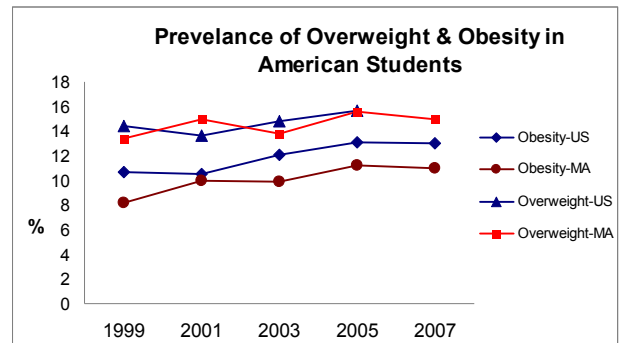


Figure 2. 1999-2007 trends for adolescent overweight and obesity in Massachusetts and the United States (Youth Risk Behavior Survey, 2007; U.S. rates of overweight for 2007 still not publicly available).

The racial and socioeconomic disparities of childhood obesity in our state mirror national findings that children living below 200 percent of the federal poverty level are more likely to be obese,<sup>17</sup> and black children are more likely to be overweight than Hispanic children who are, in turn, more likely to be obese than white children.<sup>15, 18</sup> Massachusetts, however, shows a higher prevalence among Hispanic children compared to national data.

**% Overweight or Obese Children by Family Income**

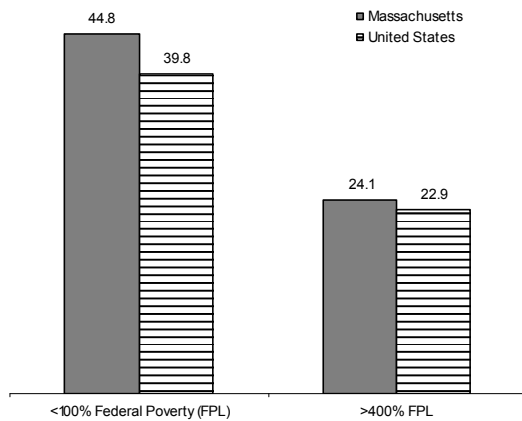


Figure 3. Percentage of overweight or obese children by family income, U.S. and Massachusetts.

**% Overweight or Obese by Hispanic Origin**

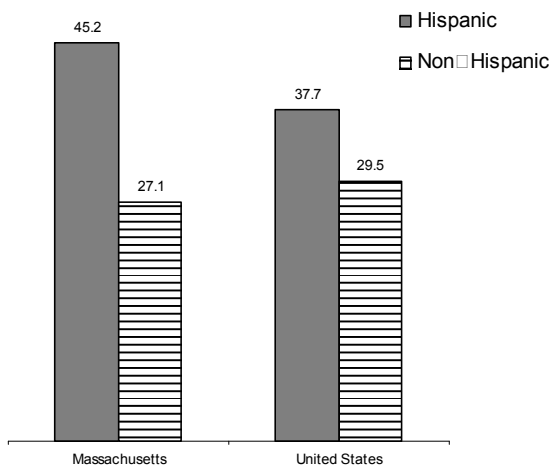


Figure 4. Percentage of overweight or obese children by ethnicity, U.S. and Massachusetts.

### Causes of Obesity

Although the causes of obesity are complex and multifaceted, and no single cause has been found, the preponderance of evidence implicates energy imbalance caused by excess caloric intake that is not offset by adequate physical activity. In Massachusetts, as in the rest of

the U.S., we are nowhere near meeting current recommendations for diet and physical activity, which have a critical impact on our obesity epidemic. While the health of Massachusetts children has improved over the past two years in terms of usage of tobacco, alcohol, and drug use, there has been no improvement in the nutrition and physical activity habits of Massachusetts youth.<sup>19</sup>

### Poor Nutrition

In Massachusetts:

- Intake of fruits, vegetables and dairy is inadequate and continues to decrease: only 15 percent of students reported consuming the recommended daily servings of fruits and vegetables or drank three or more glasses of milk per day in 2007.<sup>19</sup>
- Sixty percent of 2 to 19 year-olds eat the minimum recommended six daily servings of grains, while the mean daily intake of the more nutrient-dense whole grains is much lower than the recommended three servings.
- Children who eat breakfast have better quality diets. Thirty-five percent of high school students reported eating breakfast daily for the prior week and 14 percent report never eating breakfast that week.<sup>19</sup>
- School breakfast program participation is among the lowest in the country, with only 69 percent of schools participating.
- Breastfeeding for six months is protective against obesity. Nearly 78 percent of mothers initiate breastfeeding. This falls to 45 percent at six months and then 25 percent at one year.

The American diet has changed in the last 30 years. Americans and their children are eating away from home more, eating fewer meals

together and consuming more snacks. These snacks are often calorie dense and nutrient poor and are being substituted for healthy, balanced meals, crowding out the nutritional value of the balanced diet that children need to maintain healthy weight.<sup>20-23</sup>

Energy balance and diet composition are the nutritional keys to maintaining healthy weight. U.S. children are not eating the recommended amounts of fruits, vegetables, whole grains, and dairy, and are consuming way too much saturated fat and sugar. As children get older, they eat less fruit, vegetables, and milk and skip breakfast more frequently.<sup>19</sup> In general, diet quality decreases as children transition from preschool to elementary and middle schools and finally into high school.<sup>24</sup>

For children over the age of two, the U.S. Dietary Guidelines and the Institute of Medicine

stress energy balance as the key to maintaining a healthy weight and suggest caloric intake recommendations based on age and activity level.<sup>25</sup> It has been calculated that the energy gap needed to produce weight gain is between 110 and 165 calories per day,<sup>26, 27</sup> roughly equivalent to the calories in one can of soda, a 1 ounce bag of chips, or an ice cream bar, depending on activity level. The importance of and strategies for maintaining physical activity to complement good nutrition and achieve energy balance will be discussed further below.

From 1974 to 1994, there was a significant change in the types of foods that U.S. children are eating for all pediatric age groups.<sup>28</sup> For many children, there has been an increase in the amount of sweets, desserts, and snack foods in their diet which is often displacing fruits and vegetables, dairy products, and

### ***Definition of overweight and obesity in children***

Body mass index (BMI; kg/m<sup>2</sup>) is an easy, non-invasive approach to estimate relative weight for height in children and in turn, has been useful in screening for and determining whether children less than 20 years of age are underweight, normal weight, overweight or obese. Because of age-related body composition changes, weight status in children is identified by BMI-for-age and gender on the Centers for Disease Control and Prevention (CDC) Growth Charts (as opposed to a standard BMI measure used in adults).<sup>1</sup> In 2007, the Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity revised its definitions and terminology for BMI classification (see below) to eliminate confusion and improve continuity between adolescent and adult caregivers.<sup>2</sup> The 99<sup>th</sup> percentile of measured BMI-for-age is used to identify severe childhood obesity. For children less than two years, weight-for-length is used instead of BMI and in this age range, greater than 95<sup>th</sup> percentile weight for length is defined as overweight.

<b>BMI Category</b>	<b>Former Terminology</b>	<b>Recommended Terminology</b>
<5 <sup>th</sup> Percentile	Underweight	Underweight
5 <sup>th</sup> -84 <sup>th</sup> Percentile	Healthy Weight	Healthy Weight
85 <sup>th</sup> -94 <sup>th</sup> Percentile	At Risk of Overweight	Overweight
≥ 95 <sup>th</sup> Percentile	Overweight	Obese

whole grains (Figures 5a & 5b). In total, likely over half of U.S. and Massachusetts children are at risk for inadequate intake of multiple nutrients including calcium, Vitamin D, and fiber, and consume excess unhealthy dietary components such as saturated fat and cholesterol.

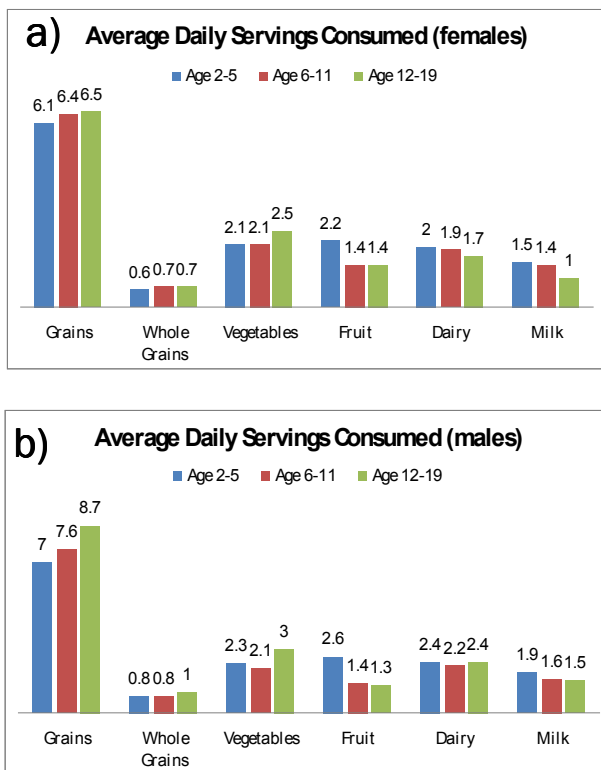


Figure 5. Average daily servings consumed for a) females and b) males.

### Factors contributing to the decline in the quality of children’s nutrition:

- **Breakfast.** Eating breakfast contributes to improved diet quality, increased school attendance, higher test scores and more balanced nutrient intake for children.<sup>30</sup> Despite this, breakfast is the meal most likely to be skipped by Americans of all ages.<sup>31</sup> As adolescents transition into adulthood, they become increasingly likely to skip breakfast.<sup>22</sup>

However, although breakfast may provide improved nutrient intake, research is mixed on the link between eating breakfast and weight status. Most studies indicate that individuals who eat breakfast regularly have a lower BMI, but some have found that skipping breakfast may increase weight loss.<sup>30</sup> More study is needed on the effects of specific breakfast foods on children’s weight status.

- **Fast-food meals & portion sizes.** Parents and caregivers are a key influence on children’s eating habits.<sup>32</sup> Family meals eaten at home, including breakfast, have a positive effect on the quality of a child’s diet. However, American families are eating more meals and snacks away from home, especially at fast food restaurants, that tend to be higher in calories, fat and sugar, resulting in a lower quality diet.<sup>33</sup> Although there is a stated desire for restaurants to serve healthier foods, menu developers cite poor demand and lower profits from healthier options.<sup>34</sup> Not only do restaurant meals tend to be less healthy, families that eat at fast food establishments are less likely to have healthy food choices at home.<sup>33</sup> In addition, portion sizes at the three major fast food chains have been increasing since the 1950s: serving sizes of soda and hamburgers have increased by approximately 500 percent<sup>35</sup> and there is some evidence that portion sizes at home have increased as well. Children who eat at fast food restaurants are more likely to have a preference for larger portion sizes.<sup>36</sup> The increased portion sizes can result in higher caloric intake in children and adults, if individuals do not compensate with reduced intake during other meals and snacks.<sup>37</sup>



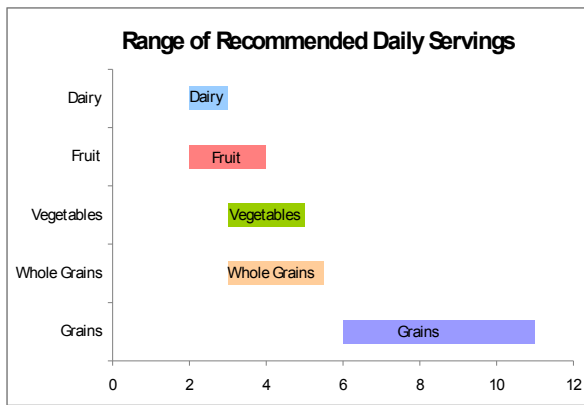


Figure 6. Recommended daily servings.

- Food Marketing.** Television viewing and exposure to advertisements increases caloric intake and decreases diet quality in children and adolescents.<sup>38-40</sup> Research indicates that for each hour of television viewed, there is a decreased intake of fruits and vegetables by children.<sup>41</sup> Children who watch more television are also more likely to have a preference for larger portion sizes.<sup>36</sup> Although eating meals together as a family is associated with healthier eating, watching television during a meal is associated with decreased fruit and vegetable intake.<sup>38,39</sup> Food marketing both in the form of television advertisements and embedded in newer media has a powerful effect on the preferences and intake of children and families, especially for children in elementary and early middle school.<sup>42</sup> For the past three decades, the television advertising industry has been self-regulating marketing of food and products to children, however, nearly half of commercials on Saturday mornings are for food and the vast majority are for energy dense and non-nutritious products.<sup>43</sup> In 2006, the Institute of Medicine issued a report and recommendations calling for stricter standards for food marketing and increased promotion of healthy eating habits for children and families.<sup>42</sup>

- Rural and urban neighborhoods.** The availability and affordability of healthy food options is a challenge faced by people in both rural and urban neighborhoods and is strongly associated with poorer nutrition and higher rates of obesity and diabetes.<sup>44,45</sup> Convenience stores in low income urban neighborhoods and rural areas that lack supermarkets offer a lower quality produce selection, provide less variety, and are more expensive than supermarkets in wealthier neighborhoods.<sup>46</sup> Neighborhoods surrounding middle and high schools are 30 percent more likely to have a fast food restaurant or convenience store.<sup>47</sup> The poor food choices at fast food and convenience stores likely contribute to the increasing intake of energy dense foods. Californians that live in neighborhoods with a higher proportion of fast food restaurants and convenience stores relative to grocery stores and produce outlets are significantly more likely to be obese or have diabetes.<sup>48</sup> The influence of the local food environment is even greater for low income neighborhoods.<sup>46</sup> New York is addressing the limited availability of produce by increasing permits for vegetable carts, initiating a Healthy Bodegas campaign and supporting retailers in underserved neighborhoods where residents reported no fruit or vegetable intake in the past 24 hours.<sup>49</sup> Efforts such as these are examples of the multi-level nature of obesity prevention and health promotion efforts being applied.
- School nutrition.** The school environment influences children's eating habits and has been blamed for not serving healthy choices to students. No more than seven percent of schools serve meals that meet all of the fed-

eral School Meal Initiative standards.<sup>50</sup> These standards expect that school lunch provides 30 percent and school breakfast provides 25 percent of the RDA for calories, protein, vitamin A, vitamin C, calcium and iron. In addition, both breakfast and lunch should provide less than 30 percent of total calories as fat and less than 10 percent of total calories as saturated fat. Schools are least likely to meet goals for energy, fat and saturated fat.<sup>50</sup> Foods sold outside of school meals, including a la carte, vending machines, school stores and food based fundraisers, are not required to meet the School Meal Initiative guidelines and are generally high-sugar, high-saturated fat, processed foods that often displace the more balanced meal offered as part of the school lunch program.<sup>50,51</sup> Although the presence of junk foods at school places all students at higher risk of increased BMI, students who are overweight or have an obese parent show greater increases in BMI compared with healthy weight students.<sup>52</sup> Importantly, however, schools that have attempted to improve their competitive food choices by applying nutrient standards and portion size controls have struggled to find products that meet their criteria.<sup>53</sup> Additionally, policy changes may not have the intended effect: in a sample of middle schools in Texas, intake of soda and chips did not decrease after these foods were no longer sold in the cafeteria because students purchased more of these items from the school vending machine or brought them from home.<sup>54</sup>

- **Fetal and infant nutrition.** Newer research has explored how obesity risk may “start in the womb” and the early months of life through breastfeeding and infant feeding practices. Mothers who gain excessive

amounts of weight during pregnancy or are obese during pregnancy are more likely to produce high birth-weight babies and increase the risk of their child becoming overweight.<sup>55</sup> Breastfeeding for more than six months is protective against developing obesity<sup>56</sup> and the Centers for Disease Control (CDC) and Surgeon General recommend it to reduce a child’s risk of becoming obese. Breastfeeding rates are rising nationally with 74 percent of mothers initiating breastfeeding, approaching the Healthy People 2010 goal of 75 percent.<sup>57</sup> Unfortunately, decreased rates are seen at six and twelve months both nationally and in Massachusetts (Figure 7).

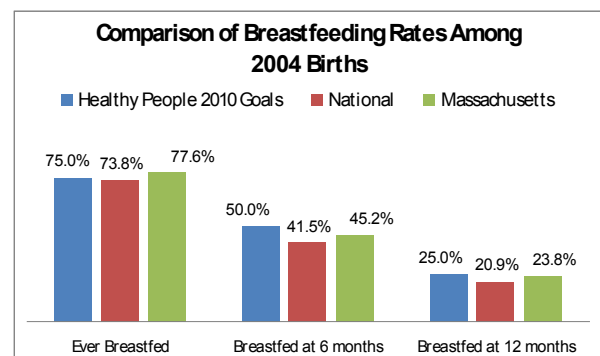


Figure 7. Comparison of breastfeeding rates.

### Lack of Physical Activity

Physical activity is necessary to expend energy and is helpful in achieving energy balance, improving eating behavior, and enhancing psychological well-being, but the majority of American children and adults are not physically active.<sup>59-62</sup> Physical activity declines dramatically across age groups, especially between childhood and adolescence, and then continues to decline as people get older.<sup>63</sup> The Surgeon General, along with the American College of Sports Medicine and the CDC, recommend that children accumulate at least 60

minutes per day of physical activity,<sup>64</sup> but only 42 percent of 6-11 year olds and less than eight percent of adolescents reach this goal.<sup>63</sup>

In Massachusetts:

- More than 50 percent of students are not physically active.
- Fewer than half of students report moderate or heavy physically activity for at least 60 minutes per day on 5 or more days during the past week.<sup>19</sup>
- Activity declines with grade level, with 49 percent of 9<sup>th</sup> graders and 36 percent of 12<sup>th</sup> graders reporting meeting the guidelines.<sup>19</sup>
- Approximately 10 percent of children report absolutely no daily moderate or vigorous activity.<sup>19</sup>

These reported youth physical activity levels have remained fairly constant since 1999 and are very similar to U.S. youth.

### **Why aren't our children physically active?**

Factors range from increased sedentary time spent watching television or sitting behind a computer screen to parents not encouraging free play in the outdoors due to over-scheduling or other time demands and safety concerns. Other factors include the built environment where the ability to access sidewalks and parks has diminished or even in some areas where parks and sidewalks abound, safety concerns restrict the ability of children to play outside. Finally, schools have been blamed for decreasing physical education and recess time.

- **Increased screen time.** Not only has increased screen time and television viewing been linked to unhealthy nutritional practices in children, but it is also related to in-

creased BMI in children because screen time reduces active time.<sup>65-67</sup> Nearly half of Boston high school students reported daily screen time that exceeded three hours<sup>68</sup> with non-school screen time estimated at 3.6 hours on an average school day for Massachusetts high school students<sup>19</sup>. Even in middle school 18 percent of Massachusetts students report three or more hours of daily Internet use alone. In total, students' screen time is well beyond the recommended 2-hour limit suggested by the American Academy of Pediatrics.<sup>69</sup>

- **Built environment.** An active lifestyle may be limited by our environment. For example, walking to school for many children is not easy or safe if sidewalks are unavailable. Playing outdoors is more difficult if there are not adequate parks and recreational areas for children to play safely. Many housing developments lack sidewalks or recreational areas.<sup>70</sup> Physical activity in children has been shown to be associated with proportion of green space, residential density, general impression of activity-friendliness of the neighborhood, sports fields, water, dog waste, heavy traffic, and safe walking and cycling conditions in the neighborhood.<sup>71</sup> State spending on parks and recreation is positively associated with girls' overall physical activity.<sup>72</sup> Children's physical activity is, therefore, associated with certain modifiable factors of the built environment.
- **Free play.** State park officials, educators, and innovators have advocated for more free play time.<sup>73</sup> This implies that our children are over-scheduled and need time to play as they please, in an unstructured manner which will spontaneously stimulate physical activity on a regular basis. This

may also give children the time and freedom to explore the outdoors and nature and become more interested in being outside which would increase physical activity. There may also be an overestimation of how much activity a child is getting in structured play settings. For example, a parent may assume that a child playing organized soccer is sufficiently active. However, a child may only have a game and/or practice a few times per week, or may not play an entire 50-minute game, and possibly not even meet the recommendation of 60 minutes of physical activity per day even on a soccer day.

**Physical education and recess time.** In Massachusetts, where physical education (PE) attendance is on the decline (Figure 8), 61 percent of adolescents attend PE class one or more days per week and a mere 8 percent attend PE classes daily.<sup>19</sup> Schools have been blamed for scheduling inadequate time for exercise, whether that be recess or physical education classes.<sup>74</sup> Budgetary constraints and increasing pressure to improve standardized test scores have caused school officials to question the value of PE and recess. PE classes may be important in maintaining and/or improving children's physical fitness and may also decrease adiposity and insulin sensitivity.<sup>75</sup> Only four percent of elementary schools, eight percent of middle schools, and two percent of high schools in the U.S. provide daily PE.<sup>76</sup> Massachusetts law requires that PE be taught to all public school students, but in 1996, the Board of Education repealed regulations mandating minimum annual hours of PE.<sup>77</sup> Currently, Illinois is the only state that requires PE five days per week from kindergarten through high school. In Alabama, daily PE is required through the 8<sup>th</sup> grade. California,

Kentucky, Maine, Missouri, New York, South Carolina and Vermont are in the process of developing standards for health and PE programs.

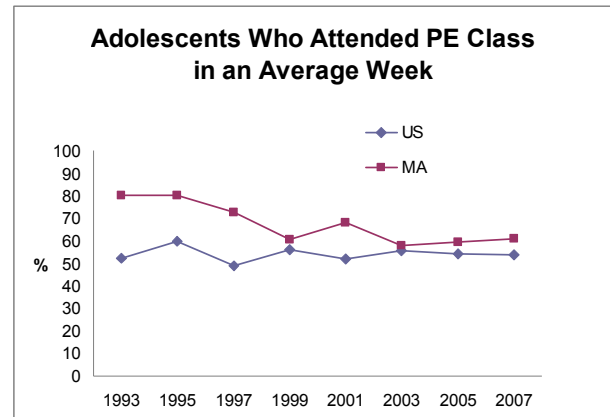


Figure 8. Physical education attendance in high school students, 1993-2007 (Youth Risk Behavior Survey).

Recess can also add significant activity time to a child's total daily physical activity.<sup>78, 79</sup> In Massachusetts, recess time depends on the individual school's wellness policy. Legislation has been proposed to increase recess time, but none has passed in Massachusetts.

**Physical fitness.** Cambridge and Somerville are among the few communities in Massachusetts that perform fitness testing in the public schools. In 2007, 61 percent of 4<sup>th</sup> through 8<sup>th</sup> grade students in Cambridge and half of the 4<sup>th</sup> through 8<sup>th</sup> grade students in Somerville did not pass the physical fitness test.<sup>80, 81</sup> In Cambridge, researchers demonstrated that the endurance shuttle run, which is a good measure of cardiovascular fitness, was predictive of the incidence of overweight over one year in these schoolchildren.<sup>82</sup> National data on the physical fitness of school children in the United States are limited to the 1980s.<sup>83</sup> However, there are

some data indicating declines in cardiovascular physical fitness as measured by the shuttle run test from 1981 to 2000.<sup>84, 85</sup> Only eleven states have policies requiring administration of a physical fitness test and Massachusetts is not among them.<sup>86</sup> These trends highlight the need for updated national physical fitness data for American youth.

### **Lack of recognition**

At the same time that survey data demonstrate that childhood overweight and obesity have reached epidemic proportions, there are also data showing that parents do not recognize the problem, especially in their own children. Nationally, more than half of parents of obese children between 6 and 11 years old reported that their child was about the right weight or slightly underweight.<sup>87</sup> This was consistent with several studies that showed a disconnect between a child's BMI classification and their parents' perception of weight status.<sup>88-90</sup> Likewise, a recent study of the school food environment found that school principals and food service managers acknowledged that childhood obesity is a problem but did not see it as a problem in their school.<sup>91</sup> In Arkansas, parental perception of their child's weight status improved with BMI notification by schools.<sup>92</sup> Increased awareness by all parties, including schools, governments, communities, health-care providers and parents, will be needed to reverse the childhood obesity trend.

According to recent research, other factors may contribute to the obesity epidemic such as sleep duration<sup>93</sup> and the fetal environment.<sup>94</sup> Just as the nature of the problem is complex, so will be the solution. Weight control was once thought to be primarily an individual's

problem, leading to weight control interventions primarily focused on individual behavior change, but experts now agree that environmental factors have a substantial impact on weight status. This indicates that a shift towards a social-ecological approach that integrates behavior change strategies with environmental-based interventions is necessary.<sup>95</sup> Research suggests that changes in these contributing factors can form parts of an integrated solution to the childhood obesity epidemic.

### **Costs and Consequences**

Obesity creates a significant health, productivity and economic cost burden, nationally and in Massachusetts. The considerable healthcare costs attributable to obesity are borne by insurers, public payers, consumers and employers. In 2002, physical inactivity, overweight and obesity cost an estimated \$27.2 billion in the United States.<sup>96</sup> A 2008 report found that obesity costs the nation's businesses \$45 billion annually due to medical expenses and lost productivity.<sup>97</sup> In Massachusetts, Medicare and Medicaid spent approximately 1.1 billion dollars attributable to adult obesity in 1998,<sup>98</sup> and it is estimated that costs for medical care, workers compensation and lost productivity statewide related to adult obesity were nearly \$15 billion in 2002.<sup>99</sup> These costs are expected to increase with the increasing prevalence of obesity. Nationally, out of pocket medical costs attributable to adult obesity increased 26 percent between 1996 and 1998.<sup>100</sup> Annually, per child medical expenditures for overweight and obese children are \$180-\$220 more than expenditures for a healthy weight child.<sup>101</sup>

We know that the consequences of obesity on the health of children in the Commonwealth

are considerable, but difficult to estimate with precision. Overweight and obese children are more likely to become overweight or obese adults and their chances increase as they get older, from an increased likelihood of eight percent at the youngest ages to 79 percent in older children.<sup>3</sup> The odds of becoming an obese adult more than double for children under ten years with one or more obese parent, regardless of whether the child is normal weight or obese.<sup>3</sup> Overweight adults, in turn, are likely to develop obesity-related diseases such as Type II diabetes and cardiovascular disease<sup>102</sup> and risk a high rate of mortality from these diseases.<sup>103</sup> Importantly, these diseases are now showing up in obese children.

Obese children have a greater than two-fold chance of having diabetes and are at increased risk for developing cardiovascular disease, compared to children of normal weight.<sup>104</sup> It is estimated that among the 0.5 percent of U.S. 12 to 19 year-olds with diabetes, almost a third probably have Type II diabetes,<sup>105</sup> which is historically rarely found in children. This form of diabetes is associated with obesity and was previously more common in adults<sup>106</sup> and accounted for less than five percent of all childhood diabetes.<sup>107</sup> During the 2006-2007 school year, the prevalence of Type II diabetes for Massachusetts students was 0.6 per 1000 students (0.06 percent).<sup>14</sup> This may likely be a conservative estimate and even though these numbers seem small, they are increasing. This is evidenced by the increased number of children assisted by medical technology in the Massachusetts public school system in recent years: in-school blood glucose testing and insulin pump care by school nurses for diabetic students have gone up by over 35 percent since 2001.<sup>14</sup>

The physiological stress caused by excess body weight and adiposity can influence health of the immune system<sup>108</sup> and impact health over the long term by increasing the risk for development of coronary heart disease and diabetes in adulthood.<sup>109-111</sup> Risk factors that are important in the development of cardiovascular disease and diabetes that are common in overweight children and adolescents include low HDL, elevated triglycerides, high blood pressure, and impaired glucose tolerance.<sup>112, 113</sup> One recent study showed that children with these risk factors were significantly more likely to have cardiovascular disease 25 years later as adults compared to their peers.<sup>114</sup>

In a cascade of negative health and social impacts, overweight youth are involved in less physical activity and are less physically fit than their lean counterparts.<sup>115-119</sup> Fitness is important to maintaining skeletal muscle health,<sup>118, 120</sup> which plays a critical role in insulin sensitivity and effects blood lipid profile and in turn the risk of developing obesity, diabetes, and cardiovascular disease.<sup>121</sup> In addition to biological health effects, childhood obesity has other psychosocial ramifications for children such as predisposition to sleeping problems, social stigmas and teasing.<sup>122</sup>

Obese children have lower circulating levels of several of nutrients, specifically antioxidant nutrients.<sup>123-126</sup> Whether these lower levels in obese children are due to increased usage due to higher levels of metabolic stress, poor dietary intake, or sequestering in the adipose tissue is still subject to further investigation. Obesity aside, ten percent of U.S. children do not receive adequate levels of vitamins A, C, and E and low intake of these nutrients increases throughout adolescence.<sup>127</sup> Nutrient intake is a concern for all children, but needs

to be particularly emphasized and further researched in overweight children.

Severely obese children have been shown to be absent up to four times more often than healthy weight students,<sup>128</sup> but there is very little research on whether overweight children miss school due to illness as schools do not systematically collect and report reasons for students' absences.<sup>128, 129</sup> Boys who became overweight during the first four years of school had significantly more absences than boys who remained normal weight.<sup>130</sup> Being overweight may cause students to miss more class time because being overweight can trigger or exacerbate a variety of chronic medical conditions in school-aged children, including asthma, Type II diabetes, high blood pressure, high cholesterol, depression and anxiety.<sup>131, 132</sup>

Clearly, illness, school absenteeism and these two in combination can lead to decreased academic performance by children. Indeed, overweight youth have significantly lower test scores than healthy weight children.<sup>129</sup> However, this association may be strongly influenced by social factors such as parental education and the home environment.<sup>129</sup> Still, this association exists and may further exacerbate the social stigma of weight bias that teachers and normal weight children may have toward overweight children. In Massachusetts, a Cambridge-based study showed that physical fitness is positively associated with MCAS scores.<sup>133, 134</sup> Advocates for school-based physical activity programs argue that allocating time for daily PE does not adversely impact academic performance and that regular exercise may improve students' concentration and cognitive functioning.<sup>135-139</sup> Short activity breaks, such as recess, during the school day

can improve students' concentration skills and classroom behavior.<sup>140</sup>

In Massachusetts, with the obesity-related increase in Type II diabetes and related medical procedures, there are multiple physical and economic challenges for children, parents, school administrators, teachers and school health services personnel.<sup>14</sup> The few studies specifically examining the economic costs of obesity suggest that healthcare costs and length of stay for overweight and obese children are significantly higher than for healthy weight children.<sup>141-143</sup> In a study of adolescents insured through North Carolina Medicaid, medical expenditures were 25 percent greater for obese adolescents and 33 percent greater for overweight adolescents when compared to those who were of healthy weight.<sup>144</sup> Obese adolescents were more like to have a claim for treating diabetes, obesity, or asthma and were less likely to have a claim for a well-care visit or injury.<sup>144</sup> It is estimated that the annual cost of obesity-related hospitalization of children is \$127 million nationally.<sup>142</sup> Higher BMI in adolescence is associated with higher health care costs in middle age,<sup>145</sup> which bodes ill for future attempts to contain health costs, given current adolescent obesity trends. The cost and care burden across the delivery system strains individuals', payers' and providers' ability to pay for and deliver services.

### **Massachusetts Policy and Program Landscape**

Policies and programs that address the causes, costs and challenges of the obesity epidemic intersect with a number of policy domains including health, education, housing and urban planning, and agriculture. Just as the root

cause of the problem is multi-dimensional and complex, the potential solutions are far-reaching and involve policy stakeholders in these domains at the local, state and federal level. To decrease obesity rates, local, state, and federal governments need to work in concert with efforts by individuals and businesses. Enacted legislation has the potential to influence obesity trends and combat the epidemic through both direct and indirect measures, but broad enforcement and coordination among all stakeholders is needed to effect societal change. The following are a few of the important initiatives in the state.

#### Massachusetts Department of Public Health

Some recent initiatives from the Massachusetts Department of Public Health (MDPH) targeting childhood overweight and obesity include:

- *Statewide Taskforce on Obesity:* In 2008, MDPH Commissioner John Auerbach agreed to chair a Statewide Taskforce on Obesity to both complement and coordinate several groups that organized around the state to fight obesity including the Massachusetts Partnership on Healthy Weight, and initiatives by Harvard Pilgrim Healthcare Foundation and the Boston Foundation to address childhood obesity. The Task Force has reviewed legislative and programmatic initiatives in other states and will be determining strategic activities for policies and programs in Massachusetts.
- *Workplace Wellness Initiative:* Initiated in the spring of 2008, MDPH: developed a conceptual framework for worksite wellness initiatives; recruited 14 pilot sites from both the public and private sector; developed and implemented one of two trainings; and drafted a worksite wellness toolkit.

While this effort directly targets adults, it also addresses family issues so that parents and other adults can model and provide information and support for healthy lifestyles for children.

- *Wellness Grants:* In November, 2007, MDPH awarded \$1 million in grants across the state that focused on wellness activities, including specific community and school-based activities to reduce overweight and obesity through evidence-based practices to support healthy eating and increased physical activity. For example, *Target Hunger Springfield* – funded, in part, by a MDPH Wellness Grant – is continuing to build support in the neighborhood of Mason Square for a farmers’ market, community pantries, cooking programs, economic development and an effort to bring a major supermarket to the area. This initiative is also restarting efforts to form a Springfield Food and Fitness Policy Council.

#### Jump Up & Go!

*Jump Up & Go!* is an initiative designed by BlueCross Blue Shield (BCBS) of Massachusetts that addresses the childhood obesity problem at multiple levels within the state and in our communities. Begun in 1998, *Jump Up & Go!* is a community benefit grant making program that provides resources for families, schools, and clinicians to support healthy eating and physical activity. In the past ten years, the program has invested nearly \$12 million dollars to fund community-based organizations, school-based programs, media campaigns, prevention and treatment programs aimed at improving the health of children.

Among the many initiatives funded by this program, one of the most recognizable and



successful is the 5-2-1 message of eating 5 servings of fruits and vegetables daily, limiting screen time to 2 hours daily, and engaging in physical activity for 1 hour daily. The program provides resources for health care providers, schools, teachers and parents.

*Healthy Choices*, the school-based component of *Jump Up and Go!*, is a collaborative project

of the Department of Public Health and BCBS with additional funding from the CDC. The *Healthy Choices* program, established in 124 schools, has reached nearly 80,000 Massachusetts adolescents. Specifically, it aims to:

- Integrate nutrition and physical activity into existing core subjects by using the Planet Health curriculum

### ***A Massachusetts Community-Based Program: Shape-Up Somerville***

With CDC sponsorship, *Shape-Up Somerville: Eat Smart, Play Hard* was initiated by Tufts University and is operated by the City of Somerville. It engages schools, business and the community in cooperative efforts to promote healthful diet and lifestyles, led by the Health department and a city taskforce and a community collaboration of more than 11 initiatives and 25 stakeholders. *Shape-Up Somerville* has effectively controlled child overweight and obesity, as evidenced by a decrease in BMI z-score compared to control communities.<sup>150</sup> There are more than 11 initiatives, including:

- Healthy Eating Active Time (HEAT) curriculum for classroom and after-school programs
- Increasing availability of whole grains, fruits and vegetables at school meals
- Parent, city employee, pediatrician and community outreach
- Promotion of healthy entrees at participating restaurants
- Improved walkability through promotion of the Safe Routes to School program
- Extension of the Community Path to create access to a low income neighborhood. The path is currently 0.8 miles long with plans to connect to other rail-trail and bikeways in the greater Boston area
- Outreach and training for school nurses to conduct height and weight measurements, to identify child obesity and overweight, and to use motivational interviewing techniques to engage parents
- Policy initiatives to promote wellness of students, school staff and city employees
- Farmers markets and community/school gardens

Other Massachusetts towns have adopted *Shape-Up Somerville* practices to improve their health environments, including Attleboro and Newton. Research projects are currently getting underway in both rural and urban locations throughout the U.S. to see if Somerville's success can be systematically replicated. In 2008, Metrowest Healthcare Foundation launched a community wide child obesity prevention initiative based on the *Shape-Up Somerville* model. Grantees receive funds and technical support to prepare an obesity prevention plan. Once a plan is submitted, communities can apply for implementation funding.

## ***U.S. Surgeon General Pioneers in Innovation Award 2007: “Healthy Living Cambridge Kids”***

This award went to *Healthy Living Cambridge Kids—Healthy Children Task Force*. The program led to a 3.6 percent decrease in obesity and 1.7 percent decrease in overweight, a 5 percent increase in healthy weight, and a 10.6 percent increase in fitness testing pass rates in children living in Cambridge, MA.<sup>151</sup> Key interventions included:

- Implementation of the “Health and Fitness Progress Report” that recorded both BMI for age and fitness score
- Expansion and promotion of innovative physical education
- Improvement of school food with help from a nutritionist
- Continuation of the “CitySprouts” school garden program
- Family outreach
- Farm-to-school programs
- School nutrition policy implementation
- Staff education on nutrition and fitness programming
- Communication with public health departments
- Partnerships with the community

- Assess the nutrition and physical activity policies and systems in schools using CDC’s School Health Index
- Create before-school and after-school nutrition and physical activity programs
- Launch school-wide campaigns to promote the 5-2-1 message

The healthcare component incentivizes BMI screening for all children and reimburses participating physicians for obesity prevention and treatment. *Operation Better Start*, described in Appendix II, is one among many Massachusetts programs the Jump Up & Go! Initiative has funded.

### ***Growing Up Healthy***

In 2007, the Harvard Pilgrim Health Care Foundation launched *Growing Up Healthy*, an initiative that will invest \$1 million in each of the next five years with the goal of preventing childhood obesity in Massachusetts, New Hampshire and Maine. This funding will also be used to leverage in-kind resources to maximize impact.

This program will have three components: information, leadership development and funding to enhance or expand evidence-based programs. For each of these, the Foundation and Harvard Pilgrim Health Care will work with existing efforts and champions to maximize resources and efforts. Also, the Foundation will play an information and leadership coordi-

nation role among the efforts of the three states.

#### Massachusetts Action for Healthy Kids

*Massachusetts Action for Healthy Kids* aims to improve the health and nutrition of children in Massachusetts through schools, encouraging systemic, sustainable changes to achieve sound nutrition and physical activity habits. The group encourages schools, families, and communities to engage in improving eating and physical activity patterns in youth. The group has created resources and trainings for schools including the “A List” which identifies products that meet the Massachusetts guidelines for a la carte and vending items. This past year the *Massachusetts Action for Healthy Kids* initiated the Gold Medal Project with funding from MetroWest Community Healthy Care Foundation, and engages a youth “Team” to evaluate the quality physical education programs in schools using the CDC’s Physical Education Curriculum Analysis Tool and School Health Index. This was implemented in 10 schools in the MetroWest area. This Team will then provide recommendations to strengthen and improve physical education, promote “best practices” and create an advocacy network to assist other interested school districts.

#### Think about your Drink: Corner Store Pilot Program

On January 22, 2008, the Boston Public Health Commission, Boston Medical Center’s Nutrition and Fitness for Life program, HP Hood, and the New England Dairy & Food Council implemented the program *Think About your Drink* to encourage students to choose beverages rich in nutrients and low in sugar.<sup>146</sup>

#### Project Bread: Better Breakfast Initiative, Better Summer Meals Initiative

Project Bread is an agency devoted to fighting hunger in Massachusetts. They have partnered with the Massachusetts Department of Education to provide school breakfast and summer meals for children that exceed USDA guidelines, beginning in the fall of 2008. The program has been pilot tested in ten school districts.<sup>147</sup> The *Better Breakfast Initiative* and the *Better Summer Meals Initiative* will set strict standards for school breakfast and summer meals to include no hydrogenated or partially hydrogenated oils (trans fats), skim or one percent milk only, limitations on flavored milk, sweet deserts and baked goods, low fat cheeses and whole grain bread products whenever possible, and to require fresh or frozen fruits and vegetables at breakfast and lunch. The standards will improve the quality of breakfast foods to limit cereal to no more than five grams of sugar unless it provides three or more grams of fiber, and to permit no donuts or pastries. In addition, *Project Bread* encourages schools to purchase locally-grown produce.

#### **Massachusetts School and Community-Based Activities**

There are a multitude of school- and community-based activities throughout Massachusetts. Many of these innovative programs have been highlighted in 2007-2008 childhood obesity reports.<sup>148, 149</sup> The list of innovative programs and activities is long and we invite the reader to visit these resources for more detailed information. Unfortunately, success of many of these programs is difficult to ascertain besides through personal opinions. To determine success in combating the obesity epidemic, data needs to be collected, and unfortunately most programs and activities lack the

resources to collect this valuable information. Two successful Massachusetts-based programs, *Shape-Up Somerville* and *Healthy Living Cambridge Kids*, illustrate that coordinated efforts between individuals, institutions, and communities can make a difference in our state (see insets).

#### *The Massachusetts Farm to School Project*

Farm to school programs function to increase availability of fresh fruits and vegetables in schools and support local farms. During the 2006-2007 school year, the Massachusetts *Farm to School Project* provided technical assistance to 85 elementary schools with a total enrollment of 213,800 students, to purchase local products for school meals and connected farmers with schools and produce distributors. The project gives schools resources—both monetary and informational—to incorporate fresh fruits and vegetables into the cafeteria menu.

#### **Massachusetts Legislative Environment**

Massachusetts appears to be increasing legislative attention to childhood obesity issues. In 2007-2008, the Massachusetts legislature debated 39 bills that either directly or indirectly addressed childhood overweight and obesity. Thirty-eight of the bills focused on school lunch and breakfast programs, introduced locally grown and organic foods in schools, increased regulations on vending machines and food/beverage marketing, and provided nutrition information for school food. Physical fitness and nutrition education, along with mandated recess times were prominent and health education standards and student assessments for school districts also emerged in a number of proposals. There were also proposals to address the community at large, providing better access to trails, preventive health services, and improvement on public health programs.<sup>152</sup> This June, the house approved a bill that would remove trans fats from meals served in restaurants in Massachusetts. In September 2007, legislation was enacted to provide \$150,000 to

#### **State Legislation: Arkansas Act 1220**

Arkansas Act 1220 is best known for mandating statewide BMI screening and surveillance of public school children. The ACT had a much wider scope; its aim was to improve the nutrition and physical activity habits of students by improving the school environment and engaging Arkansas citizens to cooperatively work for a healthier future. Since the initiative was fully implemented in 2004, rates of childhood obesity in Arkansas have remained steady as opposed to trending upward as they historically had in the past.<sup>155,156</sup> Success of this initiative is credited to:

- Inclusion of input and engagement of leaders in all sectors involved (healthcare, schools, state and local government)
- Confidentiality of BMI results
- Development of an electronic data entry system (decreased labor intensity)
- Open communication between school staff and state level personnel
- Statewide protocol, training and measurement devices

## **State Legislation: California**

*A Vision for California—10 Steps Toward Healthy Living.* In 2005 California Governor Arnold Schwarzenegger called a summit to outline his *10 Steps Toward Healthy Living* for a healthier vision of California. Since then, legislative steps in line with these points have been taken to control child obesity and promote obesity prevention. Bills promoting these principles in California schools and communities include:

- Instructional gardens
- Farmers markets
- Fresh fruits and vegetables
- Diabetes screening
- Decreasing the sale of sugar-sweetened beverages

the *Childhood Obesity School Nutrition Pilot Project* within the Massachusetts Department of Public Health. This project focuses on the school lunch program, providing a grant of \$10,000 per school year to food service providers within the public school system to enhance child overweight prevention.<sup>153</sup>

### **The States**

State policy plays an important role in forming children's nutritional and physical activity habits and can tilt the energy balance equation towards achieving or maintaining a healthy weight. State spending on parks and recreation is positively associated with girls' overall physical activity, while PE requirements and a state physical education curriculum correlate with participation in PE for both sexes.<sup>72</sup> Across the United States, many individual states have begun to address the issue of child obesity. In 2007, 21 states, including Massachusetts, deliberated legislation pertaining to school nutrition. Of these 21 states, 8 enacted legislation regarding healthful options for food and beverages during school. In addition, more states considered additional policy

approaches. These included nutrition education, BMI measurement and report to parents, physical activity opportunities during school, nutrition information on foods provided by the school, and taxes on snack foods with minimal nutritional value.

BMI screening, whether done in medical clinics or in schools, yields data that can indicate the pervasiveness of the obesity epidemic. Currently, 12 states require BMI measurement in schools and four states (including Massachusetts) use weight-related screening assessments.<sup>5</sup> Some BMI measurement requirements are a part of a larger physical fitness test or part of the yearly student growth screening required in schools. In 2007, Arkansas changed the BMI measurement and reporting requirement from yearly to every other year, and also allowed parents to refuse BMI reporting.

In addition, in the past year:<sup>154</sup>

- Twenty four states either have established or debated legislation with regard to nutrition education in schools

- Thirty four states focused on changing physical activity legislation, for example: the incorporation of physical activity during required recess
- Six states either enacted or proposed legislation regarding school wellness policies
- Fifteen states considered legislation regarding trans fats. 5 of which enacted restrictions on trans fat being served to students
- Seventeen states established school meal regulations that exceeded federal standards determined by the USDA

Almost half of states established parameters on food sold in schools that did not encompass school meal programs and over half of states set restrictions on the time and location that these foods are sold, but these parameters and restrictions are not part of Massachusetts legislation. All states except Colorado and Oklahoma have health education requirements, and all states have physical education requirements. Taxes on soda and snacks have been established in twenty-four states. While policies exist, they are not well-enforced.<sup>5</sup>

Obesity treatment, not just prevention, is now on the legislative front. One state enacted a non-invasive screening and risk analysis for diabetes, and two states proposed legislation regarding this issue. Currently, two states already have legislation that requires diabetes screening in schools. In addition to diabetes screening, 11 states have either enacted or considered legislation for Type II diabetes care in school. While state insurance requirements do not specifically cover treatment for child obesity, 4 states have required health insurance companies to cover morbid obesity in adults. A summary of the state legislation that has been proposed and enacted is presented in Appendix IV.

### **Federal Policy Environment**

The CDC, U.S. Department of Agriculture (USDA) and the Department of Health and Human Services (DHHS) are responsible for the vast majority of federal programming targeting obesity. Data from federal surveillance surveys are used to develop action plans geared toward preventing obesity. Many of

#### ***State Initiative: Arkansas - Changing the Culture of Health in Arkansas***

Through CDC's Division of Nutrition, Physical Activity and Obesity (DNPAO) funding and program support, the state of Arkansas has worked to develop a plan entitled Changing the Culture of Health in Arkansas. Within this plan, changes include:

- Creating 24 miles of new trails to link with an existing 225-mile wilderness trail and a pedestrian river bridge, The Arkansas River Trails project.
- Starting 20 new community gardens and 30 new farmers markets to increase access to fresh fruits and vegetables.
- Within schools, adding healthy food and drink options to vending machines, implementing healthy snack policies, changing cafeteria cooking methods to reduce frying, and adding more fresh fruit to menus.

these programs and initiatives encourage cooperation between different sectors, implementation of multi-level interventions and evaluation of interventions for effectiveness. During the 2007 federal legislative session, 17 bills were submitted that either directly or indirectly addressed childhood overweight or obesity, of which several focused on school lunch and breakfast programs, agriculture, and health-care,<sup>157</sup> but no concrete proposal for an integrated strategy to combat childhood obesity was launched. Congress overrode a presidential veto to pass the Food and Energy Security Act of 2007, more commonly known as the Farm Bill. The \$280 billion, five-year federal farm bill, added \$10.4 billion to support nutrition programs focusing on low-income families.<sup>158</sup> The Improving Head Start for School Readiness Act was signed into law. The Act requires Head Start staff to receive training in obesity prevention and calls for the Secretary of DHHS to prepare a report for Congress on obesity prevention efforts among Head Start participants. A listing of federal programs that address childhood nutrition, physical exercise or obesity is included in Appendix II.

### **Conclusion: The need for a coordinated strategy**

Like the rest of the nation, Massachusetts is suffering from an epidemic of childhood obesity. We have a problem: physical activity is low, poor nutritional practices are rampant, diabetes is on the rise, and the economic burden is real.

Obesity stems from problems on many fronts: the individual, the family, schools, communities, society, industry and the government. It is not only a problem for the affected child, but a

public health problem. Perception and recognition, by all of these entities, are among the first steps to addressing the problem – we need to acknowledge that we have an epidemic in our state. The routine collection of data on children’s BMI, nutritional habits, and physical activity levels may be the first step in achieving this goal. With this data we can acknowledge that the problem exists, and monitor the effectiveness of the policies, programs and environmental efforts that may impact obesity.

Just as the problem arises from several levels, so must the solution: from the individual to the social environment to the physical environment and finally to the policy level. Future investments in children's well-being need to strike a balance between good parenting and policy improvements, and efforts need to be made to encourage sound nutrition practices and promote exercise as top policy priorities. Parents need to be role models for healthy eating and leading active lifestyles. They need to provide healthy foods in the home, monitor screen time, and promote safe outdoor play. On a broader policy level, we need to advocate for changes in nutrition and physical activity standards.

On the nutrition front we need:

- Participation of schools in school breakfast programs
- Regulation of marketing of foods to children
- Zoning changes in the built environment around access to healthy and affordable food
- Changes in nutritional standards at schools along with limiting access to junk food in cafeterias and vending machines

In the realm of physical activity we need:

- Increased physical education and recess time in schools

- Schools to administer annual fitness testing
- Public officials, planners, and advocates to design cities with attractive sidewalk networks; create schoolyards, playgrounds, and trails that are safe and accessible; and convert areas to be bike-friendly within communities to promote active living

School and community interventions that have attacked the problem on several of these levels have shown that it is possible to achieve change. Successful initiatives such as *Shape-Up Somerville* indicate that coordinated, community-wide strategies may offer a solution that could be applied on a broader level. Efforts such as these can bring all stakeholders together for a common goal that is realistic in scope and catered to the individual needs of the families and the community. Media can play an important role in the effort and advocacy by champions of the cause can lead and inspire.

Many of these policy changes will cost money, but ultimately healthier kids will offset many of these costs. As program managers, legislators, school administrators, and academics independently work to address this far-reaching problem, a coordinated strategy will allow for heightened communication among these entities to positively impact the movement against child obesity. Clearly, steps need to be taken to attack the problem from many angles and we are all responsible for making the move.

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## REFERENCES

1. Kuczmarski R, Ogden C, Grummer-Strawn L, et al. CDC growth charts:United States. In: National Center for Health Statistics, ed. Vol 314. Hyattsville, MD; 2000:1-27.
2. Barlow SE, Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*. 2007;120(S4):S164-192.
3. Whitaker R, Wright J, Pepe M, Seidel K, Dietz W. Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine*. 1997;337(13):869-873.
4. Kopelman P. Health risks associated with overweight and obesity. *Obesity Reviews*. 2007;8(s1):13-17.
5. Levi J, Segal L, E G. *F as in Fat: How Obesity Policies are Failing in America 2007*. Washington, DC: Trust for America's Health; August 2007.
6. De Ferranti S, Osganian S. Epidemiology of paediatric metabolic syndrome and type 2 diabetes mellitus. *Diabetes and Vascular Disease Research*. 2007;4(4):285-296.
7. Dabelea D, Bell R, D'Agostino R, et al. Incidence of diabetes in youth in the United States. *JAMA* 2007;297:2716-2724.
8. Olshansky S, Passaro D, Hershow R, et al. A potential decline in life expectancy in the United States in the 21st century. *New England Journal of Medicine*. 2005;352(11):1138-1145.
9. Janssen I, Katzmarzyk P, Boyce W, et al. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. *Obesity Reviews*. 2005;6:123-132.
10. Ogden C, Carroll M, Flegal K. High body mass index for age among US children and adolescents, 2003-2006. *JAMA*. 2008;299(20):2401-2405.
11. Ogden C CM, Curtin L, McDowell M, Tabak C, Flegal K. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA*. April 5 2006;295(13):1549-1555.
12. Singh G, Kogan M, vanDyck P. A multilevel analysis of state and regional disparities in childhood and adolescent obesity in the United States. *Journal of Community Health*. 2008;33(2):90-102.
13. Land K. *2008 Special Focus Report: Trends in Infancy/Early Childhood and Middle Childhood Well-Being, 1994-2006. The Foundation for Child Development Child and Youth Well-Being Index (CWI) Project*. Durham, NC: Duke University; April 25 2008.
14. Massachusetts Department of Public Health, Bureau of Community Health Access and Promotion, Office of Statistics and Evaluation. *The Essential School Health Services Program Data Report 2006 – 2007 School Year* Spring 2008.
15. Tudor-Locke C, Kronenfeld J, Kim S, Benin M, Kuby M. A geographical comparison of prevalence of overweight school-aged children: The National Survey of Children's Health 2003. *Pediatrics*. October 2007;120(4):e1043-e1050.
16. Childhood Obesity Action Network. How much do you know about the childhood obesity epidemic in Massachusetts? <http://nschdata.org/Viewdocument.aspx?item=220>. Accessed May 14, 2008.
17. Child and Adolescent Health Measurement Initiative. 2003 National Survey of Children's Health, Data Resource Center for Child and Adolescent Health website. Accessed 04/28/08 from [www.nschdata.org](http://www.nschdata.org).
18. Ogden C, Carool M, Curtin L, McDowell M, Tabak C, Flegal K. Prevalence of overweight and obesity in the United States, 1999-2004. *JAMA*. April 5 2006;295(13):1549-1555.

19. Massachusetts Department of Elementary and Secondary Education, Massachusetts Department of Public Health. *Health and Risk Behaviors of Massachusetts Youth, 2007: The Report* 2008.
20. Jahns L, Siega-Riz AM, Popkin BM. The increasing prevalence of snacking among US children from 1977 to 1996. *The Journal of Pediatrics*. 2001;138(4):493-498.
21. Kant AK, Graubard BI. Secular trends in patterns of self-reported food consumption of adult Americans: NHANES 1971-1975 to NHANES 1999-2002. *American Journal of Clinical Nutrition*. 2006;84(5):1215-1223.
22. Niemeier HM, Raynor HA, Lloyd-Richardson EE, Rogers ML, Wing RR. Fast food consumption and breakfast skipping: Predictors of weight gain from adolescence to adulthood in a nationally representative sample. *Journal of Adolescent Health*. 2006;39(6):842-849.
23. Van Horn L, Obarzanek E, Friedman LA, Gernhofer N, Barton B. Children's adaptations to a fat-reduced diet: The Dietary Intervention Study in Children (DISC). *Pediatrics*. 2005;115(6):1723-1733.
24. Demory-Luce D, Morales M, Nicklas T, Baranowski T, Zakeri I, Berenson G. Changes in food group consumption patterns from childhood to young adulthood: The Bogalusa Heart Study. *Journal of the American Dietetic Association*. 2004;104(11):1684-1691.
25. US Department of Health and Human Services, US Department of Agriculture. *Dietary Guidelines for Americans* 2005.
26. Wang YC, Gortmaker SL, Sobol AM, Kuntz KM. Estimating the energy gap among US children: A counterfactual approach. *Pediatrics*. 2006;118(6):e1721-1733.
27. Plachta-Danielzik S, Landsberg B, Bosy-Westphal A, Johannsen M, Lange D, Muller M. Energy gain and energy gap in normal-weight children: Longitudinal data of the KOPS. *Obesity*. 2008;16(4):777-783.
28. Troiano RP, Briefel RR, Carroll MD, Bialostosky K. Energy and fat intakes of children and adolescents in the United States: data from the National Health and Nutrition Examination Surveys. *American Journal of Clinical Nutrition*. 2000;72(5):1343S-1353.
29. Cook A, Friday J. Pyramid serving intakes in the United States 1999-2002, 1 Day. In: Community Nutrition Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, US Department of Agriculture, eds; 2005.
30. Rampersaud GC, Pereira MA, Girard BL, Adams J, Metz J. Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association*. 2005;105(5):743-760.
31. Affenito S. Breakfast: A missed opportunity. *Journal of the American Dietetic Association*. 2007;107(4):565-569.
32. Arcan C, Neumark-Sztainer D, Hannan P, van den Berg P, Story M, Larson N. Parental eating behaviours, home food environment and adolescent intakes of fruits, vegetables and dairy foods: longitudinal findings from Project EAT. *Public Health Nutrition*. Nov 2007;10(11):1257-1265.
33. Boutelle KN, Fulkerson JA, Neumark-Sztainer D, Story M, French SA. Fast food for family meals: relationships with parent and adolescent food intake, home food availability and weight status. *Public Health Nutrition*. 2006;10(01):16-23.
34. Glanz K, Resnicow K, Seymour J, et al. How major restaurant chains plan their menus: The role of profit, demand, and health. *American Journal of Preventive Medicine*. 2007;32(5):383-388.
35. Young LR, Nestle M. Portion sizes and obesity: Responses of fast-food companies. *Journal of Public Health Policy*. 2007;28(2):238-248.
36. Colapinto CK, Fitzgerald A, Taper LJ, Veugelers PJ. Children's preference for large portions: Prevalence, determinants, and consequences. *Journal of the American Dietetic Association*. 2007;107(7):1183-1190.

37. Fisher JO, Liu Y, Birch LL, Rolls BJ. Effects of portion size and energy density on young children's intake at a meal. *American Journal of Clinical Nutrition*. 2007;86(1):174-179.
38. Feldman S, Eisenberg ME, Neumark-Sztainer D, Story M. Associations between watching TV during family meals and dietary intake among adolescents. *Journal of Nutrition Education and Behavior*. 2007;39(5):257-263.
39. Gable S, Chang Y, Krull JL. Television watching and frequency of family meals are predictive of overweight onset and persistence in a national sample of school-aged children. *Journal of the American Dietetic Association*. 2007;107(1):53-61.
40. Taveras EM, Sandora TJ, Shih M-C, Ross-Degnan D, Goldmann DA, Gillman MW. The association of television and video viewing with fast food intake by preschool-age children. *Obesity*. 2006;14(11):2034-2041.
41. Boynton-Jarrett R, Thomas T, Peterson K, Wiecha J, Sobol A, Gortmaker S. Impact of television viewing patterns on fruit and vegetable consumption among adolescents. *Pediatrics*. 2003;112(6):1321-1326.
42. Committee on Food Marketing and the Diets of Children and Youth. *Food Marketing to Children and Youth: Threat or Opportunity?*. Washington: Institute of Medicine of the National Academies; 2006.
43. Batada A, Seitz M, Wootan M, Story M. Nine out of 10 food advertisements shown during Saturday morning children's television programming are for foods high in fat, sodium, or added sugars, or low in nutrient. *Journal of the American Dietetic Association*. 2008;108(4):673-678.
44. Baker E, Schootman M, Barnidge E, Kelly C. The role of race and poverty in access to foods that enable individuals to adhere to dietary guidelines. *Preventing Chronic Disease*. 2006;3(3):1-11.
45. Rose D, Richards R. Food store access and household fruit and vegetable use among participants in the US Food Stamp Program. *Public Health Nutrition*. 2007;7(8):1081-1088.
46. Liese AD, Weis KE, Pluto D, Smith E, Lawson A. Food store types, availability, and cost of foods in a rural environment. *Journal of the American Dietetic Association*. 2007;107(11):1916-1923.
47. Zenk SN, Powell LM. US secondary schools and food outlets. *Health & Place*. 2008;14(2):336-346.
48. California Center for Public Health Advocacy, PolicyLink, UCLA Center for Health Policy Research. *Designed for Disease The Link between local food environments and obesity and diabetes*; 2008.
49. New York City Council Weekly Newsletter. Council votes to create new permits for green vendors, bringing more fresh produce to underserved communities. Vol 11; 2008.
50. Gordon A, Fox M, Mathematica Policy Research Inc. School Nutrition Dietary Assessment Study III: summary of findings. In: United States Department of Agriculture Food and Nutrition Service Office of Research Nutrition and Analysis, ed; 2007.
51. Snelling A, Korba C, Burkey A. The National School Lunch and competitive food offerings and purchasing behaviors of high school students. *Journal of School Health*. Decembr 2007;77(10):701-705.
52. Anderson P, Butcher K. Reading, writing and Raisinets: Are school finances contributing to children's obesity? *NBER Working Paper*. 2005;11177.
53. Beaudoin C, Davee A, Devore R, et al. Implementation of low-fat, low-sugar, and portion-controlled nutrition guidelines in competitive food venues of Maine Public High Schools. *Journal of School Health*. 2007;77(10):687-693.
54. Cullen KW, Watson K, Zakeri I, Ralston K. Exploring changes in middle-school student lunch consumption after local school food service policy modifications. *Public Health Nutrition*. 2007;9(06):814-820.
55. Jaina N, Denka C, Kruse L, Dandolu V. Maternal obesity: Can pregnancy weight gain modify risk of selected adverse pregnancy outcomes? *American Journal of Perinatology*. 2007;24(5):291-298.

56. Shields L, O'Callaghan M, Williams GM, Najman JM, Bor W. Breastfeeding and obesity at 14 years: A cohort study. *Journal of Paediatrics and Child Health*. 2006;42(5):289-296.
57. Centers Disease Control. Does breastfeeding reduce the risk of pediatric overweight?; 2007.
58. Division of Nutrition Physical Activity and Obesity, National Center for Chronic Disease Prevention and Health Promotion. Table 2. Geographic-specific Breastfeeding Rates among Children born in 2004. 9/6/07; [http://www.cdc.gov/breastfeeding/data/NIS\\_data/data\\_2004.htm](http://www.cdc.gov/breastfeeding/data/NIS_data/data_2004.htm). Accessed 4/28/08.
59. Centers for Disease Control and Prevention. Physical activity trends--United States, 1990-1998. *MMWR- Morbidity & Mortality Weekly Report*. 2001;50(9):166-169.
60. Centers for Disease Control and Prevention. Physical activity levels among children aged 9-13 years -- United States, 2002. *MMWR- Morbidity & Mortality Weekly Report*. 2003;52(33):785.
61. Centers for Disease Control and Prevention. Adult participation in recommended levels of physical activity -- United States, 2001 and 2003. *MMWR- Morbidity & Mortality Weekly Report*. 2005;54(47):1208.
62. McCracken M, Jiles R, Blanck H. Health behaviors of the young adult U.S. population: Behavioral Risk Factor Surveillance System, 2003. *Preventing Chronic Disease*. 2007;4(2):A25.
63. Troiano R, Berrigan D, Dodd K, Masse L, Tillet T, McDowell M. Physical activity in the United States measured by accelerometer. *Medicine & Science in Sports & Exercise*. 2008;40(1):181-188.
64. Pate R, Pratt M, Blair S, al. e. Physical activity and public health. A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 1995;273:402-407.
65. Fleming-Moran M, Thiagarajah K. Behavioral interventions and the role of television in the growing epidemic of adolescent obesity: Data from the 2001 Youth Risk Behavioral Survey. *Methods of Information in Medicine*. 2005;44:303-309.
66. Kaur H, Choi W, Mayo M, Harris K. Duration of television watching is associated with increased body mass index. *Journal of Pediatrics*. 2003;143:506-511.
67. Robinson T. Television viewing and childhood obesity. *Pediatric Clinics in North America*. 2001;48:1017-1025.
68. Brener N, Kann L, Garcia D, et al. Youth risk behavior surveillance--selected steps communities, 2005. *MMWR Surveill Summary*. 2007;56(SS02):1-16.
69. Committee on Public Education. Children, Adolescents, and Television. *Pediatrics*. 2001;107(2):423-426.
70. Frank L, Andersen M, Schmid T. Obesity relationships with community design, physical activity, and time spent in cars. *American Journal of Preventive Medicine*. 2004;27:87-96.
71. deVries S, Bakker I, vanMechelen W, Hopman-Rock M. Determinants of activity-friendly neighborhoods for children: results from the SPACE study. *Am J Health Promot*. 2007;21(4):312-316.
72. Cawley J, Meyerhoefer C, Newhouse D. The correlation of youth physical activity with state policies. *Contemporary Economic Policy*. 2007;25(4):506-517.
73. Burdette H, Whitaker R. Resurrecting free play in young children looking beyond fitness and fatness to attention, affiliation, and affect. *Archives of Pediatric and Adolescent Medicine*. 2005;159:46-50.
74. Nader P. Frequency and intensity of activity of third-grade children in physical education. *Archives of Pediatric and Adolescent Medicine*. 2003;157:185-190.
75. Carrel A, Clark R, Peterson S, Nemeth B, Sullivan J, Allen D. Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program. *Archives of Pediatric and Adolescent Medicine*. 2005;159:963-968.

76. Lee S, Burgeson C, Fulton J, Spain C. Physical education and physical activity: Results from the School Health Policies and Programs Study 2006. *Journal of School Health*. 2007;77:435-463.
77. Massachusetts Department of Education. A Guide to Federal and State Special Education Requirements in Massachusetts. 2000.
78. Beighle A, Morgan C, Masurier G, Pangrazi R. Children's physical activity during recess and outside of school. *Journal of School Health*. 2006;76(10):516-520.
79. Stratton G, Ridgers N, Fairclough S, Richardson D. Physical activity levels of normal-weight and overweight girls and boys during primary school recess. *Obesity*. 2007;15:1513-1519.
80. Healthy Children Task Force. *Research and Evaluation*. Cambridge, MA: Institute for Community Health; 2007.
81. Institute for Community Health. *PEP Presentation to Somerville Public School District*. Somerville: Somerville Public School Department; Dec 5, 2007 2007.
82. Kim J, Must A, Fitzmaurice GM, et al. Relationship of physical fitness to prevalence and incidence of overweight among schoolchildren. *Obesity Research*. Jul 2005;13(7):1246-1254.
83. Malina RM. Physical fitness of children and adolescents in the United States: status and secular change. *Medicine & Sport Science*. 2007;50:67-90.
84. Pate RR, Wang CY, Dowda M, Farrell SW, O'Neill JR. Cardiorespiratory fitness levels among US youth 12 to 19 years of age. *Archives of Pediatric and Adolescent Medicine*. 2006;160:1005-1012.
85. Tomkinson GR, Leger LA, Olds TS, Cazorla G. Secular trends in the performance of children and adolescents (1980-2000): an analysis of 55 studies of the 20m shuttle run test in 11 countries. *Sports Medicine*. 2003;33(4):285-300.
86. American Heart Association, American Stroke Association, National Association for Sport and Physical Education. State of the Nation Report: State Requirements for Student Assessment in Physical Education. <http://www.aahperd.org/naspe/shapeofthenation/>. Accessed Jan 8, 2008.
87. C. S. Mott Children's Hospital. *Parental Concerns about Childhood Obesity: Time for a Reality Check?* Ann Arbor, MI: C.S. Mott Children's Hospital, the University of Michigan Department of Pediatrics and Communicable Diseases and the University of Michigan Child Health Evaluation and Research (CHEAR) Unit; 2007.
88. Akerman A, Williams ME, Meunier J. Perception versus reality: An exploration of children's measured body mass in relation to caregivers' estimates. *Journal of Health Psychology*. 2007;12(6):871-882.
89. He M, Evans A. Are parents aware that their children are overweight or obese? Do they care? *Canadian Family Physician*. Sep 2007;53(9):1493-1499.
90. Hackie M, Bowles CL. Maternal perception of their overweight children. *Public Health Nursing*. Nov-Dec 2007;24(6):538-546.
91. Nollen N, Befort C, Snow P, Daley C, Ellerbeck E, Ahluwalia J. The school food environment and adolescent obesity: qualitative insights from high school principals and food service personnel. *International Journal of Behavioral Nutrition and Physical Activity*. 2007;4(1):4-18.
92. West DS, Raczynski JM, Phillips MM, Bursac Z, Heath-Gauss C, Montgomery BE. Parental recognition of overweight in school-age children. *Obesity*. 2008;16(3):630-636.
93. Hasler G, Buysse D, Klaghofer R, et al. The association between short sleep duration and obesity in young adults: a 13-year prospective study. *Sleep*. 2004;27(4):661-666.
94. Oken E, Gillman M. Fetal origins of obesity. *Obesity*. 2003;11(4):496-506.

95. Stokols D. Translating social ecological theory into guidelines for community health promotion. *American Journal of Health Promotion*. 1996;10:281-298.
96. Health Management Associates. *The Financial Cost Of Specific Risk Factors In The Commonwealth of Massachusetts*. Boston, MA 2003.
97. The Conference Board. *Weights and measures: What employers should know about obesity* April 9 2008.
98. Finkelstein E, Fiebelkorn I, Wang G. State-level estimates of annual medical expenditures attributable to obesity. *Obesity Research*. 2004;12(1):18-24.
99. Health Management Associates. *The financial cost of specific risk factors in the Commonwealth of Massachusetts: a report to Massachusetts Department of Public Health Boston, Massachusetts* November 7 2003
100. Finkelstein E, Fiebelkorn I, Wang G. National medical spending attributable to overweight and obesity: How much, and who's paying? *Health Affairs (Millwood)*. Jan-Jun 2003(Web Exclusives):W3-219-226.
101. Finkelstein E, Trogon J. Public health interventions for addressing childhood overweight: analysis of the business case. *American Journal of Public Health*. 2008;98(3):411-415.
102. Baker JL, Olsen LW, Sorensen TIA. Childhood body-mass index and the risk of coronary heart disease in adulthood. *New England Journal of Medicine*. 2007;357(23):2329-2337.
103. Must A JP, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. *N Engl J Med*. Nov 5 1992;327(19):1350-1355.
104. Lee J, Herman W, McPheeters M, Gurney J. An epidemiologic profile of children with diabetes in the U.S. . *Diabetes Care*. 2006;29:420-421.
105. Duncan G. Prevalence of diabetes and impaired fasting glucose levels among US adolescents: National Health and Nutrition Examination Survey, 1999-2002. *Archives of Pediatric and Adolescent Medicine*. 2006;160:523-528.
106. National Diabetes Information Clearinghouse. Diabetes Overview. <http://diabetes.niddk.nih.gov/dm/pubs/overview/index.htm>. Accessed June 6, 2008.
107. Fagot-Campagna A, Pettitt D, Engelgau M, et al. Type 2 diabetes among North American children and adolescents: an epidemiologic review and a public health perspective. *Journal of Pediatrics*. 2000;136:664-672.
108. McEwen BS, Seeman T. Protective and damaging effects of mediators of stress. Elaborating and testing the concepts of allostasis and allostatic load. *Annals of the New York Academy of Sciences*. 1999;896:30-47.
109. Baker J, Olsen L, Sorenson T. Childhood body-mass index and the risk of coronary heart disease in adulthood. *New England Journal of Medicine*. 2007;357(23):2329-2337.
110. Bibbins-Domingo K, Coxson P, Pletcher M, Lightwood J, Goldman L. Adolescent overweight and future coronary heart disease. *New England Journal of Medicine*. 2007;357(23):2371-2379.
111. Duncan GE, Li SM, Zhou XH. Prevalence and trends of a metabolic syndrome phenotype among U.S. adolescents, 1999-2000. *Diabetes Care*. Oct 2004;27(10):2438-2443.
112. Ford ES, Ajani UA, Mokdad AH, National Health and Nutrition E. The metabolic syndrome and concentrations of C-reactive protein among U.S. youth. *Diabetes Care*. Apr 2005;28(4):878-881.
113. Hedley A, Ogden C, Johnson C, Carroll M, Curtin L, Flegal K. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA*. 2004;16(23):2847-2850.
114. Morrison J, Friedman L, Gray-McGuire C. Metabolic syndrome in childhood predicts adult cardiovascular disease 25 years later: the Princeton Lipid Research Clinics Follow-up Study. *Pediatrics*. 2007;120(2):340-345.

115. Bar-Or O, Baranowski T. Physical activity, adiposity, and obesity among adolescents. *Pediatric Exercise Science*. 1994;6:348-360.
116. Berkey CS, Rockett HRH, Field AE, Gillman MW, Colditz GA. One-year changes in activity and in inactivity among 10- to 15-year-old boys and girls: relationship to change in body mass index. *Pediatrics*. 2003;111(4):836-843.
117. Bovet P, Auguste R, Burdette H. Strong inverse association between physical fitness and overweight in adolescents: a large school-based survey. *International Journal of Behavioral Nutrition and Physical Activity*. 2007;4:24.
118. Grund A, Dilba B, Forberger K, et al. Relationships between physical activity, physical fitness, muscle strength and nutritional state in 5- to 11-year-old children. *European Journal of Applied Physiology*. 2000;82(5-6):425-438.
119. Trost S, Sirard J, Dowda M, Pfeiffer K, Pate R. Physical activity in overweight and nonoverweight preschool children. *International Journal of Obesity & Related Metabolic Disorders*. 2003;27(7):834-839.
120. Watts K, Jones T, Davis E, Green D. Exercise training in obese children and adolescents: current concepts. *Sports Medicine*. 2005;35(5):375-392.
121. Ferguson MA, Gutin B, Le NA, et al. Effects of exercise training and its cessation on components of the insulin resistance syndrome in obese children. *International Journal of Obesity & Related Metabolic Disorders*. 1999;23(8):889-895.
122. Daniels SR, Arnett DK, Eckel RH, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. *Circulation*. 2005;111(15):1999-2012.
123. Decsi T, Molnar D, Koletzko B. Reduced plasma concentrations of alpha-tocopherol and beta-carotene in obese boys. *Journal of Pediatrics*. Apr 1997;130(4):653-655.
124. Molnar D, Decsi T, Koletzko B. Reduced antioxidant status in obese children with multimetabolic syndrome. *International Journal of Obesity & Related Metabolic Disorders*. Oct 2004;28(10):1197-1202.
125. Sarni R, deSouza F, Ramalho R, et al. Serum retinol and total carotene concentrations in obese pre-school children. *Medical Science Monitor*. 2005;11(11):510-514.
126. Strauss RS. Comparison of serum concentrations of alpha-tocopherol and beta-carotene in a cross-sectional sample of obese and nonobese children (NHANES III). National Health and Nutrition Examination Survey. *Journal of Pediatrics*. 1999;134(2):160-165.
127. Suitor CW, Gleason PM. Using Dietary Reference Intake-based methods to estimate the prevalence of inadequate nutrient intake among school-aged children. *Journal of the American Dietetic Association*. Apr 2002;102(4):530-536.
128. Schwimmer J, Burwinkle T, Varni J. Health-related quality of life of severely obese children and adolescents. *JAMA*. 2003;289(14):1813-1819.
129. Datar A, Sturm R, Magnabosco J. Childhood overweight and academic performance: National Study of Kindergartners and First-Graders. *Obesity Research*. 2004;12(1):58-68.
130. Datar A, Sturm R. Childhood overweight and elementary school outcomes. *International Journal of Obesity*. 2006;30(9):1449-1460.
131. Bonilla S, Kehl S, Kwong K, Morphew T, Kachru R, Jones C. School absenteeism in children with asthma in a Los Angeles inner city school. *Journal of Pediatrics*. 2005;147(6):802-806.
132. Glaab L, Brown R, D D. School attendance in children with Type 1 diabetes. *Diabetic Medicine*. 2005;22(4):421-426.

133. Chomitz V SM, Dawson G, McGowan R, Hacker K. Is there a relationship between physical fitness and academic achievement? Positive results from Cambridge, MA Public Schools. Paper presented at: The 134th Annual Meeting & Exposition (November 4-8, 2006) of APHA, 2006; Boston, MA.
134. Chomitz V SM, Dawson G, McGowan R, Hacker K. Is there a relationship between physical fitness and academic achievement? Postive results from public school children in the northeastern U.S. *Journal of School Health*. In press.
135. Sibley B, Etnier J. The relationship between physical activity and cognition in children: A meta-analysis. *Pediatric Exercise Science*. 2003;15:243-256.
136. Tomporowski P. Cognitive and behavioral responses to acute exercise in youths: A review. *Pediatric Exercise Science*. 2003;15(348-359).
137. Shephard R. Curricular physical activity and academic performance. *Pediatric Exercise Science*. 1997;9:113-126.
138. Coe D, Pivarnik J, Womack C, Reeves M, Malina R. Effect of physical education and activity levels on academic achievement in children. *Medicine and Science in Sports and Exercise*. 2006;38:1515-1519.
139. Ahamed Y, MacDonald H, Reed K, Naylor P, Liu-Ambrose T, McKay H. School-based physical activity does not compromise children's academic performance. *Medicine and Science in Sports and Exercise*. 2007;39:371-376.
140. Jarrett O, Maxwell D, Dickerson C, Hoge P, Davies G, Yetley A. Impact of recess on classroom behavior: group effects and individual differences. *The Journal of Educational Research* 1998;92:121-126.
141. Hampl SE, Carroll CA, Simon SD, Sharma V. Resource utilization and expenditures for overweight and obese children. *Archives of Pediatrics & Adolescent Medicine*. 2007;161(1):11-14.
142. Wang G, Dietz WH. Economic burden of obesity in youths aged 6 to 17 years: 1979-1999. *Pediatrics*. 2002;109(5):e81.
143. Woolford S, Gebremariam A, Clark S, Davis M. Incremental hospital charges associated with obesity as a secondary diagnosis in children. *Obesity*. 2007;15(7):1895-1901.
144. Buescher PA, Whitmire JT, Plescia M. Relationship between body mass index and medical care expenditures for North Carolina adolescents enrolled in Medicaid in 2004. *Preventing Chronic Disease*. Jan 2008;5(1):A04.
145. Daviglus M, Liu K, Yan L, et al. Relation of body mass index in young adulthood and middle age to Medicare expenditures in older age. *JAMA*. 2004;292(11):2743-2749.
146. Boston Public Health Commission. Mayor Menino unveils Think About Your Drink 2008.
147. Child Nutrition Outreach Program. Better Breakfast Initiative. <http://www.meals4kids.org/sb/betterbreakfast.html>. Accessed 5/1/08.
148. Harvard Pilgrim Healthcare Foundation. *Tipping the Scales in Favor of Our Children* June 2008.
149. MetroWest Community Healthcare Foundation. *Childhood obesity: Understanding and addressing an epidemic* 2007.
150. Economos C, Hyatt R, Goldberg J, et al. A community intervention reduces BMI z-score in children: Shape Up Somerville first year results. *Obesity*. May 2007;15(5):1325-1336.
151. Healthy Children Task Force. *Healthy Living Cambridge Kids How the Cambridge Healthy Children Task Force brought a community together to work toward healthy weight – and succeeded*. Cambridge, MA 2007.
152. The Commonwealth of Massachusetts. <http://www.mass.gov/legis/> Accessed Feb 14, 2008.



153. An act making appropriations for the fiscal year 2008 for the maintenance of the departments, boards, commissions, institutions and certain activities of the Commonwealth, for interest, sinking fund and serial bond requirements and for certain permanent improvements. 185th ed; 2007.
154. National Conference of State Legislatures. Childhood Obesity – 2007 Update of Legislative Policy Options. December 2007; <http://www.ncsl.org/programs/health/ChildhoodObesity-2007.htm#state>. Accessed 2/14/08.
155. Justus M, Ryan K, Rockenbach J, Katterapalli C, Card-Higginson P. Lessons learned while implementing a legislated school policy: Body mass index assessments among Arkansas's public school students. *Journal of School Health*. 2007;77(10):706-714.
156. Ryan K, Card-Higginson P, McCarthy S, Justus M, Thompson J. Arkansas fights fat: Translating research into policy to combat childhood and adolescent obesity. *Health Affairs*. 2006;25(4):992-1004.
157. Library of Congress. Thomas.
158. Food and Nutrition Act of 2007 (Public Law 88-525); 2008.
159. Gordon-Larsen P, Adair LS, Nelson MC, Popkin BM. Five-year obesity incidence in the transition period between adolescence and adulthood: the National Longitudinal Study of Adolescent Health. *American Journal of Clinical Nutrition*. 2004;80(3):569-575.
160. Brener ND KL, Garcia D, MacDonald G, Ramsey F, Honeycutt S, Hawkins J, Kinchen S, Harris WA; Centers for Disease Control and Prevention (CDC). Youth risk behavior surveillance--selected steps communities, 2005. *MMWR Surveill Summ*. February 23, 2007 2007;56(SS02):1-16.
161. Office of Disease Prevention and Promotion, US Department of Health and Human Services. Healthy People 2010 <http://www.healthypeople.gov/>. Accessed 1/10/08.
162. U.S. Department of Health and Human Services, U.S. Department of Agriculture. Dietary Guidelines for Americans, 6th Edition. January 2005; 6th:<http://www.health.gov/dietaryguidelines/dga2005/document/pdf/DGA2005.pdf>.
163. US Department of Agriculture. MyPyramid. [www.mypyramid.gov](http://www.mypyramid.gov). Accessed 1/3/08.
164. Rodearmel SJ, Wyatt HR, Stroebele N, Smith SM, Ogden LG, Hill JO. Small changes in dietary sugar and physical activity as an approach to preventing excessive weight gain: The America on the Move Family Study. *Pediatrics*. 2007;120(4):e869-879.
165. US Department of Agriculture. Team Nutrition <http://teammnutrition.usda.gov/Default.htm>. Accessed 5/1/08.
166. US Department of Health and Human Services, Centers for Disease Control and Prevention. Physical activity and good nutrition: essential elements to prevent chronic disease and obesity 2008. <http://www.cdc.gov/nccdphp/publications/aag/pdf/dnpa.pdf>. Accessed 5/1/08.
167. Centers for Disease Control. Physical Activity and Good Nutrition: Essential Elements to Prevent Chronic Diseases and Obesity: At A Glance 2008. <http://www.cdc.gov/nccdphp/publications/aag/pdf/dnpa.pdf>.

## **Appendix I.**

### **State, National and International Health Data on Childhood Obesity**

National Health and Nutrition Examination Survey (NHANES). NHANES data are obtained by direct measurement and physical examinations conducted by study staff. The National Health and Nutrition Examination Survey formulated a report entitled “Health, United States, 2007,” which summarizes child obesity trends from the early 1960s to 2004.

Pediatric Nutrition Surveillance System (PedNSS). PedNSS tracks health outcome data in low-income children between birth and five years old participating in Federal child nutrition programs. Data are collected as part of clinic visits then analyzed at the state level.

National Longitudinal Study of Adolescent Health (AddHealth). AddHealth examined the influence that social and community factors have on risk behaviors of adolescents and subsequent health outcomes in young adulthood. Subjects were initially surveyed in 1994-1996, with followup in-home interviews one, two and six years later. BMI was assessed by self-reported height and weight, then by direct measure in followup interviews.<sup>159</sup>

National Survey of Children’s Health (NSCH). NSCH data are obtained by random digit dialing using the State and Local Area Integrated Telephone Survey program. Massachusetts data are available from the 2003-2004 survey. Data collection on the most recent round of NSCH concluded February 2008.

Youth Risk Behavior Surveillance Survey (YRBSS). The YRBSS collects anonymous self-reported data on height, weight, diet, physical activity from students in grades 9-12. Massachusetts data are available through 2007. Boston data from the YRBSS are available due to the city’s participation in the CDC’s “Steps to a Healthier U.S.” campaign. Data specifically from Boston (YRBSS), indicate that 19.7 percent of students (21.7 percent of girls, 17.7 percent of boys) are overweight and 15.8 percent of students (11.8 percent of girls and 19.6 percent of boys) are obese.<sup>160</sup>

Massachusetts Essential School Health Services Data (MESHS). The Massachusetts Department of Public Health’s MESHS program promotes comprehensive school health services and coordination with local healthcare providers. Health screenings, including height and weight measurements are part of this model. During 2006-2007, height and weight of pupils in grades 1, 4, 7 and 10 were measured in 89 of the 109 Massachusetts school districts (82 percent of participating districts) participating in the ESHS Program. Statewide data are expected to be more complete in the 2008-2009 school year when BMI screening will be mandatory for grantees.

## **Appendix II.**

### **National Childhood Obesity Programs**

#### *Healthy People 2010*

The DHHS Office of Disease Prevention and Health Promotion coordinates Healthy People objectives. This framework establishes goals and objectives for the health of the United States population.<sup>161</sup>

#### *U.S. Dietary Guidelines/MyPyramid*

To reduce risk of chronic disease, the Dietary Guidelines for Americans makes recommendations for healthful dietary practices. The guidelines are formulated by a committee comprised of nutrition and health experts and set the standard for U.S. policy on school lunch and food labeling.<sup>162</sup> Stemming from the Dietary Guidelines, the “MyPyramid” campaign was launched in 2005, revising the original Food Pyramid to offer a personalized approach to guiding dietary practices. Tailored food pyramids focus on special populations including children, mothers, pregnant and breastfeeding women.<sup>163</sup>

#### *USDA National School Lunch Program (NSLP)*

The federal requirement for the establishment of a school wellness policy, in schools participating in the USDA NSLP, has brought a focus on the school nutrition environment. Since its initiation in 1946, child nutrition programs have been expanded to include breakfast, afterschool snacks, summer meals, farm to school initiatives and fruit and vegetable distribution programs. The common goal for all these programs remains the same: to prevent malnutrition and improve the health of the nation’s children. The USDA has proposed a change in commodity allocation to allow states to purchase more fruits and vegetables at lower commodity prices. This would help schools to better achieve the goals set by the Dietary Guidelines for Americans and the School Meals Initiative.

#### *The Small Steps Kids Campaign*

This partnership between DHHS and the America on the Move Foundation focuses on making small changes for prevention of overweight and obesity through an ad campaign promoting physical activity and nutrition in children. Small Steps uses television advertisements featuring celebrity athletes and online games and resources to motivate and teach children to eat healthfully and become more physically active and a website to educate children about diet and activity.<sup>164</sup>

#### *The Corporate Challenge To Step Up and End Childhood Obesity*

This government-industry partnership aims to prevent child obesity by empowering the household gatekeeper to model healthy lifestyle and by providing information to guide healthy food choices. A government-sponsored meeting took place on February 6, 2008 that invited 25 trade associations to formulate ways to encourage a healthy lifestyle for consumers. Projects are posted on the *mypyramid.gov* website.

### Food and Nutrition Service Team Nutrition: Healthier U.S. School Challenge

This USDA program recognizes schools' effectiveness in promoting healthful diet and physical activity, hoping to encourage other schools to strive for improvement. *Team Nutrition* provides resources that guide schools to improve the health and nutrition environment through education, technical assistance and fostering community support. The tool kit *Changing the Scene – Improving the School Nutrition Environment* guides schools to improve their wellness environment.<sup>165</sup>

### CDC Initiatives

The CDC conducts multiple surveillance surveys that collect data on child weight status including evaluation and a guide to public health practice (Appendix I). The CDC provides clinical guidelines and toolkits, and encourages health professionals to be updated on literature concerning nutrition, physical activity, and obesity to promote clinical best practices to address childhood overweight and obesity. These services will soon be part of a network that has the potential to enhance communication about successful program strategies. The CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO) will work to reduce and prevent obesity and chronic disease through a \$38 million 2008 fiscal budget. The DNPAO funded 28 states to prevent and control obesity in 2007. The 2008 funding announcement has not yet occurred, but newly funded states in 2008 will aim to promote physical activity, encourage eating of fruits and vegetables, discourage sugar-sweetened beverages, promote initiation and duration of breastfeeding, and reduce energy-dense food consumption and screen time.<sup>166 167</sup>

In 2007, the CDC supported an expert panel to formulate recommendations for child and adolescent overweight and obesity, which was released in *Pediatrics*. The CDC worked with the National Initiative for Children's Healthcare Quality to establish a communication and networking center to share effective child obesity prevention practices and policies.

### Fruits and Veggies - More Matters

Replacing the *5-A-Day* program, "More Matters" is an awareness tool whose label accompanies fruits and vegetables in stores. Information about the positive impact of fruits and vegetables on the prevention of chronic diseases is published online for public viewing. In addition, the program aims to raise awareness about the different forms of fruits and vegetables, including fresh, frozen, canned, dried, and 100 percent juice products. Through partnerships with the CDC, and Produce for Better Health Foundation, the *More Matters* program aims to increase daily eating of fruits and vegetables.

### Healthy Youth for a Healthy Future

The Department of Health and Human Services launched this initiative in November 2007. It aims to recognize communities fighting childhood obesity in the U.S. through physical activity, healthful diet, and healthy lifestyle. It will use the HHS *Childhood Overweight and Obesity Prevention Council* to research, support, and apply programs that prevent child obesity.

### President's Council on Fitness and Sports

The president's council on fitness and sports is a volunteer organization through the federal office of HHS. The council consists of 20 members that encourage the public to be physically active through publications, projects, and programs. For schools, this program now has four components: the physical fitness test, the health fitness test, the active lifestyle program, and the presidential champions program. Each component of the program aims to promote physical activity. The physical fitness and health fitness tests assess basic components of fitness for students—endurance, flexibility, and strength. The active lifestyle and presidential champions programs offer education tools and activities to allow students to reach the physical activity goal of 60 minutes daily, five days each week.

### WE CAN (Ways to Enhance Children's Activity and Nutrition)

*WE CAN* is a program lead by the National Heart Lung and Blood Institute. It is an evidence-based program focusing on nutrition, physical activity and decreased screen time for families, schools, communities, healthcare providers, health departments, and worksites. Partners in Massachusetts include:

- *Boston Steps* (Boston Public Health Commission) is funded by the CDC as part of the Steps to a Healthier U.S. campaign. The program focuses on reducing overweight and obesity, diabetes and asthma in high risk neighborhoods. The campaign is centered around a multi-level action plan that engages community partners to enable community members to improve their diet, physical activity and reduce tobacco use. The Commission utilized the *WE CAN* framework to extend its outreach to parents. It partnered with Boston Organization of Nutritionists of Color to deliver culturally appropriate nutrition and lifestyle education.
- *Operation Better Start* (Hillcrest Campus of Berkshire Medical Center) coordinates healthcare providers, community agencies and the Pittsfield school system to promote healthy lifestyles. *WE CAN* components include:
  - Implementation of *CATCH* curriculum at YMCA after-school programs and at Pittsfield Public schools.
  - Use of the *WE CAN* parent curriculum in Head Start.
  - Distribution of *WE CAN* educational flyers by pediatricians.

### The Institute of Medicine Committee on Childhood Obesity Prevention

This committee leads discussions and publishes reports outlining strategies for the prevention and treatment of child overweight and obesity.

### **Appendix III. National Private Initiatives**

#### *Alliance for a Healthier Generation*

The *Alliance for a Healthier Generation*, through the American Heart Association and the Clinton Foundation, has created a Healthy Schools Program, Industry Program, Kids Movement, and Healthcare Program to combat obesity. These programs work in different facets of society to prevent and treat child overweight and obesity. The Healthy Schools Program works with schools to increase physical activity, sell healthful foods in both vending machines and cafeterias, and encourage teachers and staff to live healthy lifestyles and act as role models. The Industry Program works with companies and trade associations to offer children healthy options for physical activity and diet. The Kids Movement will assist children by helping them incorporate healthful foods and activities into their day. The Healthcare Program works by providing tools and resources to healthcare professionals.

#### *Active Living Research (ALR)*

ALR is a program of the Robert Wood Johnson Foundation. It supports scientific research to determine factors in the environment and aspects of politics that affect physical activity. The research mainly focuses on youth in low-income and high-risk communities. Research findings are used, among other things to promote an active lifestyle, to inform policy and contribute to a successful design of the built environment. A local example of a funded project through ALR was the *Boston Schoolyards Initiative*, which was initiated by the Boston Greenspace Alliance and the Urban Land Use task force supported by Mayor Menino. They came together as a public-private partnership which was dedicated to redeveloping schoolyards and transforming them into active play spaces and outdoor learning environments. Approximately half of Boston's schools were renovated and the schoolyards have colorful, safe play equipment, teaching gardens, outdoor amphitheaters, and classroom space.

#### *AAHPERD STARS*

This is a National Association for Sport and Physical Education (NASPE) national achievement program recognizing outstanding physical education programs in K-12 schools across America. Among others, criteria for receiving a STAR include time requirements for physical education and activity, professional qualifications and development for school staff, physical education teacher-to-student ratio, facilities and equipment for safe physical activity, inclusion of students with disabilities, and a program mission statement and evaluation procedure.

**Appendix IV.**

**Table 1. 2007 State Legislation (adapted from Trust for America’s Health)<sup>5</sup>**

Type of Legislation	Proposed, not Enacted	Enacted
School Nutrition Standards	<b>14 States:</b> FL, IN, IA, ME, <b>MA</b> , MO, MT, NH, NY, OH, TN, TX, VI, WV	<b>7 States:</b> AR, CA, CO, MS, NJ, NC, OR
Nutrition Education Requirement	<b>12 States:</b> CA, HI, IL, IA, <b>MA</b> , NJ, NM, NY, OH, TX, VA, WY	<b>2 States:</b> MS, NV*
BMI Collection	<b>6 States:</b> CT, KS, ME, MS, NJ, VA	<b>2 States:</b> NY, TX
Physical Activity (min requirement)	<b>20 States:</b> AZ, CO, CT, HI, IL, IA, KS, KY, LA, ME, MD, MI, MN, MO, NJ, NY, OH, TN, VA, WA	<b>13 States:</b> AR, KS, CA, FL, MS, NV* NH, NM, ND, OK, OR, PA*, RI, TX
Type II Diabetes Screening	<b>2 States:</b> IN and VA	<b>4 States:</b> OK, RI, SD, TN
Wellness Policies	<b>1 State:</b> MS	<b>5 States:</b> FL, <b>MA</b> , MN, OH, WA
Trans Fat Restrictions	<b>10 States:</b> FL, IN, ME, <b>MA</b> , MS, MO, NY, OH, TN, VI	<b>4 States:</b> CA, NJ, NC, OR

