


Health of Massachusetts:
Impact of Overweight and Obesity (1998-2007)

Overweight and Obesity Prevention and Control
Wellness Division
Bureau of Community Health Access and Promotion

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Deval L. Patrick, Governor
Timothy P. Murray, Lieutenant Governor
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John Auerbach, Commissioner of Public Health

Massachusetts Department of Public Health | 2009

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Figures

Tables

[i] In this document: ***Percent*** (proportion) is defined as fraction of the population affected by the specific disease/condition under discussion. ***Prevalence*** is defined as the ratio of the number of cases of a disease present in a statistical population at a specified time. The term percent is used whenever the fraction is determined using actual number of the population in the denominator (ex. all 2-5 year old WIC participating children) and prevalence estimate is used when data is drawn from a statistical sample (ex. BRFSS survey).

Introduction

The Overweight/Obesity Prevention and Control Initiative (OPCI) within the Wellness Division supports state and local efforts to promote good nutrition and physically active lifestyles by providing programmatic and technical assistance to public, private and community based organizations and by conducting and evaluating evidence-informed interventions. OPCI also participates in statewide strategic planning activities as a partner in the *Massachusetts Partnership for Healthy Weight* (MPHW). The MPHW is a collaborative of Massachusetts agencies, organizations, and community groups committed to preventing and controlling overweight and obesity among Massachusetts residents.

In this report, OPCI uses data from multiple sources (such as the Behavioral Risk Factor Surveillance System, Youth Risk Behavior Survey, Pediatric Nutrition Surveillance System, peer-reviewed literature, etc.) to summarize the scope and impact of overweight and obesity[ii] in the Commonwealth. The MPHW will use these data to promote an understanding of how overweight, obesity, and weight-associated conditions affect Massachusetts residents and to inform the development and implementation of a statewide action plan addressing these conditions across the lifespan. Data presented here will provide public health professionals, community coalitions, and policymakers with the information necessary to develop and sustain programs, policies, and infrastructure that support healthy eating and active living among Massachusetts residents.

[ii] In this document the word **'Obesity'** is used as a more concise term to describe the overweight-obesity continuum. Both 'overweight' and 'obesity' not only are risk factors to various chronic diseases (such as diabetes, heart disease and stroke), but also in turn are outcomes of important behavioral risk factors, namely poor nutrition and inadequate physical activity. As such effort would be made to tease out a) the duality of these characteristics (a 'risk factor' and 'outcome' at the same time) and b) the natural continuum feature they exhibit (overweight-to-obesity or vise versa). Specific data would be provided when one or both conditions are met (or mentioned for lack of it) and help the reader gain clarity of this complex relationship. For detailed definition of both overweight and obesity please see appendix A.

Executive Summary

Currently, more than half of Massachusetts adults are either overweight or obese, about 25% of high school youth and more than a third of 2-5 year old children participating in the WIC program are either at risk-of becoming overweight or are overweight.[iii] [1,14] Overweight and obesity place people at increased risk for potentially disabling conditions such as type 2 diabetes, heart disease, stroke, gall bladder disease, and musculoskeletal disorders.[17, 18, 19]

Compared with healthy weight adults, obese adults are more than three times as likely to have been diagnosed with diabetes or high blood pressure.[9] The prevalence of diabetes among overweight or obese women is fourfold that of their peers with healthy weight. For men being overweight or obese more than doubles the likelihood of having diabetes.[23]

In addition, overweight and obesity are associated with some forms of cancer, and many other health problems that interfere with daily living and reduce the quality of life.[20, 21] Nationally, one in five cancer-related deaths may be attributable to overweight and obesity in female non-smokers and one in seven among men non-smokers (≥ 50 years of age).[21]

Overweight and obesity are significantly associated with several clinical markers for morbidity.[9] On average, men and women who were obese at age 40 lived 5.8 and 7.1 fewer years, respectively, than their healthy weight peers.[37]

Overweight and obese women enrolled in the Massachusetts WIC program were more likely than healthy weight women to gain in excess of the recommended weight during their pregnancy (62.9% vs. 44.7%).[27] Studies show pre-pregnancy overweight is linked with increased risk of late fetal deaths.[28]

Overweight female middle and high school students are more likely to engage in unhealthy practices such as fasting, vomiting, or taking diet pills or laxatives to control their weight.[14] High school students who perceive themselves to be overweight are more likely than their peers to have considered suicide, attempted suicide or experienced dating violence.[14] Overweight young children face increased risks for chronic diseases and there are emerging concerns around type 2

[iii] Overweight is defined and determined differently in children and adolescents than in adults. For adults Body Mass Index≥ 25 is considered overweight. For children and adolescents, a BMI at or above the 95th percentile (based on WHO-CDC age and sex specific growth chart) indicates overweight and a BMI ≥ 85th percentile but ≤ 95th percentile is considered 'At-risk-of-overweight' .

diabetes. Four out of five Massachusetts pediatric clinicians surveyed estimate that between 1% and 9% of their young overweight patients have type 2 diabetes.[34]

There are disparities in the distribution of the obesity epidemic, especially among some ethnic groups and minorities. For example, 66.5% of Hispanics and 70.3% of Black non-Hispanic adults report being overweight as compared to their White non-Hispanic counterparts with 55.6% reporting to be overweight.[1] Obesity prevalence among non-Hispanic Black women is more than one and half times the state average (36.7% vs. 21.7%).[1] With 30.9% obesity prevalence, Hispanic women do not fare mush better.[1] These disparities are further compounded by the association of lower levels of both education and household income with higher rates of overweight and obesity.[1]

Unhealthy trends in nutrition and physical activity behaviors are at the center of the growing obesity epidemic. Obesity, a result of excessive weight gain, is influenced by two important elements: energy intake and energy expenditure (measured in calories). The energy balance equation states that when calories consumed are greater than calories expended by the body, the result is weight gain.[45] Calorie intake, among other things, is influenced by the variety and composition of food we eat. Carbohydrates and fats continue to be major calorie source in the American diet.

Fruits and vegetables are main sources of several minerals and vitamins but are not calorie dense. The United States Department of Agriculture (USDA) guidelines for a balanced and healthy diet recommend an average daily consumption of five or more servings of fruits and vegetables, [45] but more than two-thirds of Massachusetts adults and 85% of high school students fall short of this recommendation.[14, 47]

Besides nutrition (the calorie intake factor), the calorie expenditure factor - mainly through participation in some form of physical activity - is the other important element in the energy balance equation (calorie intake-calorie expanded = net weight gain). Almost half of Massachusetts residents over 18 years old do not regularly participate in either moderate or vigorous physical activity.[47] Long hours of TV watching and computer use further exacerbate the problem of sedentary lifestyles. Twice as many children who are overweight eat their meals in front of TV compared with their healthy weight peers.[14] More than half (55%)of Black high school students and 43% of Hispanic students watch three or more hours of television a day, which adds to the elevated risk for overweight these groups already face.[14]

Several health and social theoretical models explain how perception, motivation, skills and one's social environment influence health and preventative behaviors (ex. tobacco smoking and second hand smoking regulations, availability of parks and walk/bike trails).[iv] Important social environments that may influence Massachusetts residents' nutrition and physical activity behavior were assessed through a survey of Massachusetts Municipalities (cities and towns).[66] The Community Survey shows cities and towns do little to encourage healthy eating. Most vending machines in municipal buildings dispense low nutrient-value choices such as soda or candy, chips, and cookies. Only 1% of cities and towns require that vending machines offer healthier options.[66] Few towns sponsor programs, such as public information campaigns, to promote good health or nutrition.

More than a few studies across the nation show that non-white minorities and the rural poor either face higher prices and/or limited access to supermarkets that provide a variety of healthy choices at reasonable prices.[67,68,69] Currently, there is no Massachusetts statewide data system that captures residents' access to healthy foods and purchasing behavior at supermarkets and grocers.

The same Community survey showed resources to support residents' participation in moderate or vigorous physical activity are constrained. For example, most towns and cities do not have policies requiring that bikeways and walkways exist alongside roads and streets, to and around school and shopping centers, to and within parks or to public transportation. Also, only 15% of the Commonwealth's cities and towns responding to the survey encouraged children to walk or bike to school.[66] Statewide data of physical activity resources could assist communities to build capacity, conduct needs assessment and develop a plan of action.

Economic Implications

The economic implication of obesity and related health expenditures is considered to be high, but quantifying the exact figures has been difficult. Obesity is not generally recognized as a disease, and is therefore rarely listed as a primary diagnosis in hospital and medical records. Furthermore there is no single system or database existing that allows for the systematic collection and reporting of obesity's impact on state-level medical spending. Using the data sources currently

[iv] For further details see the Health Behavior Model, Stages of Change and the Socio-ecological Model in appendix A.

available, a conservative estimate of obesity-related medical costs for Massachusetts is estimated at $1.8 billion in 2003 dollars. However, these estimates do not capture out-of-pocket expenses such as over-the-counter diet pills and membership to weight loss/maintenance programs.[39]

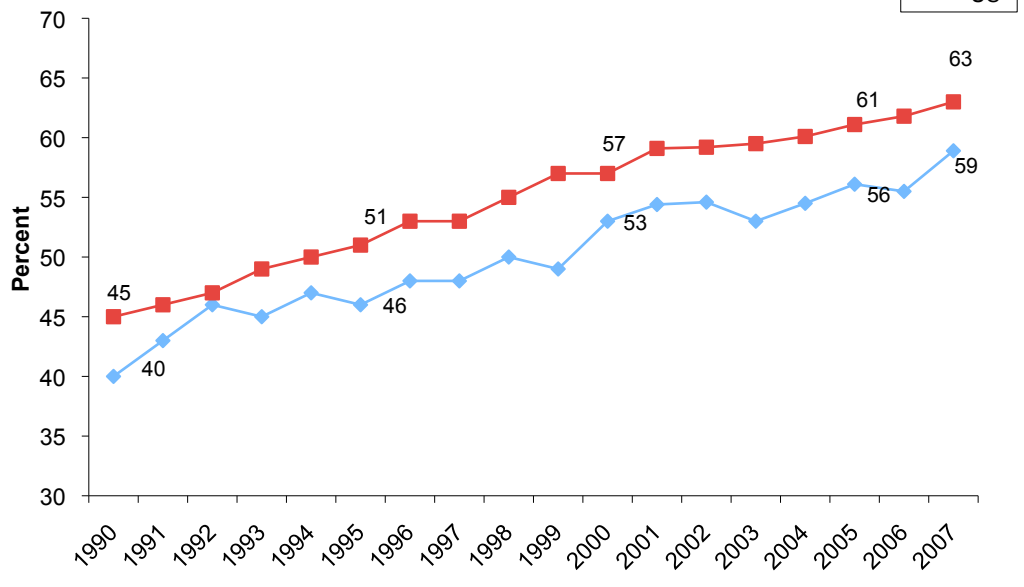
According to the "social-ecological model" theory, policies and systems within a society, community, organization, family and interpersonal relationships are part of the multi-layered system that influence individual health behaviors such as nutrition and physical activity behaviors. A comprehensive examination and understanding of these factors and their impact on overweight/obesity can facilitate a concerted and coordinated response to the growing public health epidemic. A concerted effort, at all levels of the Commonwealth, can provide opportunities for creating enabling environments that support individuals make healthy choices and help prevent the growing obesity epidemic. This in turn will help reduce the burden on the healthcare system and economy of the Commonwealth of Massachusetts. An effective public-private partnership, shared vision and community ownership of an initiative that attempt to address the obesity epidemic in Massachusetts are needed. The burden of obesity is a serious public health problem for Massachusetts affecting communities, families and individuals throughout the life span.

1. Prevalence of Overweight and Obesity

A. Prevalence of Overweight/Obesity Among Adults:

The number of Massachusetts residents who are either overweight or obese is continuing to rise. The *Massachusetts Behavioral Risk Factor Surveillance System* (MABRFSS) annually monitors health-related behaviors among adults over 18 years old, statewide. BRFSS data for 2007 indicate that the proportion of Massachusetts adults who are above a healthy weight is slightly below the national average (58.9%[1] vs. 63%);[2] however Massachusetts prevalence increased by more than 47% between 1990 and 2007, compared with a national increase of 40% (Figure 1).[3, 4] In 2007 at least one of two (58.9%) of the adult population in Massachusetts was overweight or obese; this estimate is approximately equivalent to three million people.[5]

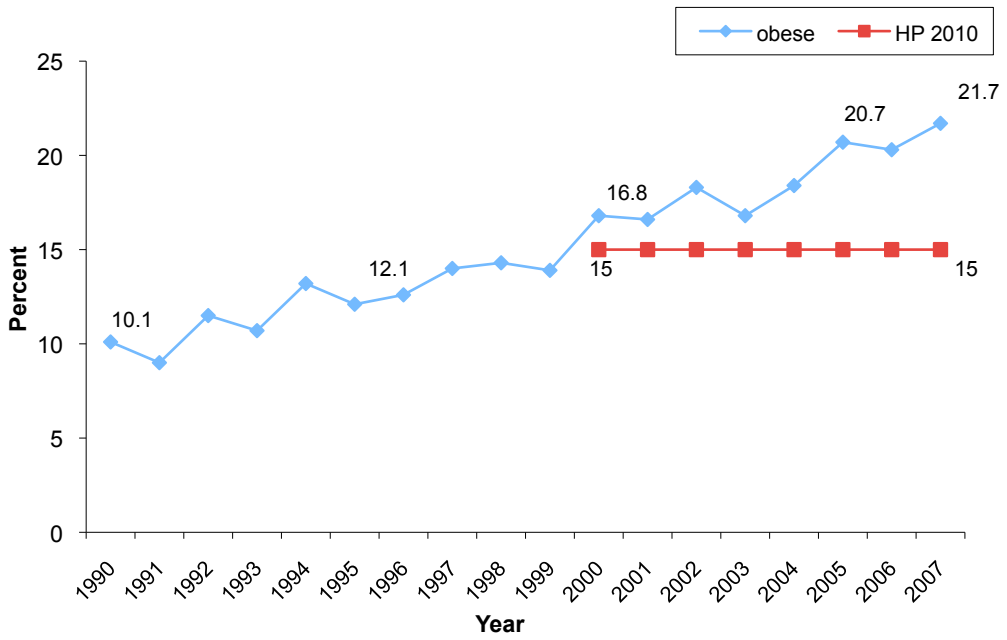
Figure 1. Trend of Overweight/Obesity in Massachusetts and US, 1990-2007



Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS), 1990-2007
*Overweight/obese status defined by BMI ≥25

Depending on BMI value, individuals with BMI above normal weight are grouped as either 'Overweight' (BMI≥25 and ≤ 29.9) or 'Obese' (≥30) (see Appendix C). A closer look of change over time within these subgroups gives a much clearer and alarming picture.

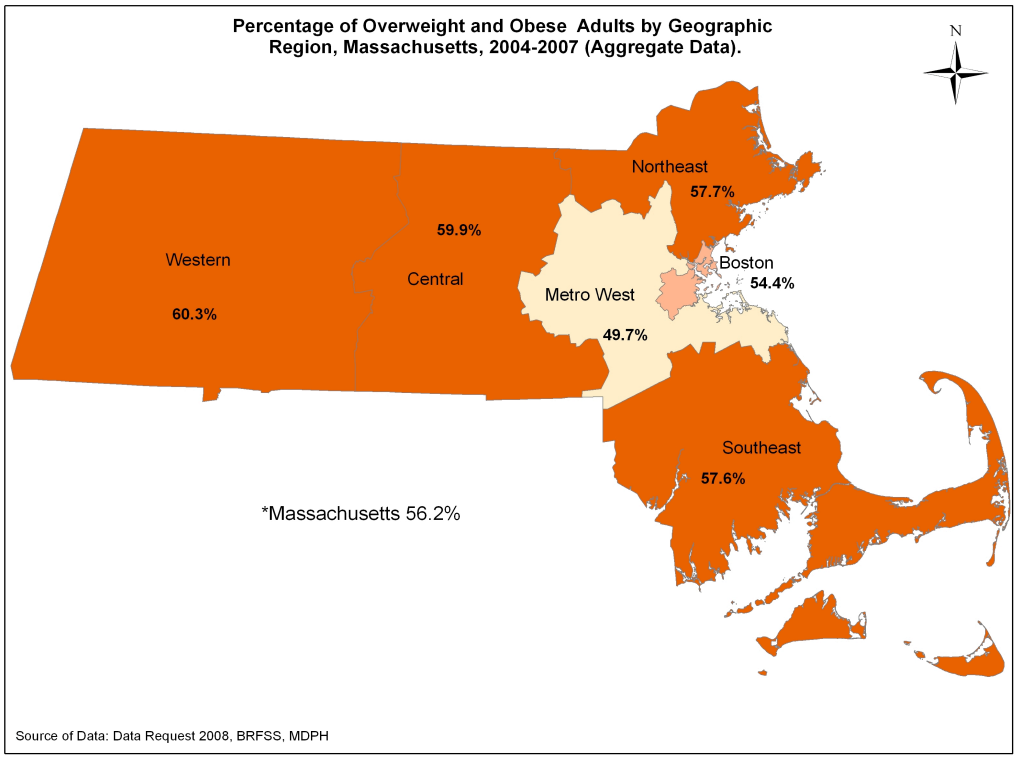
Figure 2. Trends in Massachusetts Adult Obesity, 1990-2007



Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS), 1990-2007 *Obese status defined by BM I≥ 30

According to 2007 BRFSS one in five Massachusetts adults is obese (BMI 30 or greater, see Figure 2). Obesity prevalence in Massachusetts has more than doubled in just seventeen years i.e. it climbed from10.1% in 1990 to 21.7% in 2007.[6, 7] Not only is obesity prevalence for Massachusetts rising, but it exceeds the Healthy People 2010 target of 15% (Figure 2)[8], and it is catching-up with the 2007 national median (26.3%).[2, 9] Prevalence estimates of overweight and obesity are not uniform throughout the Commonwealth. Estimates from 2004-2007 aggregate data indicate four of the six geographic regions exceed the state average 56.2 %.[10] These are Western, Central, Northeast and Southeast regions. In 2003 there were only two such regions, Central and Southeast. Additionally, in the last few years three regions: the Western region which includes the urban centers of Springfield, Holyoke; the Northeast which includes Lawrence, Lowell; and the Metro Boston showed a substantial increase in the prevalence of overweight-obesity while the other regions and the statewide estimate showed only a modest increase. Between 2003 and 2007 the overweight prevalence estimate for the Western region has increased from 52.7% to 62.2% close to the national average (at 63%).[2] Similarly, prevalence estimates for the Northeast and Metro Boston regions did rise from 51.8% to 60.9% and from 49% to 57.9%, respectively, in the same time period.

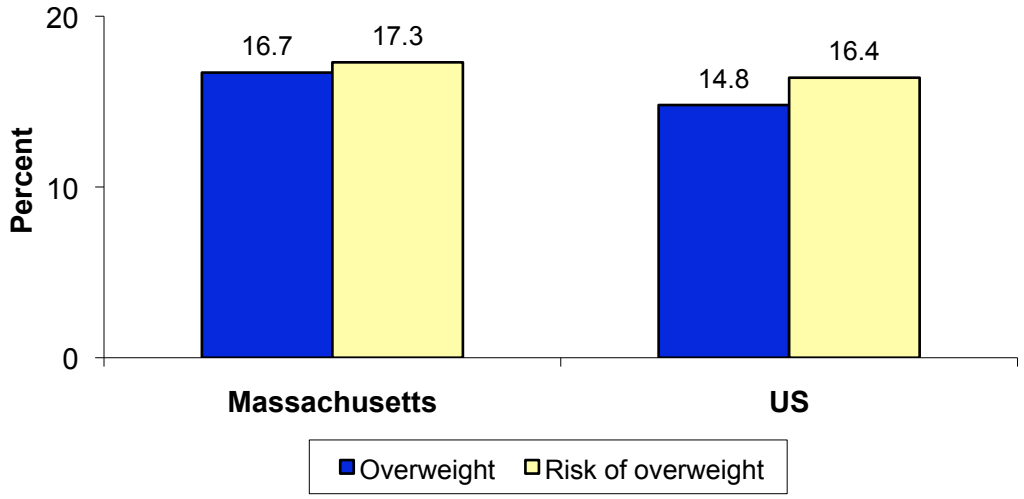
Figure 3: Percent of Overweight and Obesity by EOHHS Regions, 2004-2007



B. Prevalence of Overweight among Children and Adolescents

Overweight is defined and determined differently in children and adolescents than in adults. In children and adolescents, a BMI-for-age at or above the 95th *percentile* indicates overweight. Children with a BMI between the 85th and 95th percentiles for their age and sex are considered at risk for overweight. BMI classifications in children are both age- and sex-specific to account for changes in body fat that occur as they grow and mature.[11]

Figure 4. Percent Overweight or At-Risk-For-Overweight* Massachusetts Children aged 2 to <5 Years, compared with National Estimates, 2006



* Overweight: ≥95th percentile BMI-for-age; At Risk of Overweight: >=85th-<95th percentile BMI-for-age, CDC Growth Charts, 2000.

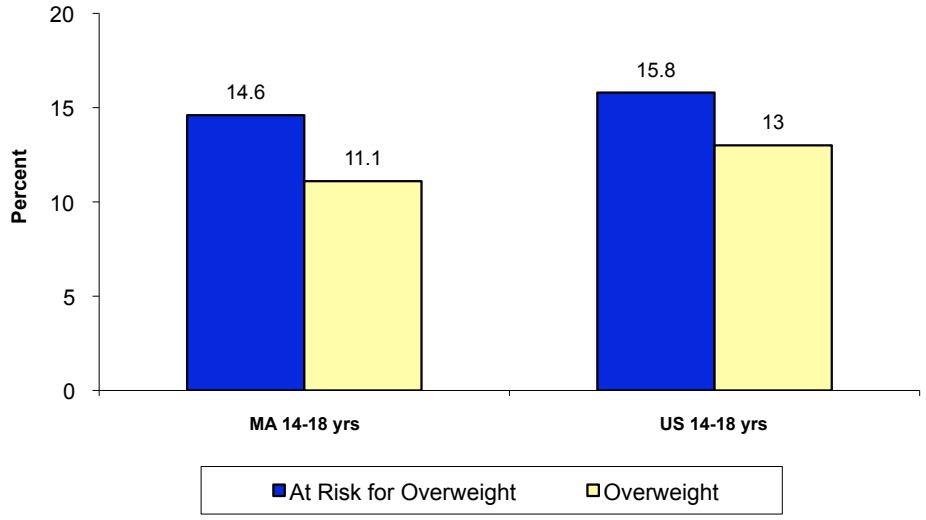
Adapted and data source from 2006 US and MA PedNSS

Rising trends of overweight are being observed at much earlier ages. The *National Health and Nutrition Examination Survey* (NHANES) indicates that the prevalence of overweight among all children aged two to five years more than doubled between 1971 and 2000, from 4.9% to 10.4%.[12] More than one third of children aged two to five years who participate in the Massachusetts *Special Supplemental Food Program for Women, Infants, and Children* (WIC) are either at risk for overweight (17.3%) or already overweight (16.7%)[6] (figure 4).[13] These Massachusetts rates exceed both the national comparison estimate (15.4% and 14.4% respectively)[13] and the *Healthy People 2010* objective for overweight among children, which is 5%.[8] However, these prevalence estimates are taken from the *Pediatric Nutrition Surveillance System* (PedNSS), and are collected from children at nutritional risk who participate in public nutrition programs and may not be representative of all children in Massachusetts between the ages of two and five years.

Similar patterns of overweight are observed among older children or adolescents. Biennially, the Massachusetts Department of Elementary and Secondary Education (ESE), formerly called the Massachusetts Department of Education (MDOE) administers the Massachusetts Youth Risk Behavior Survey (MAYRBS), which monitors health-related behaviors among adolescents in grades 9 through 12. The 2007 MAYRBS survey revealed that 11% of high school students are

overweight, an increase from 7% in 1999; in addition, 14.6% are at risk for overweight (Figure 5).[14] Similarly, the Massachusetts Department of Public Health's Youth Health Survey (YHS) shows that overweight is a serious health issue among Massachusetts middle school students.[v] 2007 YHS data shows that 11% of middle school students were overweight. [15] An additional 18% were at risk of overweight.

Figure 5. Prevalence Estimate of Overweight or At-Risk-for-Overweight among Massachusetts Adolescents, compared with National Estimates, 2007



Sources: Massachusetts and US Youth Risk Behavior Survey (YRBS) 2007.
NOTE: No data for children 6-11 years of age

C. Disparities in the Prevalence of Adult Obesity and Adolescent Overweight

In Massachusetts, Hispanic and Black adults, respectively, are 50% (Prevalence Ratio, PR = 1.50)[vi] and 60% (PR = 1.60) more likely to be obese than their White counterparts (Table 1). These comparisons are based on age-adjusted estimates that remove the differential effect age may have on the race-obesity relationship.

[v] Beginning 2007 the Youth Health Survey is administered in coordination with the MAYRBS and includes students from Grade 6 through Grade 12. Standardized questions from national surveys, such as the YRBS, have been used to allow comparisons.

[vi] Prevalence Ratio: Standardized prevalence (likelihood) of obesity among persons with demographic characteristic compared to standardized prevalence of obesity among persons in reference group.

Table 1: Prevalence of Obesity in Demographic Subgroups of Massachusetts Adults and the Associated Likelihood of Obesity 2003-2007

Characteristic	Percentage (%) of Obese (BMI ≥30)*	Prevalence Ratio¶ (CI)	
Age			
18-24 **	13.7	1.0	
24-44	18.7	1.4	(1.2-1.6)
45-64	23.9	1.7	1.5-2.0)
65+	18.1	1.3	(1.1-1.6)
Race			
White, non-H**	18.9	1.0	
Black, non-H	30.5	1.6	(1.5-1.8)
Hispanic	27.5	1.5	(1.3-1.6)
Other	12.7	0.7	(0.6-0.8)
Education			
Less than HS	30.8	2.1	(2.0-2.3)
HS grad	24.4	1.7	(1.6-1.8)
1-3 Yr College	21.5	1.5	(1.4-1.6)
4+ Yr College**	14.4	1.0	
Income			
<$25K	25.8	1.1	(1.0-1.3)
$25K-49,999	29.8	1.3	(1.2-1.5)
$50K+ **	22.5	1.0	(0.9-1.1)

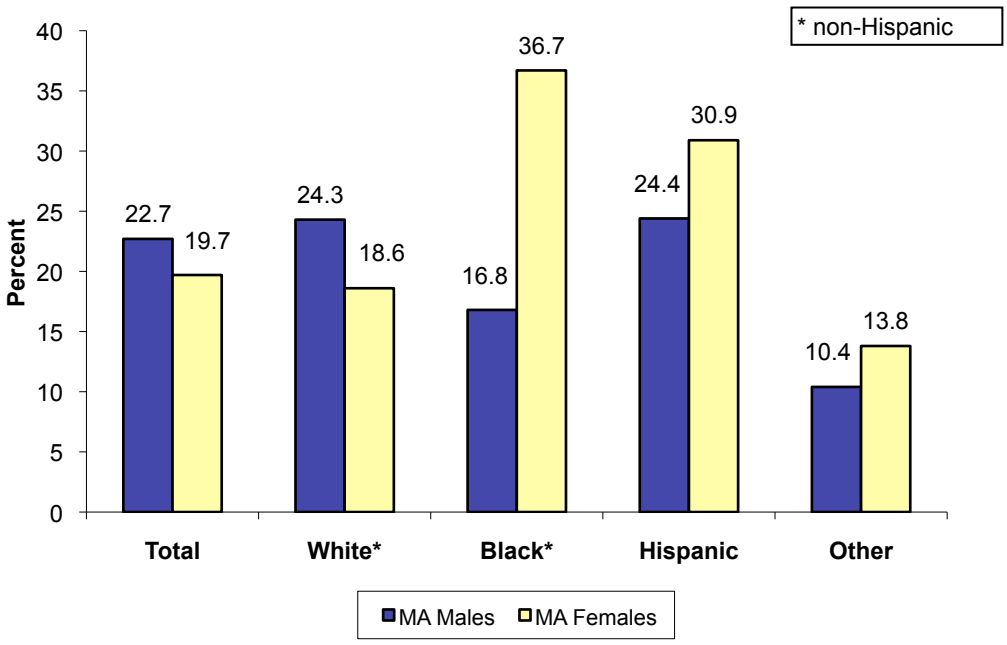
Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS) 2003-2007.
* Note: Percentage estimates for subgroups of race, education, and income are standardized to the age distribution of the 2000 US standard population.
** Referent group for calculation of prevalence ratio.
¶Note: Standardized prevalence (likelihood) of obesity among persons with demographic characteristic compared to standardized prevalence of obesity among persons in reference group.

There are disparities in obesity prevalence based on socio-economic indicators in Massachusetts as well. As Table 1 indicates, an adult without a high school diploma has a 210% increased likelihood of being obese compared with a college graduate (PR= 2.1)[16]. Similarly, though to a lesser degree, an adult who earns $50,000 or less annually is more likely to be obese than someone earning $50,000 or more (Table 1).

This pattern has been more or less consistent over the last few years. BRFSS estimates for 2003 through 2007 show similar trends. The proportion of Massachusetts adults who are obese increases as educational attainment levels decrease. For example, obesity estimates drop from 30.8% for adults without a high school diploma to 14.4% for adults with at least a 4-year college degree. Albeit less consistent, there are disparities among income levels too. For the most part, the rate of obesity increases with lower income earnings. Approximately 26% of adults earning

less than $25,000 are obese; almost 30% are obese in the $25,000-49,999 stratum; and 22.5% in the $50,000 or more stratum.

Figure 6. Prevalence Estimates of Obesity among Massachusetts Adults, by Gender and Race, 2007

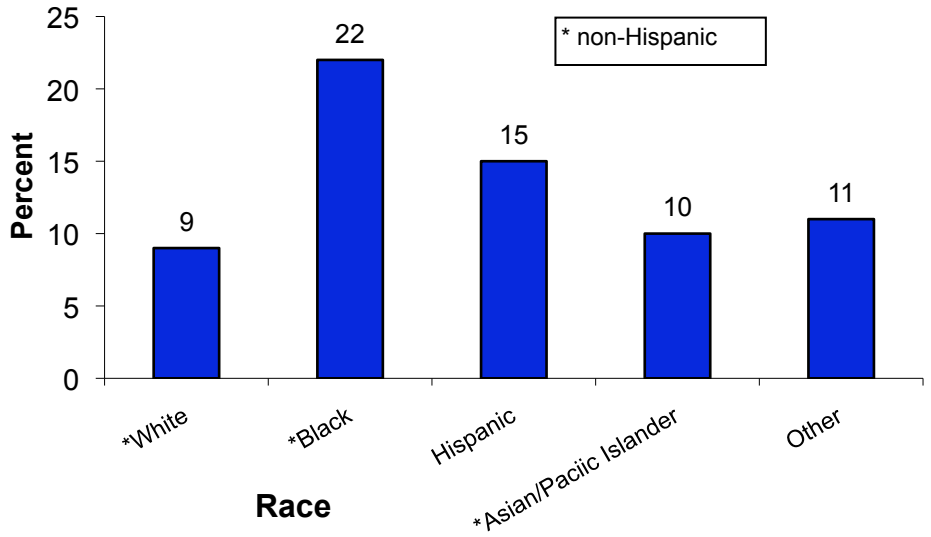


Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS), 2007

Differences exist between genders as well. Overall, obesity appears to be slightly more prevalent among men (22.7%) than women (19.7%) in Massachusetts (Figure 6).[1] However, the disparities in obesity prevalence become more apparent when we make comparisons within gender and non-White racial groups. The prevalence estimates for Black women, 36.7%, and Hispanic women, 30.9%, both exceed the corresponding state estimate for women 19.7%. The Asian sample size is too small to make any reliable prevalence estimates.[1]

Disparities in overweight also exist among adolescents in different gender and racial groups as well (Figure 7). The 2007 MAYRBS found that male high school students were more than twice as likely to be overweight than female students (14.8% vs. 7.1%, respectively).[14] In addition, black students, Hispanic students, and students of multiple ethnicities were more likely to be overweight than their white peers: 22% of black students, 15% of Hispanic students, 11% of students of multiple ethnicity, 10% of Asian students, and 9% of white students were overweight.[14]

Figure 7. Prevalence Estimate of Overweight among Massachusetts High School Students, by Race, 2007



Source: Massachusetts Youth Risk Behavior Survey (YRBS) 2007. Note: The category Other included American Indians or

2. Health Consequences of Excess Weight in Adults and Children

A. Associations between Overweight/Obesity and Adverse Health Conditions in Adults

Overweight and obesity place people at increased risk for potentially disabling conditions such as type 2 diabetes, heart disease, stroke, gall bladder disease, and musculoskeletal disorders.[17, 18, 19] In addition, overweight and obesity are associated with some forms of cancer, [20, 21] and many other health problems that interfere with daily living and reduce the quality of life (Table 2).

Table 2. Some Health Risks Associated with Excess Weight

Excess weight is associated with an increased risk of:	
• Premature death • Type 2 diabetes • Heart disease • Stroke • High blood pressure • Gallbladder disease • Joint degeneration • *Sleep apnea* • Asthma • Breathing problems • Cancer (endometrial, colon, kidney, gallbladder, and postmenopausal breast cancer)	• High blood cholesterol • Complications of pregnancy • Poor birth outcomes • Menstrual irregularities • Stress incontinence (leaky bladder) • Increased surgical risk • Psychological disorders such as depression • Psychological difficulties due to social stigmatization • Limited mobility • Increased risk of falls/bone fractures

Source: Adapted from the Surgeon General's *Call to Action to Prevent and Decrease Overweight and Obesity,* 2001.

An analysis of national BRFSS data for 2001 found that both overweight and obesity were significantly associated with several clinical markers for morbidity. The odds ratio (OR) indicates the relative odds overweight adults face in comparison with those with healthy weight.[vii] Compared with healthy weight adults, those with a BMI between 30 and 39.9 (classified as obese) were more than three times as likely to have been diagnosed with *diabetes* (OR=3.44, 95% CI 3.17-3.74) or *high blood pressure* (OR=3.50, 95% CI 3.31-3.70). Obese adults were also more likely to have *high cholesterol* (OR=1.91, 95% CI 1.80-2.01), *asthma* (OR=1.62, 95% CI 1.52-1.73), and twice as likely to have *arthritis* (OR=2.03, 95% CI 1.92-2.14). Similar, and stronger, associations were observed for severely obese adults (BMI 40 and above). These comparison estimates were adjusted to control for the confounding effects of age, education, smoking status, sex, and race or ethnicity.

Empirical evidence drawn from large prospective cohort studies (Framingham Heart Study and Cancer Prevention Study II) suggest that as BMI increases so does the risk of heart failure and cancer mortality.[22] After adjusting for age and other cardiac risk factors, the risk of experiencing heart failure almost doubles for obese women 30 years and older compared with their healthy weight peers (measured by hazard ratio, HR = 2.12). The relative risk was slightly lower for

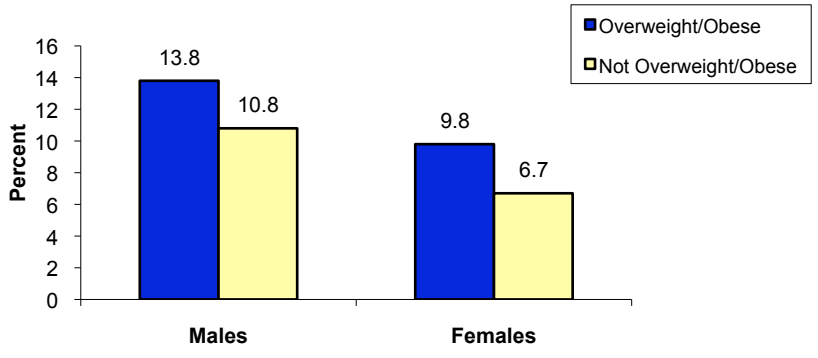
[vii] Odds ratio, instead of relative risk, is used here as relatively better explainer of risk and to capture the dynamic and continuum nature of overweight-obesity (not a categorically valued disease condition/outcome).

obese men, but still almost twice as much (HR = 1.90) when compared with their healthy weight peers.

The Cancer Prevention Study II (1982-1998), a longitudinal study of 900,000 US adults, also contributes to the body of evidence suggesting that overweight is associated with an increasing probability or increased relative risk (RR) of death. Relative risk is a measure of how much a particular risk factor influences the risk of a specified outcome. The Cancer Prevention Study estimates the contribution of overweight and obesity to the total burden of mortality from cancer. Nationally, one in five cancer-related deaths (20%) may be attributable to overweight and obesity in female non-smokers (≥ 50 years of age); in their male counterparts, overweight and obesity may account for 14% of all deaths from cancer.[21]

Among Massachusetts adults 40 years and older, those who are overweight or obese are more likely to have one or more of the *cardiovascular diseases*[viii] than are those with a healthy weight (Figure 8).[23] This likelihood is greater for males than for females. However overweight/obese women have one and half times (9.8% vs. 6.7%) the likelihood of having cardiovascular disease compared with their healthy weight peers; while for men the likelihood ratio is 1.27 to1 (13.8% vs. 10.8%).

Figure 8. Prevalence of Cardiovascular Disease* Among Massachusetts Adults Aged 40 or Over, 2007

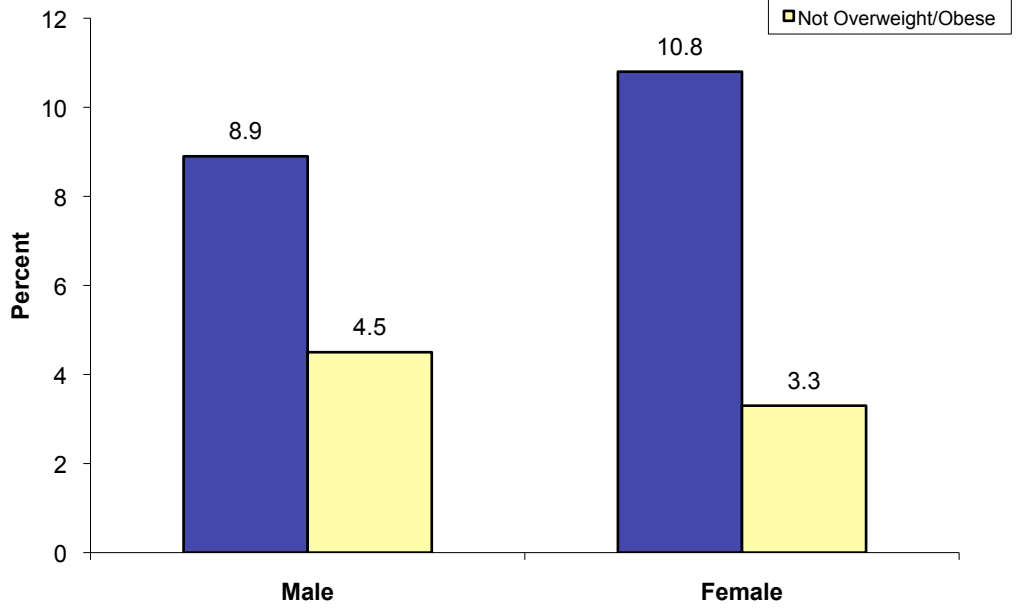


Source:Massachusetts Behavioral Risk Factor Surveillance System (MA BRFSS) 2007.
*** Included under cardiovascular disease are respondents conditions: myocardial infarction, angina, coronary artery**

[viii] Cardiovascular Disease – Refers to the many disorders of the blood vessels and heart. The two most common and lethal of these are *heart disease* and *stroke*. For Massachusetts *Behavioral Risk Factor Surveillance System* (MABRFSS) data, the following: *myocardial infarction*, *angina*, *coronary heart disease*, or *stroke* are included under the definition of cardiovascular disease.

Similarly, being overweight or obese increases the likelihood of having diabetes (Figure 9). According to the 2007 MABRFSS, the prevalence of diabetes among overweight/obese women is more than threefold that of their peers with healthy weight (10.8% vs. 3.3%). Among men, being overweight or obese more than doubles the likelihood of having diabetes (8.9% vs. 4.5%).[1]

Figure 9. Prevalence of Diabetes among Massachusetts Adults, 2007



Source: Massachusetts Behavioral Risk Factor Surveillence System (MABRFSS), 2007

MABRFSS data aggregated over 5 years (2003-2007) and adjusted for age, shows that associations exist between obesity and other health conditions (Table 3). Adults who have ever been told by a health professional that they have high blood pressure are almost two and half times (Prevalence Ratio, PR = 2.4) as likely to be obese as adults who have not and those adults with high cholesterol have a 50% higher likelihood (PR= 1.5) of being obese (Table 3). Adults with poor or fair health were almost twice as likely (PR=1.9) to be obese compared with their healthier counterparts while adults with a disability*** are 1.6 times as likely (PR=1.6) to be obese.[24]

Table 3. Prevalence of Obesity in Massachusetts Adults by Health Characteristic and Likelihood of Obesity Associated with Health Characteristic, 2003-2007

Characteristic	Percentage (%) Obese* (BMI ≥ 30)	Prevalence Ratio ¶	95% Confidence Interval
****High Blood Pressure**			
Yes	36.8	2.4	2.2-2.6
No	15.3		
****High Cholesterol**			
Yes	26.3	1.5	0.9- 1.7
No	17.4		
Fair/Poor Health			
Yes	34.0	1.9	1.8-2.1
No	17.6		
*****With Disability**			
Yes	27.7	1.6	1.5-1.8
No	17.0		

Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS) 2003-2007.
* Note: Percentage estimates for health characteristic subgroups are standardized to the age distribution of the 2000 US standard population.
** Respondents reported whether or not a health professional had ever told them that their blood pressure or blood cholesterol was high.
*** A disability can be physical, mental, emotional, or communication-related.
¶ Age-standardized prevalence of obesity among persons with health characteristic compared to age-standardized prevalence of obesity among persons without health characteristic.

B. Pre-pregnancy Overweight and Associated Risks for Women of Childbearing Age

Being overweight before and during pregnancy could pose serious health risks for both the mother and the baby. Women who gain excessive weight during pregnancy tend to retain some of the weight, resulting in post-pregnancy overweight and obesity.[25, 26] According to 2006 *Pregnancy Nutrition Surveillance System (PNSS)* data, overweight and obese women enrolled in the National WIC program were more likely than healthy weight women to gain weight in excess of the recommendation during their pregnancy (59.1%, 46.4%, and 39% respectively).[27] In addition women who gained more than ideal weight (ideal weight gain for their respective pre-pregnancy weight were twice as likely to have high weight birth outcomes (> 4000 grams) than

those who gained ideal pregnancy weight (9.7% vs. 5.1%). Studies that show pre-pregnancy overweight is linked with increased risk of late fetal deaths.[28] In addition, obesity is associated with an increased incidence of labor and delivery complications, birth inductions and Caesarean sections, and increased risk of congenital malformations such as neural tube defects.[29] Overweight and obese women face additional health challenges during pregnancy; studies show that even moderate pre-pregnancy overweight is associated with higher risks of pregnancy complications such as *gestational diabetes* and hypertensive disorders including high blood pressure and altered cardiac function.[30]

C. Associations between Overweight/Obesity and Adverse Health Outcomes and Conditions in Children

According to the 2007 *Massachusetts Youth Health Survey (YHS)*, more Massachusetts high school students worry about their weight (50.9%) than physical health or physical disability (28%) or becoming pregnant or getting someone pregnant (23.3%). Similarly, more Massachusetts middle school students worry about their weight (46.2%) than physical health or physical disability (22.3%), drug or alcohol abuse by someone else (20.0%), or being physically attacked or hurt by some else (18.3%). The rise of overweight among children and adolescents is worrisome because of the physical and sometimes complex psychological problems associated with being overweight.[31] The 2007 Massachusetts Youth Health Survey found that among high schools students with a healthy weight (BMI between the 5th and 85th percentile), four times as many girls as boys consider themselves to be slightly overweight or very overweight (16.8% vs. 4.1%). On the other hand, among all high school students with BMI above what is considered healthy weight (BMI ≥ 85th percentile), about one-third considered themselves to be about right weight. Similar patterns are observed for middle school students with a healthy weight: 7.5% of boys and 12.8% of girls consider themselves as slightly or very overweight. Perceptions related to overweight and body size image may have implications on unhealthy dieting and weight loss practices. According to 2007 MAYRBS, about 46% of all students who were trying to lose weight were not overweight or at risk of becoming overweight. In addition, 17 % of students reported using at least one unhealthy method for weight loss, such as taking diet pills, powders, or liquids without a doctor's advice (6%); fasting for more than 24 hours at a time (11%); and vomiting or taking laxatives (5%). Studies show overweight status among children does impact their school activities and performance as well. Easily observable overweight status and

associated stigma may contribute to lower academic performance.[32] According to 2003 MAYRBS survey estimates, high school students who were overweight were less likely than their peers to report receiving mostly A's, B's or C's in school.

D. Overweight and the Risk of Future Complications for Children and Adolescents

Beyond physical and psychological problems, overweight young children are facing increased chronic disease conditions. As stated earlier, *type 2 diabetes* – a disease that until now typically occurred in adults – is a growing health concern for at-risk-for-overweight or overweight youth. Research studies suggest that anywhere from 8% to 45% of children newly diagnosed with diabetes have type 2 diabetes.[33] The range is substantial due to factors such as race/ethnicity and age differences among the children studied and methodological differences among the studies themselves. Eighty percent of Massachusetts pediatric clinicians estimate that between 1% and 9% of their young, overweight patients have *type 2 diabetes*.[34]

Being overweight as a child is associated with a higher likelihood of obesity in young adulthood (defined as 21 to 29 years of age).[35] Whitaker's study indicates that obesity prevalence in young adulthood is higher for those who were at risk for overweight or were overweight in childhood than for those individuals who maintained a healthy childhood weight. This was true for all childhood age intervals considered, with the exception of one- to two-year-olds. Children who are overweight during ages six to nine face a 10 times greater likelihood than their healthy weight peers of becoming overweight as young adults. For overweight children between the ages of ten and fourteen, the likelihood is 28 times greater.

3. Overweight /Obesity and Premature Death

Because obesity is rarely if ever listed as a cause of death on mortality records, we cannot determine the exact number of deaths attributable to overweight and obesity in Massachusetts directly from mortality data. We rely instead on mortality estimates derived from research among American adults enrolled in large prospective-cohort studies. Heart disease and stroke account for more than one-third (35%) of deaths in Massachusetts, and both of these conditions are related to overweight and obesity.[36] One particular study examined differences across BMI strata for life expectancy (at 40 years of age) and premature death in a cohort of non-smoking and heart disease-free participants of the Framingham Heart Study.[37] On average, men and

women who were obese at age 40 lived 5.8 (95% CI: 1.4-10.5) and 7.1 (95% CI: 4.6-9.6) fewer years, respectively, than their healthy weight peers. Compared with their healthy weight counterparts, obese adults had 10 to 11 more deaths per 100 persons between 40 and 70 years of age. This rate represents a 115% (women) and 81% (men) increased likelihood for premature deaths over healthy weight adults.

4. Economic Costs of Obesity

In Massachusetts, it is difficult to directly quantify the economic burden of obesity. Obesity is not generally recognized as a disease, and is rarely listed as a primary diagnosis in hospital and medical records. Additionally, teasing out reimbursement codes specific for obesity-related medical procedures proves very difficult with currently available databases. No single system or database exists that allows for the systematic collection and reporting of obesity's impact on state-level medical spending.

This report presents estimates derived from three nationally representative data sets and generated from econometric regression models that predict obesity-attributable medical expenditures.[38, 39] The methodology is detailed in Appendix A (Technical Notes).
The studies showed that the national bill for adult obesity, in terms of *direct costs*, reached an estimated $48 billion in 1998, which accounted for approximately 5.3% of what the US spent annually on medical care. Among Massachusetts adults, obesity-related medical costs (in 2003 dollars) reached an estimated $1.8 billion, which was about 4.7% of what Massachusetts spent annually on heath care. However, these estimates do not capture out-of-pocket expenses such as over-the-counter diet pills and membership in Weight Watchers© or similar weight loss/maintenance programs.

Direct medical costs explain only a portion of the total costs of obesity. Costs incurred due to lost productivity, reduced quality of life, etc., are the less tangible *indirect costs.* According to another study,[40] the national bill for obesity reached an estimated $117.1 billion (in 2002 dollars) of which $56.3 billion reflected indirect costs.

5. Modifiable Factors for Overweight and Obesity

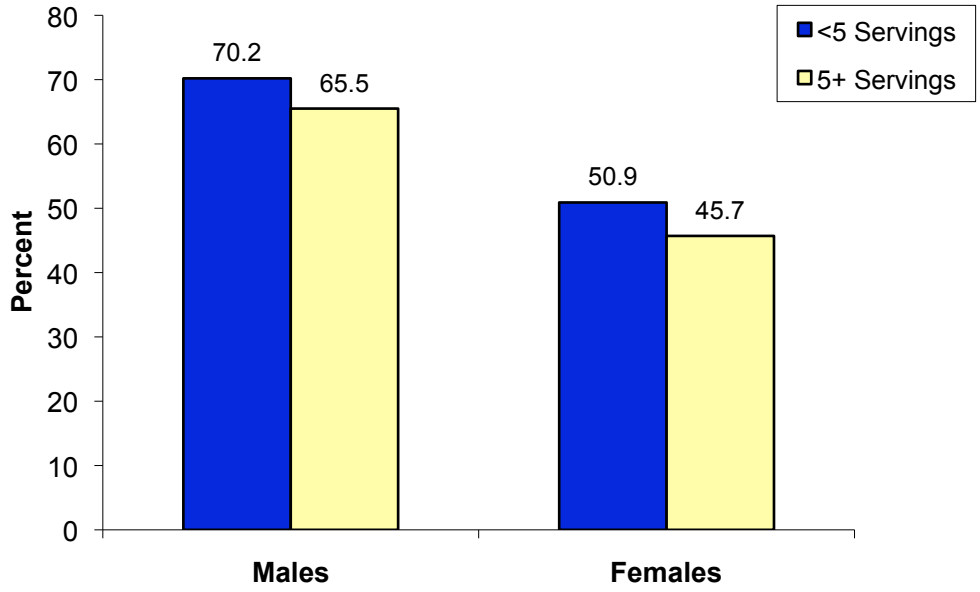
Although family history, gender, age and race or ethnicity may predispose some people to weighing more than others, these factors alone cannot explain a 74% national increase in the prevalence of obesity in the last decade. When calories consumed are greater than calories expended by the body, the result is weight gain. Positively modifying nutrition and physical activity restores energy balance and reduces an individual's chances of becoming overweight. Research indicates that a balanced diet low in *saturated fats* and added sugars, but rich in *fiber* from fruits, vegetables, and whole grains protects and promotes good health and may help control overweight and obesity.[41, 42, 43] Also, regular physical activity is associated with many health benefits including reduced risk of chronic disease morbidity, fall-related injuries, and all-cause mortality.[44]

A. Eating Patterns

The MABRFSS uses daily fruit or vegetable consumption as one indicator of healthy eating. The *US Department of Agriculture* (USDA) recommends eating at least two servings of fruit and three servings of vegetables daily (commonly referred as five or more servings of fruits and vegetables).[45] However, both current and trend BRFSS data suggest that more than two thirds of Massachusetts adults do not eat the recommended five or more servings of fruits and vegetables daily. Massachusetts BRFSS historical data (1996-2007) indicate that low consumption of fruits and vegetable has been the trend: for example in 1996 more than 74% of Massachusetts adult residents reported that they consumed less than five servings of fruits and vegetables a day. The most recent figures for years 2000, 2003, 2005, and 2007 are very similar (72.5%, 71%, 71.4%, and 72.5 % respectively).[46] Stratifying the data by gender shows that fewer men (21.2%) are meeting this daily recommendation than women (33.3%).[1] But among those who are either overweight or obese much fewer women reported consuming five or more servings of fruits and vegetables (Figure 10). Additionally for both men and women, those who ate four or fewer servings were more likely to be overweight or obese than those who ate five or more.[7] The link between obesity and fruit and vegetable consumption is further elucidated when the percentage of obese adults is stratified by 4 categories of fruit/vegetable intake: < 1 per day, 1-3 per day, 3-5 per day, or 5+ per day. The percentage of obese adults decreases as the servings consumed daily

increases from 27% for adults who report eating less than one serving of fruit/vegetables to 14% who report eating five or more servings per day.[47]

Figure 10. Percent Overweight or Obese Massachusetts Adults by Fruit and Vegetable Consumption, 2007



Source: Massachusetts Behavioral Risk Factor Surveillance

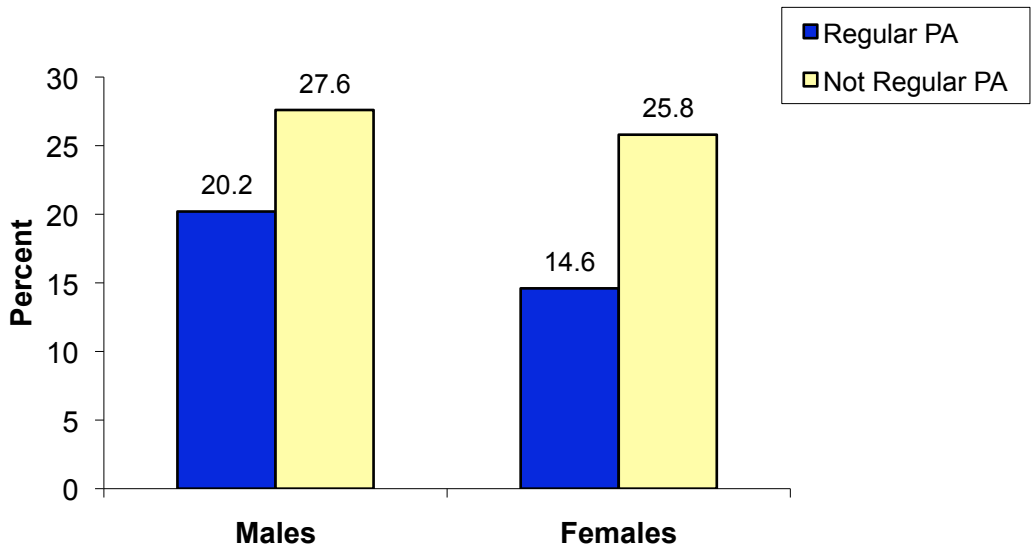
Similar low consumption patterns, below recommended level, are observed among youth. Data from the YRBS and YHS suggests that a majority of high school and middle school students consume less than the recommended five or more servings of fruit and vegetables a day. Among high school students only 15% reported consuming five or more servings of fruits and vegetables per day. Data for middle schools students showed similar levels and patterns with only 15% of boys and 13% of girls consuming 3 or more servings of vegetables the day before the survey.

B. Activity Patterns

Despite the clear benefits, many Massachusetts adults and adolescents fall short of the Surgeon General's physical activity recommendations. To promote their general health, adults are encouraged to regularly meet or exceed recommendations of 30 minutes or more of moderate-intensity physical activity most days of the week.[48] Only 51.4% of Massachusetts adults report regular moderate physical activity (both leisure and non-leisure) in the month before MABRFSS survey administration[1] (See Appendix E for definitions of moderate and vigorous PA). Disparity

with respect to race, education level, and household income is suggested by these data. MABRFSS data reveals that adult women who get no regular physical activity in either a leisure or non-leisure capacity have almost twice the likelihood of being obese compared with their counterparts who do participate in regular physical activity (25.8% vs. 14.6%) (Figure 11). More than twenty seven percent of obese men report no engagement in regular physical activity while only one in five participate in regular physical activity.[1]

Figure 11. Percent Obese Massachusetts Adults by Regular/Nonregular Physical Activity, 2007



Source: Massachusetts Behavioral Risk Factor Surveillance System (MABRFSS).

According to the Dietary Guidelines for Americans it is recommended that children and adolescents participate in at least 60 minutes of moderate intensity physical activity most days of the week, preferably daily.[49] However, among Massachusetts high school students, only 41% report engaging in moderate to vigorous physical activity on 5 or more days per week for at least 60 minutes per time. This estimate is higher than the 2007 national data that shows that only about 35% of high schools students nationally meet this recommendation, but majority of, six out of ten, Massachusetts high school students do not meet the recommended guidelines for physical activity.[50] Furthermore, the number of Massachusetts high school students attending physical education classes at least once a week declined from 80% in 1993 to 61% in 2007.[14] In

1996, the state mandate stipulating the amount of school time earmarked for physical education was eliminated.

C. Television and Video Viewing Patterns

Television viewing, a major sedentary behavior in the United States, contributes to overweight and obesity in adolescents and adults as well as adult-onset type 2 diabetes.[51,52,53] Independent of age, smoking status, physical activity levels, dietary factors, and other covariates, television viewing was associated with an elevated risk for *obesity* and *type 2 diabetes* in adulthood as indicated by two large prospective cohort studies (the Health Professional's Follow-up Study and the Nurses' Health Study). For women, each two hour per day increment in TV watching was associated with a 23% (95% CI 17%-30%) increase in obesity risk and a 14% (95% CI:5%-23%) increase in risk of type 2 diabetes. The MAYRBS reports that Massachusetts high school students who watch three or more hours of television per day are more likely than their peers to be overweight (14% vs. 8%).[14] Similar sedentary behaviors are observed among middle school students: according to the 2007 YHS data 35.9% of boys and 31.1 % of girls watch three or more hours of TV on an average school day.[15] This does not include other screen time such as time spent on computer, on-line and video games.

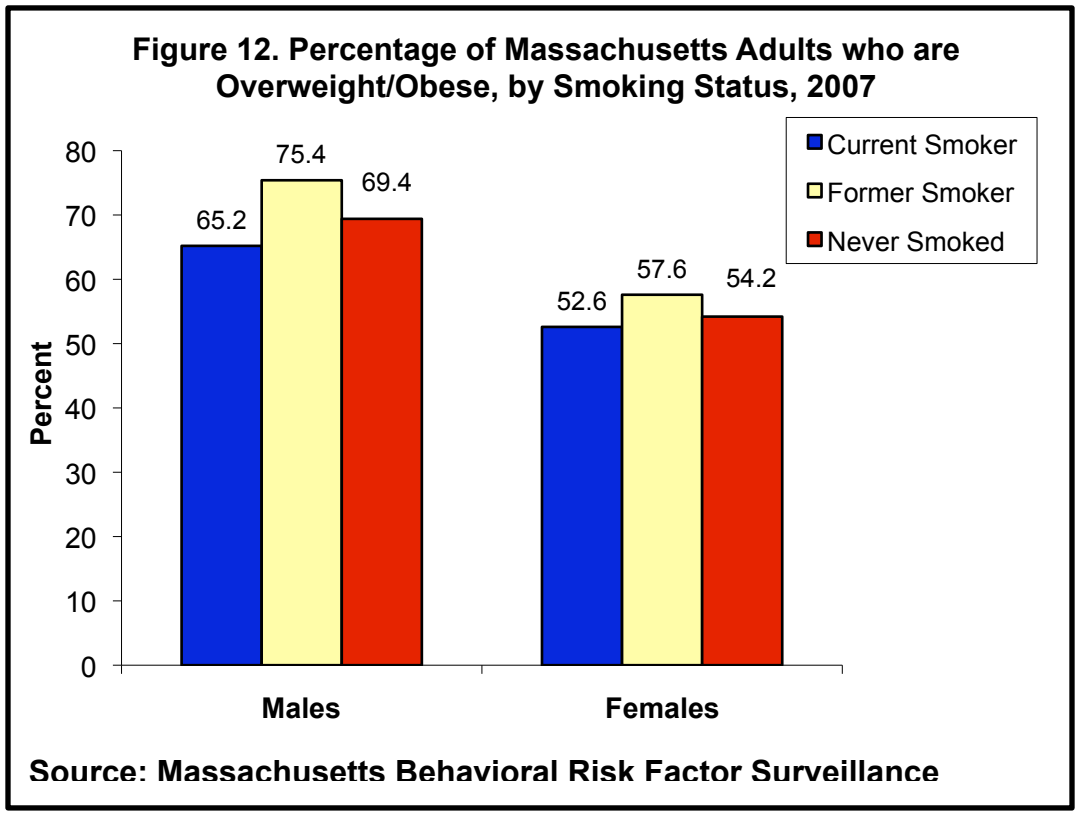
The percent of Massachusetts high school students who watch three or more hours of television a day decreased from 35% in 1999 to 28% in 2007. This encouraging estimate is also lower than the 2007 national estimate of 35.4%.[ix] But more Massachusetts students reported spending time on other similar sedentary behaviors than their national peers: 30% of Massachusetts high school students and 25% of US high school students reported playing video or computer games or using the computer for something that was not school work for 3 or more hours on an average school day.[14,50] Furthermore, differences exist in TV viewing habits among racial groups. Almost half (49%) of the Hispanic students and 46% of Black students in the Commonwealth watch three or more hours of television on an average school day followed by 35% of Asian students , 'Other' or 'Multiple ethnicity' students, and then 27% of White students.

[ix] Recent findings from MDPH's *Healthy Choices* study indicate the need for further clarification and limitations of the 'average school day' survey question. Findings from the study has shown that Middle school students TV viewing behavior on Fridays (a school day) mirrors that of a weekend (spiked TV time) than the rest of school week, Monday-Thursday (less TV-time).

D. Tobacco Smoking

Smoking is another behavior that is linked to a number of debilitating conditions such as obesity. As Figure 12 illustrates, the occurrence of overweight and obesity among Massachusetts adults is lowest among current smokers and highest among former smokers compared to their peers who did not smoke. A similar trend is seen in national BRFSS 2005[x] data among obese adults.[54,55] Additionally, men have a higher prevalence of combined overweight/obesity in each smoking category (current smoker, former smoker, never smoked) compared with women (Figure 12).

Empirical evidence suggesting associations between smoking and risk factors for overweight and obesity is limited and based primarily on cross-sectional studies. Among a Finnish adult population of 11,610 men, ex-smokers (OR=1.74, 95% CI 1.54-1.97) and to a lesser extent, smokers (OR=1.16, 95% CI 1.03-1.30), were more likely to be obese than were never-smokers.[56] Among the 12,604 women in the same



study, ex-smokers had a 23% increased likelihood of being obese (OR=1.23, 95% CI 1.05-1.45) compared with their peers who had never smoked; smokers had a decreased likelihood of being obese (OR=0.87, 95% CI 0.76-1.00). The preceding analyses controlled for both age and

[x] Most recent comparable national data available is for year 2005.

education level. Children and adults who are more likely to eat less healthy foods and be sedentary may also be more likely to smoke.[57,58] The 2003 MAYRBS data supports this premise for adolescents, suggesting that Massachusetts high school students who do not participate in regular vigorous or moderate physical activity are more likely than their physically active peers to report daily smoking (10% vs. 6%). Among other side effects, there is evidence of some weight gain associated with quitting smoking:[59] a substitution effect of replacing one life-threatening problem with another. Aggregate data for 2003-2007 MABRFSS data suggest that certain populations who have the highest prevalence of smoking may also be the most susceptible to obesity. As education attainment level decreases, the prevalence of both smoking and obesity increase among Massachusetts residents. A similar trend exists among adult wage earners in the state. There is a higher percentage of smoking and obesity prevalence among low-income residents of Massachusetts compared to their high-income peers.[7]

E. Breastfeeding as a Protective Factor Against Overweight

Research suggests that breastfeeding might confer protection against children becoming overweight during childhood. One study of an ethnically diverse group of three- to five-year-olds found that those who were "ever" breastfed had a 37% lower chance of being at risk for overweight than those who were never breastfed.[60] Similarly, a study of 15,000 nine- to fourteen-year-olds found a 22% lower risk of overweight among children who had been mostly or exclusively breastfed.[61] According to the 2006 Pediatric Nutrition Surveillance System (PedNSS) data, only one in four of low- to –moderate-income mothers enrolled in the Massachusetts WIC Program reported mostly or exclusively breastfeeding their infants for at least six months; however, this rate decreased to 13.0% of mothers at the one-year mark.[62] Since breastfeeding behaviors of this specific population may not be representative of mothers who do not participate in public nutrition programs, we present the following supplemental data obtained from birth certificates of children born in 2006 which showed about 79.9% of Massachusetts mothers reported that they breastfed or ***intended*** to breastfeed their infants.[63] The recent PedNSS data on 'ever breast fed' for WIC participants is 70.1% (for infants born during the reporting period). Though Massachusetts figure on 'ever breastfeeding' exceeds that of the national average (58.5%) it stills falls short of the Healthy People 2010 goal of achieving 75% rate.[8] In addition, these figures fall far short of the Healthy People 2010 goals for breastfeeding at six months (50%) and at one year (25%).

6. The Social Spheres in which We Live, Work, and Learn Influence the Control and Prevention of Overweight and Obesity

MDPH's Overweight and Obesity Prevention and Control Initiative has adopted the "Social-ecological Model", a conceptual framework (Figure 13) to shape strategic planning efforts directed at health promotion and the reduction of morbidity and mortality from preventable conditions. This framework recognizes that the individual's capacity to make healthy choices is influenced by the policies, systems, and environmental supports that operate at the societal, community, organizational, and interpersonal levels.[64] Unfortunately, the social spheres that influence our lives too often compromise rather than support individual efforts to eat well and to keep physically active, thereby maintaining a healthy weight (Figure 13). The result, according to James O. Hill, a physiologist and obesity expert at the University of Colorado Health Sciences Center, is that overweight and obesity have become "a normal response to the American environment."[65] Whenever possible, changes made at the policy, systems, or environmental level to support individual's healthy choices must be considered.

Figure 13. Spheres of Influence

Source: Adapted from McLeroy KR, et al. An ecological perspective on health promotion programs. *Health Education Quarterly* 1988, 15:351-77.

To inform the development of the state-wide plan to address overweight/obesity with interventions targeting system, policy and environment changes, the DHPDP conducted surveys in 2001/2002 to assess communities, workplaces, schools, and healthcare sites. The next section reports selected results from these surveys and examines how families influence their members' eating and activity patterns. [xi]

A. Inventory of Policies and Programs in Massachusetts Cities and Towns (Community Survey)[66]

In 2002, and again in 2007, the OPCI in coordination with Chronic Disease Programs of the Division of Health Promotion and Disease Prevention inventoried resources available to promote active living and healthy eating in Massachusetts cities and towns. In 2007, about 60% of the state's municipalities (209 out of 351) responded to this survey, providing the baseline information shown here.

Physical Activity: According to the 2007 survey data, between 76% and 88% of the Commonwealth's cities and towns provide playgrounds, recreational fields, conservation land, outdoor courts and school based gyms. Earlier findings from 2002 survey indicated these resources are more commonly found in towns with 5,000 or more residents rather than in those with fewer than 5,000 residents and in communities that are rural rather than in urban communities[xii]. One-third of communities do not have accessible facilities for individuals with disabilities and two-thirds have no facilities that are close to public transportation.

Most towns surveyed make efforts to keep pedestrians and bicyclists safe by providing sidewalks (76%), crosswalks (82%), reduced speed zones (81%) and street lighting on bikeways/sidewalks (57%). Other safety measures, such as speed bumps, neckdowns and raised crossings, are not widely used; however the usage of all three has increased since 2002. Most towns and cities do not provide such pedestrian- and cyclist-friendly amenities as on/off road bikeways (36%), and protective equipment such as bicycle helmets, padding, or reflective materials (22%). Although over half cities and towns provide lighting on bikeways/sidewalks in 2007, just over one in five

[xi] The complete reports of these surveys are available through MDPH's Division of Health Promotion and Disease Prevention. More specific details of these surveys are included in Appendix A.

[xii] Comparable analysis, by size of communities, for year 2007 was not available at the write-up for this report.

communities (22%) has a *policy* that requires lighting on sidewalks, only 7% of communities require lighting on pedestrian and bikepaths and only two percent require security patrols on pedestrian and bike paths, each being a smaller proportion of MA cities and towns that when the survey was administered in 2002. Four out of five towns that had one or more policies in place to enhance safety reported that they enforced the policies.

In addition, the survey assessed community-wide collaboration and promotion of physical activity opportunities for their residents. Of those cities and towns that promoted the use of facilities for physical activity, 38% partnered with private organizations to promote physical activity. Only 15% sponsor "Walk to School" programs or other programs to encourage children to walk or bike to school; however this is a significant increase from the 8% that did so in 2002. Merely a quarter of communities (26%) have policies requiring walkways or bikeways around schools.

Nutrition: Survey results indicate that the Commonwealth's cities and towns do little to encourage healthful eating; however some changes have been made to the contents of vending machines. Over half (55%) of the cities and towns in Massachusetts report having vending machines in municipal buildings, which is a decrease from the 64% that reported having vending machines in municipal buildings in 2002. In addition to a decrease in the proportion of cities reporting to have a vending machine in their municipal buildings, there was a significant decrease in the amount of machines containing soda from 2002 to 2007 (97% and 89%, respectively). There was also an increase in the proportion of machines vending water from 47% in 2002 to 60% in 2007; however most vending machines in municipal buildings still dispense candy, chips, and cookies (68%). Only 7% of towns require that these vending machines offer some healthy options such as skim milk, salads, fresh fruit or vegetables, which is an improvement from the 1% reporting the same requirement in 2002. The percent of communities that require the labeling of healthy items on menus (3%), the listing of meal calories on menus (1%) or trans fats being banned from use in cooking (0.5%) is small. Few Massachusetts towns provide trainings on healthy food including: choosing healthy foods outside the home (15%), preparing healthy foods (15%) or growing fruits and vegetables (11%).

Supermarkets and farmers' markets provide shoppers with a variety of foods at reasonable prices; however, some national studies suggest urban residents in metro cities are constrained by higher prices and fewer supermarket choices, while poor and rural communities do not have access to supermarkets.[67,68] In 1995, the University of Connecticut's Food Marketing Policy Center examined census and grocery store information for 21 major US metropolitan areas. The Center found that there were 30% fewer supermarkets in low-income areas than in higher income areas. Another study geo-coded census data and neighborhood characteristics to assess the locations of supermarkets and grocery stores in four states: Mississippi, North Carolina, Maryland, and Minnesota. This study showed that there are fourfold the number of supermarkets located in white neighborhoods compared with black neighborhoods (PR= 4.3, 95% CI 1.5-12.5).[69] Currently, there is no Massachusetts statewide data system that captures residents' access and purchasing behavior at supermarkets and grocery stores.

B. Survey of Health Related Policies and Programs among Massachusetts Employers (Work Site Survey)[70]

One-half of the jobs in Massachusetts are within businesses and non-profit organizations that employ 50 people or more. In 2001, the Massachusetts Department of Public Heath's Cardiovascular Health Initiative surveyed a sample of these employers. The purpose of the survey was to obtain baseline information on wellness-related policies and systems that promote good cardiovascular health. Physical activity and nutrition are key components of maintaining a healthy weight, an important concern for good cardiovascular health. A detailed description of the survey's methodology is given in Appendix A.

Physical activity[xiii]: According to the survey results, 86% of organizations have areas where employees can go for a walk; all but 17% have walking areas that are also safe from traffic and work machinery. Seventy-three percent of organizations have accessible stairs that employees can use for physical activity. Thirty percent offer on-site exercise facilities and an additional 58% offer discounted health club memberships directly or through their health plans in lieu of on-site facilities. However, employee participation and extent of use cannot be determined from the data. According to the data, the practice of rewarding employees for being physically active is not common; only eight percent of Massachusetts employers in this sample provide incentives.

[xiii] A new and updated statewide worksite wellness survey has been conducted in 2008; however the results are not yet available.

Employees can increase their level of physical activity by using alternative modes of transportation for at least part of their work commute. According to 2000 Census data provided by the *Massachusetts Highway Department*, only an estimated 9% (270,000 out of 3.103 million) of employed Commonwealth residents took public transportation, 4% (134,000 out of 3.103 million) walked, and less than 1% (12,000 out of 3.103 million) biked to work.[71]

Nutrition: Nearly all of the employers surveyed make food or snacks available in the workplace (92%) primarily through vending and kitchen/break room amenities and most have a place where employees can heat or refrigerate foods (98%). The food, employers offer or sell, however, is not necessarily healthy. Just under half (48%) of the businesses surveyed provide fresh fruit. Such healthy choices as salads (45%) or cooked vegetables (37%) are even less commonly available.

Vending machines are common in both workplace and municipal buildings. But the survey showed workplace vending machines are more likely to offer healthier options than those found in municipal buildings, dispensing granola bars or trail mix (71%), water (63%) and 100% fruit juice (53%). However, soda and high-fat snacks still predominate. Furthermore, only 9% of employers have policies to ensure that healthy foods are provided at meetings.

Health screening: Few employers surveyed provided health screening such as blood pressure (26%), cholesterol (17%), or blood glucose (12%) to their employees. Businesses within the healthcare industry were most likely to offer these screenings; those in the wholesale trade industries, least likely.

Over half (56%) of the businesses reimburse or provide discounts for dietary counseling, while just under half do so for smoking cessation programs. Fewer offer programs themselves: about one-quarter (24%) sponsor health education programs on nutrition and weight control, while 31% provide programs to help their employees quit smoking.

C. Surveys of School Policies and Environments in Massachusetts (School Health Index[72] and Massachusetts Overweight/Obesity Prevention and Control Initiative Focus Group Discussions[73])[xiv]

In the Spring of 2002, the Overweight/Obesity Prevention and Control Initiative (OPCI) implemented a school-based assessment tool called the School Health Index (SHI) in 18 middle schools (12 public, 5 parochial and 1 charter school). The School Health Index assists schools in evaluating their policies and practices pertaining to physical activity and healthy eating to identify opportunities for improvement. Summarized below are a few of the findings.

Physical Activity:

- Seventeen of the 18 schools feel that they have adequate physical activity facilities that are accessible, safe, or encourage student participation.
- Just over half (53%) make their outdoor and/or indoor facilities available outside of school hours.

Nutrition:

- Less than half of the 18 schools prohibit access to foods of low *nutritive value* such as candy, chips, or soda, and even fewer (22%) have written policies on nutrition that at least meet US DA-mandated *School Meal Nutrition Standards*.
- At all 18 schools, fundraising efforts can include the sale of snacks high in fat, sodium, and added sugars.

OPCI also led focused discussion sessions with parents, school staff, and students on physical activity and nutrition at three middle schools.[73] The purpose was to garner a better understanding of the barriers schools face and seek suggestions to address identified gaps. Discussion participants reveal that safety concerns make it difficult for urban schools to offer outdoor PE classes and after-school activities or to encourage children to walk to school. Despite this, all three schools provide after-school physical activity programs. A limited group of students tends to participate. Participants report that limited choices and unappealing options in the schools' cafeterias often lead students to the vending machines (see Appendix A for more details).

[xiv] Upcoming new findings may shade better understanding of the impact of *Healthy Choices*, a statewide school based intervention, implemented in more than 110 middle schools across the Commonwealth.

D. Surveys of Policies and Systems among Massachusetts Healthcare Providers and Sites (Ambulatory Management of Childhood Overweight Survey[34] and the Health Site Survey[74])

In Massachusetts, two surveys administered by the Partnership for Healthy Weight and the Cardiovascular Health Initiative provide insight into healthcare providers' practices around obesity, overweight, and related health conditions and behaviors. One examined pediatric clinicians' screening for and treatment of overweight in children; the other assessed whether systems and policies were in place to effectively screen and counsel for cardiovascular disease and associated risk factors, including poor eating and activity patterns.

1) Screening and Treating Overweight in Children (Ambulatory Management of Childhood Overweight Survey)[34]

A sample of Massachusetts family physicians, nurse practitioners, and pediatricians were surveyed to find out how they diagnose and treat overweight in children and what they believe are the greatest barriers to successful treatment.[xv] The survey was sponsored by the Massachusetts Partnership for Healthy Weight.

The Ambulatory Management of Childhood Overweight Survey revealed:

- A majority (75%) of pediatric clinicians who responded to the survey are unaware of the expert guidelines for evaluating and treating pediatric overweight.
- BMI, the recommended screening tool, is not consistently used by 69% of clinicians.
- About half (51%) of clinicians do not believe that they have had adequate clinical training to treat overweight children.
- Eighty-three percent of Massachusetts pediatric clinicians estimate that between 10% and 49% of their patients are overweight.
- Fifty-six percent of Massachusetts pediatric clinicians estimate that between 1% and 9% of their overweight patients have *type 2 diabetes*.

Clinicians say that they recommend their patients eat more fruits and vegetables, cut down on fatty foods, become more active, and watch less television, but they feel their advice is not effectively communicated to patients or remains unheeded. They name their patients' frequent

[xv] A detailed description of the survey's methodology is given in Appendix A.

visits to fast food restaurants as the number one barrier to successful treatment. Other obstacles include: lack of patient and family motivation, lack of recognition that overweight is a health risk, lack of effective treatments, the quality of school meals, and the price and availability of healthy foods. Health practitioners working in inner-city communities also noted cultural barriers and safety issues as impeding their efforts to treat overweight children.

2) Screening and Treating Cardiovascular Disease and Diabetes (Health Site Survey for Cardiovascular Disease Prevention and Care)[74]

In the Spring of 2002, the Cardiovascular Health Initiative surveyed health professionals in three practice settings (physician practices, community health centers, and hospital-based ambulatory clinics) about policies related to preventing and controlling cardiovascular disease and type 2 diabetes, two major health consequences of excess weight. [xvi]

Between 43% and 53% of Massachusetts healthcare sites automatically prompt their clinicians to provide the following cardiovascular disease prevention strategies: screening and counseling for nutrition, physical activity, and weight management. Although relatively few sites (27%) have a formal process for implementing strategies to prevent cardiovascular disease, most of them (69%) have systems for referring at-risk patients to specialized services such as cardiac rehabilitation classes and nutrition counseling. The survey reveals that less than one-third of healthcare professionals report that their healthcare setting has a specific process or system for identifying patients who already have high blood pressure (30%), high cholesterol (29%), and known cardiovascular disease (27%). Only one-quarter of healthcare sites automatically refers such patients for specialized services. More than half of Massachusetts healthcare sites train their primary care providers to screen for and counsel patients about nutrition, physical activity, and tobacco use; far fewer monitor whether clinicians actually provide these services. Survey respondents cited insufficient reimbursement for counseling, lack of time during patient visits, and lack of patient cooperation as the three major barriers to providing preventive cardiovascular health counseling to patients. The results of a Cardiovascular Health Initiative survey among seven health maintenance organizations (HMOs) operating in the state bear out the concern

[xvi] A detailed description of the survey's methodology is given in Appendix A.

about reimbursement. Only 14% of insurers reimburse providers for physical activity counseling, about 30% for tobacco counseling, and 43% for nutrition counseling.[75]

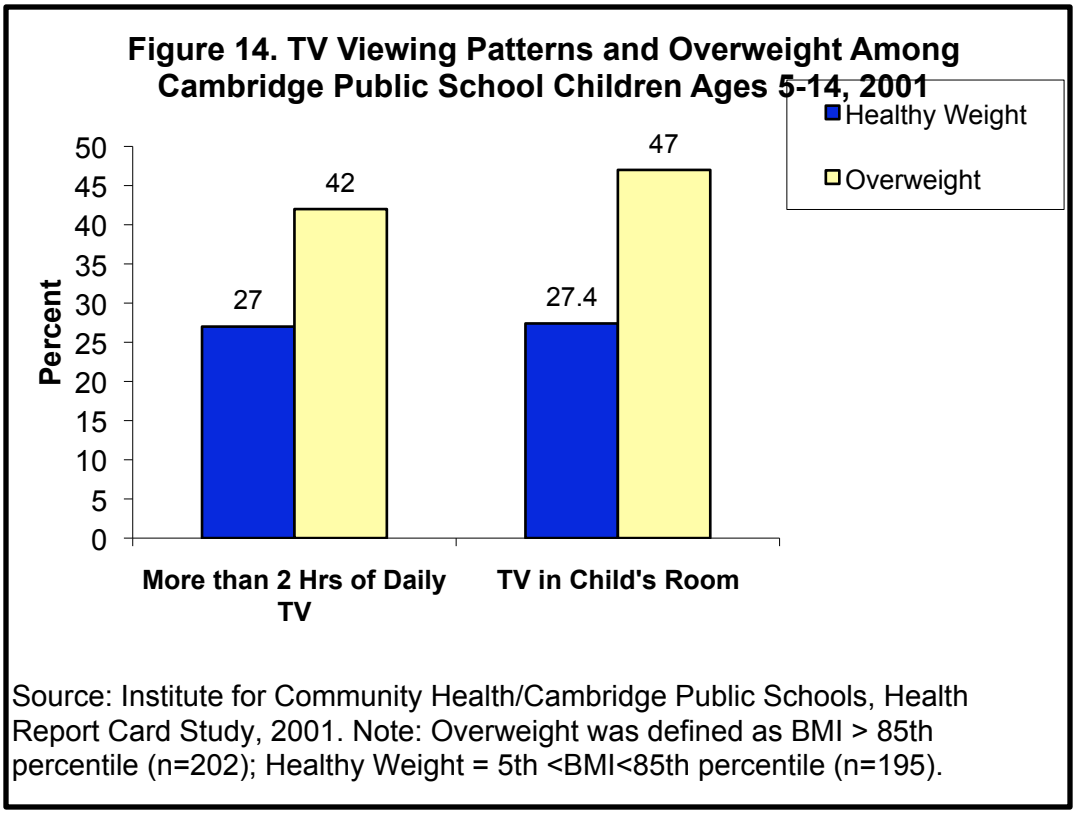
According to a report on '*The Impact Of Diabetes*', 69% of Massachusetts adults with diabetes are also overweight or obese.[76] Hence this gives more reason for important considerations of diabetes screening and treatment. But, according to the survey, only 45% of the healthcare sites automatically screen for diabetes and an even smaller percent (24%) automatically refer patients with known disease to specialized services that are essential to proper diabetes care. As noted earlier there is little support for dietary and physical activity counseling to address weight management.

E. Interpersonal Relationships and their Impact on Healthy Eating and Active Living

Evidence is mounting in support of the vital role parents and guardians play in modeling healthier behaviors for their children. Studies show that as consumption of fruits, vegetables, dairy items, and nutrient-dense foods increased as the number of weekly meals shared among family members increased.[77,78] In one study, soft drink and junk food intake among adolescents decreases as family meals increase.[78] The positive impact of interpersonal connections cannot be overestimated. Keep Moving, a program that organizes walking clubs for seniors throughout the state, reports that the camaraderie that develops between club members motivates them to make walking a routine part of their daily lives.[79]

Television viewing patterns, which are often established within the context of the family, are another important influence. In Cambridge, Massachusetts, 397 family members of both overweight (n=202) and healthy weight (n=195) 5- to14-year-olds were asked questions pertaining to the children's TV habits. This survey provides a glimpse at how decisions made by heads of households about meals and TV influence children's weight in one Massachusetts community.[80] Based on parents' reports of their children's activities, the study found:

- Twenty percent of overweight children almost always or usually eat meals in front of the TV, compared with 10% of healthy weight children.[80]
- Overweight children are more likely than their healthy weight peers to have a television in their room and to watch TV for more than 2 hours a day (Figure 14).[80]



Source: Institute for Community Health/Cambridge Public Schools, Health Report Card Study, 2001. Note: Overweight was defined as BMI > 85th percentile (n=202); Healthy Weight = 5th <BMI<85th percentile (n=195).

Summary

The information presented in this report links the rapidly rising rates of overweight and obesity throughout the state to the rise in ill health, premature death, and financial costs for our residents and economic loss for our Commonwealth. This report also reveals a gap in the state's ability to systematically monitor the impact of overweight and overweight-related behavioral factors among: children up to 11 years old, specific ethnic minority groups, and people with mental and physical disabilities.

The report is meant to provide a glimpse of the alarming overweight/obesity epidemic, its impact on the well being of residents of Massachusetts, and overall impact on the healthcare system and economy of the Commonwealth of Massachusetts. A comprehensive examination and understanding of how current policies, systems, and environments in the home, community, workplace, school, and healthcare sites impact residents' access to and capacity to obtain improved nutrition and physical activity resources is an important step in the overall effort to reduce the impact of overweight/obesity in Massachusetts.

The state and national trends towards increasing prevalence of overweight and obesity reinforce the urgency for a comprehensive and coordinated public health response at the community, state, and national levels.

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Appendix A: Description of Data Sources and Methodology

For this report, the following data sources are used to describe the status of overweight, obesity, and related factors in Massachusetts and are described in more detail below. Surveillance data (e.g. BRFSS) is reported for multiple years, depending on its availability. Obesity-attributable mortality and hospitalization estimates are not readily or easily obtained from data sets available in Massachusetts; subsequently, we rely on estimates drawn from large longitudinal studies and cross-sectional data sets. We also present Massachusetts mortality data attributable to obesity-related health conditions.

1. Prevalence of overweight and obesity among adults	Behavioral Risk Factor Surveillance System (1990-2001)
2. Region and city-specific prevalence among adults	Behavioral Risk Factor Surveillance System (2001)
3. Prevalence of overweight among high school students	Youth Risk Behavior Survey (2001)
4. Prevalence of overweight among children two to five	Pediatric Nutrition Surveillance System (2001)
5. Disparities in prevalence of overweight or obesity Among:	
a) adults 18 years and older	Behavioral Risk Factor Surveillance System (1998-2002)
b) adolescents (high school students)	Youth Risk Behavior Survey (2001)
6. Overweight/obesity and cardiovascular disease among adults	Behavioral Risk Factor Surveillance System (2001)
7. Overweight/obesity and diabetes among adults	Behavioral Risk Factor Surveillance System (2001)
8. Overweight/obesity and other adverse health conditions and outcomes among:	
a) adults 18 years and older	Behavioral Risk Factor Surveillance System (1998-2002)

b) adolescents (middle and high school students)	Youth Risk Behavior Survey (2001)
9. Overweight/obesity and modifiable risk factors among:	
a) adults 18 years and older	Behavioral Risk Factor Surveillance System (2000 and 2001)
b) adolescents (middle and high school students)	Youth Health Survey (2004, 2002) and Youth Risk Behavior Survey (2001)
10. Inventories of policies and programs in Massachusetts communities, work sites, and health sites	Surveys of the Division of Health Promotion and Disease Prevention/ Cardiovascular Health Initiative (2001-02)
11. Surveys of school policies and environments in Massachusetts	School Health Index Assessment (2002) and Massachusetts Overweight/Obesity Prevention and Control Initiative's School Discussion Groups with parents, school personnel and students (2002)
12. Screening and treatment practices and barriers for childhood overweight in Massachusetts	Ambulatory Management of Childhood Overweight Survey (2002)

State Data Surveillance Systems

Behavioral Risk Factor Surveillance System (BRFSS)

The BRFSS survey is a cross-sectional, random digit-dial telephone survey of adults ages 18 years and older, administered annually. The survey is conducted nationally (including the District of Columbia and Puerto Rico) in collaboration with the *Centers for Disease Control and Prevention* and State Departments of Public Health. Conducted in Massachusetts since 1986, the BRFSS collects information on a variety of health characteristics, risk factors for chronic conditions and health-related behaviors. Respondents answer the survey in one of three languages: English, Spanish, or Portuguese. The Bureau of Health Statistics, Research, and Evaluation at the *Massachusetts Department of Public Health* oversees and analyzes the state's MABRFSS data. This data can be used to inform policy and develop prevention and treatment approaches.

The 2001 survey respondents reported height and weight. Using *Body Mass Index* (BMI), respondents were categorized on weight status. Based on *Healthy People 2010* standards, adults with a BMI greater than 25 and less than 30 are classified as overweight. Those with a BMI greater than 30 are considered obese.

The 2001 survey was administered to a sample of 8,628 adult residents. To help ensure that this sample is representative of the entire Massachusetts adult population, the data are weighted to provide population-based estimates. For this document, MABRFSS and BRFSS data were sometimes analyzed in the aggregate to provide a larger sample.

The BRFSS is a self-reported survey. Therefore, several limitations must be considered when interpreting the data. A respondent may underestimate or overestimate his or her height and/or weight. Question responses may be subject to recall bias. Certain health conditions such as heart disease, high blood pressure, and diabetes may be underreported due to respondents' unawareness of their disease status. "Socially undesirable behaviors" may be underreported.

People who do not have a telephone, or rely on cellular phones, or who otherwise do not participate due to factors such as unavailability, language barriers, or lack of interest, are not represented in the survey. Individuals less than 18 years of age and those who are institutionalized are excluded from the survey.

More information on the BRFSS survey can be obtained at the website: www.state.ma.us/dph/bhsre/cdsp/brfss/brfss.htm

Pediatric Nutrition Surveillance System (PedNSS)

The PedNSS is a cross-sectional survey that annually monitors the growth and nutritional status of children in federally funded maternal and child health and nutrition programs. PedNSS data includes demographic characteristics (race/ethnicity, geographic location), birth weight, height and weight, infant feeding practices, and other nutrition-related behaviors of children from birth to age 18. Since 1993, the Massachusetts Department of Public Health has submitted WIC program data to the *Centers for Disease Control and Prevention* for inclusion in the PedNSS.

The 2001 Massachusetts PedNSS sample has an n of 55,896 children ages 5 and younger. These data may only be representative of those children who are known to be at nutritional risk and meet WIC's eligibility criteria, not the total population of Massachusetts children in that age group.

Pregnancy Nutrition Surveillance System (PNSS)

The federally supported Pregnancy Nutrition Surveillance System (PNSS) assists health professionals in identifying and reducing nutrition-related and behavioral risk factors that contribute to poor pregnancy outcomes. PNSS data provides information on the health status of pregnant and postpartum women who meet income eligibility guidelines and are enrolled in health, nutrition, and food assistance programs such as the *Special Supplemental Food Program for Women, Infants and Children* (WIC). The Massachusetts Department of Public Health (MDPH) has submitted WIC program data to the PNSS since 1991.

Youth Health Survey (MA YHS)

The Youth Health Survey is administered by the Bureau of Substance Abuse Services of the Massachusetts Department of Public Health. The survey has primarily focused on drug, alcohol and tobacco use among sixth through twelfth grade students. In 2004 the survey was expanded in its scope to include questions on general health issues (physical and mental) and associated risk behaviors. The purpose of the survey is to produce an accurate picture of the entire spectrum of health related issues among Massachusetts public school children.

The survey is administered every other year. Standardized questions from national surveys have been used to allow comparisons. For the 2004 survey, of the 331 high schools (ninth-twelfth) and 667 middle schools (sixth-eighth) an initial sample of 107 high schools and 125 middle schools were selected to participate. Of those selected, 73 high schools and 71 middle schools actually participated in the survey yielding 2611 high school students and 2906 middle school students.

All survey findings are based on self-reported data. Therefore, several limitations must be considered when interpreting the data. A respondent, for example, may underestimate or overestimate his or her weight status. Socially undesirable behaviors may be underreported. Adolescents who do not attend school or who otherwise do not participate, due to factors such as absenteeism, are not represented in the survey.
More information on the survey sampling and other methodological issues can be obtained by contacting the Bureau of Substance Abuse of the MDPH.

Youth Risk Behavior Survey (MAYRBS)

The YRBS is a biannual survey of public high school students grades nine-twelve conducted nationally with funding from the *Centers for Disease Control and Prevention* (CDC). It monitors behaviors that can positively and negatively affect the health, well-being and safety of adolescents and young adults. The *Massachusetts Department of Education* administers the Massachusetts version (MAYRBS) statewide. The 2001 MAYRBS was offered in both English and Spanish.

Response rates were high for both schools (96 percent) and students (80 percent). Utilizing random selection procedures, the 2001 MAYRBS was administered in three to five classes in 64

Massachusetts public high schools, yielding a final sample of 4,204 students. To account for potential differences between the MAYRBS sample and the Massachusetts high school population, data were weighted on certain demographic characteristics: gender, grade, and race/ethnicity.

The 2001 survey respondents self-reported heights and weights. Using *Body Mass Index* (BMI), respondents were categorized on weight status. All survey findings are based on self-reported data. Therefore, several limitations must be considered when interpreting the data. A respondent may underestimate or overestimate his or her height and/or weight. Socially undesirable behaviors may be underreported. Adolescents who do not attend school or who otherwise do not participate, due to factors such as absenteeism are not represented in the survey.

More information on the YRBS survey can be obtained at the following websites:
http://www.doe.mass.edu/hssss/program/youthrisk.html
http://www.cdc.gov/nccdphp/dash/yrbs/index.htm

Other Data Sources

Ambulatory Management of Childhood Overweight Survey

The *Massachusetts Partnership for Healthy Weight,* in conjunction with the Overweight/Obesity Prevention and Control Initiative of the *Massachusetts Department of Public Health,* developed and conducted this survey. The goal was to identify pediatric overweight/obesity screening, diagnosis, and treatment practices and perceived barriers among Massachusetts-based clinicians. Baseline data collected could inform the development of interventions that target Massachusetts-specific clinical practice issues and behaviors.

The survey tool was developed after consulting the literature and revised based on clinician feedback. In the summer of 2002, surveys were mailed to pediatricians, nurse practitioners, and family practice physicians identified from membership lists of the following professional organizations: Massachusetts Academy of Family Physicians, the National Association of Pediatric Nurse Practitioners, the Massachusetts Coalition of Nurse Practitioners, and the Massachusetts Chapter of the American Academy of Pediatrics. Both respondents and non-

respondents to the initial mailing were sent a second follow-up mailing. There were 1228 clinicians who returned surveys. However, surveys from 28.7 percent of respondents were ineligible for inclusion in survey analyses because these clinicians did not routinely see children six to eighteen years of age for primary care. The final sample of 875 included 199 nurse practitioners and 676 physicians.

Survey data may be prone to bias due to a self-selected sample of pediatric clinicians who were willing respondents. While this survey may not be considered representative of the entire population of Massachusetts pediatric clinicians, it included respondents who had practice sites in 13 of Massachusetts 14 counties.

Division of Community Health Promotion Inventories of Policies, Systems and Programs

Between 2001 and 2002, the Division of Community Health Promotion of the MDPH conducted three statewide assessments of existing health policies and programs within samples of Massachusetts healthcare sites, work sites, and cities/towns in conjunction with a research consultant, Ulrich Research Services, Inc. The survey methodologies are described below. A complete report for each of these three venues is available from MDPH Division of Community Health Promotion upon request.

Health Site/Managed Care Survey for Cardiovascular Disease Prevention and Care (Health Site Survey)

The Massachusetts Cardiovascular Health Initiative conducted an inventory of Massachusetts healthcare delivery sites between March and June of 2002.

This mail survey was administered to physicians from multi-physician group practices, solo practices, community health centers, and hospital-based ambulatory clinics. Survey results provided baseline data on policies and systems that healthcare sites have in place to promote the prevention, treatment and control of cardiovascular disease, diabetes, and other related conditions. Additionally, current practices related to risk factors (physical inactivity, poor nutrition, tobacco use, high blood pressure and high cholesterol) were evaluated.

The primary sampling frame for healthcare sites/practices was derived from a Folio Associates' database of 2,478 group practice physicians with at least one of the following specialties: Internal Medicine, Cardiovascular Surgery, Family Medicine, Cardiovascular Disease, General Medicine or Cardiothoracic Surgery. An unduplicated list of 821 healthcare sites/practices was extracted from the Folio database of physicians.

After the questionnaires were mailed to the sites, some practices reported that they received more than one questionnaire, and a few questionnaires were returned from non-operational practices. An estimated 807 practices received questionnaires. MDPH provided an additional 58 community health centers so the final survey sample size was 865 Massachusetts health sites. There were 254 completed and returned surveys. Nine percent (77) of the healthcare sites refused to participate while 32 percent (277) declined the survey claiming that their practice's medical specialty did not address cardiovascular disease prevention and care. Among the 254 surveys returned, community health centers (13 percent), hospital-based ambulatory clinics (six percent), multi-physician group practices (69 percent), solo practices (10 percent) and other practice types (two percent) were represented.

Survey of Policies and Programs Related to Cardiovascular Health (Work Site Survey)

Between October and November of 2001, the Massachusetts Cardiovascular Health Initiative conducted a survey among Massachusetts business and non-profit organizations. The purpose of the survey was to obtain information on wellness-related policies and programs that promote good cardiovascular health in a variety of Massachusetts work settings.

The survey sample was derived from Imarket's July-September 2001 Dun & Bradstreet MarketPlace database of 7,071 Massachusetts organizations with 50 or more employees. Organizations of this size constitute only about three percent of the total number of Massachusetts organizations, yet 50 percent of its employees. All major industry groups with a Standard Industrial Classification were represented in the database. Only organizations headquartered in the state were eligible for selection into the sample. The final sampling frame was a random selection of 1,998 organizations from this database.

A total of 422 organizations participated in the survey, for an overall response rate of 21.1 percent (422/1,998). There were 383 interviews completed by phone and 39 questionnaires were either faxed or mailed. Respondents were human resources representatives.

The sample was designed to represent organizations in each of Massachusetts Executive Office of Health and Human Services (EOHHS) six health regions in their proper proportions. Quotas were developed to ensure that organizations in all size ranges over 50 employees would be represented. The survey data was statistically weighted to adjust for over-sampling of organizations with 250 or more employees.

Inventory of Policies and Programs Related to Health for Cities and Towns in Massachusetts (Community Survey)

Between June and August of 2002, the Division of Community Health Promotion conducted a baseline inventory of *municipal* policies and programs that promote healthy eating and active living.

The study sample was selected using the 2001-2002 Massachusetts Municipal Association's Directory. A total of 695 questionnaires were mailed to public health and public works officials in all 351 cities and towns. There were 314 questionnaires returned from 239 municipalities (126 rural and 113 non-rural). In 75 cases, both the public health and public works officials returned questionnaires. In 164 cases, only one of the two officials responded (including 83 public health and 81 public works officials). The survey response rate from individuals was 45 percent (314 out of 695). The response rate from cities and towns was 68 percent (239 out of 351).

Given this fairly high response rate, the likelihood is also high that survey data obtained is representative of the entire state. Additionally, the regional distribution of responding municipalities closely corresponds to the actual state distribution. For example, 29 percent of respondent cities and towns are from western Massachusetts which exactly matches the percent of Massachusetts cities and towns that are located in the western region.

Survey results reported in this document reflect the percent of respondents answering "yes" or "no" to a given question. For most data, that percent is based on the full sample of 239. In some

cases, however, the data pertains only to those towns and cities that provide a particular service such as bicycle pathways, so the sample size is smaller.

Massachusetts Overweight/Obesity Prevention and Control Initiative

A. Focus Group Discussions

In May and June of 2002, Regina Villa Associates, Inc. conducted nine focus groups on behalf of the Overweight/Obesity Prevention and Control Initiative (OPCI). The purpose was to elicit perceptions of students, parents, and school personnel on issues that affect nutrition and physical activity practices in middle schools. Specifically, participants were asked about perceived barriers to eating healthy and being physically active. They also had to consider what environmental or policy changes would make it easier for students and staff to choose nutritious foods and lead more physically active lives in their schools.

A convenience sample of three middle schools in different geographic regions of Massachusetts was selected as focus group sites: Baird Middle School (Ludlow) in rural Western Massachusetts, Boston Renaissance School in Boston, and Roosevelt Middle School (New Bedford) in the Southeast. At each site, a separate focus group was conducted for each of the three target populations: middle school students, parents of middle school students, and school personnel (core subject teachers, physical education teachers, the nurse, food service professionals). Selected schools received a $150 donation for their participation. Focus group participants received an honorarium of $30 each.

During the discussion, participants revealed that safety concerns make it difficult for urban schools to offer outdoor PE classes and after-school activities or to encourage children to walk to school. Despite this, all three schools provide after-school physical activity programs. However, a limited group of students tend to participate and participants suggested offering non-traditional activities, such as kick boxing and yoga, to encourage wider involvement. Participants report that limited choices and unappealing options in the schools' cafeterias often lead students to the vending machines. They support providing healthier hot lunch options in the cafeteria. Many participants suggest offering salads regularly, as well as scheduling an afternoon snack time due to early lunch periods. Parents, school personnel, and students from all three schools agree that

students will choose unhealthy options if available and convenient. Parents and school personnel support eliminating vending machines or replacing snack food with healthier alternatives.

B. Preliminary Results from the 5-2-1 Go! Intervention Study

In the spring of 2002, the Overweight/Obesity Prevention and Control Initiative (OPCI) implemented the 5-2-1 Go! Intervention Study. The intervention consisted of the School Health Index (SHI), a school-based assessment tool and Planet Health Curriculum. Developed by the Centers for Disease Control and Prevention, the School Health Index assists schools in evaluating their policies and practices pertaining to physical activity and healthy eating to identify opportunities for improvement. Planet Health Curriculum is designed to teach students healthy messages and the benefit of consuming five to nine servings of fruits and vegetables a day as part of their regular diet, reducing TV watching to less than 2 hours a day and participation in physical activity an hour a day. Fourteen of these schools were implementing SHI as part of a research study, 5-2-1 Go! The additional four schools were selected because of their urban or suburban location. Five schools were from the Central region of the state, one from Metro West, and four schools represented each of the following areas: Boston/Greater Boston, North East, and South East. Eighteen Massachusetts middle schools (12 public schools, 5 parochial schools, and one charter school) completed the School Health Index self-assessment to date. These assessments were performed at a very small number of self-selected schools constituting a convenience sample. Subsequently, schools submitted action plans for one SHI component, the School Policies and Environment module, as part of the 5-2-1 Go! Intervention study. These plans detailed the priority-ranked steps schools would take to address the gaps identified in the SHI assessment.

Summarized below are a few of the findings from the SHI assessment.

Physical Activity

- Seventeen of the 18 schools feel that they have adequate physical activity facilities that are accessible, safe, or encourage student participation.
- Just over half (53 percent) make their outdoor and/or indoor facilities available outside of school hours.

Nutrition

- The School Health Index results suggest that less than half of the 18 schools prohibit access to foods of low *nutritive value* such as candy, chips, or soda, and even fewer (22 percent) have written policies on nutrition. These nutrition policies meet not only U.S.

Dept. of Agriculture-mandated *School Meal Nutrition Standards,* but also address other areas such as nutrition education, access for disparate populations, and availability of healthy options.

- At all 18 schools, fundraising efforts can include the sale of snacks high in fat, sodium, and added sugars.

Prior to the 5-2-1 Go! Intervention study, Planet Health (with out SHI) was piloted in middle schools in the Metropolitan Boston area. The Planet Health study is an intervention study consisting of a classroom curriculum that aims to reduce overweight in middle school youth by encouraging students to eat more nutritious foods, become more physically active, and watch less television. These health-related messages are integrated into the language arts, math, science, social studies, and physical education classes and are aligned with the state learning objectives and competencies mandated through the *Massachusetts Curriculum Frameworks*. Ten middle schools from four communities in the Boston, Massachusetts metropolitan area were randomized to either intervention or control status.[80] Prior to randomization, schools were matched by geographic proximity or school size and ethnic breakdown to balance the influence of these and other factors that could affect study outcomes (e.g. use of special health curricula, duration/frequency of physical education etc.). Middle school students were exposed to a curriculum intervention (Planet Health) or received usual health curricula and physical education classes.

An intervention effect (reduction in overweight prevalence) was found among girls, not boys. Further regression modeling predicted a reduction in overweight prevalence among girls with each hour of reduction in TV/video viewing (OR = 0.85, 95% CI 0.75-0.97, P=0.02); other behavioral changes observed in the study (fruit/vegetable intake etc.) did not appear to explain or mediate the intervention effect. Additionally, among overweight girls, each hour of reduction in TV viewing was independently associated with increased remission of overweight. For this study, overweight was reported using both BMI and tricep skinfold thickness measurements that were at or above the 85th percentile of age and gender-specific reference data.

The key goals of the Planet Health curricula are explained in Appendix C (Glossary). In addition to the reduction in obesity prevalence among girls, the Planet Health intervention reduced total energy intake compared with the control group (-575.4 joules/day, 95% CI: –1155 to 0 j/d) and increased fruit and vegetable consumption (+0.32 servings/day, 95% CI: +0.14 to 0.50 s/d).

Reduction in TV/video viewing among both boys and girls in the intervention group compared with controls was also observed [(boys: -0.40 hours/day, 95% CI: –0.56 to –0.24 h/d) (girls: -0.58 hours/day, 95% CI: -0.85 to –0.31)].

Final data results from the 5-2-1 Go! Study (combined SHI and Planet Health) will be available in late 2005 and will be accompanied by a more detailed methodology.

MassCHIP (Massachusetts Community Health Information Profile)

MassCHIP is an online information service developed and maintained by the Massachusetts Department of Public Health. The system provides registered users access to community-level data, which can be used in assessing health needs and for health planning. It currently has over 1,500 active users working in a variety of healthcare delivery and research settings. MassCHIP is located at http://masschip.state.ma.us.

Examples of health and social indicators monitored through MassCHIP include 1) birth rate for teenagers, 2) public school expenditures per student, 3) percentage of obese adults, 4) percentage of current smokers, and 5) number of hospital discharges for a particular chronic condition.

School Health Index (SHI)

SHI is an assessment and planning tool developed by the *Centers for Disease Control and Prevention* (CDC) to assist a multi-disciplinary team comprised of school personnel, community members, and parents in (a) identifying gaps in their school's physical activity and nutrition policies and programs and (b) developing action steps to address these gaps and create a healthier school environment. The current version of the tool includes evaluation of school tobacco policies and smoking cessation programming. There is a middle/high school version of SHI as well as an elementary school version.

SHI tools and additional information are available at the following website: http://www.cdc.gov/nccdphp/dash

Appendix B: Technical Notes

In this report, prevalence estimates and rates are assumed to be crude unless specifically reported as adjusted. Refer below for a description of how and why age standardization techniques are used. Additionally, all italicized words refer either to specific data sources (detailed in Appendix A) or technical terms (detailed in Appendix C). To the extent possible, 95% confidence intervals are reported. Where available, sample sizes (n) are reported. The research on the obesity epidemic is emerging. Some limitations of the data are presented and explicit effort has been made to qualify the statement(s) made and drawn from such data.

Age-Adjusted (Standardized) BRFSS Estimates

Age-adjustment is a form of standardization used to increase the comparability among rates (e.g. prevalence) by minimizing the effect that age may have on these rates. For illustrative purposes, consider data from Figure 8, which shows the relationship between overweight/obesity and having diabetes. By applying age standardization techniques to this data, we are able to evaluate the effect of being overweight/obese on diabetes prevalence if overweight/obese individuals and healthy weight individuals had the same age distribution. The age distribution of the 2000 US population is commonly used. In this report, BRFSS estimates are crude unless otherwise stated.

Methodology for Medical Costs Attributable to Obesity

The two Finkelstein et al. papers cited in the bibliography formed the methodological basis for cost estimations presented in this report. In both studies (national and state estimates), a series of regression analyses performed on a subset of 1998 Medical Expenditure Panel Survey (MEPS) data [drawn from 1996/97 National Health Interview Survey (NHIS) data] was used to predict total annual obesity-attributable medical expenditures among adults.

The MEPS database does not include height and weight measurements for determining *Body Mass Index* (BMI), but NHIS does. Subsequently, the MEPS and NHIS databases were merged and the intersection created was the final study sample (n= 10,128 adults). To ensure this final sample was representative of the US population, weighting variables were included to provide

population-based estimates. The regression model's main independent variables were BMI category and insurance category; other socio-demographic variables were controlled for in the model. Regressions were performed using SUDAAN to control for the complex survey design used in MEPS.

Coefficients resulting from the national regression model were applied to the pooled 1998-2000 BRFSS database of 398,446 adults to predict the medical spending per BRFSS adult. Weighting variables were considered to provide for state-representative estimates. Results were combined/compiled as described in Manning et al. Further manipulation of the national regression model and BRFSS data yielded a prediction for the total medical expenditures (costs) for each state. State-specific obesity-attributable expenditures were computed by utilizing the regression model's dummy variable feature and estimating the effect on medical expenditures of being obese versus not obese. For each state, the fraction of obesity-attributable medical expenditures was computed by dividing the estimated costs attributable to obesity by the estimated total medical costs. This state-specific fraction was multiplied by the actual published estimate of the state's medical expenditures to arrive at a final prediction for that state's annual obesity-attributable medical costs. These costs were then inflated to 2003 estimates.

Both studies relied on the *direct costs* of medical care; *indirect costs* were not considered.

Appendix C: BMI Formula and Weight Categories

Body Mass Index (BMI): A Measure of Weight in Relation to Height

$$BMI = \left(\frac{\text{Weight in pounds}}{(\text{Height in inches})^2} \right) \times 703$$

Adult BMI Calculation	Adult Classification
Below 18.5	Underweight
18.5 to 24.9	Normal
25 to 29.9	**Overweight**
30 and 39.9	**Obese**
40 and above	Severely or morbidly obese

Based on the equation above, a person who is 5'6" tall and weighs 175 pounds has a BMI of 28.2.

Source: Division of Nutrition and Physical Activity, National Center for Chronic Disease Prevention and Promotion, Centers for Disease Control and Prevention (CDC)

Appendix D: Calorie Balance

- **To maintain weight, calories in (food and beverages consumed) should equal calories out (metabolism + routine activity + physical activity).**
- **To lose weight, calories in should be *less than* calories out.**
- **To gain weight, calories in should be *more than* calories out.**

Monitor weight: Over a few weeks, check your weight regularly, and adjust your calories in and out to stay on track with your goal.

* Adapted from USDA's Dietary Guidelines for Americans, 2005.

Appendix E: Glossary

Glossary terms are *italicized* upon first mention in the text of this report. In Appendix A: Data Sources, all glossary terms are *italicized.*

Aerobic – Means "with oxygen." Aerobic conditioning raises the heart rate thereby increasing oxygen delivery to the body's muscles.

Angina – A pain or discomfort usually felt in the chest when a part of the heart does not receive enough oxygen-carrying blood. Angina is a common symptom of *coronary heart disease.*

Arthritis – A condition that causes pain, stiffness, and sometimes swelling in and around joints and can make performing daily activities difficult.

Asthma – A disease of the lungs that causes the airways to swell and secrete mucus which results in wheezing, coughing, chest pain, and difficulty breathing.

Blood pressure – The force blood exerts against the walls of the arteries as the heart pumps, measured in mm Hg (millimeters of mercury). Blood pressure is typically recorded as two numbers: the systolic pressure (as the heart beats) over the diastolic pressure (as the heart relaxes between beats).

Body mass index (BMI) – A measure of weight in relation to height (body mass) that is used to screen for overweight and obesity. It approximates total body fat and is calculated by dividing weight in kilograms by height in meters squared. BMI is not a perfect measure because it is calculated using weight and height only and does not take into account other objective measures such as waist circumference. Two people may have the same BMI but different quantities of body fat and thus different risks for overweight-related conditions. People with a lot of body fat may have a BMI of 29 that classifies them as overweight and puts them at risk for overweight-associated conditions. Well-toned athletes with the same BMI of 29 may have a lower risk for overweight-associated conditions because their excess weight is muscle not fat.

Calorie – Unit used for measuring the energy produced by the breakdown of food in the body.

Cancer – A general term for diseases in which cells in the body are triggered to grow and divide uncontrollably. Cancerous cells can spread to other parts of the body. There are over 200 different types of cancer.

Cardiovascular Disease – Refers to the many disorders of the blood vessels and heart. The two most common and lethal of these are *heart disease* and *stroke*. For *Massachusetts Behavioral Risk Factor Surveillance System* (MABRFSS) data, the following: *myocardial infarction*,

angina, *coronary heart disease*, or *stroke* are included under the definition of cardiovascular disease.

Centers for Disease Control and Prevention (CDC) – A federal division of the US Department of Health and Human Services that is charged with promoting the health and safety of the US population and preventing and controlling disease, injury and disability.

Cholesterol – A substance manufactured by the body (in the liver) and also introduced into the body through certain foods. The body uses it to manufacture cell membranes and some hormones as well as perform certain other functions.

Congestive heart failure – A condition that occurs when the heart is too weak to pump efficiently, leading to a build up of fluids in the body's tissues.

Coronary heart disease – A condition in which coronary arteries become narrowed or clogged, resulting in reduced flow of oxygen-carrying blood to the heart. When heart muscle does not receive this oxygen, it becomes damaged and can begin to die.

Diabetes – A disease in which the body does not produce or properly use *insulin*. The major types of diabetes are:

Type 1 Diabetes- A disease in which the body does not produce insulin, most often occurring in children and young adults.

Type 2 Diabetes – A disease in which the body does not produce enough insulin or cannot properly use the insulin it does make. It is the most common form of the disease, accounting for 90-95% of all diabetes.

Gestational Diabetes – A type of diabetes that occurs when a woman is pregnant. Women who develop gestational diabetes are at risk for developing type 2 diabetes later in life.

Direct costs – Represent those expenses for which a bill for service/products can be tallied with the expectation of payment such as hospital care, outpatient care, personal healthcare, clinician visits, medications, and other medical expenses.

Fiber – Bulky, indigestible plant matter that aids in the passage of food through the body. Foods high in fiber include green leafy vegetables, beans, whole fruits, bran, sprouted seeds, and certain grains. Eating fiber can reduce the chance of developing some cancers and lower blood levels of *cholesterol* and *triglycerides.*

Gestational Diabetes – See diabetes.

Glucose – A form of sugar, which is the body's main source of energy.

Hazard Ratio – Is an estimate of a relative risk within a specific time frame

Healthy People 2010 – The nation's prevention agenda drafted by the US Department of Health and Human Services. It is a statement of national health objectives designed to identify the most significant preventable threats to health and to establish national goals to reduce these threats.

Heart disease – A general term for any disease or condition of the heart. The most familiar form is *coronary heart disease* (CHD), the disorder that leads to heart attacks. *Congestive heart failure* and other abnormalities of the heart's arteries, valves, and muscle are also classified as heart disease.

High blood pressure (hypertension) - A condition occurring when *blood pressure* remains consistently elevated above its normal range, defined as systolic blood pressure at or above 140 mm Hg or diastolic pressure at or above 90 mm Hg. Under this condition, the heart has to work harder increasing the risk of a heart attack, stroke, heart failure, and other health-related problems.

High cholesterol (hypercholesterolemia) – A condition characterized by excess *cholesterol* circulating in the bloodstream. Total cholesterol levels under 200 mg/dl are considered desirable. High blood cholesterol levels can lead to increased risk of heart disease because the excess cholesterol can build up around the blood vessels, restricting blood flow to the heart.

Indirect costs – Represent expenses that can not be easily tallied such as those exacted on society and individuals for sick days taken, work productivity lost or school days missed.

Insulin – A hormone produced in the body that helps to regulate the amount of blood *glucose* that is used by cells for energy.

Massachusetts Curriculum Frameworks – Resource guides furnished by the *Massachusetts Department of Education* and used by Massachusetts school personnel in the development and delivery of classroom curricula. It sets learning and skill acquisition standards for students from pre-kindergarten through grade 12 and outlines the research to support these standards.

Massachusetts Department of Education (MDOE) – A state agency under the Executive Office of Health and Human Services that is charged with improving the quality of the public education system statewide so that students are adequately prepared for higher or continued education, rewarding employment, and responsible citizenship. MDOE carries out its mission in partnership with Massachusetts school districts and other organizations that provide educational programs and services.

Massachusetts Highway Department – A state agency under the Executive Office of Transportation with the primary responsibility of overseeing the design, construction, and maintenance of the Commonwealth's state highways and bridges.

Massachusetts Partnership for Healthy Weight (MPHW) – A statewide, collaborative network of Massachusetts agencies (including MDPH), organizations, community groups, and individuals committed to preventing and controlling overweight and obesity for all Massachusetts residents with a focus on increasing the ability of the state, local communities, and organizations to support healthy eating and active living.

Moderate physical activity – Participation in activities that get the muscles moving and are at least equivalent to brisk walking. In addition to walking, activities may include dancing, swimming, gardening, and various domestic and occupational activities.

Myocardial infarction (heart attack) – An acute episode of *heart disease* caused by disrupted blood flow to part of the heart muscle due to a blockage in one or more of the coronary arteries.

National Health and Nutrition Examination Survey (NHANES) – A survey sponsored by the National Center for Health Statistics and administered annually to a nationwide probability sample of persons two months of age and older. The survey was designed to obtain nationally representative information on the health and nutritional status of the US population through interviews and direct physical examinations and specimens.

Nutrient – Matter extracted from food that provides the fuel to maintain body functions and structures.

Nutritive value – Describes the degree of *nutrient(s)* in food available for uptake into the body. Some foods have low nutritive value, providing most *calories* in the form of fat and/or sugar but contain few nutrients such as vitamins or minerals.

Obesity – A health condition marked by excessive body fat. In adults, a *body mass index* of 30 or above constitutes obesity.

Odds ratio – The ratio of the odds of development of disease in exposed persons to the odds of development of disease in non-exposed persons

Overweight - A condition marked by excess body weight for height. In adults, a *body mass index* between 25 and 29.9 constitutes overweight. Children with a BMI in the top 5% (e.g. 95th *percentile*) for their age and sex are considered overweight.

Percent – (proportion) is defined as fraction of the population affected by the specific disease/condition under discussion.

Percentile – A ranking assigned to an individual measurement (i.e. BMI) based on how this measurement compares to the whole population of measurements taken. For example, a child with a BMI falling at the 95th percentile has a BMI higher than 95 percent of all children of the same age and sex.

Planet Health – a classroom curriculum that aims to reduce overweight in middle school youth by encouraging students to eat more nutritious foods, become more physically active, and watch less television. These health-related messages are integrated into the language arts, math, science, social studies, and physical education classes and are aligned with the state learning objectives and competencies mandated through the *Massachusetts Curriculum Frameworks*.

Postpartum – The period of time immediately following birth.

Prevalence – The number of existing cases of a particular disease or condition in a specified population at a given time point. Prevalence is usually reported as a proportion (percent) of the entire population surveyed.

Regular physical activity – According to the Massachusetts 2000 BRFSS survey, this term refers to participation in 30 minutes of leisure time *moderate physical activity* 5 days per week or 20 minutes of leisure time *vigorous physical activity* 3 days per week.

Relative-Risk – Is the ratio of the risk of disease in exposed individuals to the risk of disease in non exposed individuals. *Relative Risk = Risk in exposed/ Risk in no exposed*

Saturated fats – Fats that are especially high in animal and dairy products, meats, certain processed vegetable oil/shortening, and other prepared or processed foods (such as bakery items). These fats are one of the main dietary contributors to raise blood *cholesterol* levels.

School Meal Nutrition Standards – *US Department of Agriculture* federal regulations that all national school lunch and breakfast programs must adhere to in order to provide services in schools. They include dietary and energy (caloric) allowances for certain *nutrients*, fats and sugars as well as the promotion of varied meals that include grains, vegetables, and fruits.

Sleep apnea – A treatable disorder in which breathing is repeatedly halted for 10 to 30 seconds during sleep. Untreated, it could lead to high blood pressure and other heart-related diseases as well as memory problems and headaches.

Special Supplemental Food Program for Women, Infants and Children (WIC) – A federally-funded health, prevention, and supplemental nutrition program which serves income-eligible pregnant, breastfeeding, and *postpartum* women, infants, and children up to age 5 who

meet WIC's criteria for having nutritional risk. The Massachusetts Department of Public Health administers the Massachusetts program, and many agencies throughout the state provide services.

Stroke – Brain cell damage caused by either insufficient blood flow or bleeding in part of the brain. A stroke can impair movement, vision, and speech, among other functions.

Triglyceride – Form in which most fat exists in food, the body, and circulating in the blood. The body uses it as an energy source. Like *cholesterol*, it can build up around the blood vessels, restricting blood flow to the heart.

United States Department of Agriculture (USDA) – A federal agency that is charged with promoting the protection and safety of the US agriculture and food supply, improving the nation's health and nutrition through food assistance and educational programs, and enhancing economic opportunities and markets for US agricultural producers.

Vigorous physical activity – Participation in activities that make you sweat or breathe hard. These activities can include competitive group sports (soccer and basketball), jogging, lap swimming, cycling, *aerobic* exercise, etc.

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