



2014 MASSACHUSETTS FAMILY IMPACT SEMINAR



A LOT ON OUR PLATE: Chronic Health Threats in Massachusetts



CLARK UNIVERSITY
Mosakowski Institute for
Public Enterprise

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BRIEFING REPORT

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TABLE OF CONTENTS

5 Purpose and Presenters

6 Executive Summary

9 The Family Impact Guide for Policymakers

11 Acknowledgements

12 Cardiovascular Disease: How it Became a Problem, Risk Factors, and the Role of Public Policy

By Ira S. Ockene, M.D., with the assistance of
Jordan Daley and Julia Tran

16 Child and Adolescent Obesity in Massachusetts: Opportunities for Effective Policy Interventions at the State Level

Prepared for Christina Economos, Ph.D., by Jacqueline Daigneault, Carsten-Hendrik Rasche, Denise A. Hines, and Heather Rios

26 Type 2 Diabetes in Massachusetts: A Population Perspective and Its Implications for Public Policy

By Barbara Goldoftas, PhD, with the assistance of
Caitlin Alcorn, Maura Flanagan, and Liam Kelly Fleming

Purpose and Presenters

In 2009, Clark University was accepted as the university to represent Massachusetts in the Family Impact Institute at the University of Wisconsin—Madison (familyimpactseminars.org), an organization of universities nationwide that conduct Family Impact Seminars. The program comprises a series of annual seminars, briefing reports, and discussion sessions that provide up-to-date, solution-oriented research on current issues for state legislators and their aides. The seminars provide objective, nonpartisan research on current issues and do not lobby for particular policies. Seminar participants discuss policy options and identify common ground where it exists.

A Lot on Our Plate: Chronic Health Threats in Massachusetts is the fifth Massachusetts Family Impact Seminar, and is designed to emphasize a family perspective in policymaking on issues related to childhood obesity, cardiovascular disease, and type 2 diabetes. In general, Family Impact Seminars analyze the consequences an issue, policy, or program may have for families.

THIS SEMINAR FEATURES THE FOLLOWING SPEAKERS:

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A Lot on Our Plate: Chronic Health Threats in Massachusetts *Executive Summary*

By Denise A. Hines, Ph.D.

The health of Massachusetts citizens is a primary concern to legislators and Massachusetts families. This briefing report features three essays by experts—Ira Ockene, Christina Economos, and Barbara Goldoftas—who focus on three inter-related aspects of chronic disease: cardiovascular disease, childhood and adolescent obesity, and type 2 diabetes. Each report has further and more detailed suggestions for helping to ameliorate these health concerns of our citizens and families. Below is a summary of the problems we face.

Cardiovascular disease (CVD) is associated with many preventable and treatable risk factors. Nationwide data suggest that the primary risk factors for CVD are high cholesterol, smoking, diabetes, and high blood pressure. Secondary risk factors include low physical activity and obesity.

These risk factors are changeable and/or treatable. The three most important behavioral changes are quitting smoking, better diet, and physical exercise. Nonetheless, behavior change is difficult due to a variety of psychological, social, cultural, environmental, and economic factors. Policymakers can have the most impact on improving the health of Massachusetts citizens by addressing the environmental and economic factors.

Environmental factors include climate, land use, population density, and culture. There are interactions between the ecology of a region (climate, natural environment), the built environment (food supply, land use), and social factors (population density, culture) that contribute to CVD. Paying attention to these factors that contribute to people's interactions with the landscape can help promote or limit healthy lifestyle choices.

Behavioral counseling leads to significant improvements in individual risk factors and helps decrease CVD-related mortality. Further improvements to the health care system and clinical practices can improve these results, as would policies supporting environments that foster healthy lifestyle choices.

Access to healthy food can be addressed by prioritizing nutritional access and education among citizens and through the promotion of community-based projects that are tailored to the immediate needs of the state. Economic reform, such as a minimum wage bill, may also give more of the population access to the expensive foods necessary for a balanced, healthful diet. Policymakers could consider prioritizing infrastructure projects that promote physical activity, such as outdoor spaces for recreation and sidewalk access.

As mentioned, closely related to the issue of CVD is obesity, and the problem of obesity is getting worse for our young people. Within the last three decades, the rates of childhood obesity have doubled, while the rates of adolescent obesity have tripled. Among Massachusetts high school students in 2009, 10.9% were obese, while 16.1% of 2- to 5-year-olds were obese in 2010; these percentages have risen since 2003.

Although child and adolescent obesity is an overarching problem for our state, there are disparities in obesity rates according to race/ethnicity, income, and health insurance coverage. Black and Hispanic children have the highest rates of overweight/obesity in the state; obesity rates rise with decreasing income levels; and people with public or no health insurance coverage have higher overweight/obesity rates than people with private health insurance coverage. Over time, these disparities have persisted and increased.

At-risk groups tend to reside in neighborhoods with below-average availability of healthful food but above-average availability of fast foods. Children who live in neighborhoods without a park or recreation center have significantly higher rates of obesity, and children who live in unsafe neighborhoods or in poorly kept or dilapidated houses also have higher rates of obesity. The following would be helpful in reducing these disparities: having supermarkets instead of smaller convenience stores, having places to exercise, and increasing safety.

In the last decade, different approaches have addressed the childhood obesity problem in the U.S. Although effective to some extent, they are criticized for their narrow focus on schools and individual behavior changes. To address the complex problem of obesity, prevention efforts need to occur at all levels: individual, family, community, and the broader society.

An example of such a prevention program was implemented by Christina Economos and her colleagues in Massachusetts, called Shape Up Somerville (SUS). This project, conducted from 2002-2005 in three elementary schools in Somerville, is an environmental change intervention designed to prevent and reduce obesity in early-elementary school children from a culturally diverse and high-risk population group.

The SUS team created a series of community-based interventions that focused on increasing options for physical activity throughout the day, decreasing sedentary behavior, and improving dietary choices. Some of the community initiatives included school food service reform, enhanced nutrition and physical activity curricula, a healthy restaurants initiative, an increased number of community gardens, renovated parks, and improved bike, pedestrian, and public transport.

The children in the SUS program significantly reduced their sugar-sweetened beverage consumption, reduced screen time, and increased their participation in organized sports and physical activities. After two years, the BMI of the participants decreased, and researchers reported a nearly 30% reduction in the prevalence of overweight and obesity. These results show that interventions to prevent and reduce childhood obesity are effective when engaging many sectors and involving different members of the community over a sustained period of time.

Overall, policy initiatives should focus prevention efforts on groups at risk, start prevention efforts as early as possible, support intervention programs promoting robust, long-term community engagement and civic participation, develop communitywide policies to promote and sustain change, create policies for physical activity in school, standardize indicators evaluating obesity prevention efforts to improve existing policies, and strengthen indicators that track changes in community policies and the environment.

Childhood and adolescent obesity contributes to a rising risk of type 2 diabetes, which in turn, contributes to CVD. Type 2 diabetes is one of the fastest growing public health crises today in the United States and Massachusetts, and it is now one of the most common chronic diseases in this country.

The frequency of type 2 diabetes has increased steadily, growing nearly fourfold between the mid-1980s and 2011. During this period, both diagnosis and treatment improved, but improved diagnosis and treatment cannot explain the rise in frequency. In Massachusetts alone, between 1990 and 2008, the overall frequency of type 2 diabetes nearly doubled, with the number of diabetics in the state jumping from 183,000 to 388,000. Currently, 7.2% of Massachusetts citizens are diagnosed with this chronic disease.

Type 2 diabetes is a progressive disease, and the damage it causes develops progressively as well. It is a primary cause of blindness, kidney failure, and lower limb amputation. It is also an extremely expensive disease, with national costs estimated at \$174 billion in 2007. Because type 2 diabetes is developing earlier with the increasing rates of childhood and adolescent obesity, its lifelong costs will continue to mount.

Just a few generations ago, type 2 diabetes was considered a disease of affluence. Today, it disproportionately affects people with less education and lower income. The risk of type 2 diabetes also varies by age, gender, and race/ethnicity, with older people, men, and people of Black and Hispanic ethnicity facing a higher risk. There are similar disparities in long-term complications, burden of disease, and mortality. These disparities heighten the public health burden of type 2 diabetes.

Just like CVD, type 2 diabetes can be delayed and prevented, and many of the same individual-level changes could be made to prevent type 2 diabetes, such as better nutrition, increased physical activity, and weight loss.

However, at national, state, and local levels, the disparities in the risk of type 2 diabetes faced by different groups living in different residential locations suggest the influence of social and environmental factors. These factors include lack of available and safe opportunities for physical activity; lack of access to nutritious foods; chronic stress, which is associated with obesity, insulin resistance, and increased blood glucose levels; and environmental contaminants, including PCBs, pesticides, dioxin, arsenic, and traffic-related air pollution.

Environmental contaminants are not often discussed as contributors to type 2 diabetes, but considerable evidence shows that exposure to certain contaminants, particularly endocrine-disrupting chemicals, can trigger metabolic changes found in individuals with obesity and type 2 diabetes.

To be effective, interventions need to address the conditions and deficits of a given community. Our health behaviors—so critical to the prevention and management of type 2 diabetes—are not just a matter of individual choices. They are influenced by the people we live with, the work we do, the people we work with, and the city/town and state where we live. Thus, programs should target the general public, families, and communities, because their support is critical in the battle against type 2 diabetes.

In an effort to reduce childhood obesity, state policies—including in Massachusetts—have established measures to do some or all of the following: display calorie content of restaurant and fast-food meals, increase taxes on or reduce sizes of soft drinks and sweetened beverages, remove such products from school vending machines, increase school physical activity time, improve quality of school lunches, and reduce marketing of calorie-dense foods to children.

Cultural- and population-specific characteristics should also be taken into consideration. With marked disparities by race/ethnicity, there is a need for cultural and linguistically appropriate programs, health information, and practitioners for different racial/ethnic groups.

The Family Impact Guide for Policymakers

VIEWING POLICIES THROUGH THE FAMILY IMPACT LENS

- **Most policymakers would not think of passing a bill without asking, “What’s the economic impact?”**
- **This guide encourages policymakers to ask, “What is the impact of this policy on families?” “Would involving families result in more effective and efficient policies?”**

When economic questions arise, economists are routinely consulted for economic data and forecasts. When family questions arise, policymakers can turn to family scientists for data and forecasts to make evidence-informed decisions. The Family Impact Seminars developed this guide to highlight the importance of family impact and to bring the family impact lens to policy decisions.

WHY FAMILY IMPACT IS IMPORTANT TO POLICYMAKERS

Families are the most humane and economical way known for raising the next generation. Families financially support their members and care for those who cannot always care for themselves—the elderly, frail, ill, and disabled. Yet families can be harmed by stressful conditions—the inability to find a job, afford health insurance, secure quality child care, and send their kids to good schools. Innovative policymakers use research evidence to invest in family policies and programs that work, and to cut those that don’t. Keeping the family foundation strong today pays off tomorrow. Families are a cornerstone for raising responsible children who become caring, committed contributors in a strong democracy, and competent workers in a sound economy [1].

In polls, state legislative leaders endorsed families as a sure-fire vote winner [2]. Except for two weeks, family-oriented words appeared every week Congress was in session for over a decade; these mentions of *family* cut across gender and political party [3]. The symbol of family appeals to common values that hold the potential to rise above politics and to provide common ground. However, family considerations are not systematically addressed in the normal routines of policymaking.

HOW THE FAMILY IMPACT LENS HAS BENEFITED POLICY DECISIONS

- In one Midwestern state, using the family impact lens revealed differences in program eligibility depending upon marital status. For example, seniors were less apt to be eligible for the state’s prescription drug program if they were married than if they were unmarried but living together.
- In a rigorous cost-benefit analysis of 571 criminal justice programs, those most cost-beneficial in reducing future crime were targeted at juveniles. Of these, the five most cost-beneficial rehabilitation programs and the single most cost-beneficial prevention program were family-focused approaches [4].
- For youth substance use prevention, programs that changed family dynamics were found to be, on average, more than nine times more effective than programs that focused only on youth [5].

QUESTIONS POLICYMAKERS CAN ASK TO BRING THE FAMILY IMPACT LENS TO POLICY DECISIONS:

- How are families affected by the issue?
- In what ways, if any, do families contribute to the issue?
- Would involving families result in more effective policies and programs?

HOW POLICYMAKERS CAN EXAMINE FAMILY IMPACTS OF POLICY DECISIONS

Nearly all policy decisions have some effect on family life. Some decisions affect families directly (e.g., child support or long-term care), and some indirectly (e.g., corrections or jobs). The family impact discussion starters below can help policymakers figure out what those impacts are and how family considerations can be taken into account, particularly as policies are being developed.

Family impact discussion starters

How will the policy, program, or practice:

- support rather than substitute for family members' responsibilities to one another?
- reinforce family members' commitments to each other and to the stability of the family unit?
- recognize the power and persistence of family ties, and promote healthy couple, marital, and parental relationships?
- acknowledge and respect the diversity of family life (e.g., different cultural, ethnic, racial, and religious backgrounds; various geographic locations and socio-economic statuses; families with members who have special needs; and families at different stages of the life cycle)?
- engage and work in partnership with families?

Ask for a full Family Impact Analysis

Some issues warrant a full family impact analysis to more deeply examine the intended and unintended consequences of policies on family well-being. To conduct an analysis, use the expertise of both family scientists, who understand families, and policy analysts, who understand the specifics of the issue.

- Family scientists in your state can be found at familyimpactseminars.org
- Policy analysts can be found on your staff, in the legislature's nonpartisan service agencies, at university policy schools, etc.

Apply the Results

Viewing issues through the family impact lens rarely results in overwhelming support for or opposition to a policy or program. Instead, it can identify how specific family types and particular family functions are affected. These results raise considerations that policymakers can use to make decisions that strengthen the many contributions families make for the benefit of their members and the good of society.

ADDITIONAL RESOURCES

Several family impact tools and procedures are available on the website of the Family Impact Institute (familyimpactseminars.org).

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Acknowledgements

The views and opinions expressed in this briefing report do not necessarily reflect those of our many supporters and contributors.

We are grateful to the entire Central Massachusetts Legislative Caucus for its support in the development and implementation of the Massachusetts Family Impact Seminar series. We especially acknowledge the assistance of Sen. Harriette Chandler, and of several additional members of the Caucus for their support and advice throughout, including Sens. Michael Moore and Richard Moore and Reps. John Binienda and James O'Day.

Senator Chandler and her staff, especially Laura Paladino, have been particularly helpful with scheduling and coordinating the development of the seminars, and we thank them for their continued support. Each year, they provide valuable input on the topics selected.

We are especially grateful for the support of the Co-Chairs of the Joint Committee on Children, Families and Persons with Disabilities: Sen. Michael Barrett and Rep. Kay Khan. They and their staff members, particularly Joshua Basseches and Kevin R. Larivee (Sen. Barrett), and Lisa Rosenfeld, Ernestina Mendes, Darrell Villaruz, and Emily Szargowicz (Rep. Khan), provided invaluable input and guidance on the topics selected for this year's seminar.

This Briefing Report was researched and produced with the assistance of several Clark University graduate students, including Caitlin Alcorn, Jacqueline Daigneault, Jordan Daley, Maura Flanagan, Carsten-Hendrik Rasche, Heather Rios, and Julia Tran, and Clark

University undergraduate student, Liam Kelly Fleming '15. We are grateful for their hard work and enthusiastic contributions to this report and the seminar.

The Massachusetts Family Impact Seminars are a project of the Mosakowski Institute for Public Enterprise at Clark University. The support of the staff at the Mosakowski Institute has been essential for the execution of the Massachusetts Family Impact Seminars. Our thanks go to Lisa Coakley, Executive Assistant to the Director, Mai Pham '14, Surya Ry '14, and Mickayla Aboujaoude '17.

Last, but not least, the support and encouragement of Clark University President David Angel, Vice President for Community and Government Affairs Jack Foley, and former Senator Gerry D'Amico were central to the development of the seminar series.

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Cardiovascular Disease: How it Became a Problem, Risk Factors, and the Role of Public Policy

By Ira Ockene, M.D., with the assistance of Jordan Daley and Julia Tran

“Parts of the body unused and left idle become liable to disease, defective in growth and age quickly.” – Hippocrates

What many people don't know is that unlike diseases such as cancer, cardiovascular disease (CVD) is not an inevitable part of human life. In fact, CVD is associated with many preventable and treatable risk factors, such as high cholesterol, smoking, hypertension, diabetes, physical activity, and obesity. Within this list, the primary underlying risk factor is elevated cholesterol, although what we consider normal cholesterol is high compared to the levels that human beings used to have, and this normal level is high enough for CVD to develop. In that setting, the other factors are important accelerators of CVD.

Given these risks, it is recommended that policymakers pay close attention to the following: (1) decreasing barriers to physical activity, (2) decreasing barriers to healthy food, and (3) increasing barriers to smoking among the citizens of Massachusetts.

THE BIOLOGY OF CARDIOVASCULAR DISEASE

The underlying cause of CVD is atherosclerosis, which is plaque buildup in one's arteries. This process typically begins early in life, although it normally becomes more noticeable in one's 50's, 60's, or 70's.⁷

As time passes, aided by various accelerating factors, these fatty deposits increase in size and—in the worst case scenario—inflame and rupture, prompting blood to clot around the site. This further increases the blockage in the arteries which then leads to other serious problems such as heart attack and stroke.⁷

HOW DID CARDIOVASCULAR DISEASE BECOME SUCH A PROBLEM?

CVD is a relatively new disease, at least in the epidemic proportions that we see today, and its status as the current leading cause of death is also new. Humans are “designed” to lead a physically active life. While humans are not as good at sprinting as many other mammals, we are one of only four groups of mammals who are superb endurance runners.² That is why we have long legs. Given that we are designed to be endurance runners—yet currently live mostly sedentary lifestyles—it is not surprising that CVD has become our society's leading cause of death.

RISK FACTORS FOR CVD

Nationwide data suggest that the primary risk factors for CVD are high cholesterol, smoking, diabetes, and high blood pressure. Secondary risk factors include low levels of physical activity and obesity.⁷

High Cholesterol. Among these risk factors, high cholesterol is the primary predictive factor for CVD. Longitudinal studies show a link between diets high in saturated fat and cholesterol and risk of CVD. Experiments among lab animals showed that rats fed diets high in saturated fat and cholesterol were more likely to have high blood cholesterol than rats fed diets low in saturated fat and cholesterol. As a whole, these studies suggest that a change in diet is an important component of better cardiovascular health.⁷

Smoking. Numerous studies have documented the relationship between smoking and risk of CVD. A longitudinal study of 190,000 men found that men who smoked regularly were more likely to die from CVD than men who did not smoke regularly. Another study found that people who had quit smoking significantly decreased their risk of CVD. Nicotine in cigarettes negatively affects the cardiovascular system through increasing heart rate, decreasing the oxygen-carrying capacity of the blood, and stimulating blood clotting.⁷

High Blood Pressure. High blood pressure (a.k.a., hypertension) is also a major risk factor for CVD. Many studies have shown a direct and continuous relationship between increased blood pressure and risk of CVD, especially an increased risk of stroke. However, when treating high blood pressure in the elderly, it is necessary to be cautious because attempting to lower blood pressure to “normal” levels can increase their risk of falling.⁷

Low Physical Activity. Considerable evidence links physical activity and decreased risk of CVD. The Lipid Research Clinics Prevalence Survey (a study of 3,000 men between the ages of 30 and 69) found that men who engaged in high levels of physical activity were at a significantly lower risk of dying from CVD than men who were less physically active. Similarly, a longitudinal study of 13,000 men and women found increased levels of physical exercise correlated with lower deaths from CVD. Inactive individuals have a 35–52% greater risk of developing hypertension than physically active individuals. In addition, inactivity is linked with many other risk factors for CVD, including increased risk of diabetes and obesity.¹⁴

Diabetes and Obesity. Ninety percent of diabetics have type 2 diabetes, which requires a genetic predisposition but is triggered by obesity. Diabetes is one of the major risk factors contributing to deaths caused by CVD. Because of its link to obesity, diabetes is often the second most important factor that makes individuals susceptible to CVD. Diabetes is strongly associated with stroke and coronary heart disease. Further, although women tend to have lower rates of CVD, women with diabetes have rates of CVD equal to those of men, indicating that diabetes is a stronger risk factor for CVD among women in comparison to men.³

CVD is the leading cause of death among Latino individuals in the U.S., and evidence suggests this mortality rate due to CVD is growing. Some of this increased risk is due to a genetic predisposition to insulin resistance (a pre-diabetic condition), but lifestyle factors also contribute.³

CVD and associated risk factors, particularly diabetes, vary widely between Latino groups from different national origins. These differences may be due to variations in traditions, diets, and socio-economic backgrounds, but is largely attributed to the degree of acculturation and length of residence in the U.S. Groups that are well acculturated or have spent the longest duration of time in the U.S. are most susceptible to CVD and its risk factors.³

IMPORTANT BEHAVIORAL CHANGES

All of the risk factors mentioned above are changeable and/or treatable. The three most important behavioral changes are quitting smoking, better diet, and physical activity. These behavioral changes have been linked to many risk factors for CVD. Good nutrition is linked to lower cholesterol levels, reduced blood pressure, lower risk of diabetes, and lower risk of obesity.⁵ Physical exercise is linked with better diet, lower likelihood of smoking, reduced blood pressure, lower risk of diabetes, and lower likelihood of obesity.¹⁴

Quitting smoking is associated with prompt and substantial decreases in risk of CVD. Among smokers already diagnosed with CVD, quitting smoking is associated with a significant reduction in risk of another heart attack, sudden cardiac death, and mortality.¹¹

Despite all of these benefits, behavior change is difficult due to a variety of psychological (e.g., belief in capability to stop smoking), social (e.g., social support for behavior change), cultural (e.g., culture’s influence on food choices), environmental (e.g., availability of healthy food, access to resources that are conducive to physical activity), and economic factors (e.g., affordability of time and resources conducive to change).^{5, 11, 14}

THE BUILT ENVIRONMENT AND FOOD SUPPLY

Creating and sustaining effective behavior changes and preventing CVD are also related to environmental factors, including climate, land use, population density, and culture. A geographic analysis of obesity rates

and these environmental factors showed an association between spatial patterns of all these factors, indicating that they may produce environments that foster obesity.⁹

These associations might be due to interactions between the ecology of a region (climate, natural environment), the built environment (food supply, land use), and social factors (population density, culture). For example, rural counties might not necessarily be correlated with high obesity rates, but a rural county with low education and high unemployment is much more likely to show high obesity rates compared to a “recreation” rural county that also has higher education and lower poverty rates. Paying attention to these social and land use factors that contribute to people’s interactions with the landscape can help promote or limit healthy lifestyle choices.⁹

Food supply is also relevant. Whereas climates in Northeastern cities may not promote ready access to fruits and vegetables year-round, a high population density and extensive network of infrastructure allows for accessible grocery stores to stock healthy fruits and vegetables, whatever the weather. Alternatively, even in counties that are dominated by farming and have a more conducive climate, a lack of roads or population density can lead to food deserts, which lead to limited access to perishable foods like fruits and vegetables. Addressing these infrastructure issues to promote health may be best supported by regional efforts between states.⁹

TRENDS IN DEATHS DUE TO CARDIOVASCULAR DISEASE

In the U.S., age-adjusted death rates due to CVD have decreased in the past 30 years by 50.1% for men and 49% for women, and those rates continue to fall.⁴ Both changes in lifestyle and improvements in medical therapies have contributed to this improvement in mortality rates.

Changes in lifestyle are key to reducing risks associated with CVD and preventing/postponing CVD-related deaths. Specific risky behaviors include smoking, poor diet, sedentary behavior, and risky drinking.⁶ These behavioral risk factors are also associated with obesity, which may have a multiplicative effect for those with high CVD risk.⁸

Research shows that behavioral counseling leads to significant improvements in these risks and helps decrease CVD-related mortality. Further improvements to the health care system and clinical practices can improve these results, as would policies supporting environments that foster healthy lifestyle choices.⁶

Improvements in medical therapies account for approximately 47% of the decrease in deaths due to CVD.⁴ Specific examples of those therapies include medications to treat high blood pressure and manage diabetes, stents that treat the blockages in arteries, and coronary bypass surgery.

PUBLIC POLICY AS AN ACCELERATOR TO CHANGE

The public dissemination of information regarding the risks of CVD has played a large role in the decrease in the rates of CVD-related deaths. However, much more work is left to be done.

We need to institute policies that promote changes in practices by clinicians to provide more individualized and comprehensive therapy focusing on behavior change and prevention. The present health care system is oriented toward acute care. It would be helpful if policies enable more “patient-centered, population-based health and planned care [which] are needed to achieve broad, substantial and lasting improvements.”⁶

However, cardiovascular health is also influenced by external factors beyond clinical practices. These factors include personal behaviors (e.g., smoking), dietary restrictions, and environmental exposures (e.g., economic stress).^{1, 12, 15} Although some of these factors appear to be personal decisions, they can be influenced by public policy, should that policy take into consideration social reforms that impact these factors.^{10, 15}

Access to healthy food can be addressed through public policy by prioritizing nutritional access and education among citizens and through the promotion of community-based projects that are tailored to the immediate needs of the state.^{12, 13} Economic reform, such as a minimum wage bill, may also give more of the population access to the more expensive foods that are necessary for a balanced, healthful diet.¹⁵

Considering the integrated associations between social relationships, economy, and health, it is also important to consider the health implications of any social reform bills. Policy-makers should consider prioritizing infrastructure projects that promote physical activity, such as outdoor spaces for recreation and roadwork projects that emphasize sidewalk access,¹⁵ as well as ensuring safe environments for outdoor activity.

Tobacco usage and associated risks for CVD can be addressed through increasing barriers to access of tobacco products. Further, policies that promote better educational access should be considered not only for their benefit to the state's workforce and students, but also for their value in promoting better health outcomes (among adults, diabetes mortality rates are three times higher for high school graduates than college graduates).¹⁵

Overall, it may be most effective to combat the damages associated with CVD by integrating a health consciousness into policy actions across a broad range of issues. More immediately, direct action should be taken to address healthful food access, limiting tobacco use, and promoting safe environments for physical recreation.

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Child and Adolescent Obesity in Massachusetts: Opportunities for Effective Policy Interventions at the State Level

Prepared for Christina Economos, Ph.D., by Jacqueline Daigneault, Carsten-Hendrik Rasche, Denise A. Hines, and Heather Rios

Within the last three decades the rates of childhood obesity have doubled, while the rates of adolescent obesity have tripled. Nationwide in 2009-2010, 16.9% of children ages 2-19 were obese.^{20, 25}

Among Massachusetts high school students in 2009, 10.9% were obese,³ while 16.1% of 2- to 5-year-olds were obese in 2010.⁴ Massachusetts ranks 22nd nationwide in state prevalence of overweight and obese children, and its prevalence rate has risen since 2003.⁵

Childhood obesity can have both short- and long-term health consequences.²⁵ Examples of immediate health effects include high blood pressure, high cholesterol, prediabetes, bone and joint problems, and sleep apnea. Long-term health effects include persistent obesity into adulthood, heart disease, type 2 diabetes, stroke, some cancers, and osteoarthritis.³

This report will provide information on the extent of the problem of childhood and adolescent obesity in Massachusetts, modifiable risk factors, and effective prevention and policy programs that can help alleviate this problem.

HOW DO WE MEASURE OBESITY?

The primary means of measuring obesity is body mass index (BMI). BMI is calculated using a child's weight and height, and children are categorized into overweight and obese based on age- and sex-specific percentiles. Overweight children are at or above the 85th percentile for their age and gender. Obese children are at or above the 95th percentile.²⁴

DISPARITIES IN CHILD AND ADOLESCENT OBESITY

Although child and adolescent obesity is an overarching problem for our state, there are disparities in obesity rates in several demographics, including age, gender, race/ethnicity, income, and health insurance coverage.

Age

Nationwide in 2009-2010, the prevalence of obesity was 12.1% among 2- to 5-year-olds, 18% among 6- to 11-year-olds, and 18.4% among 12- to 19 year-olds. Between 1999 and 2010, children ages 6-19 had significantly higher rates of obesity than children ages 2-5 years.²⁵

In Massachusetts, the most recently available data is from the 2007 National Survey of Children's Health. This self-report survey breaks down overweight/obesity prevalence into 10- to 13-year-old and 14- to 17-year-old age categories. Figure 1 shows the prevalence rates by age category for both Massachusetts and the U.S. as a whole. As shown, 10- to 13-year-olds have higher rates of overweight/obesity.²¹

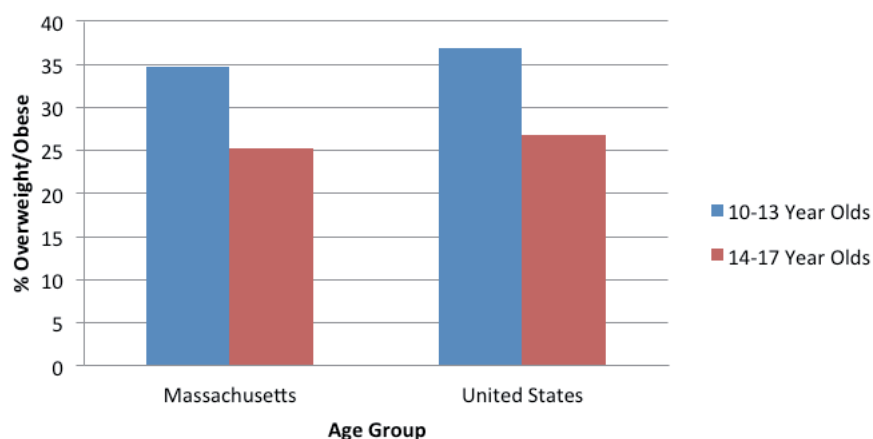


Figure 1: Age and Rates of Childhood/Adolescent Overweight/Obesity in Massachusetts and United States in 2007.

Source: National Survey of Children's Health (2007)

Gender

Nationwide in 2009-2010, the prevalence of obesity among children and adolescents ages 2-10 was significantly greater in boys (18.6%) than in girls (15.0%). When breaking these percentages down by race/ethnicity, gender differences only exist for non-Hispanic White children; there are no gender differences among non-Hispanic Black or Hispanic children. In addition, analyses over time show that between 1999 and 2010, boys showed a significant increase in obesity, but girls did not.²⁵

In Massachusetts in 2007, we see similar gender differences in rates of childhood/adolescent overweight/obesity, as shown in Figure 2. Overall, 34.3% of boys were overweight/obese, while 25.9% of girls were.²¹



Figure 2: Gender and Rates of Childhood/Adolescent Overweight/Obesity in Massachusetts and United States in 2007.

Source: National Survey of Children's Health (2007)

Race/Ethnicity

Nationwide in 2009-2010, significant racial/ethnic differences were found in childhood/adolescent obesity rates. The highest rates were found among non-Hispanic Black children/adolescents (24.3%), followed by Hispanic children/adolescents (21.2%). The lowest rates were among non-Hispanic White children/adolescents (14.0%).²⁵

Between 1999 and 2010, non-Hispanic Black and Hispanic children were significantly more likely to be obese than non-Hispanic White children. In addition, non-Hispanic Black male children showed significant increases in obesity rates over that time, while no other racial/ethnic group did for either boys or girls.²⁵

In Massachusetts in 2007, we see the highest rates of overweight/obesity for non-Hispanic Blacks (64.7%), followed by Hispanics (36.6%) (see Figure 3). This stands in contrast to nationwide percentages, where non-Hispanic Blacks and Hispanics have similar rates of overweight/obesity (~41%).²¹

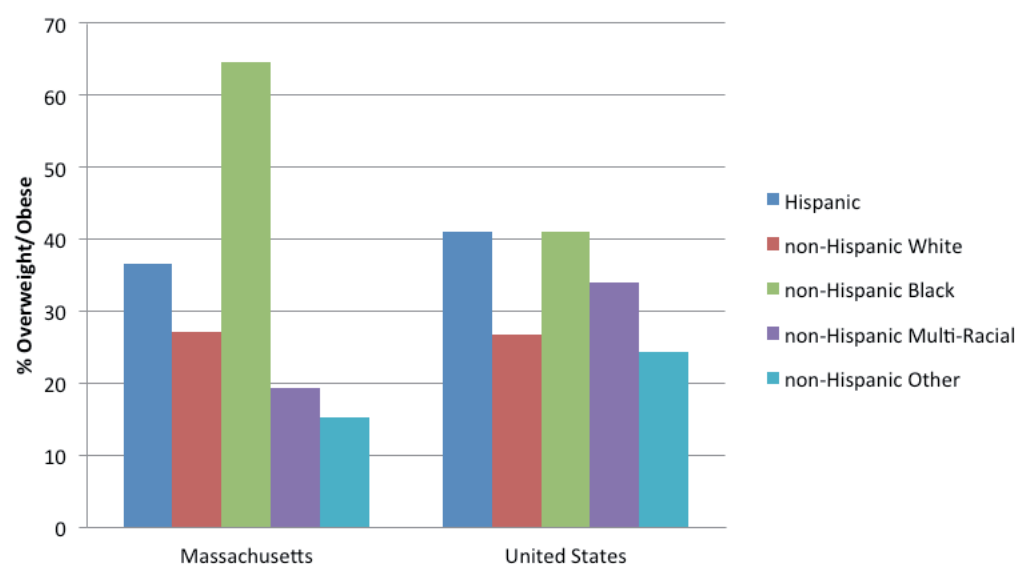


Figure 3: Race/Ethnicity and Rates of Childhood/Adolescent Overweight/Obesity in Massachusetts and United States in 2007. Source: National Survey of Children's Health (2007)

Income

In 2009, nearly 33% of the nation's low income children ages 2-4 years were overweight or obese, with approximately 14.6% obese. Among these low-income children, American Indian and Alaska Native (20.7%) and Hispanic (17.9%) children had the highest rates of obesity, and American Indian/Alaska Native children are the only racial/ethnic group to show an increase in obesity since 2003 among low income children ages 2-4 years.²⁶

In the U.S. and Massachusetts, income predicts overweight/obesity levels, as shown in Figure 4. In Massachusetts, 44.8% of those below the federal poverty line (FPL) were overweight or obese in 2007, in comparison to 22.2% who were 400% or more above the FPL. Similar decreases as a function of %FPL were seen nationwide.²¹

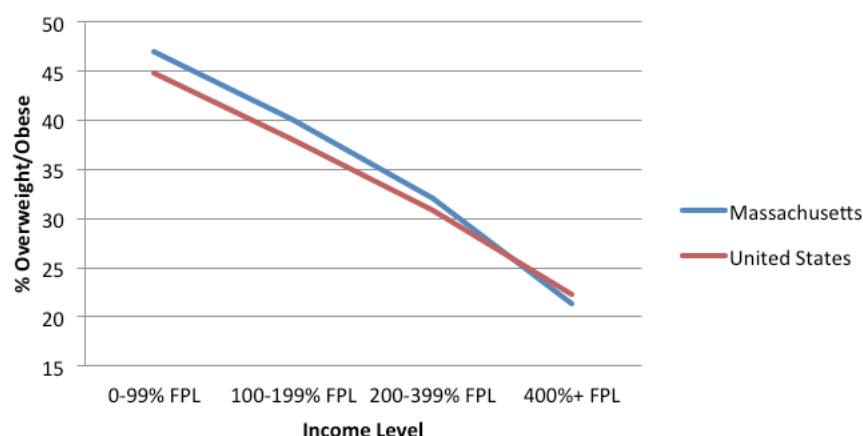


Figure 4: Income and Rates of Childhood/Adolescent Overweight/Obesity in Massachusetts and United States in 2007.
Source: National Survey of Children's Health (2007)

Health Insurance Coverage.

Data on disparities in childhood/adolescent obesity is only available from the 2007 National Survey of Children's Health. The data are consistent for Massachusetts and the nation as a whole (see Figure 5), and shows that people with private health insurance coverage have lower rates of overweight/obesity than those with either public insurance coverage or none at all.²¹

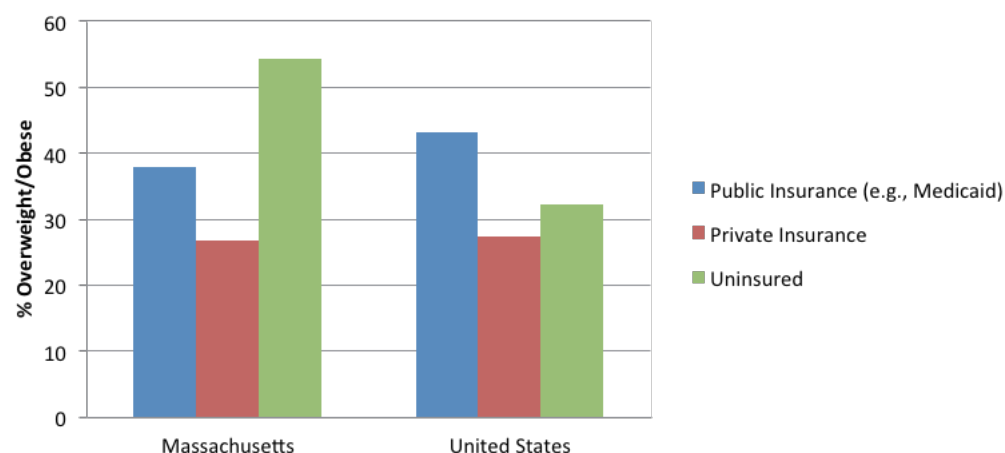


Figure 5: Insurance Coverage and Rates of Childhood/Adolescent Overweight/Obesity in Massachusetts and United States in 2007. Source: National Survey of Children's Health (2007)

Reasons for the Disparities

The majority of research on disparities in child and adolescent obesity focuses on disparities between racial/ethnic groups and income levels. As shown above, there are concerning disparities within Massachusetts and the nation as a whole based on race/ethnicity, socio-economic status, and type of health insurance coverage. Research over time suggests that these types of disparities have persisted and increased, and thus deserve serious attention from state policymakers.¹

These factors, in turn, are influenced by environments that are amenable to change. At-risk racial/ethnic groups and people of lower socio-economic status tend to reside in neighborhoods with below-average availability of healthful food but above-average availability of fast foods.¹⁵ Children and adolescents who live in neighborhoods without a park or recreation center have significantly higher rates of obesity, even after considering the influences of socio-economic status, other health behaviors, health insurance, and health care quality.¹ Children who live in unsafe neighborhoods or in poorly kept or dilapidated houses also have higher rates of obesity.¹

Racial/ethnic differences in child and adolescent obesity are at least partly due to racial/ethnic differences in food-related beliefs, preferences, and behaviors; however, these are not the only influences. Some other influences include higher rates of obesity and gestational diabetes in pregnant women of disadvantaged groups, attitudes of parents that may lead to overfeeding of children, higher than average availability and consumption of high-calorie foods and beverages, and below-average physical activity.¹⁵

Research provides strong support for the following in reducing disparities for disadvantaged groups: having supermarkets instead of smaller convenience stores, having places to exercise, and increasing safety. Thus, strategies to reduce these disparities along racial/ethnic and socio-economic lines would be to change the environments to provide safe places to exercise and increase supermarket access.¹⁶

CAUSES OF OBESITY

Primarily, obesity occurs as a result of an energy imbalance, meaning that the caloric intake through the consumption of food and drinks is greater than the calories an individual expends through metabolism and exercise over time.²⁷ But what causes this energy imbalance in the first place?

Biological factors

Biological factors, including genetic predisposition to obesity, metabolism level, and ill health, play a role in influencing energy imbalance and obesity. While biology is an important factor, environmental factors play a significant role in influencing obesity.³¹

Environmental factors

Apart from biology, there are three broad environmental factors that may contribute directly to obesity:²⁷

- activity environment
- food environment
- societal influences

In the United States, less than 50% of children between the ages of 6 and 11 are getting at least an hour of physical activity per day.³⁰ This statistic is cause for concern, as an individual's **activity environment**, referring to the influence of the environment on an individual's activity level, is one factor that may contribute to obesity. The lack of adequate bike lanes or crosswalks, for example, may prevent students from biking or walking to school.

Activity environments vary and can affect groups differently. The lack of exercise facilities in low socio-economic status areas has influences on obesity rates.¹⁶ In short, activity environment influences individuals' physical activity, including the type, frequency and intensity of the physical activities an individual undertakes.²⁷

Foods low in nutrients and high in energy, including sugar-sweetened beverages, comprise nearly 40% of children's daily caloric intake.²⁸ This relates to the second broad environmental factor influencing obesity: **food environment**. Here the availability, convenience, and price of food may influence an individual's dietary habits, including the quality, quantity and frequency of eating.

Lack of healthy options in school cafeterias, for example, may contribute to higher rates of obesity among school children. A recent study in Somerville, Massachusetts (see below), for example, found the consumption of sweetened beverages to be significantly associated with obesity in school children.⁹ Food consumption is thus linked to a wider range of environmental factors that influence what people choose to eat.

Finally, there are **societal influences** on energy imbalance and obesity. For example, media, peer pressure, culture, and/or education may expose individuals to certain ideas about food and consumption. This environment in turn contributes to an individual's psychology.²⁷

Exposure to fast food marketing, for example, may contribute to the development of a psychological drive towards particular types of high caloric and heavily processed food. Culture also matters: Variations in cultural beliefs and practices related to food and feeding may contribute to different patterns of obesity among ethnic groups.¹⁵ Patterns and preferences of consumption that contribute to energy imbalance and obesity may thus derive from social influences.²⁷

OBESITY PREVENTION

Effectiveness of Prevention Programs

In the last decade different approaches have addressed the childhood obesity problem in the U.S. A recent review of 55 intervention programs showed that BMI score reduction was highest in programs targeting children between 6 and 12 years of age.³³ Additionally, the following prevention strategies and policies were the most effective:

- incorporation of prevention programs into the school curriculum addressing healthy eating, physical activity, and body image;
- increased physical activity sessions and development of fundamental movement skills;
- higher nutritional quality food provided by schools;
- cultural practices and environments that support eating healthier foods and being more active throughout the day;
- support of teachers to implement health promotion strategies; and
- support from parents and home activities encouraging children to eat more nutritious food, spend less time on screen-based activities, and be more active.

Despite these promising results, conventional intervention programs would benefit from expanding their focus beyond schools and individual behavior changes.^{8, 29}

Because less than 50% of children's waking hours are spent in school, intervention efforts are well-advised to consider all daily influences of children's energy balance. To address the complex and stubborn problem of obesity, prevention efforts need to occur at all levels: individual, family, community, and the broader society.¹²

Rethinking: Prevention Programs Addressing the Entire Community

More recent prevention programs combine traditional hierarchical top-down approaches, such as school programs, with bottom-up approaches influencing entire communities. These new types of programs not only affect individuals' behaviors, but are also using multiple strategies across multiple settings to change behavior patterns in the entire community, creating room for holistic, versatile, and long-term change.^{8, 11} The result is a more complex intervention involving the whole community, targeting the environmental and social determinants of health.

New intervention strategies should focus on making physical activity into a routine and integral part of life, changes in the food and beverage environment allowing for healthier choices, reshaping of messages about nutrition and physical activity, and greater involvement of health care providers and insurers.¹² At the community level, possible interventions could include the improvement of bikeways, sidewalks, and public transport, as well as a healthy restaurant initiative. At the school level, intervention could include the introduction or revision of the school wellness policy.

As described earlier, no single factor is responsible for energy imbalance in children. A comprehensive approach as described here takes the complex nature of the problem into account and focuses on the most malleable determinants of health, the social and physical environment. When creating community interventions, planners must be careful to consider community needs and allow for ownership by stakeholders in their community.

PREVENTION EFFORTS IN MASSACHUSETTS

Case Study: Shape up Somerville: Eat Smart, Play Hard™

One example of a recent prevention program is one that Christina Economos and her colleagues implemented in Massachusetts called Shape Up Somerville (SUS). This study, conducted from 2002 to 2005 in three elementary schools in Somerville, Mass., was an environmental change intervention designed to prevent and reduce obesity in early-elementary school children from a culturally diverse and high-risk population group.⁶

The researchers on the SUS team worked with the community to develop strategies to influence energy balance in first-third graders through a series of interventions that focused on increasing options for physical activity throughout the day, decreasing sedentary behavior, and improving dietary choices. SUS addressed a variety of environmental factors influencing obesity rates within the targeted population through community-wide engagement. Intervention activities were developed and implemented to make changes in before-, during-, and after-school environments. Some of the community initiatives included:⁶

- School food service reform
- Enhanced nutrition and physical activity curricula
- A healthy restaurants initiative
- An increased number of community gardens
- Renovated parks
- Improved bike, pedestrian, and public transport

The SUS initiative offered positive and promising results. The children involved significantly reduced their sugar-sweetened beverage consumption, reduced screen time, and increased their participation in organized sports and physical activities. As a result, after two years, the BMI of the participants decreased, and researchers reported a nearly 30% reduction in the prevalence of overweight and obesity.⁷

These results show that interventions to prevent and reduce childhood obesity are effective when engaging many sectors and involving many different members of the community, over a sustained period. These community members may include children and families, schools, business leaders, policymakers, health care practitioners, and community organizers, among others.^{7,9}

Other Prevention Efforts in Massachusetts

In recent years, international³⁴ and national organizations²² have worked on different intervention strategies. However, many believe that the state and local level is where the most progress can be achieved. Success is highly dependent on initiatives around the state, commitment of stakeholders, and collaboration between different executive branch offices. In Massachusetts, different actors—including schools, health plans, and community organizations—have started to work on the reduction of childhood obesity.¹⁰

The statewide initiative “Mass in Motion” was launched in 2009 by the Department of Public Health with the aim to prevent overweight and obesity, and to promote wellness in Massachusetts. It focuses on healthy eating and physical activity at home, at work, and in the community.¹⁸ Key efforts for the Mass in Motion community initiatives, which are represented in 33% of Massachusetts communities, are (1) to support schools, neighborhood stores, restaurants, farmers’ markets, and food pantries to offer healthy, affordable choices to increase access to fresh foods; (2) to support physical activity by increasing safe opportunities, for example through creation of parks, enhanced open spaces or other recreational facilities; and (3) to redesign neighborhoods that promote and support walking and biking.

A special subprogram, “Mass in Motion Kids,” is running from September 2012 until June 2014, and is working with two communities in Massachusetts on making changes in children’s environment, as well as in policy. The program, funded by the Centers for Disease Control and Prevention, focuses on underserved children ages 2-12. It aims to make changes in primary care, schools, and after-school programs; create policy change; and build awareness by using a communitywide social marketing campaign.¹⁸

Policy Initiatives

The Institute of Medicine¹² identified schools as the national focal point for obesity prevention efforts. Within the last years, different school-based policies have been implemented. The largest portion focused on the improvement of healthy food in schools rather than improving physical activity.¹⁹

In 2010 and 2011, Massachusetts changed existing policies on competitive food and beverages and established standards. To date, no policies specifically address physical activity or the amount, frequency, and intensity of it.

Research has shown that schools are ideal places to increase the physical activity of young people, but also that the school setting could be better used to support physical activity.² Research also indicates that physical education programs using standardized curricula and goals result in more physically active children¹⁷ and that well-designed playgrounds, open spaces and available equipment increase activity during and after school time.²³

In addition, research shows that implementation of state policies requiring that children spend a specific amount of time in physical activity every day is an effective strategy to promote regular activity.¹⁴ To ensure changes in school, policy support is advisable. State policymakers can support the process by setting standards for physical activity, ensuring that physical activities are incorporated into school wellness policies, and improving opportunities for physical activities beyond the school day.³²

MEASURING SUCCESS

Monitoring success is a crucial part of any intervention. Only then can states and communities evaluate their efforts and identify which part of the intervention worked in which specific context. Evaluation also opens the door for adjusting specific parts of the intervention programs, comparing success factors between different communities and share with others what works.

To ensure this, statewide regulations and requirements for collecting BMI indicators and fitness assessments, and tracking community change efforts, are needed. However, this is a much bigger issue, as no consensus on a set of indicators exists yet.

The National Institute of Medicine (IOM)¹³ recently published a plan to evaluate the advancement of obesity prevention efforts and to provide guidance for systematic and routine planning. The plan consists of a set of indicators covering four areas: Community Health Assessment, Surveillance, Community Program and Intervention Monitoring, and Summative Evaluation.

At the national level, the implementation of the plan would provide the benefit of a better understanding of general trends over time. However, as the IOM points out, implementation would be particularly helpful in receiving context-specific information about each state and different communities. The focus of most information is on individual behavior, energy expenditure, food intake, and BMI. Less represented are indicators tracking changes in policies and the environments at the community and population levels. To continue and improve current intervention efforts, it is crucial to find out what works. The improvement of indicators and evaluation efforts is of great importance to help legislators and policymakers refine existing policies.¹³

SUMMARIZED POLICY IMPLICATIONS

- Focus prevention efforts on groups at risk (e.g., low income and minority populations).
- Start prevention efforts as early as possible, as early as infancy.
- Support intervention programs promoting robust, long-term community engagement and civic participation.
- Develop communitywide policies to promote and sustain change.
- Create policies for physical activity in school.
- Standardize indicators evaluating obesity prevention efforts to improve existing policies.
- Strengthen indicators that track changes in community policies and the environment.

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Type 2 Diabetes in Massachusetts: A Population Perspective and Its Implications for Public Policy

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Type 2 diabetes is one of the fastest growing public health crises today in the United States and Massachusetts. Most of us are keenly aware of the alarming rise over the past 30-40 years in overweight and obesity. The risk of type 2 diabetes has risen in tandem, making it one of the most common chronic diseases in this country.¹⁵

Especially if diagnosed late or not well managed, type 2 diabetes is a debilitating disease; it can reduce the quality of our lives, productivity, and life expectancy. It is a serious condition—a primary cause of blindness, kidney failure, and amputation. It also brings an increased risk of heart disease and stroke.²⁰

A study from the Centers for Disease Control and Prevention (CDC) estimates that, if current trends continue, by 2050 one in three U.S. adults could have type 2 diabetes.¹⁰ In Massachusetts alone, between 1990 and 2008, the overall frequency of type 2 diabetes nearly doubled, with the number of diabetics in the state jumping from 183,000 to 388,000.¹¹

Type 2 diabetes is an extremely expensive disease, with national costs estimated at \$174 billion in 2007.² In 2008, the American Diabetes Association estimated that one in five healthcare dollars was spent on someone with diabetes.² On average, even after adjusting for age, a person with type 2 diabetes has health care expenses more than twice those of a non-diabetic.³⁹ As type 2 diabetes develops earlier, the expenses incurred across a lifetime will continue to mount.

Nationally and in Massachusetts, the risk of type 2 diabetes varies by age, gender, and race/ethnicity. In general, older people, men, and people who are Black or of Hispanic ethnicity face a higher risk as do, increasingly, Asian Americans.⁴⁷

Type 2 diabetes also disproportionately affects people with less education and lower income. Further, although once primarily a condition of older adults, it strikes younger adults, adolescents, and even children.⁴³ However, unlike some diseases of ageing, type 2 diabetes can be delayed and even prevented.

RISING RISK OF TYPE 2 DIABETES

Diabetes mellitus describes a group of disorders in which glucose, the body's main source of energy, is not regulated correctly. Type 2 diabetes (formerly called adult-onset) is the most common, accounting for 90-95% of all cases of diagnosed diabetes. Type 1 or juvenile diabetes, considered an autoimmune disorder, accounts for most of the remaining cases. Diabetes can also occur only during pregnancy (gestational diabetes).

According to the most recent data from the CDC, in 2010, diabetes affected around 25.8 million people or 8.3% of the U.S. population.^{9,1} Of these, 18.8 million actually had been diagnosed, while 7.0 million were

estimated to be living with type 2 diabetes that had not yet been diagnosed and was not being treated. In addition, nearly one-third of U.S. adults are estimated to have pre-diabetes, with elevated levels of blood sugar and an increased risk of developing type 2 diabetes.¹⁰

Type 2 diabetes develops progressively, as does the damage it causes. Over time, insulin, a hormone that helps move blood sugar into cells, becomes less effective, eventually leading to insulin resistance, considered a precursor to type 2 diabetes (type 1 diabetics do not produce insulin at all).

In type 2 diabetics, if blood sugar is not controlled, persistently high levels can eventually cause serious long-term complications. Type 2 diabetes can damage every major organ system; it is a primary cause of blindness, kidney failure, and amputation of lower limbs. Type 2 diabetics on average face a two- to four-fold increased risk of heart disease and stroke.^{9,20}

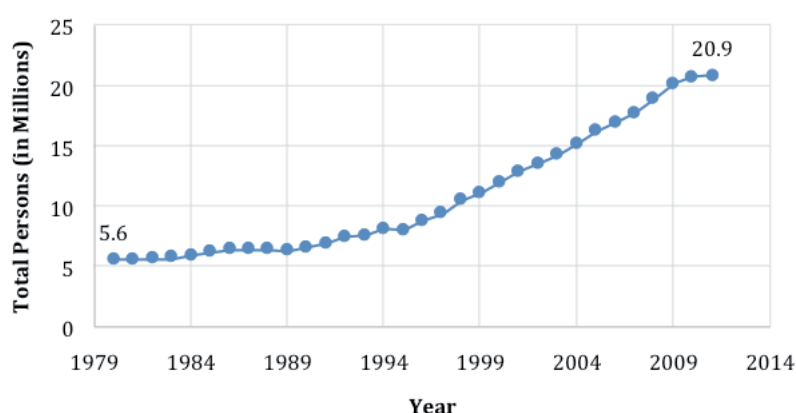


Figure 1: Total Number of People Diagnosed with Diabetes in U.S. Population, 1980-2011.

Source: Centers for Disease Control and Prevention, National Center for Health Statistics, 2013.

Since the 1980s, the frequency of type 2 diabetes has increased steadily, growing nearly fourfold between the mid-1980s and 2011.¹² During this time period, both diagnosis and treatment have improved. While there are fewer cases of undiagnosed type 2 diabetes now than 30-40 years ago, improved diagnosis and treatment alone cannot explain the unrelenting rise in frequency since the late 1980s (see Figures 1 and 2).

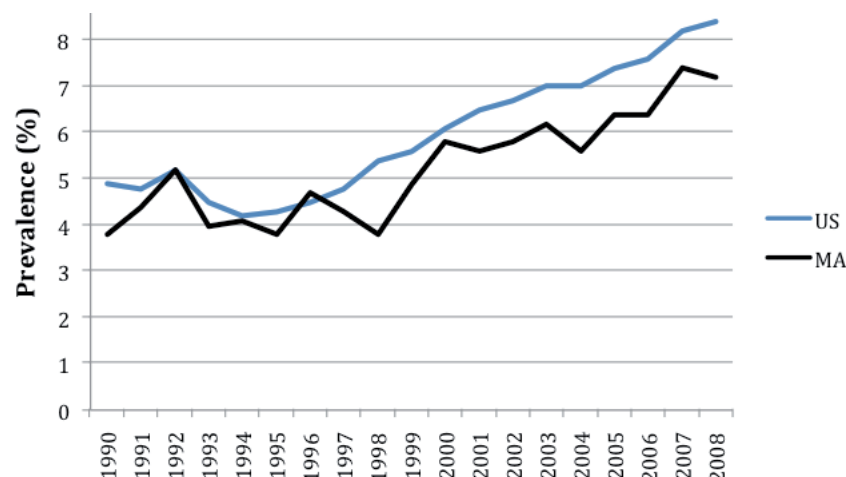


Figure 2: Prevalence of Diagnosed Diabetes in the United States and Massachusetts, 1990-2008.

Source: Massachusetts Department of Public Health, 2010.

In 2010 alone, nearly 1.9 million people aged 20 or older in the United States were newly diagnosed with diabetes.⁹ If type 2 diabetes is diagnosed early, improved blood sugar control can delay the onset of long-term complications. Those diabetics who remain undiagnosed present an additional future public-health burden.

There are disparities in the frequency of type 2 diabetes according to race/ethnic group, gender, and area of residence.^{7, 21, 31, 34} There also are similar disparities in long-term complications, burden of disease, and mortality. These disparities heighten the public health burden that type 2 diabetes presents in the United States today.²¹

TYPE 2 DIABETES IN MASSACHUSETTS

In Massachusetts, an estimated 7.2% of residents have been diagnosed with diabetes.¹⁰ While this overall frequency is slightly lower than in the United States overall, it has risen dramatically over the past 20 years. Since 1994, the burden of diabetes in the Commonwealth has more than doubled, rising from 183,000 cases in 1994 to 388,000 in 2010 (see Figure 3). However, this burden is not distributed evenly across the state or among different groups within our state's population.

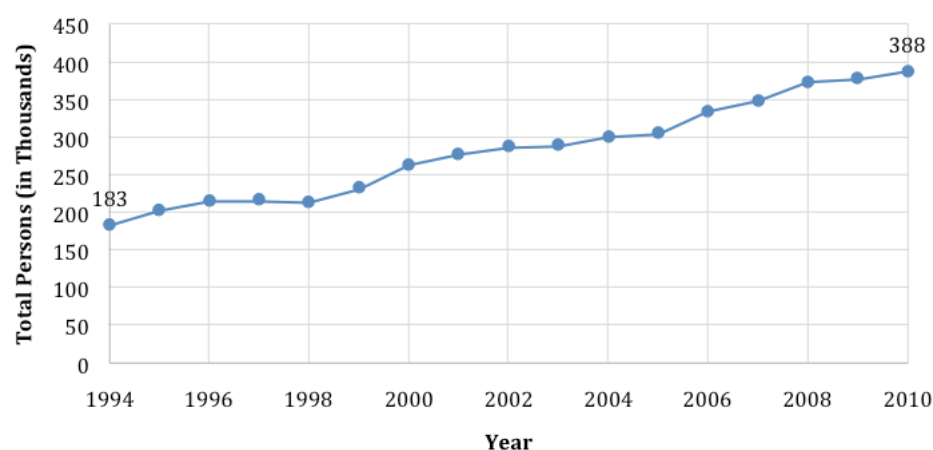


Figure 3: Total Number of Cases of Diagnosed Diabetes Among Massachusetts Adults, 1994-2010.

Source: Centers for Disease Control and Prevention, 2014.

The risk of developing type 2 diabetes rises steadily with age. Among people who are 65-74 years old in Massachusetts, nearly 20% have been diagnosed with diabetes, compared with 6.9% of people between 45 and 54 years (see Figure 4).

However, the disease is now appearing in children and adolescents, which was rare until 30 years ago. While type 1 (juvenile-onset) diabetes previously accounted for more than 97% of new cases of diabetes in adolescents, by 2007, nearly half of new adolescent cases were identified as type 2 diabetes.⁴²

The early development of type 2 diabetes has direct implications for public health. The longer individuals have the condition, the more likely they are to develop disabling long-term complications and the more health-care expenses will accrue over their lifetime.

Within Massachusetts, the prevalence (frequency) of type 2 diabetes varies among counties (see Figure 5). Even after adjusting for age, the prevalence ranges from a low of 6.2% in Barnstable County to 9.8% in Bristol County.

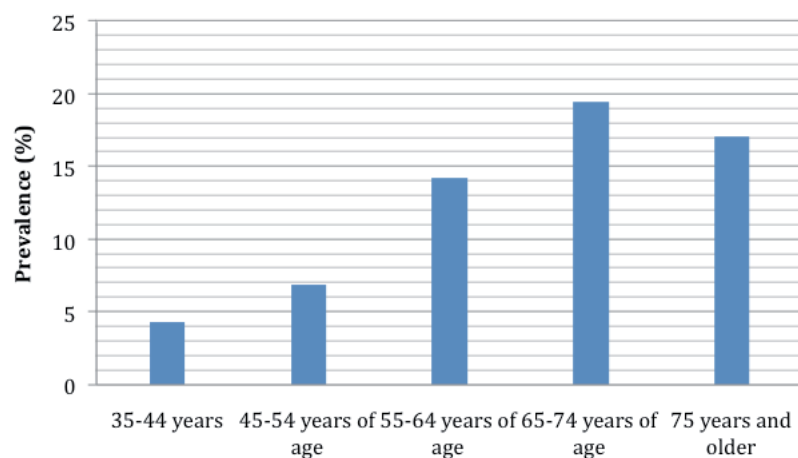


Figure 4: Prevalence of Diagnosed Diabetes in Massachusetts by Age Group, 2009.

Source: Massachusetts Department of Health and Human Services, 2014.

There also are disparities among cities and residential neighborhoods.²¹ The Massachusetts Department of Public Health reported the following age-adjusted frequencies for diagnosed diabetes in the Commonwealth's larger cities: Lawrence (13.0%) and Springfield (12.0%) had the highest prevalence, while Worcester (8.3%) and Boston (8.8%) had lower frequencies.⁴⁰ Even within these cities, the frequency varies considerably among different neighborhoods, typically reflecting disparities by race/ethnic group and income level.

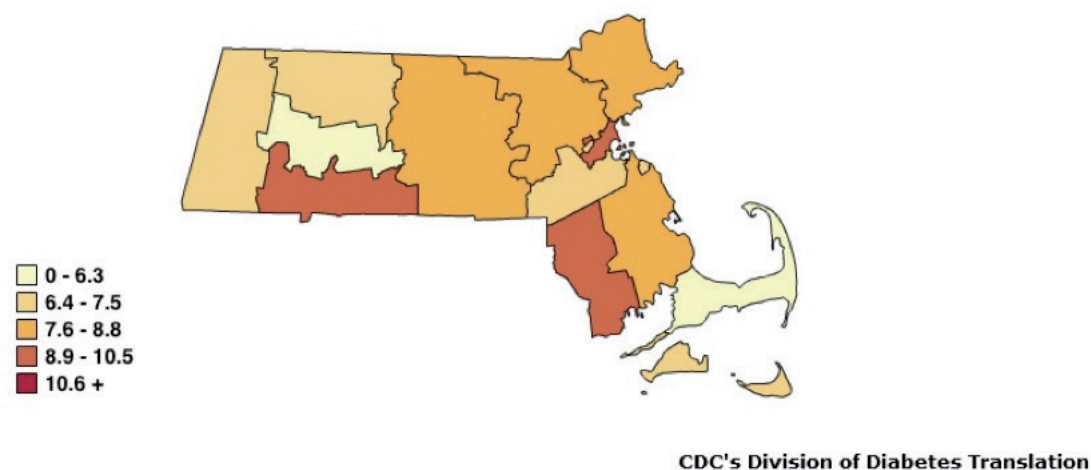


Figure 5: Age-Adjusted Prevalence of Diagnosed Diabetes Among Adults in Massachusetts, 2010.

Source: Centers for Disease Control and Prevention, 2010.

In Massachusetts, there are pronounced disparities among racial/ethnic groups. The frequency of type 2 diabetes is highest among Hispanic and Black populations (11.6% and 10.5%, respectively), compared with 7.6% for Whites in 2011.³⁹ Such disparities indicate a combination of risk factors that interact to contribute to increased prevalence of diabetes, as discussed later.

Further, there are disparities in how well diabetics fare after diagnosis. Each year between 2002 and 2007, nearly 1,300 deaths with diabetes identified as the underlying cause were reported. However, the overall mortality rate on average is twice as high among non-Hispanic Blacks as among non-Hispanic Whites.³⁸ In fact, while type 2 diabetes is the ninth leading cause of death in Massachusetts overall, it is the fourth leading cause for death for Hispanics and non-Hispanic Blacks.³⁸

Finally, in Massachusetts, diabetes prevalence varies by common measures of socio-economic status: education and income (see Figure 6). Those who have earned less than a high school diploma have a frequency of diabetes 2.6 times that of college graduates. Similarly, those earning less than \$25,000 have a frequency of diabetes 2.5 times that of those earning more than \$75,000 a year.

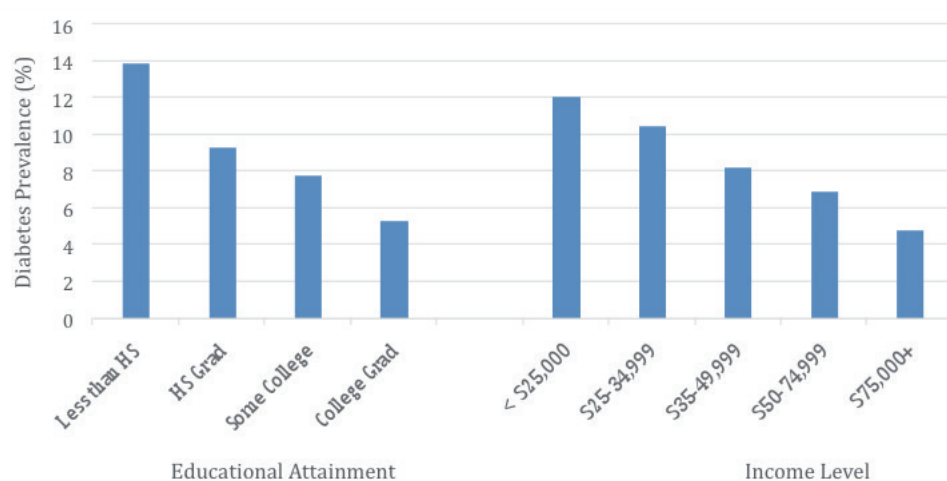


Figure 6: Prevalence of Diabetes in Massachusetts by Educational Attainment and Income Level, 2011.

Source: Massachusetts Department of Public Health, 2013.

AN INDIVIDUAL PERSPECTIVE: COMMON RISK FACTORS FOR TYPE 2 DIABETES

Type 2 diabetes is a complex disease whose multiple causes are still not fully understood. Like other chronic diseases, such as cancer and heart disease, it is attributed to an interconnected array of risk factors. It is likely that different factors trigger type 2 diabetes in different individuals or populations.

Genetic predisposition can make individuals susceptible to type 2 diabetes, but the dramatic surge in frequency in the United States—and countries around the world—has occurred too rapidly for genetic differences to be primarily responsible. There also is little evidence that genetic differences contribute in a significant way to disparities by race/ethnic group.²¹

At the individual level, evidence across many disciplines—including endocrinology, epidemiology, medicine and health services, nutrition science, physiology, and toxicology—identifies specific risk factors. These include:

- **Poor nutrition**, including a higher-carbohydrate/glycemic diet,^{23, 44} such as from soda and sweet drinks,⁶ white rice,³⁰ and a diet low in fiber or fruits and vegetables.¹⁸
- **Inactivity and sedentary activities.**^{5, 24, 30} Blood-sugar levels can be managed by physical activity at different levels of intensity, including strength training.²² That is, all kinds of physical activity—as opposed to sitting—are important not because they cause weight loss, but because they trigger physiological effects that help regulate blood glucose entirely independently of diet.

- **Overweight and obesity.**⁴⁸ People who are obese face a higher risk of type 2 diabetes. However, across populations, obesity does not fully account for the increase in new cases. In some populations, obesity may only account for about 25% of new cases.²⁵

Prevention has often focused on these common risk factors that individuals would seem to be able to control. However, these individual health behaviors themselves are influenced by environmental exposures and social conditions.

A POPULATION PERSPECTIVE: ENVIRONMENTAL AND SOCIAL DETERMINANTS OF TYPE 2 DIABETES

At national, state, and local levels, there are disparities in the risk of type 2 diabetes faced by different groups living in different residential locations. These patterns suggest that social and environmental factors are also influencing the risk of type 2 diabetes, not just individual behaviors.

From a population perspective, health disparities occur because environmental and social determinants influence health and health behaviors. Key risk factors are understood to interact with each other at the individual and population level. Biologic factors (such as genetics, obesity, and high blood pressure) interact with individual health behaviors (including diet, physical activity, and disease self-management), which are influenced by an individual's age, socio-economic position, racial/ethnic background, level of acculturation, and so on.

These individual factors in turn are influenced by the intermediate factors of available health care (access to care, quality of care, etc.) as well as the surrounding physical and social conditions (including the safety of a community or neighborhood, the availability of green space and food, the average socio-economic status).

Finally, the intermediate factors themselves are influenced by social conditions and social policies and the institutions that shape them.^{19,21} In this way, our surroundings are understood to directly and indirectly influence our health.

For type 2 diabetes, a growing body of scientific evidence supports the roles that environmental exposures and social conditions can play, including:

- **Residential neighborhoods**, including safety of a neighborhood, green space, sidewalks ("walkability"), and well-stocked grocery stores.³
- **Chronic stress**, through the "fight-or-flight" or acute stress response, which helps the body respond to threats.^{13,14} Physiologically, chronic stress is associated with increased risk of the metabolic syndrome, a combination of risk factors including obesity, insulin resistance, and increased blood glucose levels.^{13,28} Exposure to stressors can also increase negative health behaviors, such as a poorer diet and inactivity.
- **Environmental contaminants.** A growing number of studies have investigated the effects of environmental exposures on obesity, insulin resistance, and type 2 diabetes. These environmental exposures include persistent organic pollutants,^{35,36,49} particularly PCBs, pesticides such as DDT, and dioxin;⁴⁹ arsenic;⁴⁶ and traffic-related air pollution.³² Some of these contaminants can linger in the environment for extended periods of time. They can also accumulate in the body, and evidence links them with metabolic changes, obesity, and type 2 diabetes.⁴⁹
- **Changes in gut ecology.** The microbiota that inhabit our intestines are critical to health. Research shows that the gut microbiome may contribute to obesity and type 2 diabetes. In addition, its microbiota may interact with environmental exposures.⁴⁵

Just a few generations ago, type 2 diabetes was considered a disease of affluence.²⁹ Today, in Massachusetts, as in the United States and diverse countries around the world, as the frequency surges, it is disproportionately affecting people of lower socio-economic position.

Understanding how wider social and environmental conditions influence individual risk factors like lack of exercise and poor diet conditions is necessary in order to develop more appropriate interventions.³⁷ In addition, type 2 diabetes can be influenced by and also contribute to poor social outcomes because it can bring its own financial burden.²⁸

Type 2 diabetes requires unrelenting attention and 24-hour management of blood-sugar levels. Routine health behaviors that influence blood sugar can be difficult to change because they are deeply influenced by broader social determinants. To be effective, interventions need to address the conditions and deficits of the given community.¹⁶ These interventions can better prevent and lessen the consequences of diabetes if they take social determinants into account, including those specific to certain groups and cultures.¹

Considerable evidence suggests that exposure to certain contaminants, particularly endocrine-disrupting chemicals, can trigger metabolic changes found in individuals with obesity and/or type 2 diabetes.²⁷ In addition, a relatively new body of research looks at how the vital microbiota in our digestive system affect the risk of obesity and type 2 diabetes — and also how they may interact with common exposures in the surrounding environment. As we come to understand better the broader social and environmental context of the rising risk of type 2 diabetes, we will be able to design interventions that more fully take these into account.

EVIDENCE FROM CURRENT STUDIES IN WORCESTER AND NICARAGUA

Disparities in Massachusetts by race/ethnic group reflect national trends, in which Blacks, Hispanics and, increasingly, Asian Americans face an elevated risk of type 2 diabetes compared with non-Hispanic Whites. They also reflect the quickly rising rates in many Latin American and Asian countries.^{4,47} Asian Americans also tend to develop type 2 diabetes at lower body weights than people of other racial/ethnic groups.⁴¹

We have been studying type 2 diabetes in communities in Massachusetts and Central America that hold important lessons about prevention and management. In Worcester, we are working with Vietnamese-Americans, who increasingly face an elevated risk of type 2 diabetes, to probe what programs, information, and health care this community needs.

We also are working in Estelí, Nicaragua, a rural region where type 2 diabetes has quickly become a leading cause of illness and death. In Managua, the age-adjusted prevalence of type 2 diabetes is similar to that of the United States.⁴ However, several key risk factors are absent in these rural communities. There are low rates of smoking and, at least among women, little alcohol use. Also, most people do not have motor vehicles. Still, in these rural towns, type 2 diabetes has quickly become a leading cause of illness and death.

In Worcester and Nicaragua, we are investigating why these groups face a disproportionate risk, and what interventions might be most effective for management and prevention of type 2 diabetes. We expect that insights we gain also will be applicable both to other countries in Central America and Asia as well as to populations within the United States that face an elevated risk.

These studies investigated:

1. risk factors for type 2 diabetes in rural Nicaraguan towns, including recent changes in diet, physical inactivity, pesticide exposure, low birth weight, and stress;
2. the burden that type 2 diabetes places on families and communities;
3. the ways that people understand the causes of type 2 diabetes and its management;
4. social and cultural factors that influence the management of type 2 diabetes;
5. interventions at the family and community levels to improve diabetes management and prevent new cases.

Our results indicate the following:^{17, 33}

- There is little culturally appropriate medical care or type 2 diabetes information for Vietnamese-Americans in Worcester, who comprise more than 50% of the city's Asian population;
- Before diagnosis, type 2 diabetics and their family members generally knew little about the disease or its symptoms and treatment. Many did not know that the disease existed or they did not understand how serious it is;
- After diagnosis, type 2 diabetics and their family members still did not fully understand what the disease is, how they were being treated, or what they needed to do to manage the disease. A 49-year-old Vietnamese male described thinking that the medication alone could control his blood sugar: "When I ate more sweet food, I just took more medication. Then the diabetes affected the kidney, and it was too late";
- Individuals see their health-care providers as experts and do not feel comfortable questioning them or asking for clarification or additional information;
- Dietary recommendations need to be culturally appropriate and affordable. They should not focus on "American" food, and telling Central Americans, Hispanic Americans, and Asian Americans to "eat less rice" — common advice to type 2 diabetics — is ineffective if rice is a staple food;
- Both groups point to stressful events as triggers for the onset of type 2 diabetes and continued high blood sugar levels;
- In close-knit families, family and social support may be the most important factor for successful management of type 2 diabetes. Changes in the diet of the whole household can ease the burden of managing this disease. Said family members: "The best way to support the diabetic is to eat what they eat," and, "This is a family problem."
- Interventions that target family and community-level behaviors can also reach diabetic family members who have not been diagnosed and pre-diabetic and susceptible individuals.

IDEAS FOR THE FUTURE

As Massachusetts policymakers consider the need for a statewide program for prevention of type 2 diabetes, it is important to remember the magnitude of this relatively new health problem, the toll that it takes on individuals and their families, the disabilities and shortened lives it can cause, and the significant and growing health care costs.

It is also important to remember that, although serious, type 2 diabetes can be prevented and that prevention efforts may work best at the community level. Our research and that of others support the following:

- With such pronounced disparities by race/ethnicity, there is a need for culturally and linguistically appropriate programs, health information, and practitioners to help ease the burden in different racial/ethnic groups.³³
- Programs that target youth, families, and communities could reach pre-diabetics and the undiagnosed, and foster critical family and social support.¹⁷
- In an effort to reduce childhood obesity, state policies — including in Massachusetts — have established measures to do some or all of the following: display calorie content of restaurant and fast-food meals, increase taxes on or reduce sizes of soft drinks and sweetened beverages, remove such products from school vending machines, increase school physical activity time, improve quality of school lunches, and reduce marketing of calorie-dense foods to children.²⁶
- Interventions focused on diet, activity, and weight loss can be as effective as — or more effective than — common prescription medications, which also may have side effects.¹⁶ They can help with both blood sugar management and prevention, and they could also help reduce the risk of other chronic diseases that share the same risk factors.

Our health behaviors — so critical to the prevention and management of type 2 diabetes — are not just a matter of individual choices. They are influenced by the people we live with and the place where we live, the work we do and the people we do it with, and our city/town and state. Lessons from anti-smoking, HIV/AIDS, anti-drunk-driving, and other public health drives offer evidence that to improve the public's health in a meaningful way and support individuals' own behaviors, social norms about diet, physical activity, and chronic disease management themselves must change.

ⁱ Although some national and state data include type 1 diabetes, because type 2 diabetes accounts for most cases, the statistics reflect trends in type 2 diabetes alone. Gestational diabetes is not included in some national survey data.

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