

## Introduction

Diabetes mellitus, a chronic disease characterized by elevated blood sugar levels, is a significant contributor to morbidity and mortality in Massachusetts and throughout the United States. Diabetes can cause debilitating and costly complications such as blindness, renal failure, lower extremity amputations, and cardiovascular disease. Much of the health and economic burden of diabetes can be averted through known prevention measures.

In 1995, approximately 8 million persons in the United States reported that they had diabetes, and a similar number were estimated to have diabetes without being aware of it. Diabetes is the seventh leading cause of death listed on death certificates in Massachusetts and in the United States as a whole, although death certificate data underreport diabetes-related deaths.

The Massachusetts Diabetes Control Program (MDCP) seeks to develop and implement programs to reduce the burden of diabetes in the state. The MDCP collaborates with the Chronic Disease Surveillance Program in monitoring the burden of diabetes throughout the state. The Behavioral Risk Factor Surveillance System (BRFSS) is one method used to accomplish this task.

The BRFSS is a statewide random telephone survey of Massachusetts adults, 18 years of age or older, conducted annually since 1986 as part of a cooperative agreement between the national Centers for Disease Control and Prevention and the Massachusetts Department of Public Health (MDPH). The BRFSS collects information about a wide variety of health issues, ranging from health-related behavior and access to medical care to opinions on health-related policy issues. This information helps identify the need for health interventions, monitor effectiveness of prevention and intervention programs, develop health policy and legislation, and measure progress toward attaining state and national health objectives.

All respondents to the BRFSS are asked, "Have you ever been told by a doctor that you have diabetes?" Females who respond affirmatively are then asked, "Was this only when you were pregnant?" Persons who respond positively to the first question and, if female, negatively to the second are considered, for the purposes of this survey, to have diabetes\*. Beginning in 1992, respondents who were determined to have diabetes were then also asked a series of questions to learn more about the management of their diabetes. Data in this report are taken from 1994-1996, the three most recent years available. Because a relatively small number of people with diabetes are represented in the survey in any given year, analyses are based on three years of data whenever possible in order to produce more stable estimates. Not all questions were asked every year, however, and some analyses are based on only one or two years of data.

This report is divided into two main sections. Section I compares people with diabetes and those without diabetes on the prevalence of cardiovascular disease (CVD), including heart disease and stroke, and several accompanying risk factors. Section II describes preventive care awareness and practice among persons with diabetes.

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\* For most women, diabetes during pregnancy is a temporary condition which disappears immediately after delivery. However, women with diabetes during pregnancy are at increased risk of developing overt diabetes at some time in the future.

### Diabetes Prevalence

Four percent of Massachusetts adults, equivalent to approximately 196,000 persons, reported having been diagnosed with diabetes. The rate of diabetes increased dramatically with age (Figure 1). Adjusting for age and sex, racial/ethnic minorities were twice as likely as whites to have been diagnosed with diabetes. Individuals with incomes below \$15,000 were three times as likely as those with incomes of \$35,000 or more to report having been diagnosed with diabetes. The Healthy People 2000 target for diabetes prevalence is 2.5%.

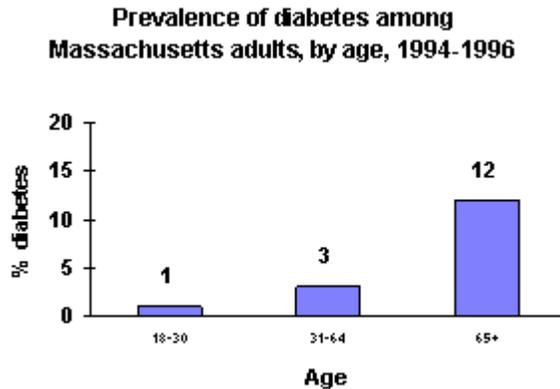


Figure 1. Source: Massachusetts BRFSS

### Health Status

Forty-two percent of people with diabetes in Massachusetts reported their health as fair or poor. After controlling for age and sex, people with diabetes were two and a half times as likely as those without diabetes to report their health as fair or poor (Figure 2). Diabetic individuals (17%) were also two and a half times as likely as people without diabetes (7%) to report that their physical health was not good on any day during the past month.

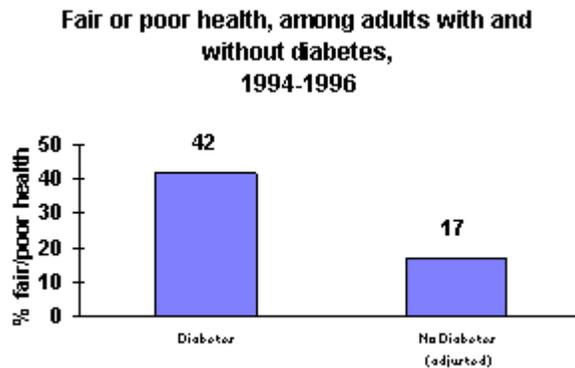


Figure 2. Source: Massachusetts BRFSS

## Section I.

### Cardiovascular Disease

Research has shown that people who have diabetes are at increased risk of developing both heart disease and stroke. Questions about cardiovascular disease (CVD) were included on the 1994 BRFSS, asking whether respondents had ever been told by a health professional that they had heart disease or had suffered a stroke. The data from the BRFSS were analyzed to evaluate whether Massachusetts adults with diabetes were more likely to ever have had CVD than adults without diabetes.

Respondents with diabetes in the Massachusetts BRFSS were more likely to be male and older than the overall population. Male sex and older age are also independent risk factors for CVD. In order to equitably compare the risk of CVD among adults with and without diabetes, it is important to minimize the role of age and sex in both conditions. We accomplished this by taking the percent estimates for people without diabetes and adjusting (standardizing) them to the percent expected if the age-sex distribution was the same as that of people with diabetes responding to the survey. Table 1, at the end of this section, summarizes the unadjusted and adjusted estimates, along with the standardized ratios and their 95% confidence intervals.

### Heart Disease

In 1994, 33% of Massachusetts adults with diabetes reported having been told by a health professional that they have heart disease. Adjusting for age and sex, people with diabetes were nearly three times as likely as people without diabetes to report ever having heart disease (Figure 3).

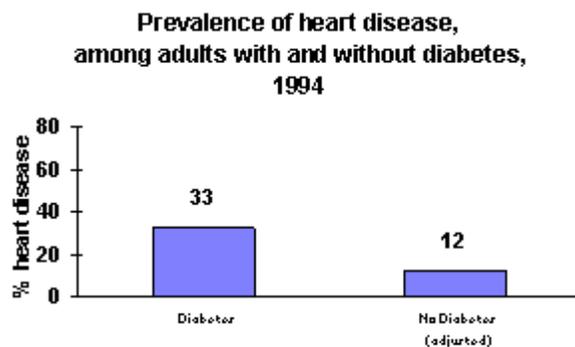


Figure 3. Source: Massachusetts BRFSS

### Cerebrovascular Disease/Stroke

In 1994, 15% of Massachusetts adults who had diabetes reported having been told by a health professional that they have cerebro-vascular disease. Adjusting for age and sex, people with diabetes were more than four times as likely as people without diabetes to report having cerebrovascular disease (Figure 4).

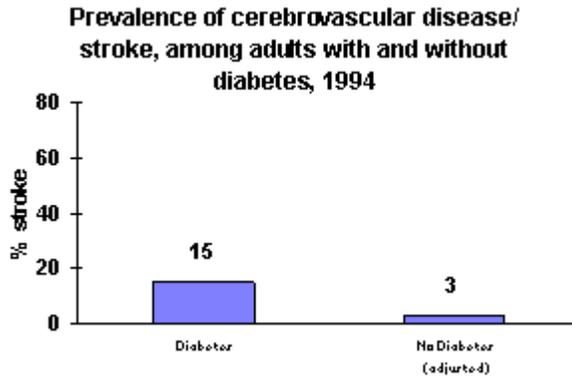


Figure 4. Source: Massachusetts BRFSS

### Risk Factors for Cardiovascular Disease

The BRFSS data support the prevailing evidence that adults with diabetes are at increased risk of developing cardiovascular disease (CVD). Other risk factors for CVD include high blood pressure, elevated blood cholesterol, excess weight, smoking, lack of physical activity, and insufficient consumption of fruits and vegetables. It is important to determine the prevalence of these additional risk factors among people with diabetes. Certainly, if the prevalence of these risk factors is higher among people with diabetes than without, the risk of developing CVD may be increased. In addition, because people with diabetes are already at higher risk of CVD due to their diabetes, health professionals would like to see a reduced prevalence of CVD risk factors among people with diabetes.

Analysis of the Massachusetts BRFSS data compared the percentage of adults with and without diabetes who had these risk factors. Estimates were adjusted by age and sex to allow a valid comparison. Adults with diabetes were more likely to have high blood pressure and to be compared to adults without diabetes. In addition, health professionals should be concerned by the lack of difference between people with and without diabetes in prevalence for smoking, high cholesterol, physical activity, and fruit and vegetable consumption .

### High Blood Pressure

After controlling for age and sex, people with diabetes were 1.7 times more likely than people without diabetes to have had a doctor or other health professional tell them that they had high blood pressure (Figure 5) .

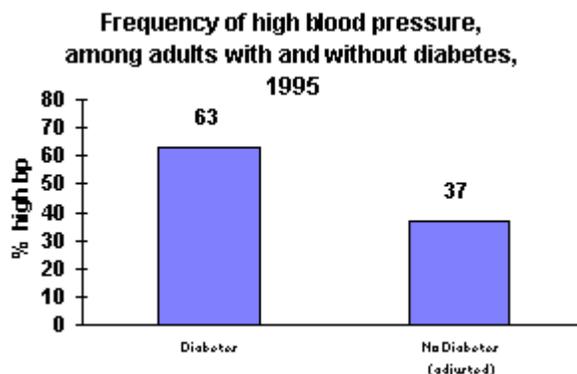


Figure 5. Source: Massachusetts BRFSS

## Overweight

Based on self-reported height and weight measurements, Massachusetts adults with diabetes were 1.8 times more likely than non-diabetic adults to be overweight (Figure 6) and two and a half times more likely to be very overweight as determined by the body mass index (BMI)\*, controlling for age and sex.

\* BMI is calculated by dividing a person's weight in kilograms by his/her height in meters squared (kg/m<sup>2</sup>). Men with a BMI of 27.8 or greater and women with a BMI of 27.3 or greater are considered overweight. Men with a BMI of 31.1 or greater and women with a BMI of 32.3 or greater are considered very overweight.

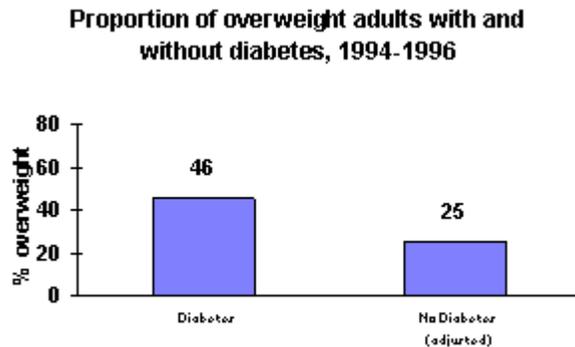


Figure 6. Source: Massachusetts BRFSS

## Elevated Cholesterol

Almost half of adult respondents with diabetes had ever been told by a doctor or other health professional that they had a high blood cholesterol level. After controlling for age and sex, rates of elevated cholesterol were similar in people with and without diabetes (Figure 7).

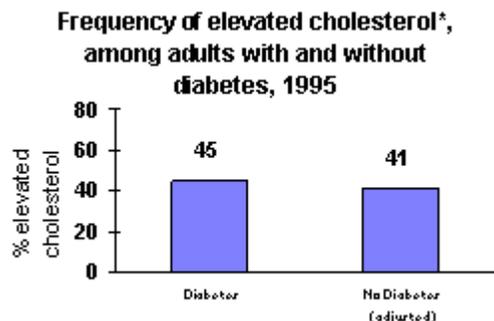


Figure 7. Source: Massachusetts BRFSS

## Smoking

Approximately 20% of people with diabetes were currently smoking cigarettes. After adjusting for age and sex, smoking rates were similar among people with and without diabetes (Figure 8).

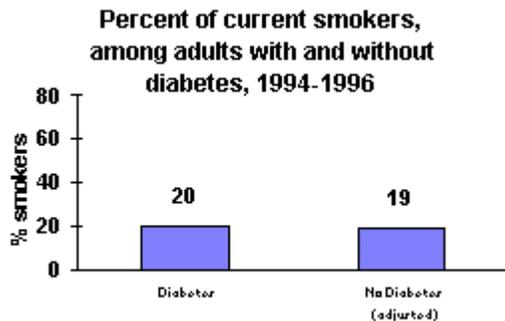


Figure 8. Source: Massachusetts BRFSS

## Physical Activity

Sufficient physical activity was defined as either vigorous activity for 20 minutes per session on 3 or more days per week, or activity regardless of intensity for 30 minutes per day 5 or more days per week. More than two-thirds of people with diabetes did not participate in sufficient physical activity. After adjusting for age and sex, a similar proportion of people with and without diabetes did not participate in sufficient physical activity (Figure 9).

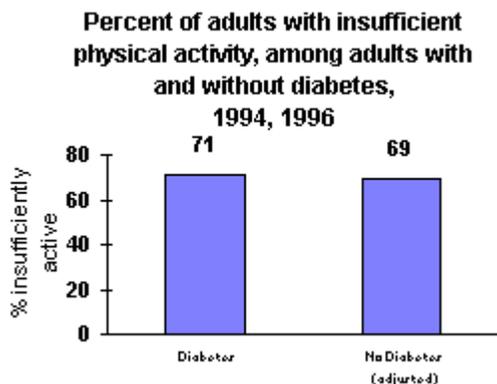


Figure 9. Source Massachusetts: BRFSS

## Consumption of Fruits and Vegetables

Almost two-thirds of people with diabetes consumed fewer than the recommended five servings of fruits and vegetables per day. After adjusting for age and sex, a similar proportion of people with and without diabetes did not consume five servings of fruits and vegetables per day (Figure 10).

Figure 10. Source: Massachusetts BRFSS

Table I. Prevalence and Risk Factors for Cardiovascular Disease, by Diabetes Status, Massachusetts BRFSS, 1994-1996 <sup>1</sup>					
	Diabetes	No Diabetes	No Diabetes (age/sex adjusted) <sup>2</sup>	SMR <sup>3</sup>	95% CI <sup>4</sup> SMR
Heart Disease <sup>5</sup>	33.1	5.6	12.3	2.70	1.70-4.30
Cerebrovascular Disease/ Stroke <sup>5</sup>	15.0	1.5	3.4	4.39	1.91-10.04
High Blood Pressure <sup>6</sup>	63.5	24.3	37.3	1.70	1.30-2.23
Elevated Cholesterol <sup>*,6</sup>	45.4	30.2	41.0	1.11	0.80-1.54
Overweight <sup>**,7</sup>	45.8	24.0	25.1	1.82	1.28-2.60
Very Overweight <sup>**,7</sup>	26.4	9.8	9.9	2.66	1.96-3.61
Current Smokers <sup>7</sup>	20.5	22.6	18.7	1.10	0.81-1.49
Insufficient Physical Activity <sup>+,8</sup>	70.9	69.0	69.0	1.03	0.92-1.15
Inadequate Fruit and Vegetable Consumption <sup>++,8</sup>	62.9	72.5	68.1	0.92	0.80-1.05

<sup>1</sup>The number of respondents to the BRFSS by year (the number with / without diabetes in parentheses) was: 1994: 3,284 (178 / 3,106); 1995: 3,308 (159 / 3,149); 1996: 3,038 (166 / 2,872)

<sup>2</sup>The adjusted rate among persons without diabetes is determined by applying sex-age specific rates among people without diabetes to the sex-age distribution of people with diabetes, and then summing over all categories.

<sup>3</sup>Standardized Morbidity Ratio. The SMR can be interpreted as the relative increase in the prevalence of a condition among people with diabetes compared to those without diabetes, assuming that the two groups were alike in their distribution by age and sex. The SMR is calculated by dividing the percentage of people with diabetes reporting a particular condition by the sex-age-adjusted percentage of people without diabetes reporting the condition. The adjusted rate among persons without diabetes is determined by applying sex-age specific rates among people without diabetes to the sex-age distribution of people with diabetes, and then summing over all categories.

<sup>4</sup>95% Confidence Interval. Standard errors were generated through SUDAAN. 95% confidence intervals for standardized measures were calculated from Rothman and Greenland using the formula  $\exp\{\ln(\text{SMR}) \pm 1.96 \cdot \text{var}[\ln(\text{SMR})]^{1/2}\}$  and where  $\text{var}[\ln(\text{SMR})] = \text{var}(I_{1w})/I_{1w}^2 + \text{var}(I_{0w})/I_{0w}^2$ .

<sup>5</sup>Question asked in 1994 only.

<sup>6</sup>Question asked in 1995 only.

<sup>7</sup>Question asked in 1994, 1995, 1996.

<sup>8</sup>Question asked in 1994 and 1996.

\*Asked only of those respondents who reported ever having had their cholesterol checked.

\*\*Overweight status is based on the body mass index (BMI). BMI is calculated by dividing a person's self-reported weight in kilograms by his/her self-reported height in meters squared (kg/m<sup>2</sup>). Men with a BMI of 27.8 or greater and women with a BMI of 27.3 or greater are considered overweight. Men with a BMI of 31.1 or greater and women with a BMI of 32.3 or greater are considered very overweight.

+Persons who neither participated in vigorous activity for 20 minutes per session on 3 or more days per week, nor activity regardless of intensity for 30 minutes per day 5 or more days per week.

++Fewer than five servings of fruits and/or vegetables per day.

## Section II. Diabetes Preventive Care Knowledge and Practice

The following section provides information specific to disease management and care among people with diabetes. In Massachusetts, and in many other states, individuals surveyed who have diabetes are asked an additional series of questions concerning the impact and management of the disease. A list of the questions and the years asked are provided at the end of the report.

### Age at Diagnosis

In 1995 and 1996 combined, 10% of Massachusetts adults with diabetes reported that they were diagnosed at or before age 30. Most cases of Type 1 diabetes are diagnosed before the age of 30 while Type 2 diabetes generally presents after age 30. Sixty-eight percent of respondents were diagnosed between the ages of 31 and 64 years, while 22% were diagnosed after age 64 (Figure 11). Sixty-one percent of respondents with diabetes had been diagnosed within the past 10 years.

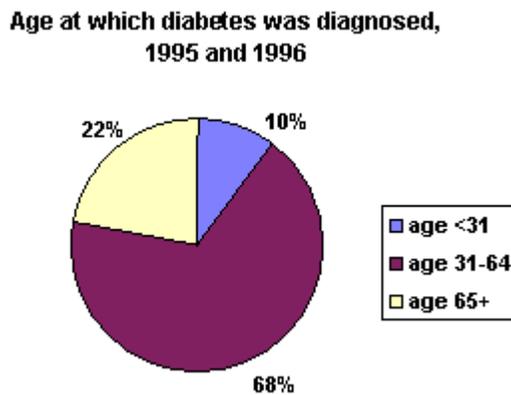


Figure 11. Source: Massachusetts BRFSS

### Insulin Use

One third of Massachusetts adults with diabetes were taking insulin, all of whom used insulin daily. People who have had diabetes for over 10 years were more likely to report taking insulin (53%) than those with diabetes for less than 10 years (22%) (Figure 12).

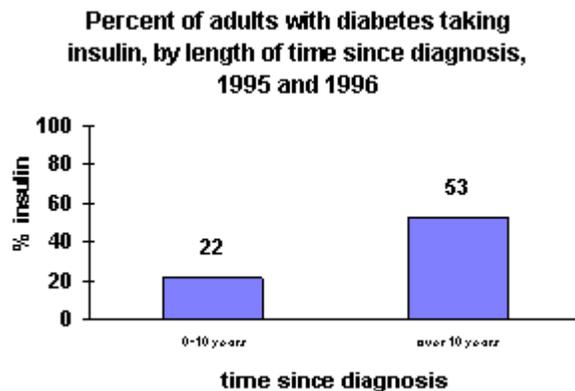


Figure 12. Source: Massachusetts BRFSS

## Blood Sugar

Just over half of Massachusetts adults with diabetes reported checking their blood sugar daily or weekly (56%). Fourteen percent of those taking insulin reported never checking their blood sugar (Figure 13).

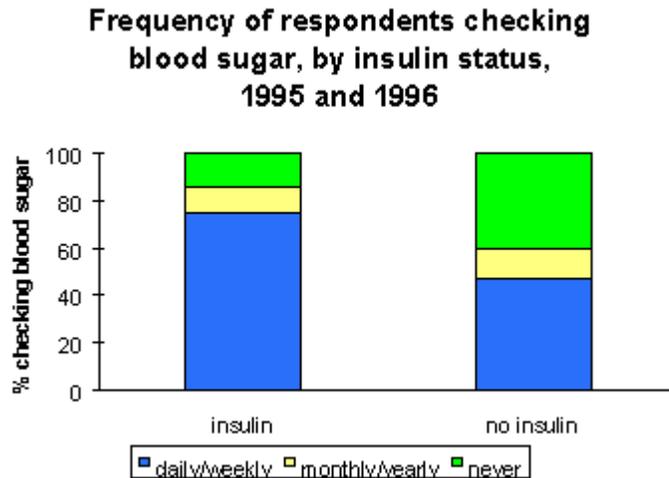


Figure 13. Source: Massachusetts BRFSS

## Hemoglobin A1C

The hemoglobin A1C (HbA<sub>1c</sub>) test indicates how well diabetes is controlled by providing a measure of average blood sugar over 2 to 3 months. Overall, 23% of persons with diabetes had heard of HbA<sub>1c</sub>. Knowledge about HbA<sub>1c</sub> decreased with age, with only 13% of Massachusetts adults with diabetes age 65 years and older having heard of HbA<sub>1c</sub> (Figure 14). 96% of adults who have heard of HbA<sub>1c</sub> have been tested at least once in the past year.

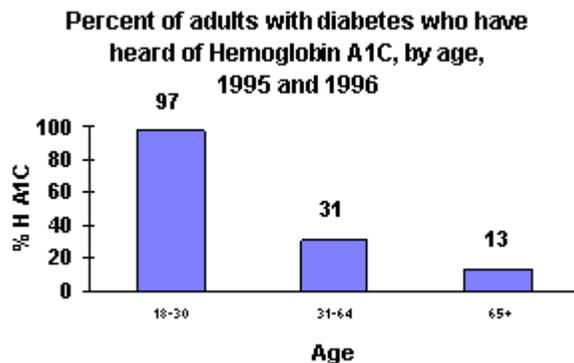


Figure 14 Source: Massachusetts BRFSS

## Visits to a Health Professional for Diabetes - past year

Overall, 17% of respondents reported not seeing a health professional in the past year for their diabetes, while 29% visited a health professional more than five times. Respondents who had diabetes for longer than ten years were more likely (35%) than those who had diabetes for fewer than ten years (25%) to have made more than five visits in the past year (Figure 15).

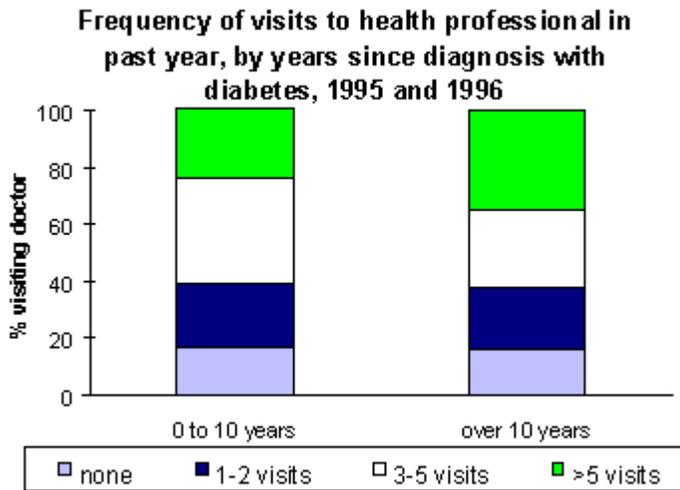


Figure 15. Source: Massachusetts BRFSS

### Feet Checked by Health Professional

More than 50% of amputations in the United States due to causes other than trauma are performed on individuals with diabetes. It is estimated that more than half of these could be prevented with proper care. Fifteen percent of those seen by a health professional in the past year for their diabetes reported not having their feet checked for sores or irritations. Thirty-one percent reported having their feet checked one to two times, 17% reported 3 to 5 times, and 37% reported being checked more than 5 times (Figure 16). Not having a recent foot examination was associated with podiatric emergencies in a Massachusetts study which found that 33 out of 210 patients with diabetes (16%) who had not had a recent exam had an emergency visit to the podiatrist. In contrast, only 72 out of 1,319 (5%) who had a recent exam had an emergency visit.

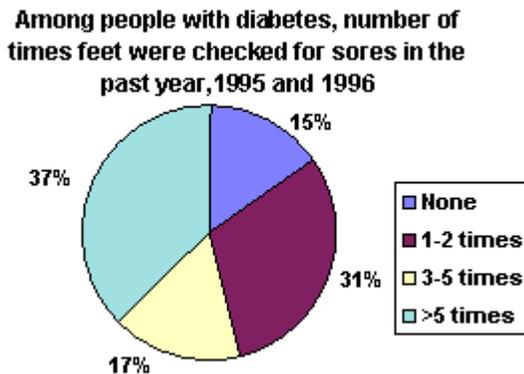


Figure 16. Source: Massachusetts BRFSS

## Diabetes Education

Individuals with diabetes who are well-educated about how to manage their condition are more likely to have a lower blood glucose level, which is associated with fewer long term complications. Diabetes education is an integral aspect of diabetes management and patient self-care. Diabetes self-management training can help improve the effectiveness of care and reduce morbidity. Almost all (98%) persons with diabetes reported receiving education from some source. Doctors were the most likely source for diabetes education (Figure 19). One third (32%) of persons with diabetes received education in a diabetes class, far short of the Healthy People 2000 goal of 75%.

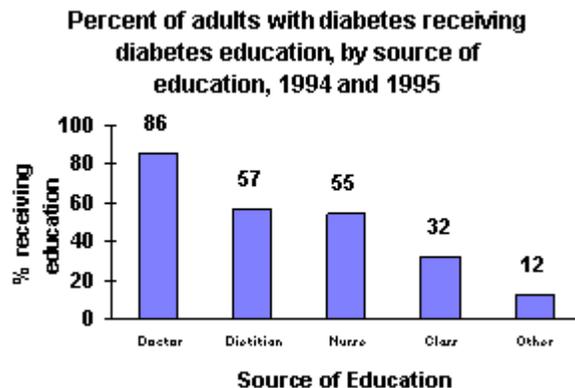


Figure 19. Source: Massachusetts BRFSS

## Massachusetts Diabetes Control Program

The Massachusetts Diabetes Control Program (MDCP), funded by the US Centers for Disease Control and Prevention, emphasizes a population-based health systems approach to diabetes control. A major emphasis is placed on ensuring access and quality of care. The MDCP is involved in the following activities:

**Defining the Burden of Diabetes:** Having a clear picture of the nature and distribution of diabetes and its complications is important for agencies and organizations striving to control the burden of disease. The MDCP obtains statistics from existing sources that provide data on diabetes trends. These data can be used to formulate policy, target interventions, identify barriers to care, and evaluate progress in preventing and controlling the disease.

**Developing and Implementing New Approaches to Reduce the Burden:** The MDCP is working in three pilot communities to enhance diabetes care by integrating community-based diabetes programs into the health care system. The MDCP is working with six health centers in these pilot communities on diabetes quality improvement initiatives to move towards meeting national diabetes standards of care. To enhance patient education, each health center also offers a peer education program. Each pilot community has a diabetes coalition that plans and implements interventions for people with diabetes.

**Professional Education:** The MDCP sponsors conferences for internal medicine residents as well as a training program for undergraduate and graduate nursing and nutrition students.

**Publications:** The MDCP has developed brochures on eye and foot care, diabetes screening, and gestational diabetes. Also available are a curriculum guide on Diabetes in the Elderly and a resource directory called the Diabetes Help-Finder.

## Impaired Vision

Diabetic eye disease does not cause visual symptoms until a fairly advanced stage. One-fifth (19%) of people with diabetes reported having difficulty all or most of the time either recognizing people or objects across the street, reading, or watching TV. Women, minorities, and those with lower income were more likely to report having impaired vision all or most of the time (Figure 18). More severe vision limitations are indicated by inability to recognize others. Thirteen percent of Massachusetts adults with diabetes reported difficulty recognizing people all or most of the time.

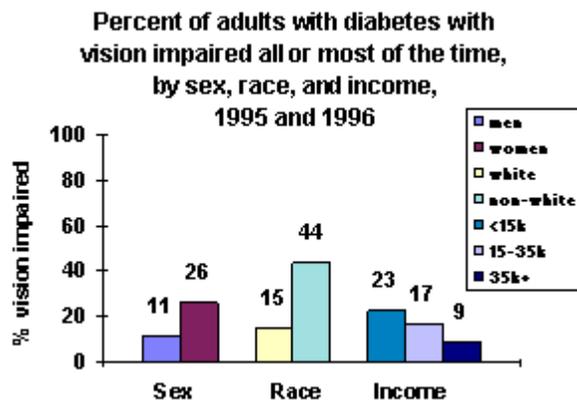


Figure 18. Source: Massachusetts BRFSS

## Methodology

The 1994-1996 BRFSS was conducted for the MDPH by Northeast Research of Orono, Maine, using a list-assisted random-digit-dial sampling methodology. Telephone numbers were randomly selected, and multiple attempts were made to reach each phone number. To be eligible for the survey, the telephone had to serve a household in which at least one adult eighteen years or older resided. Institutions, group quarters of ten or more unrelated adults, and temporary residences being occupied for less than a month, such as summer homes, were excluded. One adult from each household was randomly selected to complete the interview. No proxy respondents or substitutions were allowed if the selected adult was unable to complete the interview for any reason, such as a language barrier, disability, or lack of availability. In addition to English, the survey was also conducted in Spanish and Portuguese.

Limitations of the BRFSS need to be taken into account when interpreting the data. First, persons who do not have a telephone or who otherwise do not participate due to factors such as unavailability, language barriers, or lack of interest are not represented. Second, specific questions are subject to whatever biases may be associated with self-reporting. Diseases such as diabetes may be underreported as the survey requires that respondents be aware of their condition. Finally, because the BRFSS surveys a sample of Massachusetts adults, results will differ to some extent from another sample taken from the same population due to chance alone.

## BRFSS Diabetes Questions:

How old were you when you were told you have diabetes? (1995, 1996)

Are you now taking insulin? (1995, 1996)

Currently, about how often do you take insulin? (1995, 1996)

About how often do you check your blood for glucose or sugar? Include times when checked by a family member or friend, but do not include times when checked by a health professional. (1995, 1996)

Have you ever heard of glycosylated hemoglobin or hemoglobin A1C? (1995, 1996)

About how many times in the last year has a doctor, nurse, or other health professional checked you for glycosylated hemoglobin or hemoglobin A1C? (1995, 1996)

About how many times in the last year have you seen a doctor, nurse, or other health professional for your diabetes? (1995, 1996)

About how many times in the last year has a health professional checked your feet for any sores or irritations? (1995, 1996)

When was the last time you had an eye exam in which the pupils were dilated? This would have made you temporarily sensitive to bright light. (within the past month, within the past year, within the past 2 years, 2 or more years ago, never) (1994\*, 1995, 1996)

How much of the time does your vision limit you in recognizing people or objects across the street? Would you say... all of the time, most of the time, some of the time, a little bit of the time, or none of the time? (1995, 1996)

How much of the time does your vision limit you in reading print in a newspaper, magazine, recipe, menu, or numbers on the telephone? Would you say... all of the time, most of the time, some of the time, a little bit of the time, or none of the time? (1995, 1996)

How much of the time does your vision limit you in watching television? Would you say... all of the time, most of the time, some of the time, a little bit of the time, or none of the time? (1995, 1996)

Have you received education from any of the following on how to care for your diabetes... a nurse or nurse practitioner? a nutritionist or dietitian?, a diabetes class?, a doctor? or someone else? (1994, 1995)

\* in 1994 this question was worded slightly differently from 1995 and 1996

<sup>1</sup>US Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion. National Diabetes Fact Sheet. Atlanta, GA, November 1995.

<sup>2</sup>Massachusetts Department of Public Health, Department of Vital Statistics, MA 1996 death file, Boston, MA.

<sup>3</sup>National Diabetes Data Group. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes in America, 2nd Edition. Bethesda, MD, 1995.

<sup>4</sup>US Dept. of Health and Human Services, Public Health Service. Healthy People 2000: National Health Promotion and Disease Prevention Objectives. DHHS Publication No. (PHS) 91-50212. Washington DC: US Government Printing Office, 1990.

<sup>5</sup>National Diabetes Data Group. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes in America, 2nd Edition. Bethesda, MD, 1995.

<sup>6</sup>US Dept. of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. The Prevention and

Treatment of Complications of Diabetes. A Guide for Primary Care Practitioners. Atlanta, GA, 1991.

<sup>7</sup>Balsam, A. et al. Profile of Diabetic Patients Presenting at Podiatrists' Offices. Podiatry Today, May 1992.

<sup>8</sup>National Diabetes Data Group. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes in America, 2nd Edition. Bethesda, MD, 1995.

<sup>9</sup>National Diabetes Data Group. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. Diabetes in America, 2nd Edition. Bethesda, MD, 1995.

<sup>10</sup>American Diabetes Association. Clinical Practice Recommendations 1998. Diabetes Care: Volume 21, Supplement 1, January 1998.

<sup>11</sup>US Dept. of Health and Human Services, Public Health Service. Healthy People 2000: National Health Promotion and Disease Prevention Objectives. DHHS Publication No. (PHS) 91-50212. Washington DC: US Government Printing Office, 1990.

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