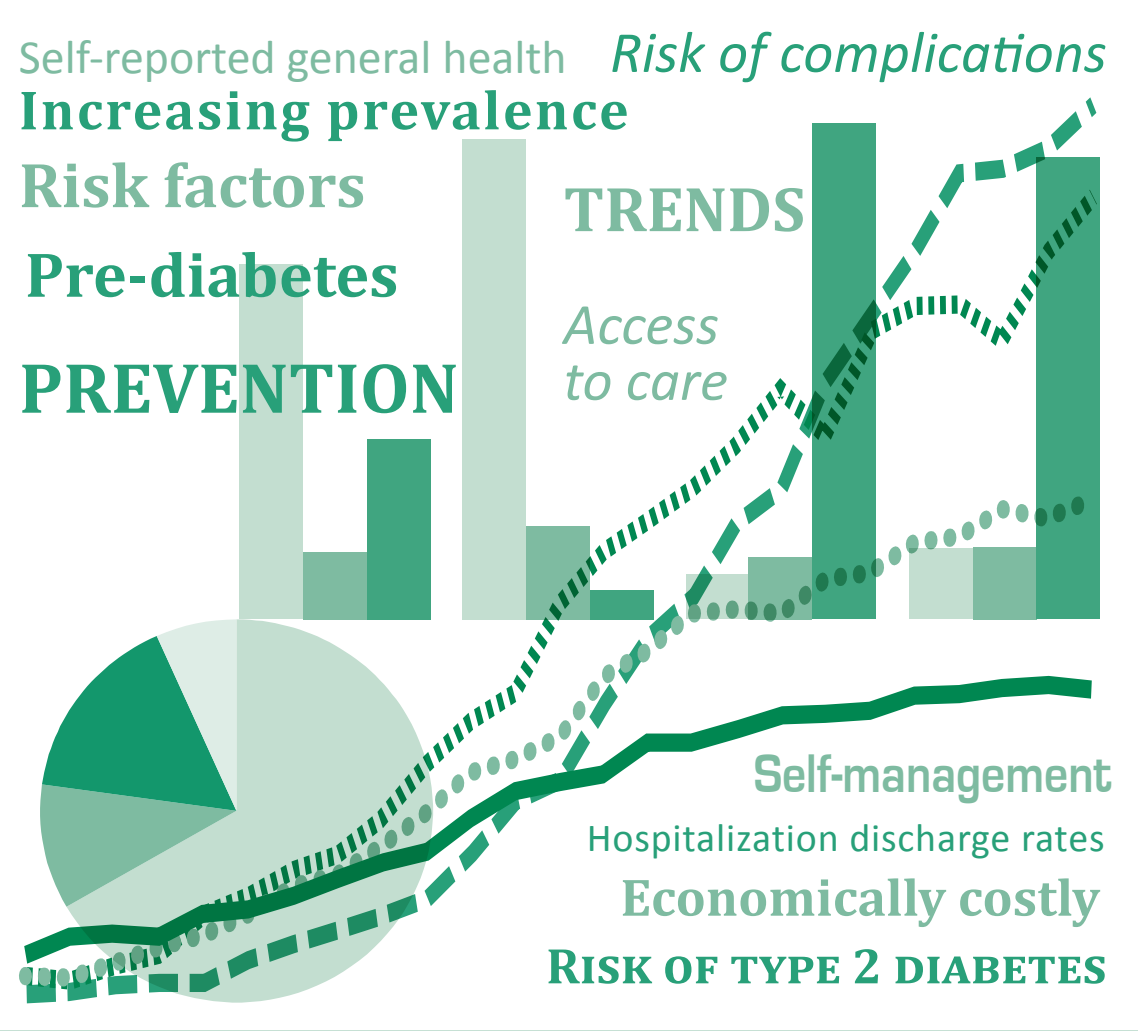
Wisconsin Diabetes Surveillance Report 2012



Diabetes Prevention and Control Program
Bureau of Community Health Promotion
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Executive Summary

- It is estimated that 346,190 adults in Wisconsin have been diagnosed with diabetes and an additional 128,900 adults are estimated to have diabetes that has not yet been diagnosed, for a total of 475,090 adults (10.1%).
- An estimated 4,500 children and adolescents have been diagnosed with diabetes.
- The 2005-2008 National Health and Nutrition Examination Survey (NHANES) found that 35% of adults aged 20 years and older had pre-diabetes. This translates into an estimated 1,460,250 Wisconsin adults aged 20 years and older with pre-diabetes.
- The costs of diabetes in Wisconsin are staggering. In 2009, direct costs for adults were estimated at $4.07 billion, indirect costs for adults were estimated at $2.04 billion, and direct costs for children and adolescents were estimated at $53 million, for a total of $6.15 billion.
- Of adults with diabetes, 38% self-reported their general health as "fair" or "poor," compared to only 10% of adults without diabetes, a statistically significant difference.
- Of adults with diabetes, 87% are overweight or obese, compared to 63% of adults without diabetes, a statistically significant difference.
- The percentage of adults with diabetes who are obese (body mass index ≥ 30.0 kg/m^2) has increased from 30% in 1995-1996 to 53% in 2010.
- Wisconsin has surpassed the Healthy People 2010 and Healthy People 2020 goals for A1C testing, eye exam in past year, and foot exam in past year. Wisconsin has surpassed the Healthy People 2020 goal for dental visit in past year and is approaching the Healthy People 2020 goal for diabetes education.
- There were 6,908 inpatient hospitalization discharges in 2010 where diabetes was listed as the principal diagnosis. In the same year, there were 92,780 hospitalization discharges where diabetes was listed as any diagnosis; this accounts for 15.3% of all Wisconsin hospitalizations.
- In 2010, there were $2.55 billion in diabetes-related hospitalization charges for Wisconsin residents; this accounts for 17.3% of all hospitalization charges.
- In 2010, there were 1,282 non-traumatic lower-extremity amputations performed when diabetes was listed as any diagnosis.
- The age-adjusted rate for non-traumatic lower-extremity amputations in males is two times the age-adjusted rate for females.
- The age-adjusted rates for end-stage renal disease (ESRD) prevalence and incidence have steadily increased from 1978 to 2009; however, currently the Wisconsin prevalence and incidence rates are lower than the rates for the United States.
- In 2010, there were 1,154 deaths where diabetes was listed as an underlying cause of death. This number is likely an underestimate, as diabetes often contributes to a death for which another disease/condition is listed as the underlying cause of death.

Introduction

Diabetes is a common, controllable, life-long condition affecting over 475,000 adults and 4,500 children and adolescents in Wisconsin.[1] Diabetes is a metabolic disorder characterized by high blood glucose levels resulting from defects in insulin production, action, or both. Type 1 diabetes occurs when the pancreas produces little or no insulin. The body needs insulin to control the amount of glucose in the blood. People with type 1 diabetes must give themselves insulin to survive. Type 2 diabetes occurs when the body makes some – but not enough – insulin, or the body is not able to use insulin normally. There are several risk factors associated with type 2 diabetes, including overweight or obesity, physical inactivity, and family history. Type 2 diabetes can sometimes be controlled with diet and physical activity; however, often medications and/or insulin must be used, depending on the progression of the disease. Gestational diabetes is a form of diabetes that is diagnosed in some women during pregnancy. Based on recently announced diagnostic criteria for gestational diabetes, it is estimated that gestational diabetes affects 18% of pregnancies.[2] Other types of diabetes occur, but they are less common. For more information about the types of diabetes, refer to the *Wisconsin Diabetes Mellitus Essential Care Guidelines.*[3]

People with diabetes are at increased risk of complications including blindness, kidney disease, foot and leg amputations, heart disease, stroke, depression, poor oral health, and death from influenza and pneumonia. Many of these complications may be prevented, delayed, and/or progression slowed, by optimizing glycemic control and providing ongoing preventive care to include early identification of problems, intervention, and treatment.[3] The Wisconsin Diabetes Prevention and Control Program works to prevent and delay complications and improve the quality of life for people living with and at risk of diabetes with many resources, one of which is the *Wisconsin Diabetes Mellitus Essential Care Guidelines,* initially developed in 1998 and revised several times. These Guidelines serve as a tool to support and influence health care provider decision making to promote consistent, comprehensive, and preventive diabetes care.[3]

Besides serious health-related complications, diabetes is also economically costly in Wisconsin. The direct (medical care) and indirect (lost productivity) costs of diabetes in Wisconsin total an estimated $6.15 billion. Approximately $4.07 billion are direct medical expenditures for adults, $2.04 billion are from indirect costs for adults, and an estimated $53 million are direct medical expenditures for children and adolescents. Note that this estimate only includes persons diagnosed with diabetes.[1,4]

Access to important and meaningful information is a critical requirement for any public health system. It is essential to be familiar with data related to diabetes, its management, and complications in order to make improvements in the care of those with and at risk of diabetes, as well as the entire community. Understanding the data also assists in prevention/delay of type 2 diabetes for those at risk. Data and information are necessary in directing diabetes-related initiatives as they provide information on where a community/system has been and where they need to go to accomplish their goal to provide the best care for people with and at risk for diabetes.

Estimated Diabetes Prevalence in Adults

Diabetes is becoming increasingly prevalent in the United States and in Wisconsin. There are 25.8 million people in the United States that have diabetes; approximately 7.0 million of these people have diabetes that has not yet been diagnosed.[5]

The Wisconsin Behavioral Risk Factor Survey (BRFS) is used as the main data source for obtaining adult diabetes prevalence estimates in Wisconsin.[1] The BRFS is a random-digit-dial telephone survey administered to a sample of Wisconsin household members 18 years and older to assess the prevalence of risk behaviors, chronic diseases, and health practices that affect health status.[6] The BRFS includes a core questionnaire, as well as additional optional modules. One of the most important questions in the core questionnaire for diabetes surveillance is "Have you ever been told by a doctor that you have diabetes?" This provides an estimate of the number of adults in Wisconsin that have diabetes. Further details on the methodology used to estimate diabetes prevalence are provided in the "Methodology and Limitations" section.

It is estimated that 346,190 adults in Wisconsin have been diagnosed with diabetes and an additional 128,900 adults are thought to have diabetes that has not yet been diagnosed, totaling 475,090 adults.[1] Table 1 provides estimated diagnosed, undiagnosed, and total numbers and percents of adults with diabetes by three separate age groups, as well as the estimate for all ages of adults.

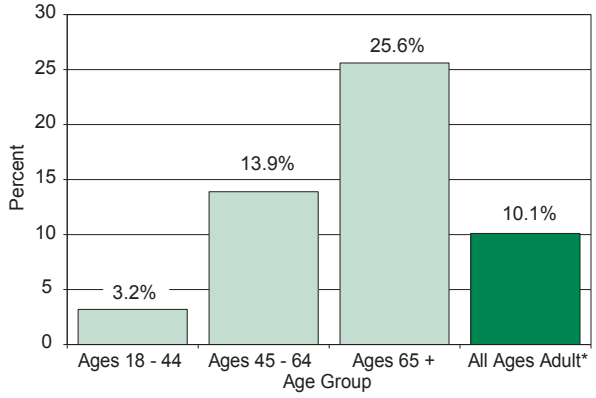
Table 1: Estimated Prevalence of Diabetes in Wisconsin Adults by Age Group, All Races and Ethnicities.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	47,870	2.4%	17,880	0.9%	65,750	3.2%
Ages 45 – 64	156,230	10.1%	58,150	3.8%	214,380	13.9%
Ages 65+	142,090	18.7%	52,870	6.9%	194,960	25.6%
All ages adult*	346,190	7.4%	128,900	2.8%	475,090	10.1%

* Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

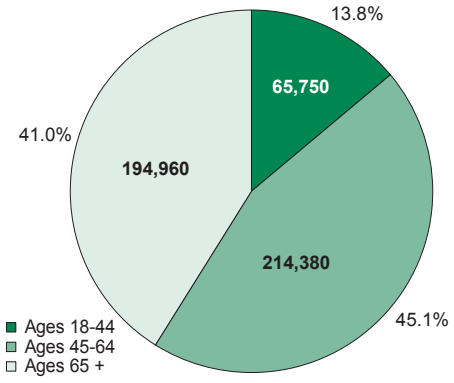
Figure 1 illustrates diabetes prevalence differences by age, while Figure 2 illustrates which age groups adults with diabetes fit into.

Figure 1: Estimated Total (Diagnosed and Undiagnosed) Percent of Wisconsin Adults with Diabetes by Age Group, All Races and Ethnicities.
Source: The 2011 Burden of Diabetes in Wisconsin



* Percent is age-adjusted (direct method) to the United States 2000 standard population.

Figure 2: Classification by Age Group of All Estimated Wisconsin Adults with Diagnosed and Undiagnosed Diabetes, All Races and Ethnicities.
Source: The 2011 Burden of Diabetes in Wisconsin



Currently, data on the prevalence of diabetes does not distinguish between type 1 and type 2 diabetes. However, the Centers for Disease Control and Prevention estimates that in adults, type 2 diabetes accounts for about 90-95% of all diagnosed cases of diabetes, while type 1 diabetes accounts for approximately 5% of all diagnosed cases of diabetes.[5]

Estimated Diabetes Prevalence In Adults By County

Figure 3: Map of Estimated Total (Diagnosed and Undiagnosed) Adult Prevalence of Diabetes in Wisconsin, Age-Adjusted Percent by County. Source: The 2011 Burden of Diabetes in Wisconsin

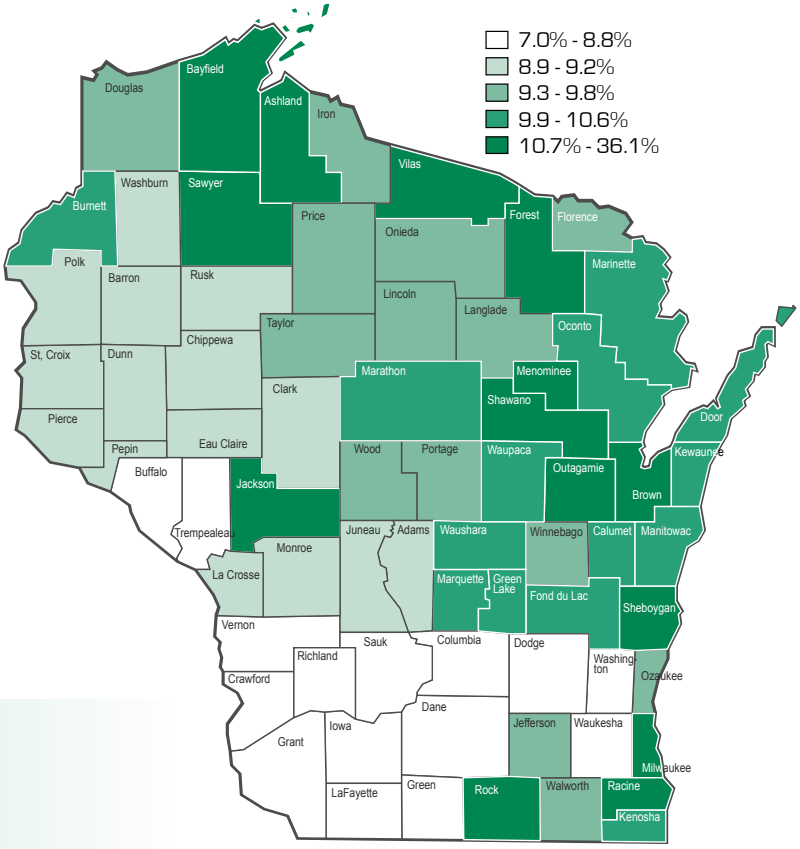


Figure 3 illustrates the total age-adjusted adult prevalence of diabetes in Wisconsin by county. As is evident, there are clear differences in prevalence by counties in Wisconsin. In general, there appears to be a higher prevalence of diabetes in the northern and northeastern counties, as well as some counties in southeastern Wisconsin. The lowest prevalence of diabetes appears to be in the southwestern and southcentral part of the state.

Estimated Diabetes Prevalence In Adults By Race/Ethnicity

Diabetes is more prevalent in some racial and ethnic populations in Wisconsin. Tables 2 through 7 provide estimates of diagnosed, undiagnosed, and total adults with diabetes by age group for six racial/ethnic groups in Wisconsin.[1] Age-specific estimates are presented for three separate age groups and age-adjusted rates are provided for the all ages adult group (18 years and above).

The highest prevalence in the 18-44 year and 45-64 year age groups is found in the American Indian racial group. For the 18-44 year age group, African Americans have almost double the prevalence (8.4%) compared to all other racial/ethnic groups, except for American Indians/Alaskan Natives. With the exception of the American Indian racial group, African Americans also have the highest prevalence (31.6%) for the 45-64 year age group, two-and-a-half times the prevalence for Non-Hispanic Whites in the same age group. African American adults have the highest prevalence (47.3%) for the age group 65 years and above, followed by Asian Americans (34.3%), American Indians/Alaskan Natives (34.2%), Hispanic/Latino (32.9%), Other/Multi-race (30.9%), and whites (24.8%).

Table 2: Estimated Prevalence of Diabetes in Wisconsin African American* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age category	Estimated Number Diagnosed	(%)	Estimated Number Undiagnosed	(%)	Estimated Total number	(%)
Ages 18 – 44	8,490	6.1%	3,180	2.3%	11,670	8.4%
Ages 45 – 64	14,940	23.0%	5,560	8.6%	20,500	31.6%
Ages 65+	6,830	34.4%	2,540	12.8%	9,370	47.3%
All ages adult◆	30,260	15.9%	11,280	5.9%	41,540	21.8%

* Non-Hispanic ◆Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

Estimated Diabetes Prevalence In Adults By Race/Ethnicity

Table 3: Estimated Prevalence of Diabetes in Wisconsin American Indian/Alaska Native* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	4,310	21.5%	1,610	8.0%	5,920	29.5%
Ages 45 – 64	5,870	53.3%	2,180	19.8%	8,050	73.1%
Ages 65+	880	25.1%	320	9.1%	1,200	34.2%
All ages adult◆	11,060	31.5%	4,110	11.7%	15,170	43.2%

* Non-Hispanic ◆Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

Table 4: Estimated Prevalence of Diabetes in Wisconsin Asian American* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	2,340	4.1%	880	1.5%	3,220	5.6%
Ages 45 – 64	2,850	15.6%	1,060	5.8%	3,910	21.4%
Ages 65+	1,440	25.1%	530	9.2%	1,970	34.3%
All ages adult◆	6,630	11.0%	2,470	4.1%	9,100	15.1%

* Non-Hispanic ◆Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

Table 5: Estimated Prevalence of Diabetes in Wisconsin Hispanic/Latino* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	4,780	3.7%	1,790	1.4%	6,570	5.0%
Ages 45 – 64	7,310	18.2%	2,720	6.8%	10,030	25.0%
Ages 65+	2,610	24.0%	970	8.9%	3,580	32.9%
All ages adult◆	14,700	11.4%	5,480	4.2%	20,180	15.6%

* Includes all races with Hispanic/Latino ethnicity ◆Percents are age-adjusted (direct method) to the United States 2000 standard population. Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

Table 6: Estimated Prevalence of Diabetes in Wisconsin Other Race/Multi-Race* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	800	4.0%	300	1.5%	1,100	5.5%
Ages 45 – 64	720	10.5%	260	3.8%	980	14.3%
Ages 65+	530	22.7%	190	8.1%	720	30.9%
All ages adult◆	2,050	9.0%	750	3.3%	2,800	12.3%

* This category includes Non-Hispanic adults identifying themselves as a race other than African-American, Asian American, American Indian, white or identifying themselves as having more than one race
◆Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

Estimated Diabetes Prevalence In Adults By Race/Ethnicity

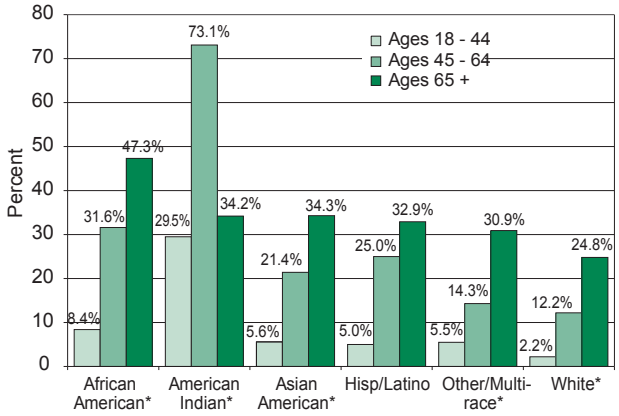
Table 7: Estimated Prevalence of Diabetes in Wisconsin White* Adults by Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	Estimated Number Diagnosed (%)		Estimated Number Undiagnosed (%)		Estimated Total Number (%)	
Ages 18 – 44	27,150	1.6%	10,120	0.6%	37,270	2.2%
Ages 45 – 64	124,540	8.9%	46,370	3.3%	170,910	12.2%
Ages 65+	129,800	18.1%	48,320	6.7%	178,120	24.8%
All ages adult◆	281,490	6.5%	104,810	2.4%	386,300	9.0%

* Non-Hispanic ◆Percents are age-adjusted (direct method) to the United States 2000 standard population.
Total percent may not equal the sum of diagnosed percent and undiagnosed percent, due to rounding.

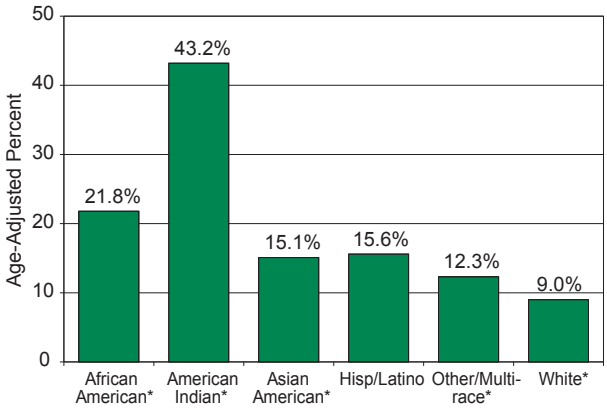
Figure 4 compares Wisconsin adult diabetes prevalence rates by age group for six different racial and ethnic groups and Figure 5 compares Wisconsin adult diabetes age-adjusted prevalence rates (all ages adult) for six different racial and ethnic groups.

Figure 4: Estimated Total (Diagnosed and Undiagnosed) Percent of Adults in Wisconsin with Diabetes by Race/Ethnicity and Age Group.
Source: The 2011 Burden of Diabetes in Wisconsin



* Non-Hispanic

Figure 5: Estimated Total (Diagnosed and Undiagnosed) Age-Adjusted Percent of Adults (Ages 18 and Above) in Wisconsin with Diabetes by Race/Ethnicity. Source: The 2011 Burden of Diabetes in Wisconsin



* Non-Hispanic

Estimated Diabetes Prevalence In Children and Adolescents

Information on the prevalence of diabetes in children and adolescents is limited. The Centers for Disease Control and Prevention (CDC) estimates that approximately 215,000 people in the United States under the age of 20 have diabetes, representing approximately 0.26% of all people in this age group.[5] In children and adolescents, the prevalence of type 1 diabetes is much more common than type 2 diabetes.

Though type 2 diabetes is much less common in children and adolescents (this is the exact opposite in adults), clinic-based reports and regional studies indicate that type 2 diabetes is increasingly being seen in children and adolescents who are overweight, obese, or physically inactive. Type 2 diabetes is also more frequently seen in children and adolescents who have a family history of type 2 diabetes or are a member of a minority racial/ethnic group.[5]

The Wisconsin Family Health Survey is a state-wide random-digit-dial telephone survey of households in Wisconsin. Information is gathered on all household members, including children and adolescents.[7] Results from the Wisconsin Family Health Survey provide us with the best available prevalence estimate for diabetes in Wisconsin children and adolescents. For the purpose of this report, children and adolescents are defined as 17 years and younger.

Estimated Diabetes Prevalence In Children and Adolescents

Table 8 reveals that approximately 4,500 children aged 0-17 years in Wisconsin have been diagnosed with diabetes.[1,8] There is currently no national estimate by which to determine an estimated number of undiagnosed children and adolescents with diabetes.

Table 8: Estimated Prevalence of Diabetes in Wisconsin Children and Adolescents, All Races and Ethnicities.
Source: The 2011 Burden of Diabetes in Wisconsin

Age Category	2009 Population Estimate	Estimated Number Diagnosed (%)	
Ages 0 – 9	720,886	1,100	0.15%
Ages 10 – 17	589,364	3,400	0.58%
All ages Children and Adolescents	1,310,250	4,500	0.34%

Estimated Pre-Diabetes Prevalence In Adults (Ages 20+ Years)

Pre-diabetes is defined as having blood sugar levels that are higher than normal, but not yet high enough to be diagnosed with diabetes.[9] People with pre-diabetes have an increased risk of developing type 2 diabetes, heart disease, and stroke.[5] Studies have demonstrated that most people with pre-diabetes will develop type 2 diabetes within 10 years unless they take steps to reduce their risk.[10] Diabetes Prevention Program results found that participants who lost 5 to 7% of their weight through increased physical activity and dietary changes reduced their risk of developing type 2 diabetes by 58%.[11,12] Recent research has shown that long-term complications can develop during pre-diabetes, especially heart disease[9] and diabetic retinopathy.[13]

Information from the Centers for Disease Control and Prevention 2011 National Diabetes Fact Sheet stated 35% of United States adults aged 20 years or older had pre-diabetes. These findings are from the 2005-2008 National Health and Nutrition Examination Survey (NHANES). Additional data from this survey found that after adjusting for population age differences, the percentage of United States adults aged 20 years and older with pre-diabetes was similar for non-Hispanic whites (35%), non-Hispanic blacks (35%), and Mexican Americans (36%).[5]

An estimate of the number of people with pre-diabetes in Wisconsin aged 20 years and older was determined by applying the NHANES data above to the population estimate for this age group. Table 9 illustrates that approximately 1,460,250 Wisconsinites aged 20 years and older are estimated to have pre-diabetes. Though NHANES data suggests that pre-diabetes prevalence was similar for non-Hispanic whites, non-Hispanic blacks, and Mexican Americans, it should be noted that there may be some differences in pre-diabetes prevalence for some racial and ethnic groups.

Table 9: Estimated Number of Wisconsin Adults Aged 20 Years and Older with Pre-diabetes by Race/Ethnicity.
Source: The 2011 Burden of Diabetes in Wisconsin

	2009 Wisconsin Population Estimate (20 + years)	Estimated Number with Pre-diabetes (20 + years)
African American*	209,713	73,400
American Indian/Alaska Native*	32,914	11,520
Asian American*	76,537	26,790
Hispanic/Latino	170,648	59,730
People of Other/Multi Races*	26,542	9,290
White*	3,655,627	1,279,470
Total	4,171,981	1,460,250◆

* Non-Hispanic ◆ The sum of pre-diabetes estimates for all race/ethnicity groups will not match the state total exactly, due to rounding.

Based on findings from the Diabetes Prevention Program (DPP) and on the estimated number of Wisconsinites aged 20 years and older with pre-diabetes, the incorporation of lifestyle interventions (increased physical activity and dietary changes leading to a 5 to 7% weight loss) has the potential to prevent or delay the development of type 2 diabetes for approximately 846,945 people aged 20 years and older in Wisconsin.

Economic Costs of Diabetes

Besides serious health-related complications, diabetes is also economically costly in Wisconsin. The American Diabetes Association published an article in the March 2008 edition of Diabetes Care titled "Economic Costs of Diabetes in the U.S. in 2007." Per capita figures in this report were obtained from this article and applied to the estimated population with diagnosed diabetes in Wisconsin to determine the estimated costs of diabetes in Wisconsin.

The article found that the per capita cost of medical expenditures for a person with diabetes was $11,744. Furthermore, the article found that 66.64% of the total costs of diabetes were direct medical expenditures, while the remaining 33.36% were indirect costs due to lost productivity. This led to the per capita estimate of $5,879 for indirect costs due to lost productivity.[4]

The direct (medical care) and indirect (lost productivity) costs of diabetes in Wisconsin total an estimated $6.15 billion. Approximately $4.07 billion are direct medical expenditures for adults, $2.04 billion are from indirect costs for adults, and an estimated $52.8 million are direct medical expenditures for children and adolescents.[1] For this analysis, an estimate of indirect costs for children and adolescents is not included, as they are generally not members of the workforce (there are some exceptions). Note that this estimate only includes persons diagnosed with diabetes. Persons with diabetes that is undiagnosed arguably don't incur the same costs as those diagnosed with diabetes; however, the figure of $6.15 billion is likely an underestimate, as it considers none of the direct or indirect costs for persons with pre-diabetes or undiagnosed diabetes.[4]

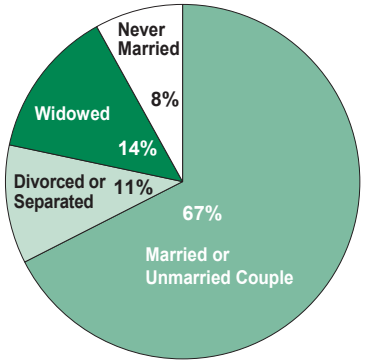
The next eight sections include information obtained from the Wisconsin Behavioral Risk Factor Survey (BRFS). The first six sections include recent data (2009-2010) to provide the most current information, and the remaining two sections include trend data (1995-2010) which show changes over time. The BRFS includes a question on the core survey that asks whether or not a person has diabetes: "Have you ever been told by a doctor that you have diabetes?" Performing cross-tabulations of data on whether a person has diabetes (hereafter referred to as "diabetes status") with other variables, risk factors, or conditions of interest provides detailed information on adults with diabetes, compared to adults without diabetes. Wisconsin 1995-2010 BRFS data sets were used in compiling the data for the following eight sections.[14]

Sociodemographics

Figure 6 illustrates that the majority (67%) of adults with diabetes are married or a member of an unmarried couple. A total of 14% of adults with diabetes are widowed, 11% are divorced or separated, and 8% have never married. These percentages are similar to those for adults without diabetes, with the exception of the widowed and never married categories. For adults without diabetes, 5% are widowed and 20% have never married (data not shown).[14] The differences are most likely due to the fact that the prevalence of diabetes is higher in older age groups.

Figure 6: Marital Status of Wisconsin Adults with Diabetes, 2009-2010.

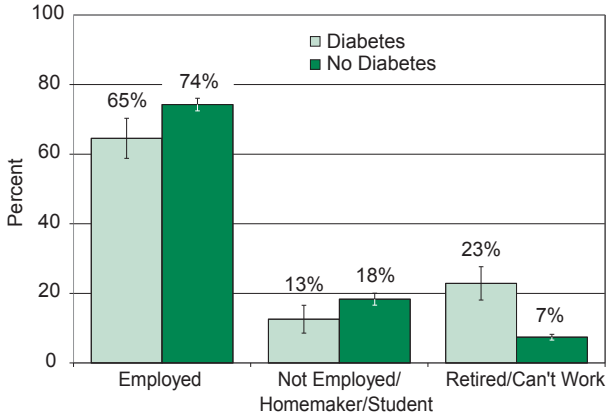
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Figures 7 and 8 show the employment status of adults with diabetes compared to adults without diabetes. For this analysis, two separate age groups were examined to address employment status differences; Figure 7 provides information on ages 18-64 years and Figure 8 provides information on age 65+ years. In the 18-64 year age group, 65% of adults with diabetes are employed, compared to 74% of adults without diabetes, a statistically significant difference. In the same age group, 13% of adults with diabetes and 18% of adults without diabetes are not employed, are a homemaker, or are a student, also statistically significant. Finally, 23% of adults with diabetes are retired or cannot work, compared to only 7% of adults without diabetes which is also statistically significant.[14]

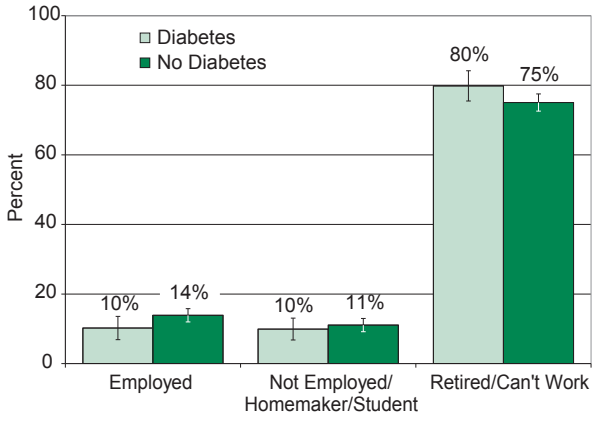
Sociodemographics

Figure 7: Employment Status of Wisconsin Adults by Diabetes Status, Ages 18-64 Years, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



In the 65+ year age group (Figure 8), percents are relatively similar for adults with and without diabetes with no statistically significant differences. A total of 10% of adults with diabetes are employed, compared to 14% of adults without diabetes. Of adults with diabetes, 10% are not employed, are a homemaker, or are a student, compared to 11% of adults without diabetes. Finally, 80% of adults with diabetes are retired or cannot work, compared to 75% of adults without diabetes.[14]

Figure 8: Employment Status of Wisconsin Adults by Diabetes Status, Ages 65+ Years, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Differences in income are also present in adults with diabetes compared to adults without diabetes. Figure 9 illustrates that people with diabetes have lower annual household incomes with 35% earning greater than $50,000 annually compared to 47% of those without diabetes, a difference that is statistically significant.[14] The other differences in income are statistically significantly different as well, though to a lesser degree. However, whether there is any causality in the relationship is unclear.

Figure 9: Annual Household Income of Wisconsin Adults by Diabetes Status, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

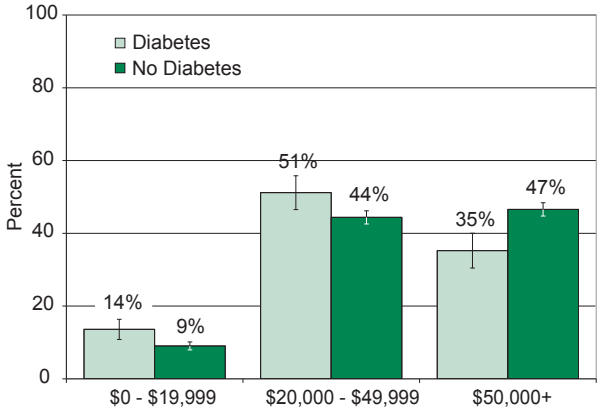
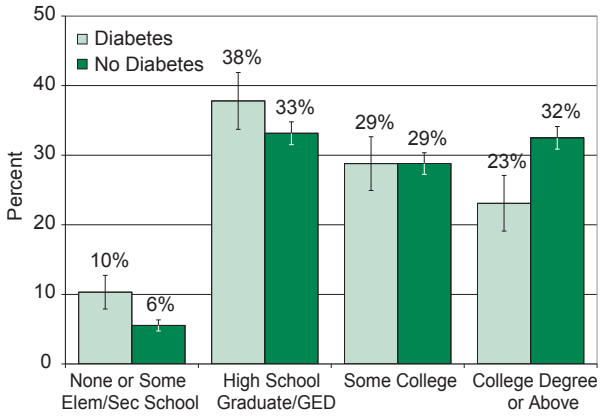


Figure 10 illustrates that the education level of adults with diabetes differs from adults without diabetes. There is a greater percentage of adults with diabetes that have less than a high school education (10%) compared to adults without diabetes (6%) and this difference is statistically significant. The largest category of adults with diabetes has a high school education (38%). Of adults with diabetes, 23% have a college degree or above, compared with 32% of adults without diabetes, also a statistically significant difference.[14] Note that these percentages are not age-adjusted.

Figure 10: Education Level of Wisconsin Adults by Diabetes Status, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



General Health

Adults with diabetes report their health status as less positive than adults without diabetes, as Figure 11 shows. Adults with diabetes rate their health as poor over five times as often (11%) as do adults without diabetes (2%). Of adults with diabetes, 28% rate their health as fair, compared to only 8% of adults without diabetes. Only four percent of adults with diabetes report their health status as excellent, compared to 21% of adults without diabetes and twice as many adults without diabetes rate their general health status as very good, compared to adults with diabetes. All levels of self-reported general health status are statistically significantly different between people with diabetes and people without diabetes.[14] Note that these percentages are not age-adjusted.

Figure 11: Self-Reported General Health Status (Five Levels) in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

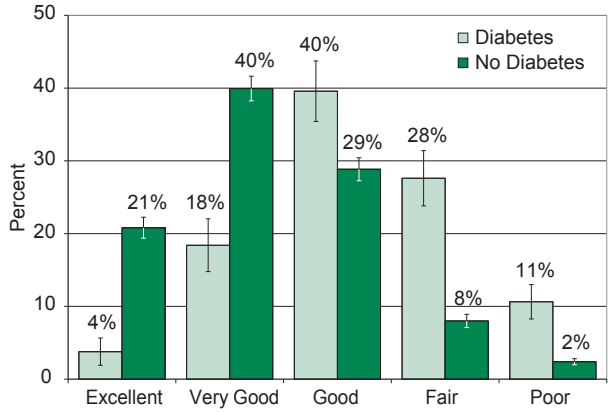
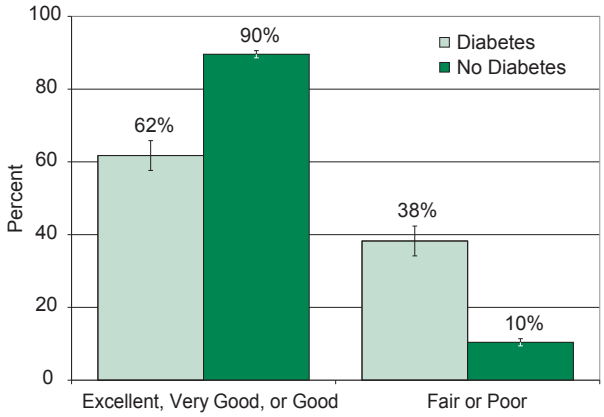


Figure 12 presents self-reported general health status in a slightly different manner, as it combines responses into two groups instead of five. Of adults with diabetes, 62% self-reported their general health status as excellent, very good, or good, while 90% of adults without diabetes self-reported their health status this way, a statistically significant difference. a statistically significant difference. Likewise, 38% of adults with diabetes self-reported their health status as fair or poor, while only 10% of adults without diabetes self-reported their health as fair or poor, also statistically significantly different.[14] Note that these percentages are not age-adjusted.

Figure 12: Self-Reported General Health Status (Two Levels) in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Respondents to the BRFS questionnaire were asked the question: "In general, how satisfied are you with your life?" A total of 93% of adults with diabetes responded that they were very satisfied or satisfied with their life and 7% responded that they were dissatisfied or very dissatisfied with their life. In comparison, 95% of adults without diabetes were very satisfied or satisfied with their life and 5% were dissatisfied or very dissatisfied with their life.[14] These differences were not statistically significant and data are not presented in a graph.

Three questions in the BRFS ask respondents about the number of days when their health was not good or when poor health kept them from normal activities. The specific questions were:

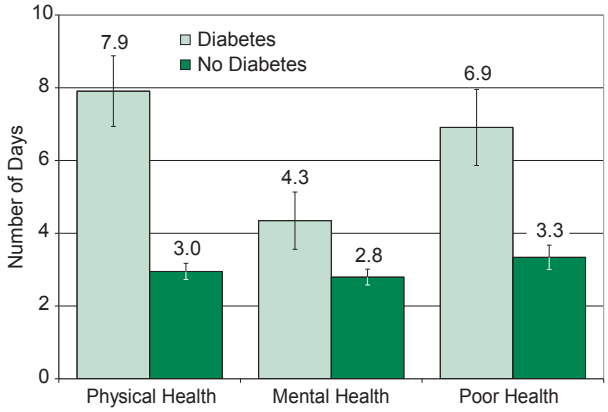
- Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?
- Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?
- During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

General Health

Figure 13 illustrates that adults with diabetes have statistically significantly more days when their physical and mental health was not good, compared to adults without diabetes. Adults with diabetes, on average, responded that out of the past 30 days, on nearly eight days their physical health was not good and on over four days their mental health was not good. Adults without diabetes reported three days that their physical health was not good and almost three days that their mental health was not good. Regarding the number of days that poor physical or mental health kept respondents from their usual activities, again adults with diabetes had on average a higher number of days (6.9) compared to adults without diabetes (3.3), which is also statistically significant.[14] Note that these percentages are not age-adjusted.

Figure 13: Number of Days that Health Was Not Good for Wisconsin Adults by Diabetes Status, 2009-2010.

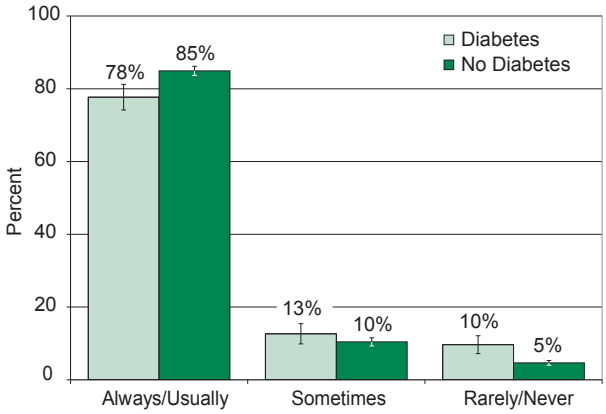
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



A question on the BRFS addresses social and emotional support that people receive: "How often do you get the social and emotional support you need?" The majority of adults with diabetes (78%) and those without diabetes (85%) report that they always or usually get the social and emotional support that they need, as shown in Figure 14. However, there is a statistically significant difference between adults with and without diabetes who report "always or usually" getting the support they need, as well as "rarely or never" getting the support they need.[14] Note that these percentages are not age-adjusted.

Figure 14: Social and Emotional Support in Wisconsin Adults by Diabetes Status, 2009-2010.

Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Access to Care

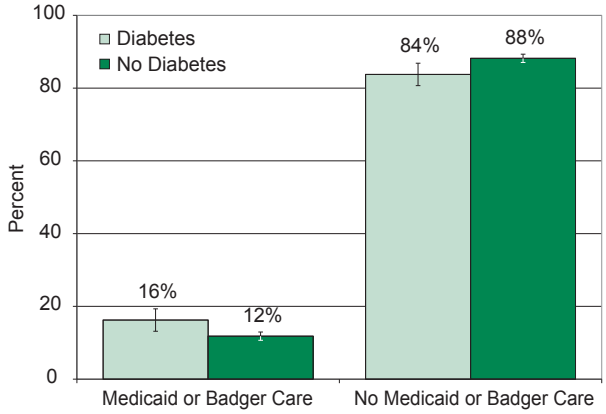
Access to health care is an issue facing many people in Wisconsin. The report *Wisconsin Health Insurance Coverage, 2009* estimates that in 2009, a total of 4,856,000 Wisconsin residents were insured during the entire year; 301,000 were insured part of the year and uninsured part of the year; and 349,000 had no insurance coverage during the year.[15] The BRFS questionnaire also asks questions regarding health care coverage and access.

One question asked "Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare?" Slightly more adults with diabetes responded "yes" to this question (92%) than adults without diabetes (89%), but the difference was not statistically significant and data are not presented in a graph.[14]

Another question asked "Was there a time in the past 12 months when you needed to see a doctor but could not because of the cost?" For both adults with and without diabetes, 10% responded "yes" to this question, leading to no statistically significant difference between the two groups.[14] These data are not presented in a graph.

Finally, a specific question addressed Medicaid: "Do you have health care coverage from Medicaid or Badger Care?" A higher percentage of people with diabetes (16%) reported having health care coverage from Medicaid or Badger Care than people without diabetes (12%), a difference that was statistically significant. These data are shown in Figure 15.

Figure 15: Health Care Coverage from Medicaid or Badger Care by Diabetes Status, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Risk Factors

Several risk factors are associated with an increased risk of developing type 2 diabetes. Some risk factors can not be controlled (e.g., age, race/ethnicity), but many risk factors can be controlled. Examples of risk factors that can be controlled include: overweight or obesity, physical inactivity, and several cardiovascular risk factors, such as high blood pressure and high cholesterol. Furthermore, there is evidence that people with diabetes who have risk factors such as those listed above are at higher risk for diabetes-related complications and for other chronic diseases.

In Wisconsin and nationally, there is concern about the increasing prevalence of overweight and obesity in the past several decades. An overweight or obese person is at risk of multiple chronic conditions and premature death. Some of the conditions include: heart disease, high blood pressure, high cholesterol, type 2 diabetes, breathing problems (sleep apnea and asthma), arthritis, complications of pregnancy, infertility, gallbladder disease, incontinence, depression, and some cancers.[16]

Body mass index (BMI) is a number calculated using a person's weight and height. BMI is a fairly reliable indicator of body fatness for most people. While it doesn't measure body fat directly, research has shown that BMI correlates to direct measures of body fat, and so it can be considered an alternative for direct measures of body fat. BMI is used to identify overweight and obesity in people and calculating BMI is one of the best methods for population assessment of overweight and obesity. Body mass index can be calculated using pounds and inches with the following equation:[17]

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

Table 10 illustrates that for adults 20 years and older, BMI falls into one of four categories: underweight, normal weight, overweight, or obese.[17]

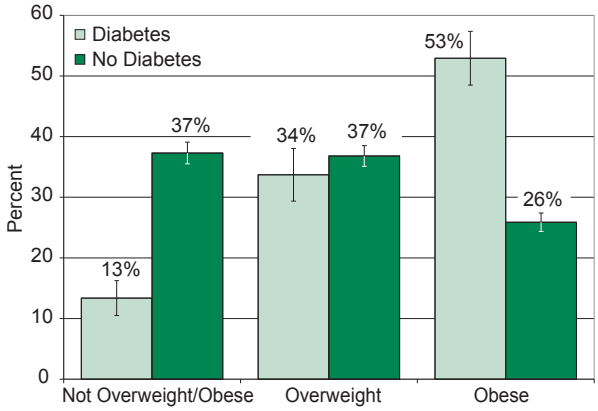
Table 10: Body Mass Index (BMI) and Accompanying Weight Status Categories.
Source: Centers for Disease Control and Prevention

BMI (in kg/m^2)	Weight Status
Below 18.5	Underweight
18.5 – 24.9	Normal Weight
25.0 – 29.9	Overweight
30.0 and Above	Obese

Risk Factors

The percentages of adults with diabetes who are overweight or obese are significantly different than percentages for adults without diabetes, as Figure 16 demonstrates. Only 13% of adults in Wisconsin with diabetes are not overweight or obese, compared to 37% of adults without diabetes, a statistically significant difference. There are slightly more adults without diabetes that are in the overweight category (37%), compared to those with diabetes (34%), but this difference is not statistically significant. However, the majority of people with diabetes are obese (53%), in contrast to those without diabetes (26%), a statistically significant difference.[14]

Figure 16: Weight Status (Not Overweight/Obese, Overweight, and Obese) in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Not overweight or obese: Body Mass Index < 25.0 kg/m^2
Overweight: Body Mass Index 25.0 kg/m^2 – 29.9 kg/m^2
Obese: Body Mass Index ≥ 30.0 kg/m^2

Note that adults who are underweight are not separated out from those with a normal weight for this analysis, as the percentage that are underweight is very small.

Figure 17 presents weight status in a slightly different manner, as it uses two levels instead of three (combining overweight and obese into one group). Of adults with diabetes, 87% are overweight or obese, compared to 63% of adults without diabetes, a statistically significant difference. Likewise, only 13% of adults with diabetes are not overweight or obese, compared to 37% of adults without diabetes, also statistically significant.[14] As presented in Figure 16, obesity, rather than overweight, has the highest correlation to diabetes.

Figure 17: Weight Status (Not Overweight/Obese and Overweight or Obese) in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

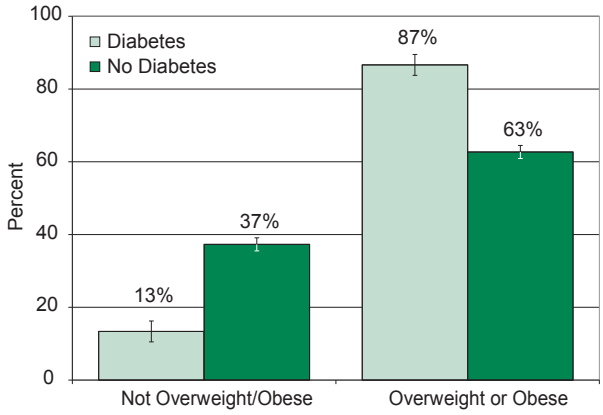
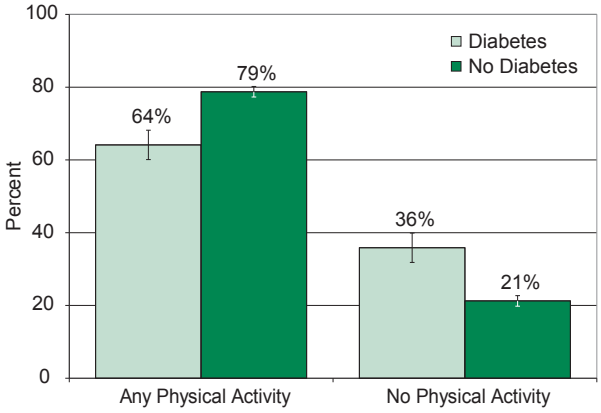


Figure 18 illustrates that 64% of adults with diabetes report some type of physical activity (other than their regular job) in the past month, compared to 79% for adults without diabetes.[14] This difference is statistically significant.

Figure 18: Physical Activity Status in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



In general, the majority of Wisconsin adults do not eat the recommended five fruits and vegetables a day. Figure 19 illustrates that adults with diabetes report meeting the recommendations slightly more often (25%) relative to adults without diabetes (22%); however, this difference is not statistically significant.[14]

Risk Factors

Figure 19: Fruit and Vegetable Consumption Status in Wisconsin Adults by Diabetes Status, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

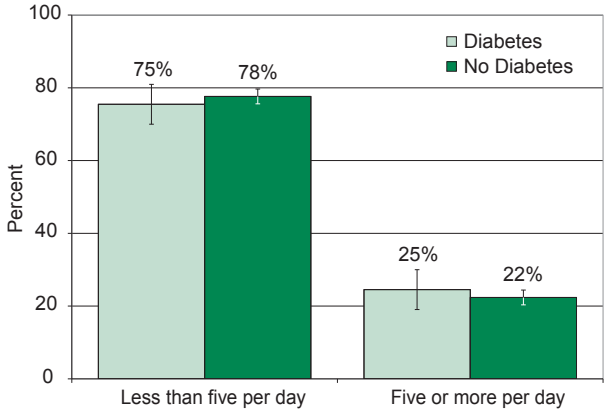
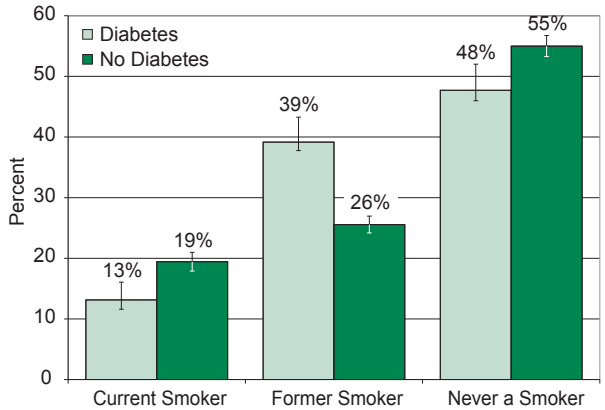


Figure 20 illustrates smoking status for adults with diabetes, compared to those without diabetes. Adults with diabetes are less often current smokers (13%) than adults without diabetes (19%), and this difference is statistically significant.[14] There are also a statistically significantly smaller percent of adults with diabetes who have never smoked (48%), compared to adults without diabetes (55%). Finally, there are more adults with diabetes who are former smokers (39%) compared to adults without diabetes (26%), also a statistically significant difference. Because diabetes and smoking each by themselves lead to an increased risk of cardiovascular disease, a person with diabetes who smokes compounds his or her risk of cardiovascular disease.[18]

Figure 20: Smoking Status (Current Smoker, Former Smoker, Non-smoker) in Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



As explained previously, people with diabetes are at higher risk of cardiovascular complications including heart attack, stroke, hypertension (high blood pressure), and high cholesterol. Controlling blood pressure and cholesterol for people with diabetes is an important aspect of good diabetes care. Figure 21 illustrates that adults with diabetes report having been told that they have high blood pressure to a greater degree (71%) than adults without diabetes (24%); this difference is statistically significant.[14]

Figure 21: High Blood Pressure Status in Wisconsin Adults by Diabetes Status, 2009. Source: Wisconsin Behavioral Risk Factor Survey, 2009

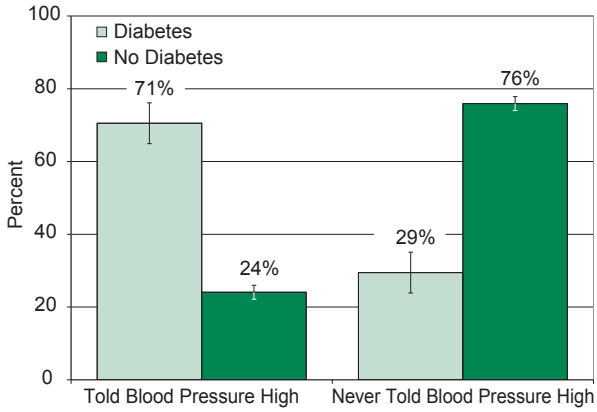
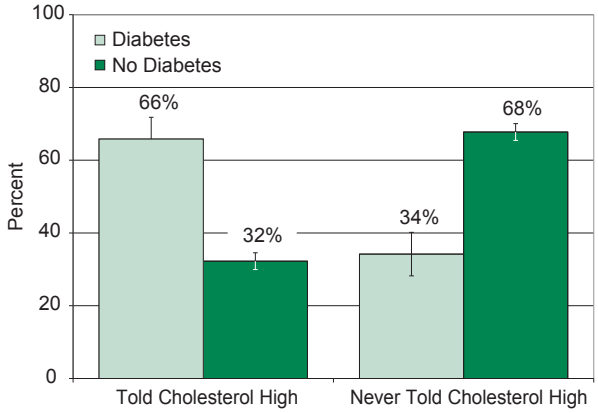


Figure 22 illustrates that adults with diabetes report having been told that they have high cholesterol more often (66%) than adults without diabetes (32%); this difference is statistically significant.[14]

Figure 22: High Cholesterol Status in Wisconsin Adults by Diabetes Status, 2009. Source: Wisconsin Behavioral Risk Factor Survey, 2009

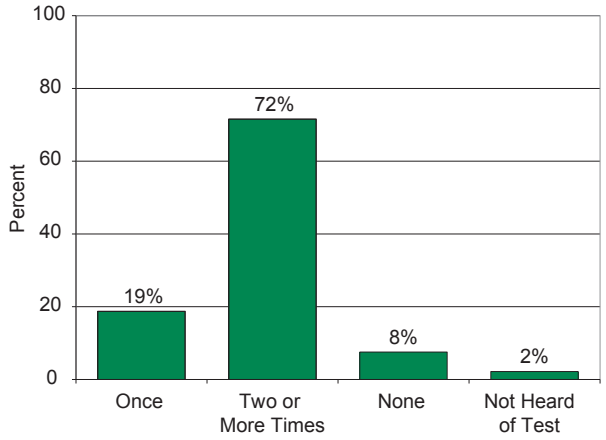


Current Status of Diabetes Care

Wisconsin has included questions from the optional diabetes module on the Behavioral Risk Factor Survey (BRFS) since 1995, with the exception of two years (2005 and 2006). The diabetes module poses a set of diabetes-specific questions to anyone who has answered "Yes" to the question "Have you ever been told by a doctor that you have diabetes?" The diabetes module includes questions on typical lab tests and exams that a person with diabetes should receive, as well as self-care practices that a person with diabetes is recommended to follow.

An A1C (also referred to as "hemoglobin A1C" or "glycosylated hemoglobin") test is a measure of a person's blood sugar control over the past 60 to 90 days. The *Wisconsin Diabetes Mellitus Essential Care Guidelines,* which align with the *American Diabetes Association Clinical Practice Recommendations,* recommend testing A1C at least two times per year in patients who have stable glycemic control and quarterly for those who need therapy changes and are not at goal.[3,19] Figure 23 illustrates that 72% of adults with diabetes in Wisconsin have had two or more A1C tests in the past year; an additional 19% have had one A1C test in the past year. A total of 8% of adults with diabetes have not had an A1C test within the past year, and 2% have not heard of the test.[14]

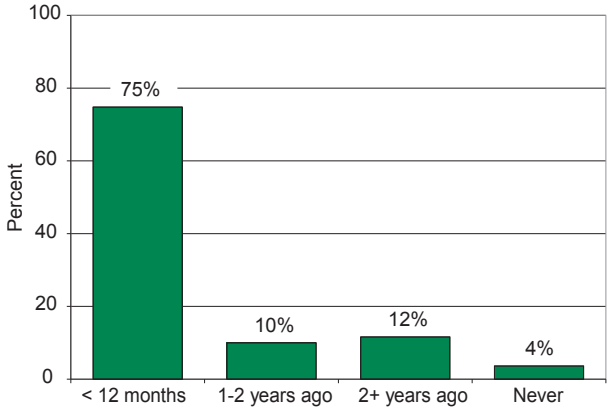
Figure 23: Self-reported Frequency of A1C Testing in Past Year for Wisconsin Adults with Diabetes, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Diabetic retinopathy is a complication of diabetes that can lead to blindness. Early detection and treatment of diabetic retinopathy can prevent or delay blindness. A dilated retinal eye exam by an experienced optometrist or ophthalmologist is the most reliable test to assess for diabetic retinopathy. The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommended that a person with diabetes have a dilated eye exam each year by an ophthalmologist or optometrist. Less frequent exams can be considered if one or more exams are normal.[3]

One of the diabetes module questions on the BRFS queries respondents about whether they have had a dilated retinal eye exam in the past year. Figure 24 illustrates that 75% of adults in Wisconsin with diabetes have had a dilated eye exam in the past year, with 22% having had an exam more than a year ago. Only 4% of adults with diabetes report never having had a dilated eye exam.[14]

Figure 24: Self-reported Time Respondent had Last Dilated Eye Exam for Wisconsin Adults with Diabetes, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

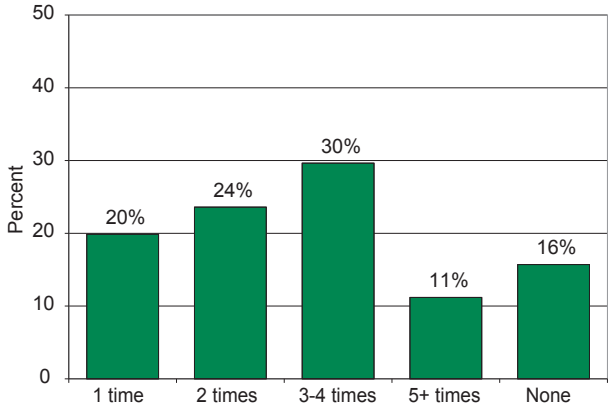


The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommend that a person with diabetes see a health care provider for a comprehensive diabetes evaluation at least two times a year (and more often when necessary).[3] A question in the diabetes module of the BRFS asks adults with diabetes how often they had seen a health professional for their diabetes in the past year.

Current Status of Diabetes Care

Figure 25 illustrates that 65% of adults with diabetes had reported seeing a health professional for their diabetes two or more times during the past year. An additional 20% reported seeing a health professional one time in the past year. A total of 16% of adults with diabetes had not seen a health professional for their diabetes at all in the past year.

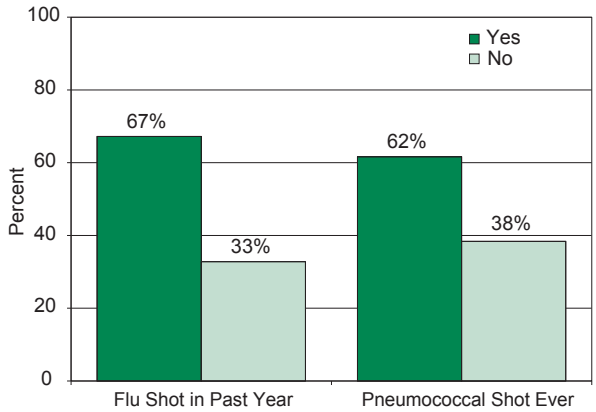
Figure 25: Self-reported Number of Times Respondent had Seen Health Professional for Diabetes in Past Year, Wisconsin Adults with Diabetes, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



People with diabetes are more susceptible to infections, including influenza and pneumonia. The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommend that persons with diabetes have an annual influenza vaccination, as well as a pneumococcal vaccination at least once in their lifetime.[3]

Figure 26 illustrates that 67% of adults with diabetes reported having had an influenza vaccination within the past year and 62% of adults with diabetes report having ever had a pneumococcal vaccination.[14]

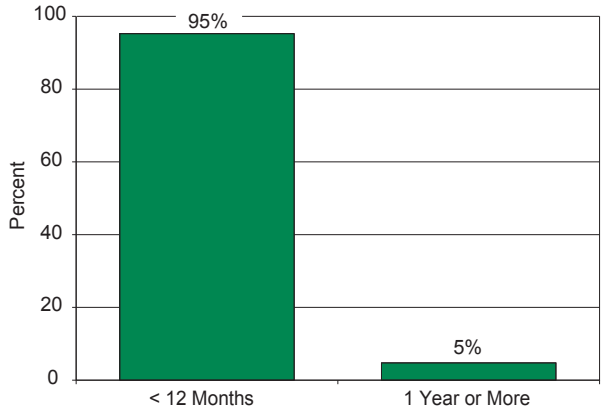
Figure 26: Self-reported Responses for Wisconsin Adults with Diabetes Regarding Receiving Flu Shot in Past Year and Pneumococcal Shot Ever, 2009-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



People with diabetes have a greater risk for cardiovascular complications than people without diabetes. Therefore, part of optimal diabetes care is regular assessment of cholesterol and blood pressure and appropriate treatment to manage high cholesterol and hypertension (high blood pressure).

The BRFS asks questions regarding testing of cholesterol and blood pressure, as well as having been told that cholesterol or blood pressure is high. A total of 96% of adults with diabetes reported ever having their cholesterol checked (2009 data only). The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommends that people with diabetes have a fasting lipid profile done annually.[3] Of those adults with diabetes that report ever having their cholesterol checked, 95% of them had their cholesterol checked in the past year, as Figure 27 illustrates.

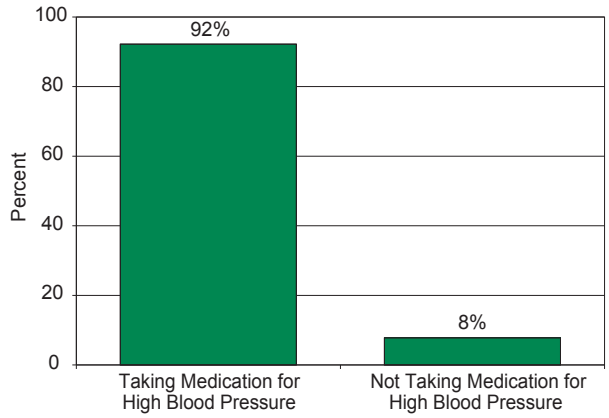
Figure 27: Percent of Wisconsin Adults with Diabetes Who Have Ever had Their Cholesterol Checked Reporting When Cholesterol was Checked, 2009.
Source: Wisconsin Behavioral Risk Factor Survey, 2009



As shown earlier in this report, 71% of adults with diabetes in Wisconsin have high blood pressure (Figure 21) and 66% of adults with diabetes in Wisconsin have high cholesterol (Figure 22). A question on the BRFS asks if the respondent is currently taking medicine for high blood pressure. A total of 92% of adults with diabetes reported taking medication for high blood pressure.[14] In comparison, 74% of adults without diabetes reported taking medication for high blood pressure, a statistically significant difference (data not shown).

Current Status of Diabetes Care

Figure 28: Percent of Wisconsin Adults with Diabetes who Report Taking Medication for High Blood Pressure, 2009. Source: Wisconsin Behavioral Risk Factor Survey, 2009



Healthy People 2020 is a set of science-based national objectives with the goal of improving the health of all Americans. Healthy People 2020 replaces the older version, Healthy People 2010. Healthy People 2020 has four overarching goals: 1) attain high-quality, longer lives free of preventable disease, disability, injury, and premature death, 2) achieve health equity, eliminate disparities, and improve the health of all groups, 3) create social and physical environments that promote good health for all, and 4) promote quality of life, healthy development, and healthy behaviors across all life stages. Diabetes is one of the 42 focus areas in Healthy People 2020.[20] Figure 29 shows six diabetes-related measures, along with the Healthy People 2010 and Healthy People 2020 targets for each measure, where applicable. Wisconsin has already surpassed the Healthy People 2010 target for A1C testing, with 90% of adults with diabetes report having received an A1C test one or more times in the past year.[14,21] The A1C testing measure changed from "One or More A1C Tests in Past Year" (Healthy People 2010) to "Two or More A1C Tests in Past Year" (Healthy People 2020).[20,21] Wisconsin has already surpassed the Healthy People 2020 target for A1C testing; 72% of adults with diabetes have had two or more A1C tests in the past year (the Healthy People 2020 target is 71%).[14,20] Wisconsin reached the Healthy People 2010 target for eye exam and surpassed the Healthy People 2010 target for foot exam.[14,21] Given the new (lower) Healthy People 2020 targets for eye exam, foot exam, and dental exam, Wisconsin has already surpassed those targets.[14,20]

Wisconsin is close to reaching the Healthy People 2010 target for formal diabetes education; over half (58%) of adults with diabetes responded that they had taken a class or course in how to manage their diabetes. The Healthy People 2010 target is 60% and the Healthy People 2020 target is 63%.[14,20,21]

Figure 29: Selected Diabetes Care Measures for Wisconsin Adults with Diabetes and Associated Healthy People 2010 and Healthy People 2020 Targets. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010, Healthy People 2010, and Healthy People 2020

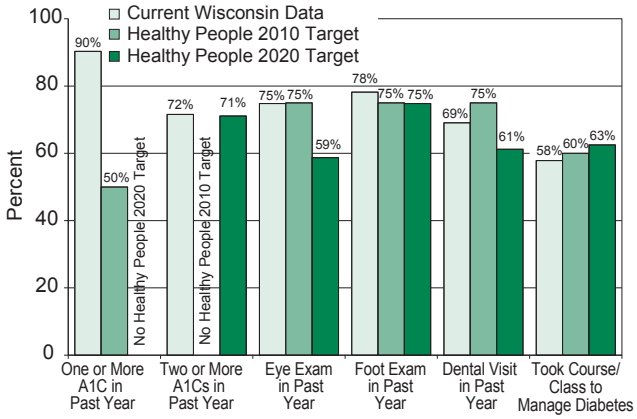
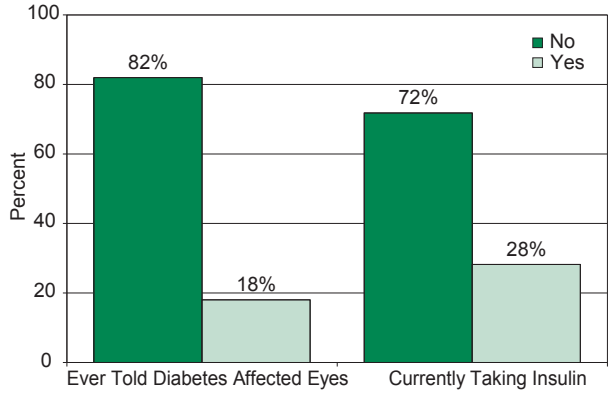


Figure 30 illustrates self-reported responses from adults with diabetes regarding selected aspects of diabetes care. The figure shows that 28% of adults with diabetes report that they are currently taking insulin and 18% report that they have ever been told by a doctor that diabetes has affected their eyes or that they had retinopathy.[14]

Figure 30: Self-reported Responses for Wisconsin Adults with Diabetes Regarding Selected Aspects of Diabetes Care, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Comorbid Chronic Diseases and Other Complications

People with diabetes are at higher risk of other chronic diseases. Furthermore, people with diabetes often have a higher prevalence of certain chronic diseases, compared to people without diabetes.

Figure 31 illustrates that over half of adults with diabetes (51%) also have arthritis, compared to 23% of adults without diabetes; this difference is statistically significant. A higher percentage of adults with diabetes have been told that they have asthma (15%), compared to adults without diabetes (13%), but this difference was not statistically significant. More adults with diabetes have ever been told that they have a depressive disorder compared to adults without diabetes (18% vs. 16%), but this difference was also not statistically significant.[14]

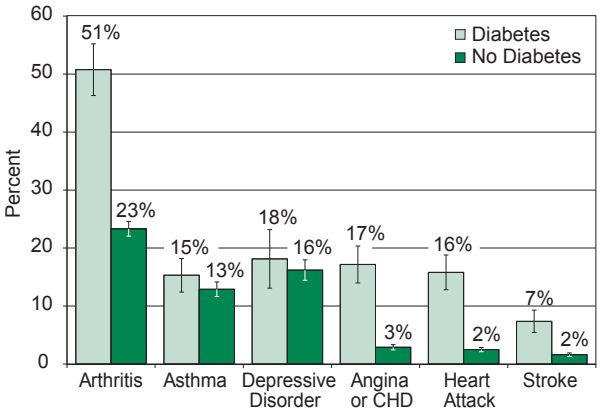
Cardiovascular complications are much more frequent in adults with diabetes, compared to those without diabetes. Three questions on the BRFS addressed cardiovascular complications; the wording is listed below:

Has a doctor, nurse, or other health professional ever told you that you had any of the following?

- (Ever told) you had angina or coronary heart disease?
- (Ever told) you had a heart attack, also called a myocardial infarction?
- (Ever told) you had a stroke?

Adults with diabetes are over five times as likely to report having been told they had angina or coronary heart disease (17%) compared to adults without diabetes (3%). Likewise, adults with diabetes are eight times as likely to report having been told they had a heart attack (16%) compared to adults without diabetes (2%). Finally, adults with diabetes are over three times as likely to report having been told they had a stroke (7%) compared to adults without diabetes (2%). All of these differences are statistically significant.[14]

Figure 31: Prevalence of Select Chronic Diseases and Comorbid Conditions for Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

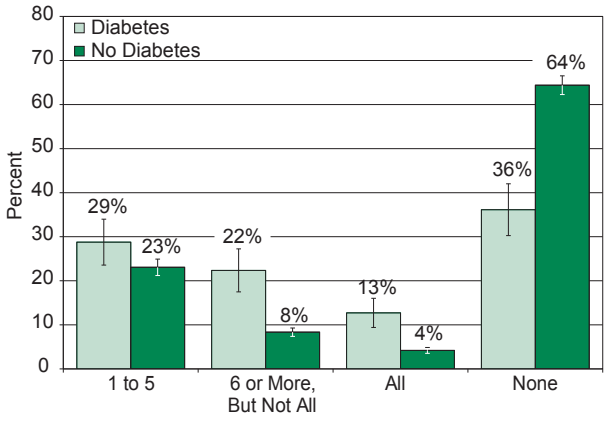


People with diabetes are more susceptible to oral infections such as periodontal disease. Periodontal disease can lead to tooth loss/removal and cardiovascular complications. A question on the BRFS asked respondents about the number of their permanent teeth that had been removed. The specific wording of the question was: "How many of your permanent teeth have been removed because of tooth decay or gum disease? Include teeth lost to infection, but do not include teeth lost for other reasons, such as injury or orthodontics."

Comorbid Chronic Diseases and Other Complications

Figure 32 illustrates that a higher percentage of adults with diabetes (29%) reported having 1 to 5 teeth removed compared to adults without diabetes (23%), but this difference was not statistically significant. Almost three times as many adults with diabetes (22%) report having 6 or more teeth (but not all) removed, compared to adults without diabetes (8%), a difference that is statistically significant. Furthermore, over three times as many adults with diabetes (13%) report having all of their teeth removed compared to 4% of adults without diabetes, also a statistically significant difference. Finally, significantly more adults without diabetes (64%) report having none of their teeth removed, compared to 36% of adults with diabetes. Some of these differences may be due to the increased average age in those who have diabetes, but some of the differences are likely due to the increased risk of periodontal disease and associated tooth loss in people with diabetes.

Figure 32: Self-reported Responses to Question Addressing Removal of Permanent Teeth Due to Tooth Decay or Gum Disease for Wisconsin Adults by Diabetes Status, 2009-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010



Assessing Risk For Type 2 Diabetes and Pre-Diabetes

The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommends performing an A1C test, fasting plasma glucose test, or an oral glucose tolerance test on all adults ages 45 and older or with a BMI ≥ 25 kg/m^2 and one other risk factor.

A specific optional pre-diabetes module is available for states to add to the BRFS; Wisconsin added this module in 2008 and has asked it each year since then. The questions asked are as follows:

1) Have you had a test for high blood sugar or diabetes within the past three years?
2) Have you ever been told by a doctor or other health professional that you have pre-diabetes or borderline diabetes?

These questions are only asked of people who do not respond "yes" to the core diabetes awareness question: "Have you ever been told by a doctor that you have diabetes?"

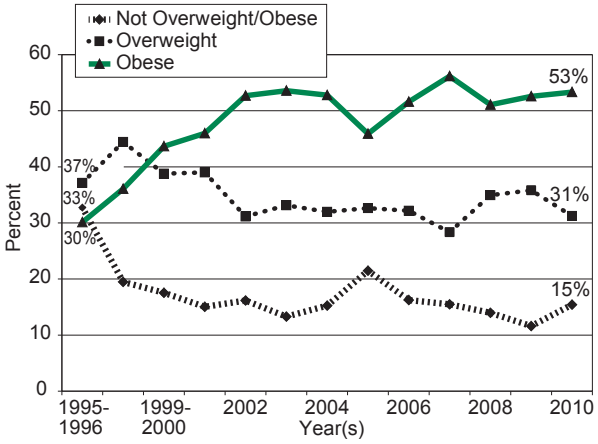
Of adults ages 45 years and older without diabetes, 66% responded that they had a test for high blood sugar or diabetes within the past three years (2009-2010 data).[14]

Of all adults without diabetes, 5.8% reported having been told by a doctor or other health professional that they have pre-diabetes or borderline diabetes (2009-2010 data).[14] It should be noted that this percentage is vastly different from pre-diabetes estimates provided in the beginning of this document. The pre-diabetes estimates provided earlier are from the Centers for Disease Control and Prevention (CDC) National Diabetes Fact Sheet and applied to the appropriate population in Wisconsin. The National Diabetes Fact Sheet states that a 2005-2008 study found that among U.S. adults ages 20 years and older, 35% had pre-diabetes (based on fasting glucose or A1C). Because the 35% was determined from a study that involved actual lab values and because the BRFS is a survey where adults provide self-reported answers, it is likely that the 35% is more accurate than the 5.8% when referring to pre-diabetes prevalence. There are likely many people who responded to the BRFS survey who are unaware that they have pre-diabetes but who would be tested and found to have the condition.

Trends In Selected Characteristics of Adults With Diabetes

The percent of adults with diabetes who reported a weight that did not classify them as overweight or obese according to BMI (see earlier discussion on BMI on page 12) has decreased from 33% in 1995-1996 to 15% in 2010, as shown in Figure 33.[14] Concurrently, the percentage of adults with diabetes reporting overweight peaked in 1997-1998 at 44%, and then decreased to 31% in 2010. The percentage of adults with diabetes reporting obesity increased from 30% in 1995-1996 to 49% in 2010, a relative increase of 66%.[14]

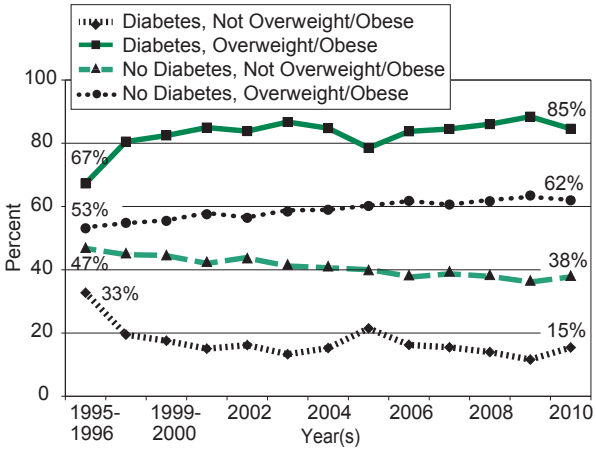
Figure 33: Percent of Wisconsin Adults with Diabetes Self-reporting a Weight Corresponding to (1) Not Overweight or Obese, (2) Overweight, and (3) Obese, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010



Not overweight/obese = BMI < 25.0 kg/m^2
Overweight = BMI of 25.0 - 29.9 kg/m^2
Obese = BMI of 30.0 kg/m^2 and above

Figure 34 illustrates that the percentage of adults without diabetes who are overweight or obese has increased over time, but to a lesser extent than the percentage of adults with diabetes who are overweight or obese. From 1995-1996 to 2010, the percentage of adults without diabetes who are overweight or obese increased from 53% to 62%, a relative increase of 17%. During the same time, the percentage of adults with diabetes who are overweight or obese increased from 67% to 85%, a relative increase of 27%.[14] The positive news is that it appears that the increase in overweight/obesity in both adults with and without diabetes has slowed in the past several years, compared to the mid- to late-nineties.

Figure 34: Percent of Wisconsin Adults Self-reporting a Weight Corresponding to Not Overweight/Obese OR Overweight/Obese by Diabetes Status, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2009-2010

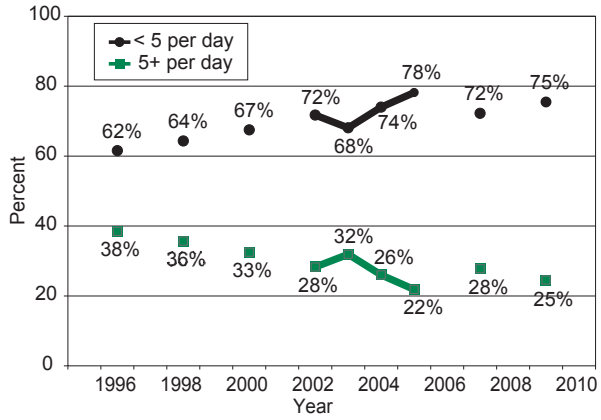


There are several questions on the BRFS that address physical activity. These questions have changed quite a bit over time and are asked during different years in the BRFS. One question that has remained constant over time asks: "During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?" The percentage of adults with diabetes who responded "yes" to this question has remained relatively stable from 1995 to 2010. In 1995, 70% of adults with diabetes responded "yes" to this question; the percentage dropped slightly to 67% in 2010. Data ranged from a low of 57% to a high of 70% over the time period. These data are not presented in a graph.[14]

Fruit and vegetable consumption is one measure that addresses a healthful diet. While the 2010 Dietary Guidelines for Americans doesn't recommend a specific number of fruits and vegetables for people to consume each day (instead the recommended number is based on gender, age, and physical activity level), they do recommend choosing a variety of fruits and vegetables daily. A proxy measure often used in the BRFS asks if respondents eat at least five fruits/vegetables each day. The majority of Americans do not achieve this goal. Figure 35 illustrates that the percent of adults with diabetes reporting that they consumed five or more fruits and vegetables per day decreased from 38% in 1996 to 25% in 2009, a relative decrease of 34%.[14] Missing data for several years is due to the question not being asked those years.

Trends In Selected Characteristics of Adults With Diabetes

Figure 35: Percent of Wisconsin Adults with Diabetes Who Report Eating at Least Five Fruits/Vegetables a Day, 1996-2009. Source: Wisconsin Behavioral Risk Factor Survey, 1996-2009



The percentage of adults with diabetes who are current, former, or never smokers has remained relatively constant over time, as shown in Figure 36. The prevalence of adults with diabetes who are current smokers was 10% in 1995-1996 (the lowest prevalence over the time period) and 14% in 2010. This prevalence has decreased in recent years from a high of 19% in 2007.[14]

Figure 36: Percent of Wisconsin Adults with Diabetes Who are Current, Former, and Never Smokers, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010

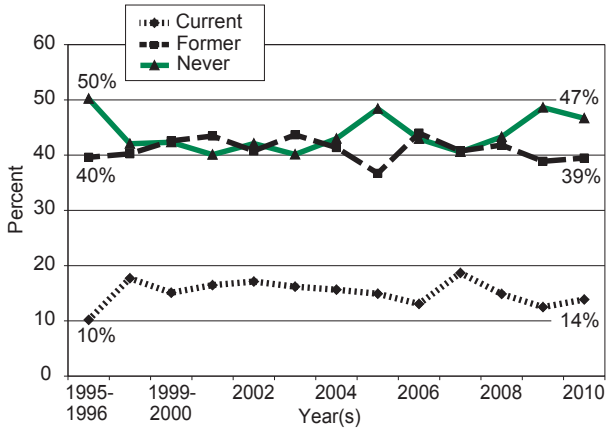
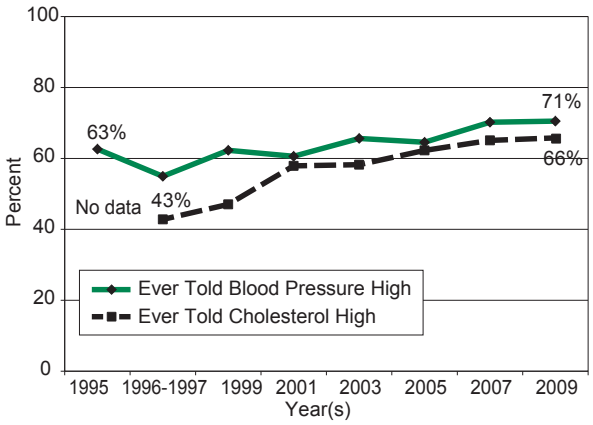


Figure 37 illustrates that the percent of adults with diabetes reporting they had been told they have high blood pressure has increased from 63% in 1995 to 71% in 2010, a relative increase of 13%. In addition, the percent of adults reporting being told they have high cholesterol has increased from 43% in 1996-1997 to 66% in 2010, a relative increase of 53%. In Figure 37, single years are used for nearly all of the data points, as the questions were not asked in even-numbered years (with the exception of 1996). Data on the prevalence of high blood cholesterol is not shown for 1995, as the sample size for this measure and year was not large enough to report for that year.[14]

Figure 37: Percent of Wisconsin Adults with Diabetes Who Report They Have Ever Been Told Their Blood Pressure is High and the Percent of Wisconsin Adults with Diabetes Who Report They Have Ever Been Told Their Cholesterol is High, 1995-2009 (Selected Years). Source: Wisconsin Behavioral Risk Factor Survey, 1995-2009



Trends in Diabetes Care

It is important to examine how diabetes care has changed over time. Because the diabetes module questions have been asked since 1995 (with the exception of 2005 and 2006), changes in diabetes care over time can be reviewed using BRFS data. In some cases, two years have been combined for one data point due to small sample sizes; one year is used if sample sizes are large enough.

Figure 38 illustrates the percent of adults with diabetes reporting the number of times they had an A1C test in the past year. Data are only available from 2000 and subsequent years, as the survey question changed in 2000, and data prior to 2000 are not comparable to data from 2000 and beyond. The percent of adults with diabetes who report having one A1C test in the past year has remained fairly constant from 2000 to 2010 with some variability over the years. However, the percent of adults with diabetes reporting two or more A1C tests in the past year has increased from 64% to 69% during the same time period. The percent of adults who report that they have never had an A1C test has decreased from 13% to 7% over the same time period and the percent of adults who report that they had never heard of the test remained stable over this time period.[14]

Figure 38: Percent of Wisconsin Adults with Diabetes Self-reporting Frequency of A1C Testing in Past Year (One Time, Two or More Times, No Times), and the Percent of Wisconsin Adults with Diabetes Who Have Never Heard of the Term A1C, 2000-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2000-2010. Data not available for 2005-2006

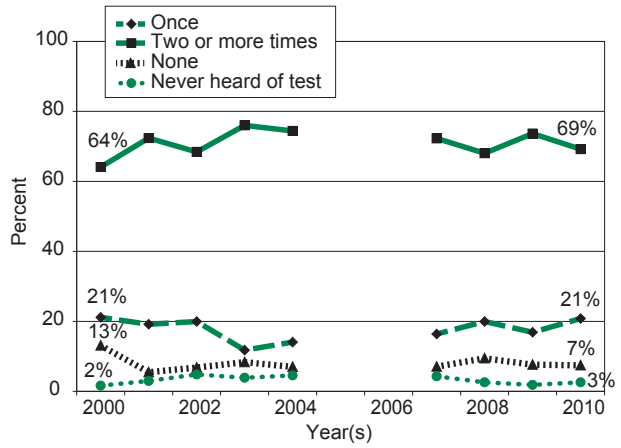
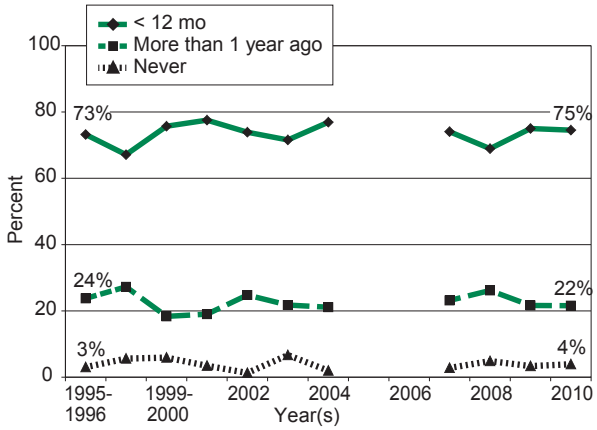


Figure 39 illustrates trends in the percent of adults receiving a dilated eye exam in the past year, more than a year ago, and never. The percent of adults with diabetes receiving a dilated retinal eye exam in the past year remained fairly constant from 1995-1996 to 2010, as has the percent of adults with diabetes reporting that they had an eye exam more than one year ago and those reporting never having had an eye exam.[14]

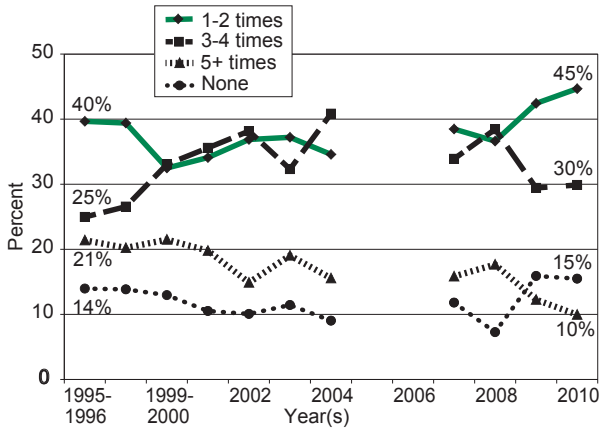
Figure 39: Percent of Wisconsin Adults with Diabetes Reporting When They Last Had a Dilated Eye Exam, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010. Data not available for 2005-2006



The percent of adults who saw a health professional for their diabetes has increased slightly since 1995-1996, with a fair amount of variability over time. The percent of adults with diabetes who reported seeing a health professional 1-2 times in the past year increased from 40% in 1995-1996 to 45% in 2010 and the percent reporting seeing a health professional 3-4 times in the past year increased from 25% in 1995-1996 to 30% in 2010, as shown in Figure 40. While a smaller percentage of adults with diabetes report seeing a health professional five or more times in the past year (21% in 1995-1996 to 10% in 2010), the percent who report seeing a health professional no times in the past year remained relatively stable during the same time period.[14]

Trends in Diabetes Care

Figure 40: Percent of Wisconsin Adults with Diabetes Self-reporting Frequency of Seeing Health Provider for Their Diabetes, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010. Data not available for 2005-2006



Since 1995-1996, the percentage of adults with diabetes who report having had their feet checked by a health professional in the past year has increased slightly from 1995-1996 to 2010. In 2010, 75% of adults with diabetes reported having received a foot exam in the past year from a health professional, up from 69% in 1995-1996, as shown in Figure 41.[14] This is a relative increase of 9%.

Figure 41: Percent of Wisconsin Adults with Diabetes Self-reporting Frequency of Health Professional Checking Their Feet in the Past Year, 1995-2010. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010. Data not available for 2005-2006

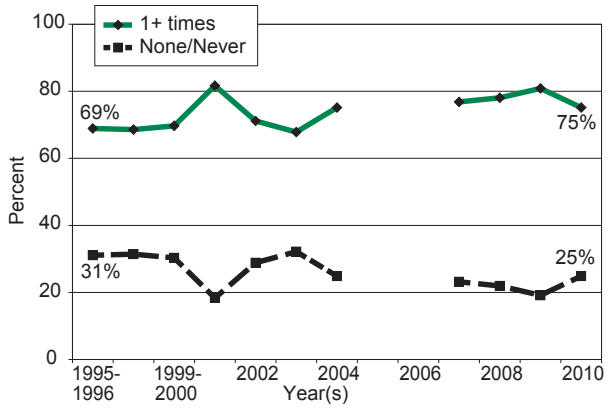
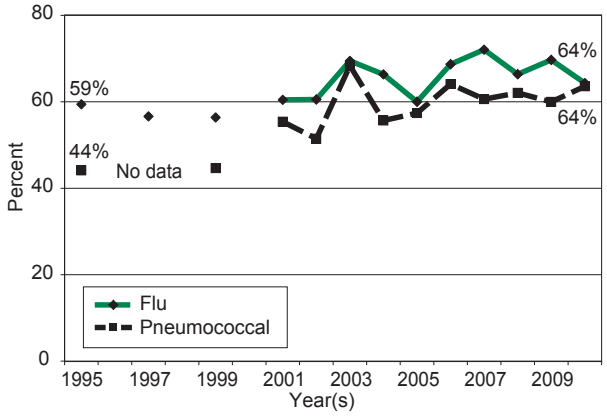


Figure 42 illustrates trends in influenza and pneumococcal vaccinations from 1995 to 2010. For this measure, single years are used as data points during the earlier years in this time period as the question was only asked in odd years until 2002. Furthermore, for 1997, the sample size for the pneumococcal vaccination question was not large enough to report data on, so this information is not included. The percent of adults with diabetes reporting they received an influenza vaccination in the past year increased slightly from 59% in 1995 to 64% in 2010, a relative increase of 8%. The percent of people with diabetes who report ever having received a pneumococcal vaccination has increased from 44% in 1995 to 64% in 2010, a relative increase of 45%.[14]

Figure 42: Percent of Wisconsin Adults with Diabetes Self-reporting Receiving a Flu Shot in the Past Year and the Percent of Wisconsin Adults with Diabetes Self-Reporting Receiving a Pneumococcal Shot Ever, 1995-2010 (Select Years). Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010

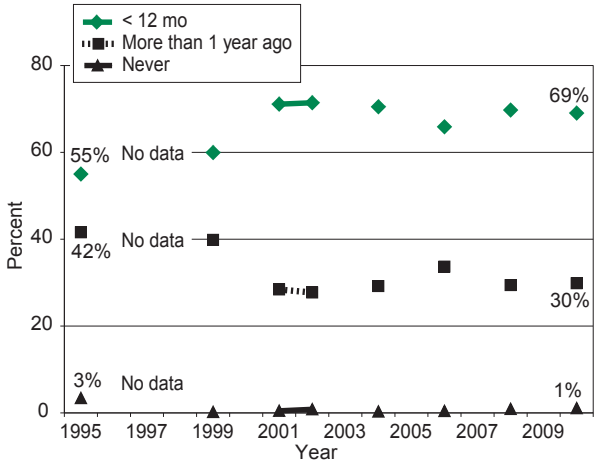


Adults with diabetes are more prone to oral infections and diseases than are people without diabetes. For this reason, the *Wisconsin Essential Diabetes Mellitus Care Guidelines* recommends that adults with diabetes should receive a dental exam at diagnosis and at least once every six months.[3] A question on the BRFS asks respondents if they have visited a dentist within the past year.

Trends in Diabetes Care

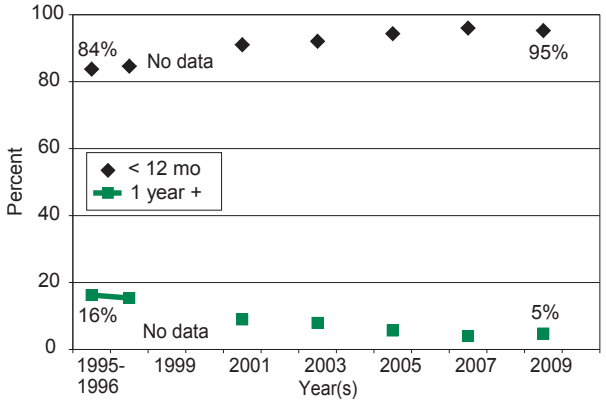
As with the influenza and pneumococcal vaccination graph, single years are used as data points if the question was not asked in a particular year. Furthermore, the dental visit question was not asked in 1997, and therefore, there is no data for this year. In 1995, the percentage of adults with diabetes who report last seeing a dentist within the past year was 55%; by 2010, this percent had increased to 69%, a relative increase of 25%. Simultaneously, the percent of adults with diabetes reporting a dental visit more than a year ago decreased from 42% in 1995 to 30% in 2010, a relative decrease of 29%. Figure 43 also illustrates that the percent of adults with diabetes who report never having seen a dentist remained consistently low throughout the time period addressed.[14]

Figure 43: Percent of Wisconsin Adults with Diabetes Self-reporting When They Were Last Seen by a Dentist, 1995-2010 (Select Years). Source: Wisconsin Behavioral Risk Factor Survey, 1995-2010



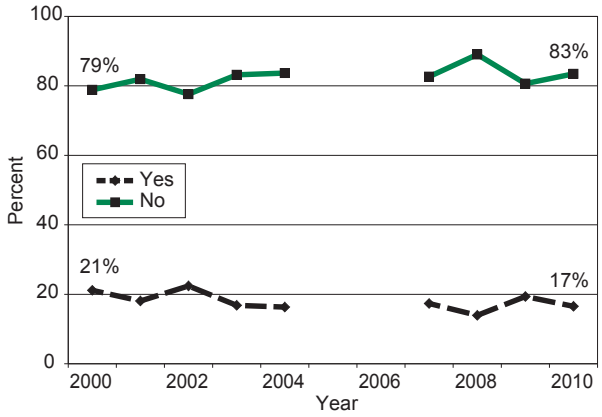
The *Wisconsin Diabetes Mellitus Essential Care Guidelines* recommends a fasting lipid profile annually for adults with diabetes.[3] One question on the BRFS asks respondents if they have ever had their blood cholesterol checked. Adults with diabetes responding "yes" to this question increased from 94% in 1995-1996 to 96% in 2009, a very slight increase (data not shown). An additional question in the BRFS asks respondents who answered "yes" to the above question an additional question asking them when they last had their cholesterol checked. Figure 44 illustrates that the percent of adults with diabetes who answered this question increased from 84% in 1995-1996 to 95% in 2009, a relative increase of 13%.[14] This question was asked each year from 1995-1998 and afterwards, each odd-numbered year. There is no data for 1999 as the sample size was not large enough.

Figure 44: Percent of Wisconsin Adults with Diabetes Self-reporting When They Last Had Their Cholesterol Checked, 1995-2009. Source: Wisconsin Behavioral Risk Factor Survey, 1995-2009



A question was added to the diabetes module in 2000 that addressed the presence of diabetic retinopathy (an eye condition that is a complication of diabetes). The question asked: "Has a doctor ever told you that diabetes has affected your eyes or that you had retinopathy?" Figure 45 illustrates that the percentage of adults with diabetes responding "yes" to this question decreased from 21% in 2000 to 17% in 2010, a slight decrease. Despite the decrease, there has been great variability during this time period; we will need additional years of data to determine if there is a true decline in these data.

Figure 45: Percent of Wisconsin Adults with Diabetes Reporting They Had Been Told They Have Retinopathy, 2000-2010. Source: Wisconsin Behavioral Risk Factor Survey, 2000-2010. Data not available for 2005-2006



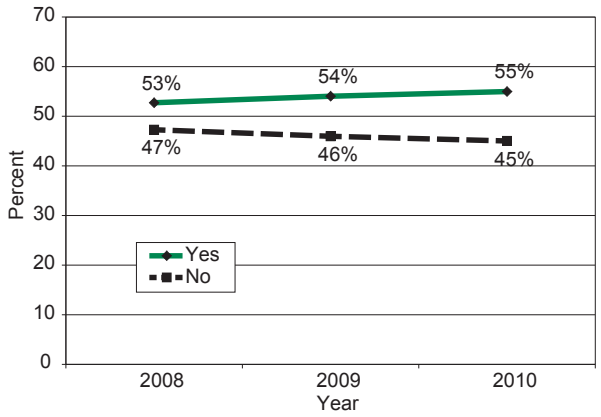
Trends in Diabetes Care

A question addressing diabetes education was also added to the diabetes module in 2000. The question asked: "Have you ever taken a course or class in how to manage your diabetes yourself?" The percentage of adults with diabetes decreased from 65% in 2000 to 60% in 2010 with relatively great variability during the time. These data are not provided in a graph.

As explained earlier, the pre-diabetes module is composed of two questions addressing testing for diabetes and being told by a doctor or other health professional that you have pre-diabetes. The pre-diabetes module was asked in the Wisconsin BRFS beginning in 2008. The pre-diabetes module is asked of adults who do not respond "yes" to the question: "Have you ever been told by a doctor that you have diabetes?"

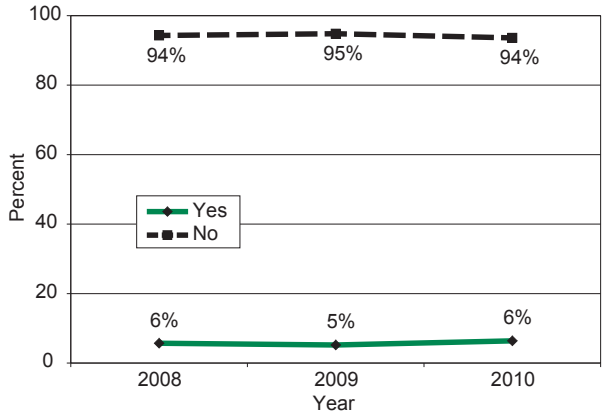
The first question of the pre-diabetes module asks: "Have you had a test for high blood sugar or diabetes within the past three years?" Figure 46 illustrates that the percentage of adults indicating they had a test for high blood sugar or diabetes in the past three years has slightly increased from 53% to 55% in the three years it has been asked. This increase is slight and we will need additional years of data to determine if the increase is true.

Figure 46: Percent of Wisconsin Adults without Diabetes Self-reporting Testing for High Blood Sugar or Diabetes within Past Three Years, 2008-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2008-2010



The second question of the pre-diabetes module asks: "Have you ever been told by a doctor or other health professional that you have pre-diabetes or borderline diabetes?" Figure 47 illustrates that the percentage of adults indicating they had been told they have pre-diabetes or borderline diabetes has remained constant over the three years that it has been asked. As explained earlier, this percentage is vastly different from pre-diabetes estimates provided in the beginning of this document. Those pre-diabetes estimates are from the Centers for Disease Control and Prevention (CDC) National Diabetes Fact Sheet and were applied to the appropriate Wisconsin population. The National Diabetes Fact Sheet states that a 2005-2008 study found that among U.S. adults ages 20 years and older, 35% had pre-diabetes (based on fasting glucose or A1C). Because the 35% was determined from a study that involved actual lab values and because the BRFS is a survey where adults provide self-reported answers, it is likely that the 35% is more accurate than the percents provided in Figure 47 when speaking of pre-diabetes prevalence. There are likely many people who responded to the BRFS survey who are unaware that they have pre-diabetes but who would be tested and found to have the condition.

Figure 47: Percent of Wisconsin Adults without Diabetes Self-reporting They Were Told They Have Pre-diabetes or Borderline Diabetes, 2008-2010.
Source: Wisconsin Behavioral Risk Factor Survey, 2008-2010



Diabetes-Related Inpatient Hospitalizations

Diabetes is often considered an ambulatory care condition, one in which opportune and effective primary care has the opportunity to reduce diabetes-related hospitalizations. While some diabetes-related hospitalizations are anticipated, many of these hospitalizations can be prevented with optimal control and management of diabetes. Access to quality diabetes care, receiving the recommended tests and exams, and increasing or enhancing self-care skills (including support for behavior and lifestyle change) may help decrease the number of diabetes-related inpatient hospitalizations.

A study by the Agency for Healthcare Research and Quality reported in March 2005 that the United States could save almost $2.5 billion annually by preventing diabetes-related hospitalizations. This study also found in 2001, 30% of people with diabetes who were hospitalized had two or more hospital stays during that year.[22]

When a person is admitted to a hospital, the main reason for the admission is recorded as the principal diagnosis. In many cases, one or more "Other Diagnosis" codes are listed as well. A diabetes-related condition (such as diabetic ketoacidosis) or diabetes itself may be listed in one or more of these "Other Diagnosis" codes.

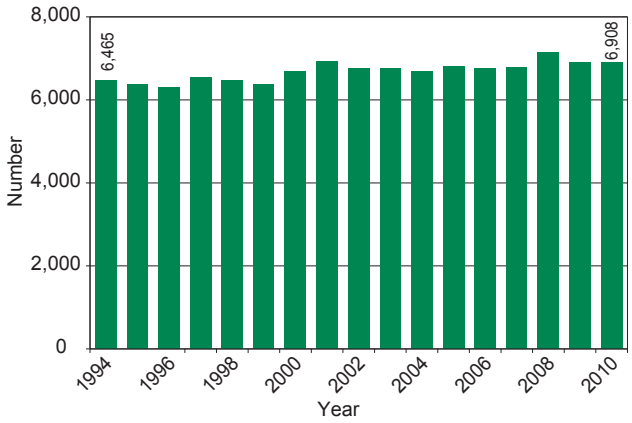
Prior to the fourth quarter of 1993, in Wisconsin, there was one "Principal Diagnosis" space and four "Other Diagnosis" spaces utilized in recording hospitalization information. Beginning with the fourth quarter of 1993, four additional "Other Diagnosis" spaces were added in the collection of hospitalization information, for a total of eight "Other Diagnosis" spaces. Data examining diabetes-related hospitalizations are only presented for years 1994 and after, to allow for comparison of consistent data during the time period.

All data provided in this section and the "Diabetes-related Lower Extremity Amputations" section are from the Wisconsin Inpatient Hospitalization Discharge Database. These data include all ages (children and adults), but do not include hospitalizations at any Veteran's Administration (VA) hospitals, which are exempt from the state reporting requirements. Hospitalizations for non-Wisconsin residents and for Wisconsin residents hospitalized outside of Wisconsin are not included. Therefore, data on inpatient hospitalizations and lower-extremity amputations are likely underreported.

Figure 48 illustrates that the total number of inpatient hospital discharges where diabetes was listed as the principal diagnosis has increased from just over 6,450 in 1994 to over 6,900 in 2010.[23] This was an increase of 7% and compares to an increase in the population of Wisconsin of 12% over this time period. These data are only raw numbers and are not adjusted.

Figure 48: Number of Inpatient Hospitalization Discharges with Diabetes Listed as the Principal Diagnosis, Wisconsin Residents, 1994-2010.

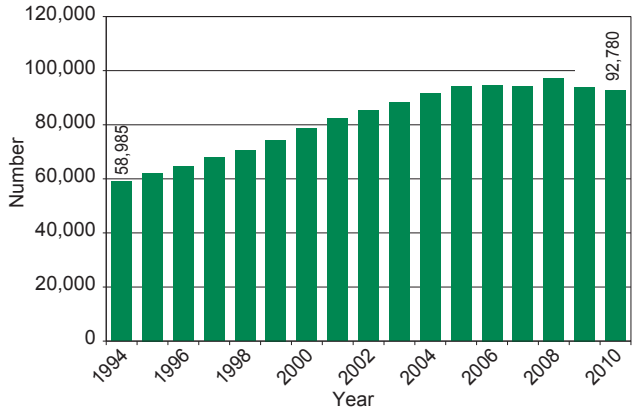
Source: Wisconsin Inpatient Hospitalization Discharge Data Sets, 1994-2010



Diabetes can be listed as the principal diagnosis and/or as one or more of the other diagnoses. The number of inpatient hospitalization discharges where diabetes was listed as any diagnosis is presented in Figure 49. Almost 59,000 inpatient hospitalizations occurred in 1994; this number increased to nearly 93,000 by 2010.[23] These data are only raw numbers and are not adjusted. Though the number of hospitalization discharges has increased over the last fifteen years, it appears to have stabilized and even slightly decreased in the past six years. Additional years of data are necessary to see if this trend continues.

Diabetes-Related Inpatient Hospitalizations

Figure 49: Number of Inpatient Hospitalization Discharges with Diabetes Listed as Any Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Data Sets, 1994-2010



In 2010, there were a total of 607,761 inpatient hospitalization discharges of Wisconsin residents in Wisconsin hospitals. Of those, 92,780 hospitalizations had diabetes listed as a principal or other diagnosis. Overall, 15.3% of all Wisconsin hospitalizations had diabetes listed as any diagnosis, as shown in Figure 50.[23]

Figure 50: Percent of All Inpatient Hospitalization Discharges that Were Diabetes-related When Diabetes is Listed as Any Diagnosis, Wisconsin Residents, 2010. Source: Wisconsin Inpatient Hospitalization Discharge Data Set, 2010

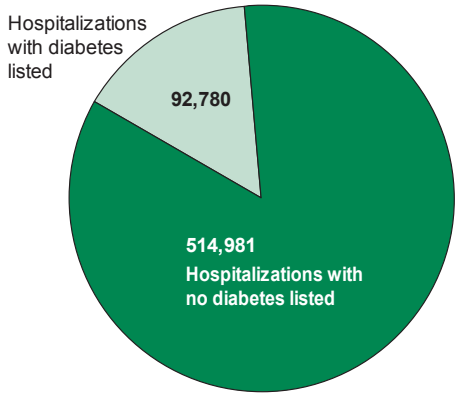


Figure 51 illustrates the percent of total inpatient hospitalization charges for stays with diabetes listed as any diagnosis for Wisconsin residents. In 2010, there were $14.75 billion in hospitalization charges for Wisconsin residents. Of this, 17.3%, or $2.55 billion, was potentially diabetes-related.[23]

Figure 51: Percent of All Charges for Inpatient Hospitalization Discharges with Diabetes Listed as Any Diagnosis, Wisconsin Residents, 2010. Source: Wisconsin Inpatient Hospitalization Discharge Data Set, 2010

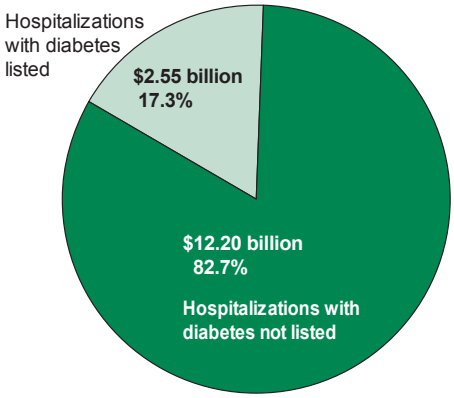
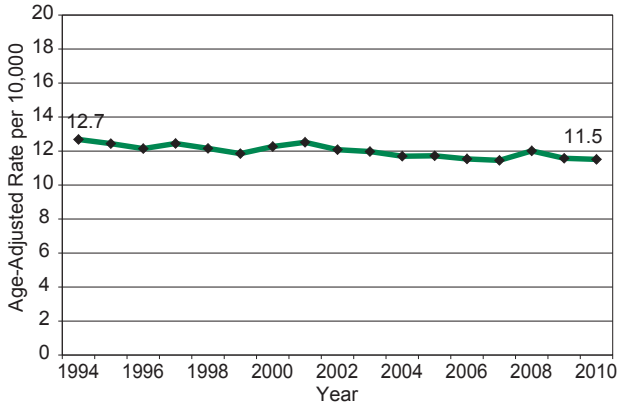


Figure 52 illustrates the age-adjusted rate for inpatient hospitalization discharges when diabetes is listed as the principal diagnosis from 1994 to 2010. Rates were age-adjusted to the 2000 United States standard population. Age-adjustment allows us to remove differences in the age distribution over time, so that we are able to look at changes in rates over time while controlling for fluctuations in the age distribution of the population. The age-adjusted rate has remained very constant over time with a minor overall decrease.[23]

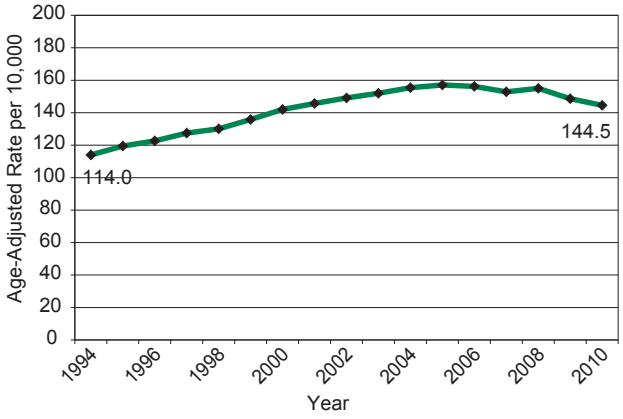
Figure 52: Age-adjusted Rates per 10,000 Population of Inpatient Hospitalization Discharges with Diabetes Listed as the Principal Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Diabetes-Related Inpatient Hospitalizations

Figure 53 illustrates the age-adjusted rate for inpatient hospitalization discharges when diabetes is listed as any diagnosis (principal diagnosis or any of the other eight diagnoses) from 1994 to 2010. The age-adjusted rate for hospitalization discharges when diabetes was listed as any diagnosis increased from 114.0 discharges per 10,000 population in 1994 to 144.5 per 10,000 population in 2010. The rate reached its peak in 2005 at 157.1 discharges per 10,000 and has slowly declined over the past 5 years.[23] Additional years of data are necessary to see if this trend continues.

Figure 53: Age-adjusted Rates per 10,000 Population of Inpatient Hospitalization Discharges with Diabetes Listed as Any Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Age-specific inpatient hospitalization discharge rates where diabetes is listed as the principal diagnosis are presented in Figure 54. The figure illustrates that rates for hospitalizations where diabetes is the principal diagnosis are lowest for the youngest age groups. Rates have remained fairly stable over time for most age groups with minor changes, though there has been a decrease for the 65+ year age group from 37.1 per 10,000 population in 1994 to 25.5 per 10,000 population in 2010.[23]

Figure 54: Age-specific Rates per 10,000 Population of Inpatient Hospitalization Discharges with Diabetes Listed as the Principal Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010

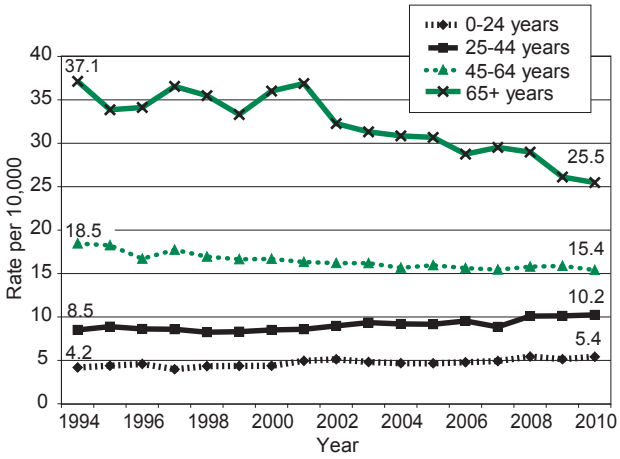
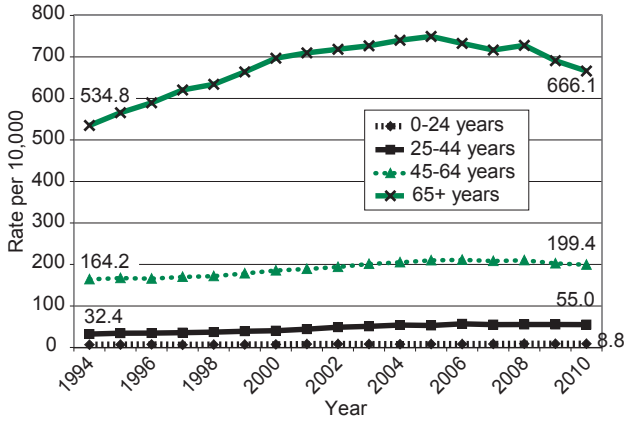


Figure 55 illustrates age-specific inpatient hospitalization discharge rates when diabetes is listed as any diagnosis (either the principal diagnosis or any of the other eight diagnoses). Similar to age-specific rates where diabetes was the principal diagnosis, younger age groups have lower rates. Rates for all groups, except the 65+ year age group, have remained fairly consistent from 1994 to 2010, with minor changes. The rate for the 65+ year age group has increased from 534.8 per 10,000 population in 1994 to a high of 749.4 per 10,000 population in 2005, and has since decreased to 666.1 per 10,000 population in 2010.[23] Additional years of data are necessary to see if this downward trend will continue for this age group.

Figure 55: Age-specific Rates per 10,000 Population of Inpatient Hospitalization Discharges When Diabetes is Listed as Any Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Diabetes-Related Inpatient Hospitalizations

Figure 56 illustrates the change in the average length of stay (in days) for hospitalizations over the past 16 years. Until recently, the average length of stay for a hospitalization with diabetes listed as any diagnosis was longer than that for a hospitalization where diabetes was not listed as any diagnosis. For those with diabetes listed, the average length of stay has decreased from 6.5 days in 1994 to 4.4 days in 2010. The average length of stay for hospitalizations with no listing of diabetes has decreased from 5.2 days in 1994 to 4.3 days in 2010. In general, the average length of stay for a hospitalization has decreased over the past 16 years, but has decreased at a faster rate for hospitalizations with diabetes listed as any diagnosis. Currently, the average length of stay for a hospitalization with diabetes listed as any diagnosis is nearly identical to that of a hospitalization with diabetes not listed.[23]

Figure 56: Mean Length of Stay in Days of Inpatient Hospitalization Discharges with Diabetes Listed as Any Diagnosis and Inpatient Hospitalization Discharges with Diabetes Not Listed, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010

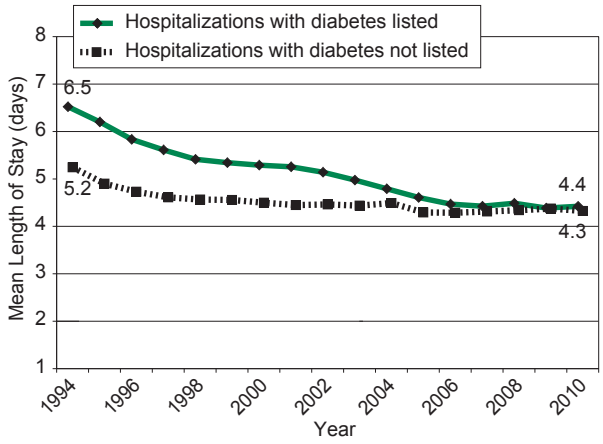
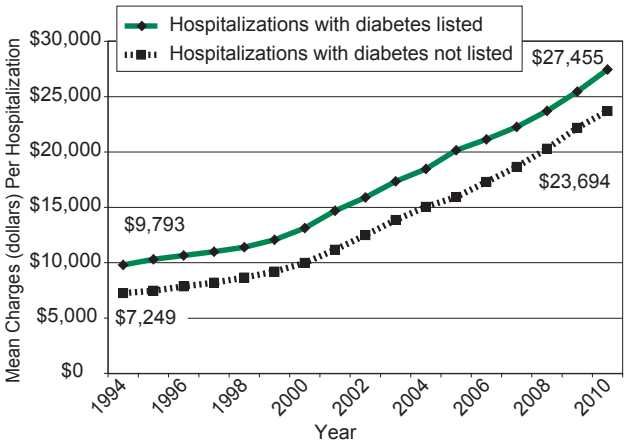


Figure 57 illustrates the average charges for a hospitalization with diabetes listed as any diagnosis compared with a hospitalization that does not list diabetes as a diagnosis from 1994 to 2010. Charges for a hospitalization, whether it includes a diagnosis of diabetes or not, have nearly tripled in the past 16 years, despite the average length of stay decreasing. However, in general, a hospitalization with diabetes listed as any diagnosis incurs more charges than does a hospitalization that does not list diabetes. This difference between average hospital charges has remained fairly consistent over time.[23]

Figure 57: Mean Charges Associated with Inpatient Hospitalizations with Diabetes Listed as Any Diagnosis and Inpatient Hospitalizations with Diabetes Not Listed, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Diabetes-Related Lower-Extremity Amputations

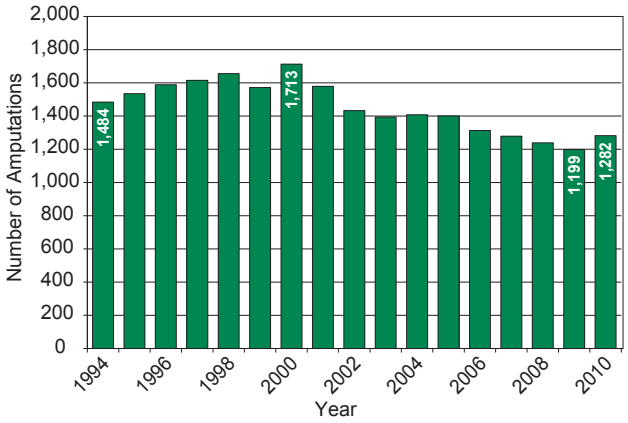
Diabetes is the leading cause of non-traumatic lower-extremity amputations, a serious and disabling complication.[5] Neuropathy and peripheral vascular disease are two common conditions seen in adults with diabetes, and may result in increased risk of amputation.[3]

With respect to the recording of hospitalization and lower-extremity amputation data, prior to the fourth quarter of 1993, in Wisconsin, there was one "Principal Diagnosis" space, four "Other Diagnosis" spaces, one "Principal Procedure" space, and two "Other Procedure" spaces utilized in recording hospitalization data. Beginning with the fourth quarter of 1993, four additional "Other Diagnosis" spaces and three additional "Other Procedure" spaces were added in the collection of hospitalization data, for a total of eight "Other Diagnosis" and five "Other Procedure" spaces. Data examining non-traumatic lower-extremity amputations when diabetes is listed as any diagnosis are only presented for years 1994 and after, to allow for comparison of consistent data during the time period.

All data provided in this section are from the Wisconsin Inpatient Hospitalization Discharge Database. These data include all ages (children and adults), but do not include hospitalizations at any Veteran's Administration (VA) hospitals, which are exempt from the state reporting requirements. Hospitalizations for non-Wisconsin residents and for Wisconsin residents hospitalized outside of Wisconsin are not included. Therefore, data on lower-extremity amputations are likely underreported.

Figure 58 illustrates the total number of non-traumatic lower-extremity amputations that were performed when diabetes was listed as any diagnosis. There were 1,484 non-traumatic lower-extremity amputations performed in 1994, a high of 1,713 non-traumatic lower extremity amputations in 2000, and 1,282 non-traumatic lower extremity amputations performed in 2010. These data are only raw numbers and are not adjusted. Over time, the number of non-traumatic lower extremity amputations increased to a high in 2000 and has since decreased.[23] The decrease is striking when considering the 12% increase in the Wisconsin population over this time period.

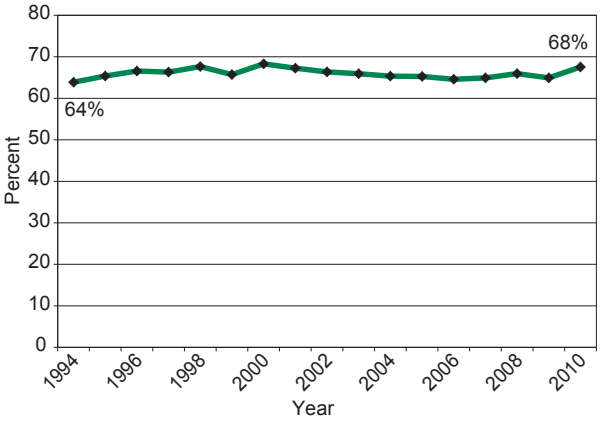
Figure 58: Number of Non-Traumatic Lower-Extremity Amputations with Diabetes Listed as Any Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



A 1989 report indicated that in the United States, an estimated 44%-85% of lower-extremity amputations could be prevented with increased foot care programs.[24] Amputation prevention efforts in Wisconsin could likely be credited with the decline represented in this graph.

Figure 59 illustrates the percentage of all non-traumatic lower-extremity amputations performed in Wisconsin hospitals that listed diabetes as any diagnosis. For these data, diabetes-related is defined as diabetes being listed as any diagnosis. The percent has not changed a great deal from 1994 to 2010, but has increased very slightly.[23]

Figure 59: Percent of All Non-Traumatic Lower-Extremity Amputations Performed in Wisconsin Hospitals with Diabetes Listed as Any Diagnosis, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Diabetes-Related Lower-Extremity Amputations

Figure 60 presents trends in the age-adjusted rate of non-traumatic lower-extremity amputations where diabetes is listed as any diagnosis, and a lower-extremity amputation is listed as any procedure. The age-adjusted lower-extremity amputation rate remained fairly stable from 1994 to 1999, peaking at 3.1 amputations per 10,000 in 2000, and decreasing slightly but fairly consistently in the past ten years, with a low of 2.0 amputations per 10,000 in 2009.[23]

Figure 60: Age-adjusted Rates per 10,000 Population of Non-Traumatic Lower-Extremity Amputations with Diabetes Listed as Any Diagnosis and Lower-Extremity Amputation Listed as Any Procedure, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010

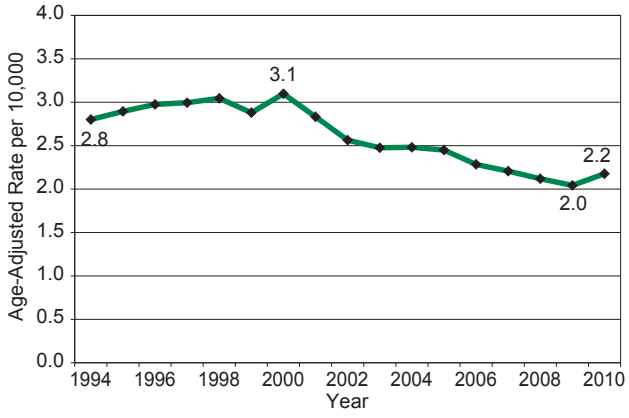


Figure 61 presents trends in the age-adjusted rate of non-traumatic lower-extremity amputations by sex, where diabetes is listed as any diagnosis, and a lower-extremity amputation is listed as any procedure. Age-adjusted rates for both males and females remained relatively constant from 1994 to 2001, but decreased a small amount, but consistently from 2001 to 2010. The lower-extremity amputation rate for males was double that for females during the entire span of time covered in the figure.[23]

Figure 61: Age-adjusted Rates per 10,000 Population of Non-Traumatic Lower-Extremity Amputations with Diabetes Listed as Any Diagnosis and Lower-Extremity Amputation Listed as Any Procedure by Sex, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010

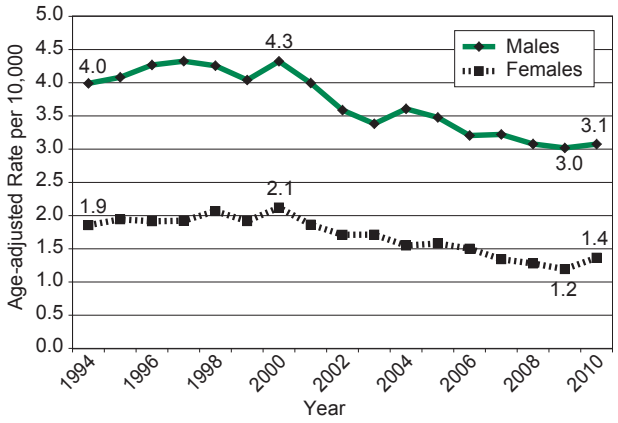
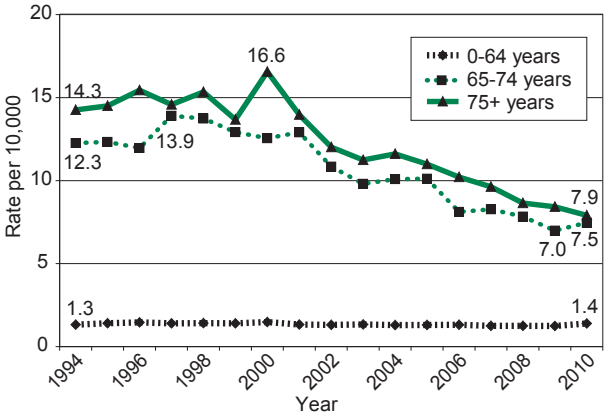


Figure 62 illustrates trends in age-specific rates of non-traumatic lower-extremity amputations, where diabetes is listed as any diagnosis and a lower-extremity amputation is listed as any procedure. The rate for the age group 0-64 years has remained unchanged from 1994 to 2010. The rate for the age group 65-74 years has decreased from 12.3 per 10,000 in 1994 to 7.5 per 10,000 in 2010, a relative decrease of 39%. The rate for the age group 75 years and older has decreased from 14.3 per 10,000 in 1994 to 7.9 per 10,000 in 2010, a relative decrease of 45%.[23]

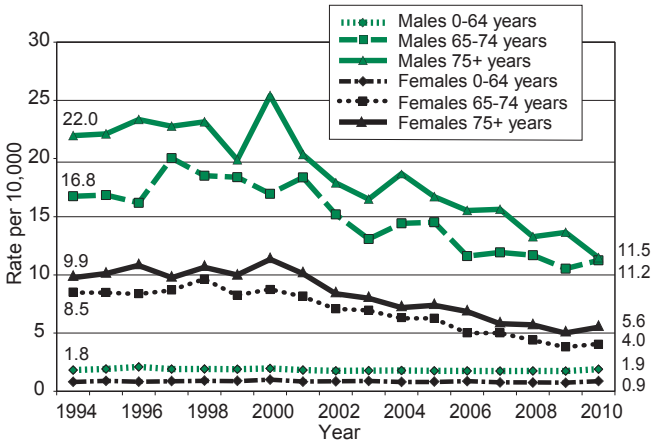
Figure 62: Age-specific Rates per 10,000 Population of Non-Traumatic Lower-Extremity Amputations with Diabetes Listed as Any Diagnosis and Lower-Extremity Amputation Listed as Any Procedure, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



Diabetes-Related Lower-Extremity Amputations

Figure 63 illustrates trends in age-specific rates of non-traumatic lower-extremity amputations by sex, where diabetes is listed as any diagnosis and a lower-extremity amputation is listed as any procedure. For every age group, male rates are double that for females. Rates for the age group 0-64 years (for both males and females) have remained unchanged from 1994 to 2010. The rate for males in the age group 65-74 years has decreased from 16.8 per 10,000 in 1994 to 11.2 per 10,000 in 2010, a relative decrease of 33%. The rate for females in the age group 65-74 years has decreased from 8.5 per 10,000 in 1994 to 4.0 per 10,000 in 2010, a relative decrease of 53%. The rate for males in the age group 75 years and older has decreased from 22.0 per 10,000 in 1994 to 11.5 per 10,000 in 2010, a relative decrease of 48%. The rate for females in the age group 75 years and older has decreased from 9.9 per 10,000 in 1994 to 5.6 per 10,000 in 2010, a relative decrease of 43%. The positive results seen from this data indicate that age groups with the highest rates of non-traumatic lower-extremity amputations (ages 65-74 and ages 75+) have seen decreasing rates over the past 16 years. However, rates for males are double that for females and this disparity between sexes is an area that should be addressed in the future.[23]

Figure 63: Age-specific Rates per 10,000 Population of Non-Traumatic Lower-Extremity Amputations with Diabetes Listed as Any Diagnosis and Lower-Extremity Amputation Listed as Any Procedure, by Sex, Wisconsin Residents, 1994-2010. Source: Wisconsin Inpatient Hospitalization Discharge Database, 1994-2010



End-Stage Renal Disease

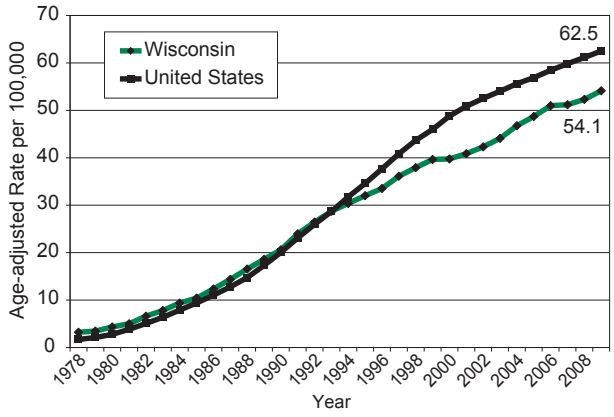
End-stage renal disease (ESRD) is a complication of diabetes where the kidneys no longer function normally. Typically, in ESRD, the kidneys function at less than 10% of their normal capacity. When ESRD occurs, either dialysis (filtering of the blood completed by a machine) or a kidney transplant is required for survival. Diabetes is the leading cause of ESRD, accounting for 44% of all new cases of ESRD in 2009.[5,25] Prior to the development of ESRD, kidney function can be preserved and the disease process slowed or prevented by optimal blood sugar and blood pressure control. Use of certain blood pressure medications (i.e., ACE inhibitors and angiotensin receptor blockers [ARBs]) have also been shown to slow progress of disease.[3]

Data in this report is from the United States Renal Data System (USRDS). An online data querying application called the Renal Data Extraction and Referencing (RenDER) System was used to obtain the numbers of prevalent and incident ESRD in Wisconsin from 1978 through 2009.[26] All data were age-adjusted to the 2000 United States standard population. Data on the prevalence and incidence of ESRD for Wisconsin and the United States are presented. Prevalence is the total number of cases of a condition in a population in a specified period of time (usually a year), while incidence is the number of new cases of a condition in a specified period of time (usually a year).

Figure 64 illustrates the age-adjusted prevalence rate of ESRD in Wisconsin and the United States from 1978 to 2009 when the primary diagnosis is diabetes. The age-adjusted prevalence rates of ESRD for Wisconsin and the United States have been quite similar, with Wisconsin slightly higher, from 1978 through 1992. Beginning in the early 1990's, the Wisconsin rate increased more slowly than the rate for the United States. The trend has continued over the past sixteen years, and in 2009, the United States age-adjusted rate was 62.5 per 100,000 population, while the Wisconsin age-adjusted rate was 54.1 per 100,000 population. In general, the prevalence of ESRD has dramatically increased in the United States and Wisconsin over the past 32 years.[26]

End-Stage Renal Disease

Figure 64: Age-adjusted Prevalence Rates per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes, Wisconsin and the United States, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System



In Figure 65, the age-adjusted incidence rate of ESRD is provided for Wisconsin and the United States when the primary diagnosis is diabetes. During the period of 1978 to 1991, the United States and Wisconsin age-adjusted incidence rates were quite similar. Similar to the prevalence rates shown earlier, in the early 1990's, the Wisconsin rate began to increase more slowly than the rate for the United States. In 2009, the United States age-adjusted incidence rate was 14.8 cases per 100,000 population, while the age-adjusted incidence rate for Wisconsin was 11.3 cases per 100,000 population. In general, the incidence of ESRD for the United States and Wisconsin has drastically increased during the past 32 years, but rates for both the United States and Wisconsin appear to have stabilized somewhat over the past eight years, with Wisconsin showing a greater degree of variation between years.[26]

Figure 65: Age-adjusted Incidence Rate per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes, Wisconsin and the United States, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System

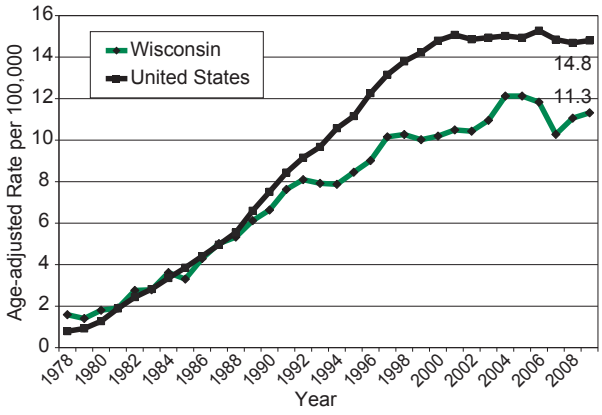
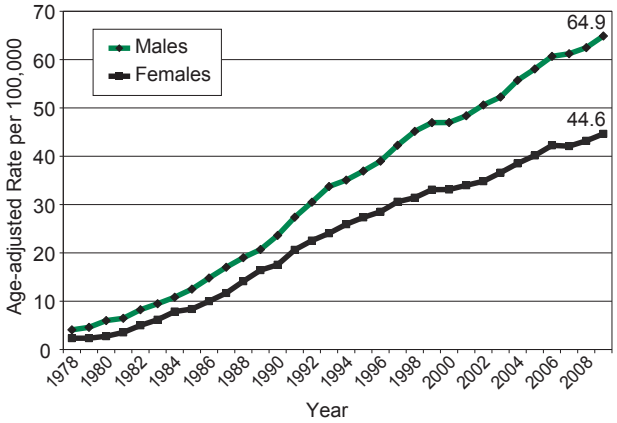


Figure 66 illustrates the age-adjusted prevalence rate of ESRD in Wisconsin by sex from 1978 to 2009 when the primary diagnosis is diabetes. The age-adjusted prevalence rates of ESRD for males and females have both increased over the past 32 years. However the age-adjusted prevalence rate has always been higher for males than females, ranging from 1.3 times higher in 1989 to 2.2 times higher in 1980. In the past 15 years, males have consistently had a rate approximately 1.4 times as high as females.[26]

Figure 66: Wisconsin Age-Adjusted Prevalence Rate per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes by Sex, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System



End-Stage Renal Disease

Figure 67 illustrates the age-adjusted incidence rate of ESRD in Wisconsin by sex from 1978 to 2009 when the primary diagnosis is diabetes. The age-adjusted incidence rates of ESRD for males and females have both increased over the past 32 years. However the age-adjusted incidence rate has always been higher for males than females (with the exception of one year), ranging from approximately equal rates in 1989 to 1.6 times higher in 1980.[26]

Figure 67: Wisconsin Age-Adjusted Incidence Rate per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes by Sex, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System

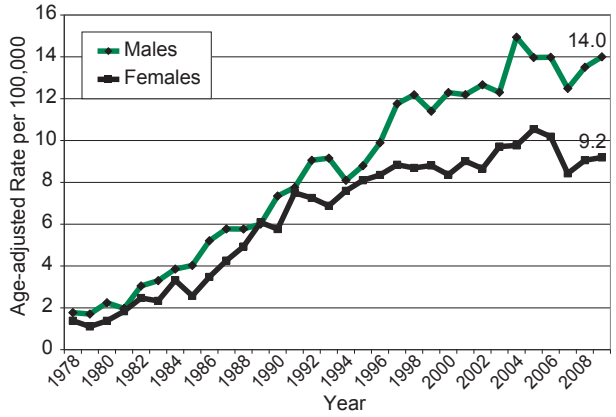


Figure 68 provides age-specific prevalence rates of ESRD for Wisconsin when the primary diagnosis is diabetes. The highest rates are in the oldest age groups (ages 55-64 and ages 65 and above). The lowest prevalence rate of ESRD is seen in the youngest age group (0-34 years). The only age group where the prevalence of ESRD has remained stable over the entire 32 years is the 0-34 age group. Prevalence rates have increased for all other age groups over the same period of time, though the 55-64 years and the 65 years and above age groups have increased at a faster rate. It appears that the 35-44 year age group rate has stabilized over the past 15 years.[26]

Figure 68: Wisconsin Age-Specific Prevalence Rates per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System

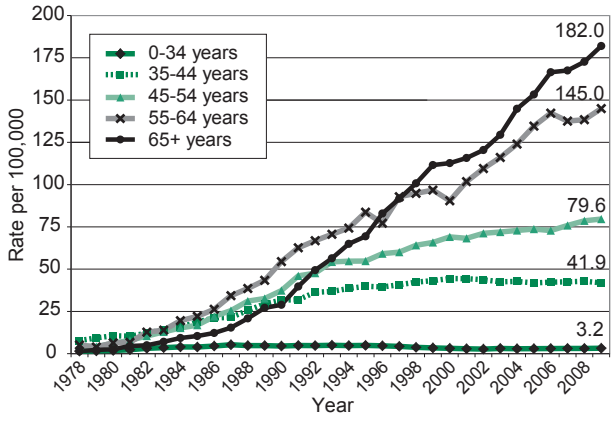
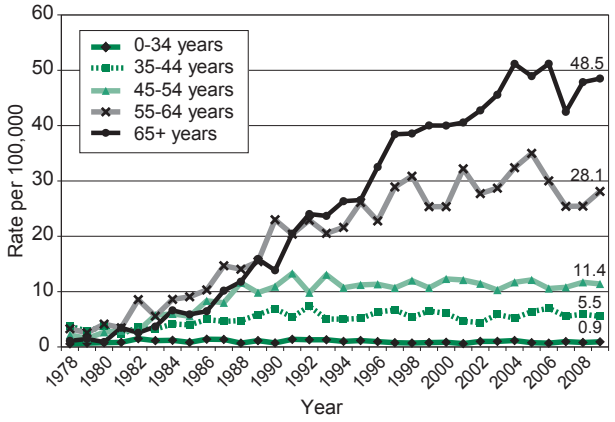


Figure 69 provides age-specific incidence rates of ESRD for Wisconsin when the primary diagnosis is diabetes. As seen with the prevalence rates, the highest rates are in the oldest age groups (ages 55-64 and ages 65 and above), while the lowest incidence rate of ESRD is seen in the youngest age group (0-34 years). Both the 0-34 age group and the 35-44 age group incidence rates have remained quite constant over time. The 45-54 year age group incidence rate increased from 1978 to 1990, but has leveled off in the past 19 years. The remaining two age groups (the 55-64 and the 65 years and above) have increased significantly over the 32 year period.[26]

Figure 69: Wisconsin Age-Specific Incidence Rates per 100,000 Population of End-Stage Renal Disease with a Primary Diagnosis of Diabetes, 1978-2009. Source: United States Renal Data System, Renal Data Extraction and Referencing (RenDER) System



Diabetes Mortality

In 2010, diabetes was the eighth leading cause of death in Wisconsin, with 1,154 deaths occurring that listed diabetes as the underlying cause of death, often referred to as the "cause of death," or the disease or injury initiating the sequence of events leading to death. These data are only raw numbers and are not adjusted. The transition from International Classification of Diseases, Ninth Revision (ICD-9) to International Classification of Diseases, Tenth Revision (ICD-10) in 1999 was taken into account for all of the mortality data presented in this report. A comparability ratio of 1.008167 (specific for diabetes) was applied to all deaths before 1999, so that raw numbers from 1989-1998 can be compared accurately with numbers from 1999-2010.[27]

Figure 70 illustrates the total number of deaths where diabetes was listed as the underlying cause of death.[28] Diabetes is likely to be underreported as a cause of death, because it is often not listed as a cause of death for decedents who had diabetes.[5] One study found that diabetes was recorded on only 39% of death certificates for people with diabetes and as the underlying cause of death for only 10% of people with diabetes.[29] Heart disease is the most common cause of death in people with diabetes. Adults with diabetes have heart disease death rates about 2 to 4 times higher than adults without diabetes.[5]

Figure 70: Number of Deaths Where Diabetes was Listed as the Underlying Cause of Death, Wisconsin Residents, 1989-2010. Source: Wisconsin Deaths Data Sets, 1989-2010

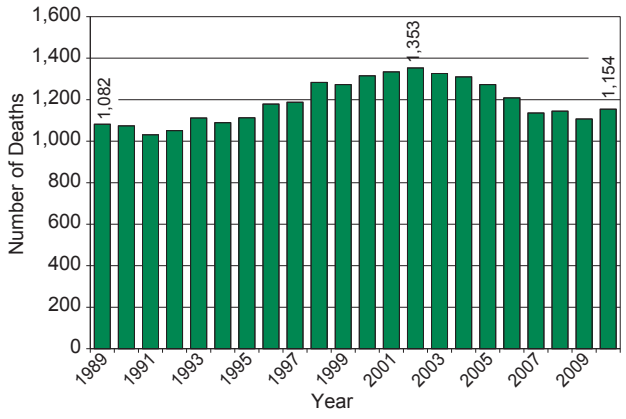
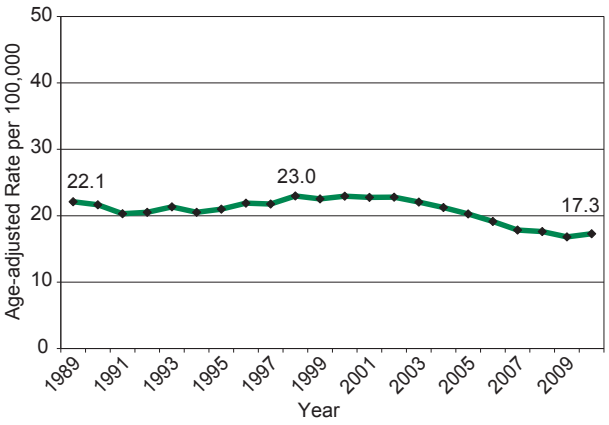


Figure 71 illustrates the age-adjusted mortality rate when diabetes is listed as the underlying cause of death from 1989-2010. The age-adjusted rate has varied little over this period, but has shown a slight decrease in the last eight years. Additional years of data are necessary to see if this pattern continues.[28] As explained earlier, a comparability ratio of 1.008167 was applied to all deaths before 1999, so that rates from 1989-1998 (using ICD-9 codes) can be compared accurately with rates from 1999-2010 (using ICD-10 codes).[27]

Figure 71: Age-Adjusted Mortality Rate per 100,000 Population for Deaths Where Diabetes Was Listed as the Underlying Cause of Death, Wisconsin Residents, 1989-2010. Source: Wisconsin Deaths Data Sets, 1989-2010



Prior to 1993, Wisconsin death certificates only provided space for an underlying cause of death and three other causes of death. Beginning in 1993, seventeen additional spaces were added for other causes of death. Therefore, when addressing diabetes listed as any cause of death, data is only presented for years 1993 and after, to allow for comparison of consistent data during the time period.[28] The comparability ratio of 1.008167 was applied to all deaths before 1999, so that raw numbers from 1989-1998 (using ICD-9 codes) can be compared accurately with numbers from 1999-2010 (using ICD-10 codes).[27]

Diabetes Mortality

Figure 72 illustrates the total number of deaths where diabetes was listed as any cause of death. The number of deaths where diabetes was listed as any cause of death was 3,717 in 1993 and rose to 4,426 in 2010.[28] These data are only raw numbers and are not adjusted. Even when diabetes is listed as any cause of death, it is still likely to be underreported.[5]

Figure 72: Number of Deaths Where Diabetes was Listed as Any Cause of Death, Wisconsin Residents, 1993-2010. Source: Wisconsin Deaths Data Sets, 1993-2010

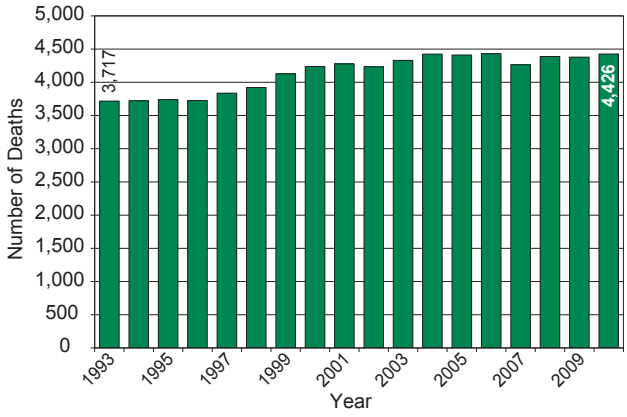
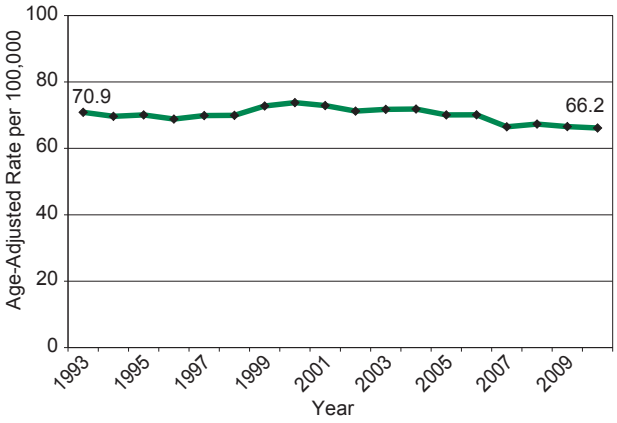


Figure 73 illustrates the age-adjusted mortality rate when diabetes is listed as any cause of death from 1993-2010. The age-adjusted rate has varied little over this period, but has shown a slight decrease in recent years. Additional years of data are necessary to see if this pattern continues.[28] As with the previous graph, data is only presented for years 1993 and after, to allow for comparison of consistent data during the time period (due to the additional cause of death spaces on the death certificate for years 1993 and after).[28] The transition from ICD-9 to ICD-10 in 1999 was taken into account for the data in this figure. The comparability ratio of 1.008167 was applied to all deaths before 1999, so that rates from 1989-1998 (using ICD-9 codes) can be compared accurately with rates from 1999-2010 (using ICD-10 codes).[27]

Figure 73: Age-Adjusted Mortality Rate per 100,000 Population for Deaths Where Diabetes Was Listed as Any Cause of Death, Wisconsin Residents, 1993-2010. Source: Wisconsin Deaths Data Sets, 1993-2010



Data Sources

Behavioral Risk Factor Survey

The Behavioral Risk Factor Survey (BRFS) is a random-digit-dial telephone survey administered to Wisconsin household members 18 years and older to assess the prevalence of risk behaviors and health practices that affect health status. Data from the BRFS is self-reported from respondents. The Wisconsin BRFS is part of the national Behavioral Risk Factor Surveillance System (BRFSS), which is organized by the United States Centers for Disease Control and Prevention. All 50 states and United States territories conduct the BRFS through their health departments. The Wisconsin BRFS is a representative statewide survey. Wisconsin began conducting the BRFS in 1984 and has carried it out each year since then. Adults living in nursing homes, dormitories, and other institutional settings are not included in the survey.[6]

The BRFS includes a core survey (which each state and U.S. territory is required to ask) and additional modules (which are optional and include more specific topics, such as HIV/AIDS, tobacco use, injury prevention, and diabetes).[30] One of the most important questions for diabetes surveillance in the core survey is "Have you ever been told by a doctor that you have diabetes?" This provides an estimate of the number of adults in Wisconsin who have diabetes.

In 1995, Wisconsin began using the diabetes module, a set of questions asked of adults who answered "yes" to the core diabetes question "Have you ever been told by a doctor that you have diabetes?" Diabetes module questions allow collection of information on diabetes care that respondents receive, including foot exams, eye exams, A1C tests, and diabetes education. They also provide information on self-monitoring of blood glucose, insulin usage, diabetes medication usage, self-foot exams, and frequency of doctor's visits. Many of the diabetes module questions have remained the same from 1995-2010, but some have been eliminated, some have changed, and others have been added.[30] The diabetes module was not asked in years 2005 and 2006, so data is unavailable for those years.

In 2008, Wisconsin began asking the pre-diabetes module, a series of two questions that are asked of adults who respond "no" to the core diabetes question "Have you ever been told by a doctor that you have diabetes?" The two pre-diabetes module questions address preventive screening for diabetes and having been told that you have pre-diabetes or borderline diabetes.[30]

Additional information on the United States Behavioral Risk Factor Surveillance System can be found at http://www.cdc.gov/brfss/ and additional information on the Wisconsin BRFS can be found at http://www.dhs.wisconsin.gov/stats/BRFS.htm.

Wisconsin Family Health Survey

The Wisconsin Family Health Survey (FHS) is a is a random-digit-dial telephone survey administered to Wisconsin household members of all ages to assess things such as health status, health problems, health insurance coverage, and use of health care services. The survey began in 1989 and has been conducted each year since that time. The FHS is a representative statewide survey and data is self-reported from respondents. Adults living in nursing homes, dormitories, and other institutional settings are not included in the survey.[7]

The FHS provides the best estimate of the number of children and adolescents in Wisconsin who have diabetes, as the health information of every household member is inquired about during the survey.

Additional information on the Wisconsin Family Health Survey can be found at: http://www.dhs.wisconsin.gov/stats/familyhealthsurvey.htm.

National Health and Nutrition Examination Survey

The National Health and Nutrition Examination Survey (NHANES) is a national population-based survey examining the health and nutrition of United States households. There are two parts to the survey: the home interview and the health examination. During the home interview, participants are asked about their health status, history, and diet. During the health examination, many tests are performed (e.g., hearing test, urine, and blood tests), and a great deal of information is collected (e.g., body weight, blood pressure, body fat percentage, physical activity, and lab values from the urine and blood tests). There are no invasive tests completed during the health examination.[31] For purposes of this report, data from NHANES provided in the CDC National Diabetes Fact Sheet are used to determine an estimate of the number of adults aged 20 years and above with pre-diabetes in Wisconsin.[5]

Data Sources

Wisconsin Inpatient Hospitalization Discharge Database

Wisconsin hospitals are required to report select Uniform Billing elements for all hospital inpatient discharges (federal hospitals in Wisconsin are exempt from reporting) on a quarterly basis to the state under Chapter 153, Wis. Stats.[32] The reported records were received and edited by the Department of Health Services, Division of Public Health, Office of Health Informatics for discharge dates through September 30, 2003. That responsibility was transferred under contract to the Wisconsin Hospital Association beginning with discharge dates from October 1, 2003. Wisconsin is one of the forty-six states involved in the Healthcare Cost and Utilization Project (HCUP), sponsored by the Agency for Healthcare Research and Quality (AHRQ). HCUP is a set of health care databases, one of which is the Nationwide Inpatient Sample (NIS). All states involved in HCUP are invited to submit their inpatient hospitalization data to be included in the Nationwide Inpatient Sample (NIS); the number of states submitting data varies from year to year. The NIS database is designed to approximate a 20% sample of United States community hospitals.[33]

Data do not include hospitalization discharges at any Veteran's Administration (VA) hospitals, which are exempt from state reporting requirements. Due to this, numbers and charges of diabetes-related hospitalization discharge data and non-traumatic lower-extremity amputation data presented are an underestimate of the true numbers and charges. Hospitalization discharges for non-Wisconsin residents and Wisconsin residents hospitalizations outside of Wisconsin are not included.

It should be noted that for many counties along Wisconsin's borders, hospitalizations may be occurring in a neighboring state. In fact, for some counties, more hospitalizations occur in the neighboring state than occur in Wisconsin. Data presented in this report only include hospitalization discharges occurring in Wisconsin hospitals. This information should be considered when observing hospitalization discharges and lower-extremity amputations in this report. Data on hospitalization discharges (including diabetes-related hospitalizations) and lower-extremity amputations, as well as associated charges likely represent an underestimate of the true number and this should be considered when evaluating the data.

United States Renal Data System Renal Data Extraction and Referencing System

Data in this report were obtained from the United States Renal Data System (USRDS). The USRDS provides an online querying tool in which to acquire data on end-stage renal disease (ESRD), referred to as the Renal Data Extraction and Referencing (RenDER) System.[26] The tool is web-based and allows the user to gather information on the prevalence and incidence of ESRD by indicating specifications he or she wishes to examine. Specifications include: year, gender, race, ethnicity, age, modality, primary diagnosis, hospital service area (HSA), county, state, and renal network. Data may be requested in a variety of forms, including: raw count, death count, raw percent, unadjusted rate of disease, unadjusted rate of death, unadjusted hospital days, unadjusted admission rate, and average biochemical levels (body mass index, estimated GFR, height, hemoglobin, initial BUN, initial UREA, creatinine clearance, serum albumin, serum albumin lower limit, serum creatinine, and weight). RenDER rapidly returns a table of data or an interactive map based upon the user's query specifications. Data is available in RenDER from 1978 to 2009.

Wisconsin Mortality Sets

Chapter 69.18 of the Wisconsin Statutes requires registration of every death taking place in Wisconsin.[34] Diabetes mortality information is from death certificates filed with the State Vital Records Office, Office of Health Informatics, Division of Public Health, Department of Health Services.

Methodology and Limitations

Estimated Diabetes Prevalence in Adults (18 years and older)

Age Groups – The age groups utilized for diabetes prevalence in this report are: 18-44 years, 45-64 years, and 65+ years. Although the American Indian/Alaska Native prevalence rate provided to the Wisconsin Diabetes Prevention and Control Program is for the age group 15-44 years, the rate is applied to the appropriate population aged 18-44 years (see the American Indian/Alaska Native Prevalence section below).

Race and Ethnicity Groups – The six race and ethnicity groups utilized in this report are: 1) Non-Hispanic African American, 2) Non-Hispanic American Indian/Alaska Native, 3) Non-Hispanic Asian American, 4) Hispanic/Latino American, 5) Non-Hispanic Other Race/Multi-Race, and 6) Non-Hispanic White. Hispanic/Latino persons include persons of any race who have Hispanic/Latino ethnicity.

Population – At the time that diabetes prevalence data was determined, Wisconsin 2010 detailed census data were not yet available. Population estimates from 2009 were used to calculate estimated diabetes prevalence, and were obtained from the United States Census Bureau web site.[35] Population was first determined for each county for three age groups and six race/ethnicity groups, using the statistical software SAS®.[36] Information from the Census Bureau web site provided population estimates for ages 15-19 years and 20-44 years for each county and each race/ethnicity group, but did not provide specific data for the age group 18-44 years. Therefore, to determine an estimate of the number of people aged 18-44 years for the 2009 population estimates, the following steps were undertaken:

1) Access 2000 United States Census counts (2010 United States Census counts were unavailable). Specifically look at the age groups 15-17 years and 18-19 years.
2) Add these two age groups for each county (72 counties) for each race/ethnicity group (6 race/ethnicity groups).
3) Determine the proportion of 18-19 year olds in the 15-19 year old age group (using 2000 census data) for each county and each racial/ethnicity group.
4) Multiply the proportion of 18-19 year olds (using the 2000 census data) by the actual number of 15-19 year olds (using the 2009 population estimates) for each county and race/ethnicity group.
5) The resulting numbers are estimates of the number of persons 18-19 years old in 2009 for each county and race/ethnicity group; add this to the 20-44 year old age group (for each county and race/ethnicity group) to get an estimate of the number of 18-44 year olds in 2009 for each county and each race/ethnicity group.

Population counts are not rounded; county totals were summed to determine the 2009 estimated state population.

Estimated Diagnosed Prevalence in Adults – Prevalence is the number of cases of a disease that are present in a population during a specified time. Estimated prevalence was determined for the age groups and race/ethnicity groups described above. The statistical software SAS®[36] was used to obtain all prevalence estimates using 2008-2010 Behavioral Risk Factor Survey (BRFS)[14] data, except for the American Indian/Alaska Native estimates, which were provided by Great Lakes Inter-Tribal Epidemiology Center.[37] Wisconsin-specific BRFS data were used when the sample size was large enough to calculate a reliable estimate; when the sample size for Wisconsin-specific data was too low, prevalence rates are based on regional (Wisconsin, Illinois, Iowa, Michigan, and Minnesota) Behavioral Risk Factor Surveillance System (BRFSS) data. There are limitations to these data due to survey sample size of certain racial/ethnic groups in Wisconsin. A minimum sample size of 100 was used to provide reliable prevalence estimates. Age- and race/ethnicity-specific rates were applied to the applicable populations for each county (in order to ascertain numbers of adults with diagnosed diabetes for each age group and each race/ethnicity group in each county). Numbers of adults with diagnosed diabetes in each county were rounded to the nearest ten, and age and race/ethnicity groups for each county were summed to determine the state's adult population with diagnosed diabetes. Percents of estimated diagnosed adults were calculated by dividing the numbers of diagnosed adults by the appropriate population estimates for the age groups 18-44 years, 45-64 years, and 65 years and older; percents were rounded to one decimal point. Overall adult (ages 18 years and older) diagnosed prevalence estimates for all counties, regions, and races/ethnicities were age-adjusted (using the direct method) to the 2000 United States standard population and presented as percents rounded to one decimal point. Age-adjustment is explained in further detail later in this section.

Methodology and Limitations

Included below is further information on the specific data sources utilized for each of the age groups within each of the racial/ethnic groups. It should be noted that different sources were used to obtain prevalence data, based on sample size constraints for certain age and race/ethnicity groups. However, an attempt was made to select similar data sources to provide consistency in data analysis.

- ***Non-Hispanic African American Prevalence***

  Prevalence rates for Non-Hispanic African American adults are from the Wisconsin Behavioral Risk Factor Survey (BRFS), 2008-2010.[14] Milwaukee County Non-Hispanic African American rates for 2008-2010 were applied to the appropriate populations in Milwaukee County (for all three age groups). Specific Southeastern Region Non-Hispanic African American rates for 2008-2010 were applied to the appropriate populations in counties found in the Southeastern Region, except for Milwaukee County (Jefferson, Kenosha, Ozaukee, Racine, Walworth, Washington, and Waukesha Counties) for all three age groups. Non-Hispanic African American 2008-2010 Wisconsin BRFS rates were applied to the appropriate populations for all other counties. State rates were used for all counties not in the Southeastern Region because sample sizes for the other four regions were not large enough to provide a reliable prevalence estimate for their appropriate counties. Application of these rates allowed determination of an estimated number of Non-Hispanic African American adults diagnosed with diabetes in each of the three age groups for each county.

- ***Non-Hispanic American Indian/Alaska Native Prevalence***

  Prevalence rates for Non-Hispanic American Indian/Alaska Native adults are 2009 rates from the publication titled *Community Health Data Profile: Minnesota, Wisconsin, and Michigan Tribal Communities, 2010*.[37] This publication was produced by Great Lakes Inter-Tribal Epidemiology Center, Great Lakes Inter-Tribal Council, Inc. in 2011. Data from the diabetes audit is a sample of the overall diabetes user population in Wisconsin and unfortunately there is no information for undiagnosed individuals or for American Indian/Alaska Native individuals who do not visit an Indian Health Service (IHS) facility, and there are incomplete and missing reports. The sample size for the 2009 diabetes audit was 1,135. Prevalence rates were applied to the appropriate populations in each county to determine an estimated number of Non-Hispanic American Indian/Alaska Native adults diagnosed with diabetes in each of the three age groups for each county. The specific rate for the 18-44 year age group was not available for the American Indian/Alaska Native population; the rate for the 15-44 year age group was applied to the appropriate population 18-44 years of age.

- ***Non-Hispanic Asian, Native Hawaiian, and Other Pacific Islander Prevalence***

  Prevalence rates for Non-Hispanic Asian, Native Hawaiian, and Other Pacific Islander adults for all three age groups were obtained from the 2008-2010 Behavioral Risk Factor Surveillance System (BRFSS)[38] from the following states: Wisconsin, Illinois, Iowa, Michigan, and Minnesota. The reason for the use of multiple states is because the sample sizes for Wisconsin were not large enough to provide reliable prevalence estimates. These rates were applied to the appropriate populations in each county to determine an estimated number of Non-Hispanic Asian, Native Hawaiian, and Other Pacific Islander adults diagnosed with diabetes in each of the three age groups for each county.

- ***Hispanic/Latino American Prevalence***

  Prevalence rates for Hispanic/Latino American adults for all three age groups were obtained from the 2008-2010 Behavioral Risk Factor Surveillance System (BRFSS)[38] from the following states: Wisconsin, Illinois, Iowa, Michigan, and Minnesota. The reason for the use of multiple states is because the sample sizes for Wisconsin (for 45-64 and 65+ age groups) were not large enough to provide reliable prevalence estimates for these age groups. Upon examination, the sample size for the age group 18-44 years using only Wisconsin Behavioral Risk Factor Survey (BRFS) data was technically large enough with 122 persons. However, the weighted prevalence for this age group was unusually and unexpectedly low and we did not feel comfortable using Wisconsin BRFS data for this age group as we believed it would produce a falsely low prevalence estimate for Wisconsin Hispanic/Latino adults, especially given the relatively large population of 18-44 year olds compared to other age groups. Therefore, we used Hispanic/Latino data for the five states mentioned above

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to provide a more reliable estimate for this age group. These rates were applied to the appropriate populations in each county to determine an estimated number of Hispanic/ Latino American adults diagnosed with diabetes in each of the three age groups for each county.

- ***Non-Hispanic Some Other Race and Multi-Race***

  It is estimated that over 29,000 adults in Wisconsin 18 years and above are "Non-Hispanic Some Other Race" or "Non-Hispanic Multi-Race." The prevalence rate for Non-Hispanic Some Other Race and Non-Hispanic Multi-Race for the age group 45-64 years was obtained from the 2008-2010 Wisconsin Behavioral Risk Factor Survey (BRFS).[14] Prevalence rates for Non-Hispanic Some Other Race and Non-Hispanic Multi-Race for the age groups 18-44 years and 65 years and above were obtained from the 2008-2010 Behavioral Risk Factor Surveillance System (BRFSS) from the following states: Wisconsin, Illinois, Iowa, Michigan, and Minnesota.[38] The reason for the use of multiple states for these age groups is because the sample size for Wisconsin was not large enough to provide a reliable prevalence estimate for these age groups. These rates were applied to the appropriate populations in each county to determine an estimated number of Non-Hispanic Some Other Race or Non-Hispanic Multi-Race adults diagnosed with diabetes in each of the three age groups for each county.

- ***Non-Hispanic White***

  Prevalence rates for Non-Hispanic white adults are from the 2008-2010 Wisconsin Behavioral Risk Factor Survey (BRFS).[14] For the 18-44 year age group, the following counties had a large enough sample size for county-specific rates for the Non-Hispanic white population: Brown, Dane, and Milwaukee. For the 45-64 year age group, the following counties had a large enough sample size for county-specific rates for the Non-Hispanic White population: Brown, Dane, Fond du Lac, La Crosse, Marathon, Milwaukee, Outagamie, Ozaukee, Racine, Rock, Sheboygan, Washington, Waukesha, and Winnebago. For the 65 years and older age group, the following counties had a large enough sample size for county-specific rates for the Non-Hispanic white population: Brown, Dane, Milwaukee, Outagamie, Waukesha, and Winnebago. For counties not mentioned above, rates for the three age groups within each of the five Department of Health Services (DHS) regions were determined. These region-specific rates were applied to the appropriate county's population (except as described above) to determine an estimated number of Non-Hispanic white adults diagnosed with diabetes in each of the three age groups for each county. A map of the DHS regions and corresponding counties is available at: http://www.dhs.wisconsin.gov/aboutdhs/regions.htm.

Undiagnosed Prevalence – In the United States, an estimated 18.8 million persons have been diagnosed with diabetes, and 7.0 million persons have diabetes that has not been diagnosed.[5] This ratio of undiagnosed to diagnosed (7.0 million:18.8 million or 37.2340426%) was used in estimating the number of adults in Wisconsin who have undiagnosed diabetes. Unrounded numbers of diagnosed adults were multiplied by the above percentage to determine the estimated number of adults who have undiagnosed diabetes in each age group and each race/ethnicity group for each county. Rounded county estimates of undiagnosed adults were summed to determine state estimates for the three age groups for each race/ ethnicity and all races/ethnicities combined. Percents of estimated undiagnosed adults were calculated by dividing the numbers of undiagnosed adults by the appropriate population for the age groups 18-44 years, 45-64 years, and 65 years and older; percents were rounded to one decimal point. Overall adult (ages 18 years and older) undiagnosed prevalence estimates for all counties, regions, and race/ethnicity groups were age-adjusted (using the direct method) to the 2000 United States standard population and presented as percents rounded to one decimal point. Age-adjustment is explained in further detail later in this section.

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Total Prevalence – County-specific rounded numbers of diagnosed adults and rounded numbers of undiagnosed adults were summed for each of the three age groups to determine the total estimated number of adults with diabetes by county. Rounded estimates were summed to determine state estimates. Percents of estimated totals were calculated by dividing the numbers of total adults by the appropriate population for the age groups 18-44 years, 45-64 years, and 65 years and older; percents were rounded to one decimal point. Overall adult (ages 18 years and older) diagnosed prevalence estimates for all counties were age-adjusted (using the direct method) to the 2000 United States standard population and presented as percents rounded to one decimal point. Age-adjustment is explained in further detail later in this section. In some cases, the total percents may not equal the sum of diagnosed percents and undiagnosed percents, due to rounding.

Estimated Diabetes Prevalence in Adults by Race/Ethnicity

Age-specific estimated diabetes prevalence by race/ethnicity – County estimates in each of the three age groups for each race/ethnicity group were summed to determine a state-wide estimate of the number of adults with diabetes in each of the six racial/ethnic groups for each of the three age groups. This applies to diagnosed, undiagnosed, and total prevalence.

Age-adjusted estimated diabetes prevalence rates by race/ethnicity – Overall adult (ages 18 years and older) prevalence estimates for all racial/ethnic groups were age-adjusted (using the direct method) to the 2000 United States standard population and presented as percents rounded to one decimal point for diagnosed, undiagnosed, and total estimates. Age-adjustment is explained in further detail below.

Age-adjustment

Age-adjustment allows the ability to remove differences in rates between groups while controlling for differences in the age variations of the populations. Differences in population distribution can cause misleading overall prevalence estimates (especially for different racial/ethnic groups, some of which have very different population distributions). For example, according to 2009 population estimates, 71.9% of the adult Hispanic/Latino population is aged 18-44 years, compared to 44.0% of the Non-Hispanic white population. Due to this difference in age distribution and the fact that the prevalence of diabetes is lower for younger age groups, the prevalence estimate for the "All ages" group for the Hispanic/Latino population would be an underestimate if it were presented in crude percent format (not age-adjusted).

Estimated Diabetes Prevalence in Children and Adolescents (17 years and younger)

Population – At the time that this report was created, Wisconsin 2010 detailed census data were not yet available. Population estimates from 2009 were used to calculate the estimated diabetes prevalence, and were obtained from the United States Census Bureau web site.[35]

Estimated Diagnosed Prevalence – Prevalence is the number of cases of a disease that are present in a population during a specified time. Prevalence rates were obtained for the age groups 0-9 years and 10-17 years from the Wisconsin Family Health Survey 2008-2009.[8] Weighting for the 2010 Wisconsin Family Health Survey data was not complete at the time this data was compiled, so 2010 data are not included. The Office of Informatics, Division of Public Health, Wisconsin Department of Health Services provided the estimates for this report.

Pre-diabetes Estimates

Information from the Centers for Disease Control and Prevention (CDC) National Diabetes Fact Sheet states that a 2005-2008 study found that among U.S. adults aged 20 years and older, 35% had pre-diabetes (based on fasting glucose or A1C).[5]

An estimate of the number of people aged 20 years and older with pre-diabetes in each county, in each region, and for each race/ethnicity group in Wisconsin was determined using U.S. Census 2009 population estimates data for this age group. (Population estimates for pre-diabetes prevalence estimates were obtained from the same data file as population estimates for the diabetes prevalence estimates.[35]) County population estimates, regional population estimates, and race/ethnicity population estimates (for ages 20 years and older) were separately multiplied by 0.35 (based on the data on the CDC National Diabetes Fact Sheet) to determine the estimated number of persons aged 20 years and older with pre-diabetes. County estimates were rounded to the nearest 10 and county totals were summed to determine state estimates. Regional estimates were

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sums of the counties in that particular region. Totals of pre-diabetes estimates for all race/ethnicity groups will not match state totals exactly, due to rounding. Data from the CDC National Diabetes Fact Sheet suggests that the percentage of U.S. adults aged 20 years or older with pre-diabetes in 2005-2008 was similar for Non-Hispanic whites (35%), Non-Hispanic African Americans (35%), and Mexican Americans (36%).[5] Based on this, an assumption is made that each county, each region, and each race/ethnicity group has an equal estimated pre-diabetes prevalence of 35%. Though there may are likely some variations in the prevalence of pre-diabetes among different counties, regions, and racial/ethnic groups, using a pre-diabetes prevalence of 35% allows the ability to provide a rough estimate of the number of adults 20 years and older with pre-diabetes for all counties, regions, and race/ethnicity groups.

Economic Costs of Diabetes

The American Diabetes Association published an article in the March 2008 edition of *Diabetes Care*, titled "Economic Costs of Diabetes in the U.S. in 2007."[4] Although this article is outdated, we learned that new estimates on the economic costs of diabetes would not be out until the end of 2012; therefore, we used these data and applied it to current prevalence estimates. Per capita figures for this report were obtained from this article and applied to the estimated population with diagnosed diabetes in Wisconsin to determine the estimated costs of diabetes in Wisconsin. The article found that the per capita cost of medical expenditures for a person with diabetes was $11,744. Table 10 in the article indicated that total (direct) health care expenditures for the United States were $116.257 billion and Table 14 indicated that total (indirect) costs attributed to diabetes for the United States were $58.2 billion, for a total of $174.457 billion.[4] These figures were used to calculate percentages of direct (66.63934379%) and indirect (33.36065621%). The percentages, along with the figure of $11,744 for per capita direct costs allowed the calculation of $5,879 for a per capita indirect cost. The direct and indirect per capita figures were used to calculate the estimated costs for those diagnosed with diabetes in Wisconsin. It should be noted that total costs may not equal the sum of direct and indirect costs, due to rounding. An example of this is direct, indirect, and total costs for Wisconsin. Direct costs are $4.0658 billion (rounded off to $4.07 billion), indirect costs are $2.0354 billion (rounded off to $2.04 billion), and total costs are $6.1012 billion (rounded off to $6.10 billion).

Total Economic Costs (Children/Adolescents and Adults) – The total estimated economic cost of diabetes is $6.15 billion. This includes the estimated total for adults ($6.10 billion) and the estimated total for children and adolescents ($52.8 million). For this analysis, an estimate of indirect costs for children/adolescents is not included, as children/adolescents are generally not members of the workforce (there are some exceptions). It must be noted that these estimates only include persons diagnosed with diabetes. Persons with diabetes that is undiagnosed arguably don't incur the same costs as those diagnosed with diabetes; however, the total figure of $6.15 billion is likely an underestimate, as it considers none of the direct or indirect costs for persons with undiagnosed diabetes. Furthermore, the figure does not include persons with pre-diabetes.

Sociodemographics

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Statistical significance was determined by non-overlapping 95% confidence intervals.

General Health

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Statistical significance was determined by non-overlapping 95% confidence intervals.

Access to Care

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Statistical significance was determined by non-overlapping 95% confidence intervals.

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Risk Factors

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. In some cases, only one year of data was available for some of the variables, due to that question not being asked during a particular year. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Statistical significance was determined by non-overlapping 95% confidence intervals. For the purposes of this report, not overweight or obese is defined as a body mass index (BMI) < 25.0 kg/m^2, overweight is defined as a BMI of 25.0 kg/m^2 – 29.9 kg/m^2, and obese is defined as a BMI ≥ 30.0 kg/m^2. Current smoker is defined as an adult who has smoked at least 100 cigarettes in his/her lifetime and smokes cigarettes every day or some days, former smoker is defined as an adult who has smoked at least 100 cigarettes in his/her lifetime and does not currently smoke cigarettes, and non-smoker is defined as an adult who has not smoked at least 100 cigarettes in his/her lifetime and does not currently smoke.[14]

Current Status of Diabetes Care

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. In some cases, only one year of data was available for some of the variables, due to that question not being asked during a particular year. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Healthy People 2010 goals were obtained from the Healthy People 2010 web site[21] and Healthy People 2020 goals were obtained from the Healthy People 2020 web site.[20]

Comorbid Chronic Diseases and Other Complications

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Statistical significance was determined by non-overlapping 95% confidence intervals.

Assessing Risk for Type 2 Diabetes and Pre-Diabetes

Data are from the 2009-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used to provide more accurate and reliable estimates. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36]

Trends in Selected Characteristics of Adults with Diabetes

Data are from the 1995-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used for some data points to provide more accurate and reliable estimates when sample sizes are smaller. One year of data is used when samples sizes are larger and provide more reliable estimates. In some cases, only one year of data was available for some measures (e.g., blood pressure), due to the question not being asked during a particular year. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36] Definitions for not overweight or obese, overweight, obese, current smoker, former smoker, and non-smoker are identical to those described earlier.

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Trends in Diabetes Care

Data are from the 1995-2010 Wisconsin Behavioral Risk Factor Survey.[14] Two years of data are used for some data points to provide more accurate and reliable estimates when sample sizes are smaller. One year of data is used when samples sizes are larger and provide more reliable estimates. In some cases, only one year of data was available for some measures (e.g., influenza vaccination), due to the question not being asked during a particular year. For some measures, diabetes module questions have been changed, deleted, or added over time; in effect, some measures do not have data available for all years. The diabetes module was not asked in 2005 or 2006 and therefore, there is missing data for these years. All percentages are weighted and representative of the entire state of Wisconsin. Missing values, refusals, and responses of "don't know" are not included in the denominator for that particular question. The statistical software SAS was used to analyze all data.[36]

Diabetes-related Inpatient Hospitalizations

All data are from the Wisconsin Hospital Inpatient Discharge Database.[23] Data on diabetes-related inpatient hospitalizations include all ages (children and adults), but do not include hospitalizations at any Veteran's Administration (VA) hospitals, which are exempt from the state reporting requirements. Hospitalizations for non-Wisconsin residents and for Wisconsin residents hospitalized outside of Wisconsin are not included. As explained earlier, for many counties along Wisconsin borders, hospitalizations may be occurring in a neighboring state and are not included in the data presented in this report. Therefore, diabetes-related hospitalizations are likely underreported and this should be taken into consideration when examining the data.

For this report, when diabetes is listed as the principal diagnosis, the reporting of an ICD-9 code 250.0 – 250.93 is found in the data element "Principal Diagnosis." When diabetes is listed as any diagnosis, the reporting of an ICD-9 code 250.0 – 250.93 is found in the "Principal Diagnosis" data element or any of the "Other Diagnosis" data elements. Those hospitalizations that report more than one diabetes code for one hospitalization are only counted once.

Raw numbers of hospitalizations for age groups 0-24 years, 25-44 years, 45-54 years, 55-64 years, 65-74, 75-84 years, and 85+ years were obtained using the statistical software SAS.[36] Population estimates (and counts for census years) were obtained from the online Wisconsin Interactive Statistics on Health (WISH).[39] Raw numbers of diabetes-related hospitalizations were divided by applicable population estimates/counts to determine age-specific rates. Age-specific rates were age-adjusted (direct method) to the 2000 United States standard population.

Data from inpatient hospitalization discharges is recorded on the Uniform Health Insurance Claim (UB-92) form. Prior to the fourth quarter of 1993, Wisconsin collected the following data elements related to diagnoses listed upon discharge:

- Principal Diagnosis
- Other Diagnosis 1
- Other Diagnosis 2
- Other Diagnosis 3
- Other Diagnosis 4

Beginning with the fourth quarter of 1993, Wisconsin started collecting four additional data elements to assess diagnoses, including:

- Other Diagnosis 5
- Other Diagnosis 6
- Other Diagnosis 7
- Other Diagnosis 8

The addition of the collection of these four data elements likely led to increases in the numbers of persons with a discharge when diabetes was any diagnosis in 1994 and subsequent years, compared to earlier years. Therefore, data examining diabetes-related hospitalizations are only presented for years 1994-2010, to allow for comparison of consistent data during the time period.

Methodology and Limitations

Diabetes-related Lower-Extremity Amputations

All data are from the Wisconsin Hospital Inpatient Discharge Database.[23] Data on diabetes-related lower-extremity amputations include all ages, but do not include amputations at any Veteran's Administration (VA) hospitals, which are exempt from the state reporting requirements. Only non-traumatic lower-extremity amputations are included in these data. Lower-extremity amputations for non-Wisconsin residents and for Wisconsin residents hospitalized outside of Wisconsin are not included. Also, as explained earlier, for many counties along Wisconsin borders, hospitalizations (and therefore, diabetes-related lower-extremity amputations) may be occurring in a neighboring state and are not included in the data presented in this report. Therefore, diabetes-related lower-extremity amputations are likely underreported and this should be taken into consideration when examining the data.

For this report, a diabetes-related lower-extremity amputation is defined as a non-traumatic lower-extremity amputation (ICD-9 code 84.1 – 84.19); the reporting of this code is found in the data element "Principal Procedure" or any of the "Other Procedure" data elements and diabetes (ICD-9 code 250.0 – 250.93) is found in the "Principal Diagnosis" data element or any of the "Other Diagnosis" data elements. Those hospitalizations that report more than one amputation code or more than one diabetes code for one hospitalization are only counted once.

Raw numbers of lower-extremity amputations for age groups 0-64 years, 65-74 years, 75+ years were obtained using the statistical software SAS.[36] Population estimates (and counts for census years) were obtained from the online Wisconsin Interactive Statistics on Health (WISH).[39] Raw numbers of diabetes-related lower-extremity amputations were divided by applicable population estimates/counts to determine age-specific rates. Age-specific rates were age-adjusted (direct method) to the 2000 United States standard population.

As explained earlier, data from inpatient hospitalization discharges is recorded on the Uniform Health Insurance Claim (UB-92) form.

Prior to the fourth quarter of 1993, Wisconsin collected the following data elements related to procedures performed during a hospital stay:

- Principal Procedure
- Other Procedure 1
- Other Procedure 2

Beginning with the fourth quarter of 1993, Wisconsin started collecting three additional data elements related to procedures, including:

- Other Procedure 3
- Other Procedure 4
- Other Procedure 5

The addition of the collection of these three data elements (and the additional four data elements related to diagnoses) may have led to increases in the numbers of persons with a discharge when a non-traumatic lower-extremity amputation was listed as any procedure and diabetes was listed as any diagnosis. Therefore, data examining diabetes-related lower-extremity amputations are only presented for years 1994-2010, to allow for comparison of consistent data during the time period.

End-Stage Renal Disease

The United States Renal Data System (USRDS) Renal Data Extraction and Referencing (RenDER) System online tool was used to obtain raw prevalence and incidence numbers of end-stage renal disease for age groups 0-34 years, 35-44 years, 45-54 years, 55-64 years, and 65+ years in persons with diabetes listed as the primary diagnosis.[26] Data were obtained for each year from 1978 to 2009. All races/ethnicities, all modalities of treatment, and both genders (except when examining by gender) were included in the analyses. Population estimates (and counts for census years) were obtained from the United States Census Bureau web site,[35] as well as the Wisconsin Interactive Statistics on Health (WISH).[39] Raw numbers were divided by applicable population estimates/counts to determine age-specific rates. Age-specific rates were age-adjusted (direct method) to the 2000 United States standard population.

The data reported here have been supplied by the United States Renal Data System (USRDS). The interpretation and reporting of these data are the responsibility of the author(s) and in no way should be seen as an official policy or interpretation of the U.S. government.

Methodology and Limitations

Diabetes Mortality

Prior to 1999, International Classification of Diseases, Ninth Revision (ICD-9) codes were used to code deaths; diabetes ICD-9 codes are 250.0 – 250.93. Beginning in 1999, causes of death were coded using the International Classification of Diseases, Tenth Revision (ICD-10); diabetes ICD-10 codes are E10 – E14. Because the change from ICD-9 to ICD-10 can affect coding and classification, a comparability ratio allows one to compare deaths prior to 1999 (using ICD-9 codes) to deaths in 1999 and thereafter (using ICD-10 codes). The comparability ratio for diabetes is 1.008167; this means that for every one death in 1999 (or later years) due to diabetes, 1.008167 deaths were coded listing diabetes in years prior to 1999. In this report, the comparability ratio was used to allow for comparison of data over the 1989-2010 time period for all mortality data.

Raw numbers of deaths where diabetes was listed as the underlying cause of death were obtained from Wisconsin death files (vital records),[28] using the statistical program SAS.[36] For this report, diabetes as the underlying cause of death is defined with a code for diabetes (ICD-9 code 250.0 – 250.93 for years 1989-1998 and an ICD-10 code E10 – E14 for years 1999-2010) in the "Underlying Cause of Death" data element. Numbers of deaths were determined for age groups 0-44 years, 45-54 years, 55-64 years, and 65-74 years, 75-84 years, and 85+ years. All races/ethnicities and both genders were included in the analyses. Population estimates (and counts for census years) were obtained from the online Wisconsin Interactive Statistics on Health (WISH).[39] Raw numbers were divided by appropriate population estimates/counts to determine age-specific rates. Age-specific rates were age-adjusted (direct method) to the 2000 United States standard population.

It should be noted that the use of "underlying cause of death" is likely an underestimate of the number of diabetes-related deaths, as diabetes often contributes to a death for which another disease/condition is listed as the underlying cause of death.

Raw numbers of deaths where diabetes was listed as any cause of death were obtained from Wisconsin death files (vital records),[28] using the statistical program SAS.[36] Prior to 1993, Wisconsin death certificates only provided space for the underlying cause of death and three other causes of death. Beginning in 1993, seventeen additional spaces were added for other causes of death, leading to one space for the underlying cause of death and 20 spaces for other causes of death. Therefore, when reporting diabetes as any cause of death, data is only presented for years 1993 and after, to allow for comparison of consistent data during the time period.[28] For this report, diabetes as any cause of death is defined with a code for diabetes (ICD-9 code 250.0 – 250.93 for years 1993-1998 and an ICD-10 code E10 – E14 for years 1999-2010) in the "Underlying Cause of Death" or any of the other 20 "Cause of Death" data elements. Those deaths reporting diabetes in more than one data field for the same death are only counted once. Deaths were determined for age groups 0-44 years, 45-54 years, 55-64 years, and 65-74 years, 75-84 years, and 85+ years. All races/ethnicities and both genders were included in the analyses. Population estimates (and counts for census years) were obtained from the online Wisconsin Interactive Statistics on Health (WISH).[39] Raw numbers were divided by appropriate population estimates/counts to determine age-specific rates. Age-specific rates were age-adjusted (direct method) to the 2000 United States standard population.

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