The Impact of Diabetes in Nebraska
Published: January 2010

I. Prevalence

In Nebraska and throughout the United States, diabetes is becoming increasingly common. According to data collected in 2008 by the Behavioral Risk Factor Surveillance System (BRFSS), the number of Nebraska residents 18 years of age or older who have been diagnosed with diabetes is estimated at about 103,000, or 7.8% of the state's adult population *(see Figure 1)*. By contrast, the number of Nebraska adults with diabetes was estimated at about 60,000 in the year 2000 and about 50,000 in 1990. BRFSS data gathered in 2008 also indicate that there are over 63,000 adults in Nebraska who have been diagnosed with pre-diabetes. Compared to other states, the percentage of Nebraska adults who have diabetes falls slightly below the national median of 8.3%. The most recent estimate (2007) from the Centers for Disease Prevention and Control (CDC) is that there are 17.9 million adult Americans who have been diagnosed with diabetes. CDC has also prepared county-specific estimates of the number of adults who have been diagnosed with diabetes, and these numbers for Nebraska counties are presented in Figure 2.

Two trends strongly suggest that the size of Nebraska's diabetic population will not decrease any time soon. First, as is true throughout the United States, the increase in the prevalence of diabetes has been accompanied by a simultaneous increase in the prevalence of obesity and overweight. In Nebraska, the prevalence of obesity has doubled in less than two decades, and close to two-thirds of Nebraska adults are now above their healthy weight *(see Figure 4)*, putting them at increased risk for developing diabetes. Second, the risk of diabetes increases with age, and Nebraska's population is getting older. According to the 2008 BRFSS, about one of every six (17.2%) Nebraska residents 65 and older have been diagnosed with diabetes, compared to only about one in 18 (5.6%) among those under the age of 65. In addition, the US Census Bureau predicts that Nebraska's 65-and-older population will grow by more than 50% between 2010 and 2030, increasing in size from about 240,000 to 375,000.

Figure 1. Percentage of Nebraska Adults with Diagnosed Diabetes, 1995-2008
(Source: Nebraska Behavioral Risk Factor Surveillance System)

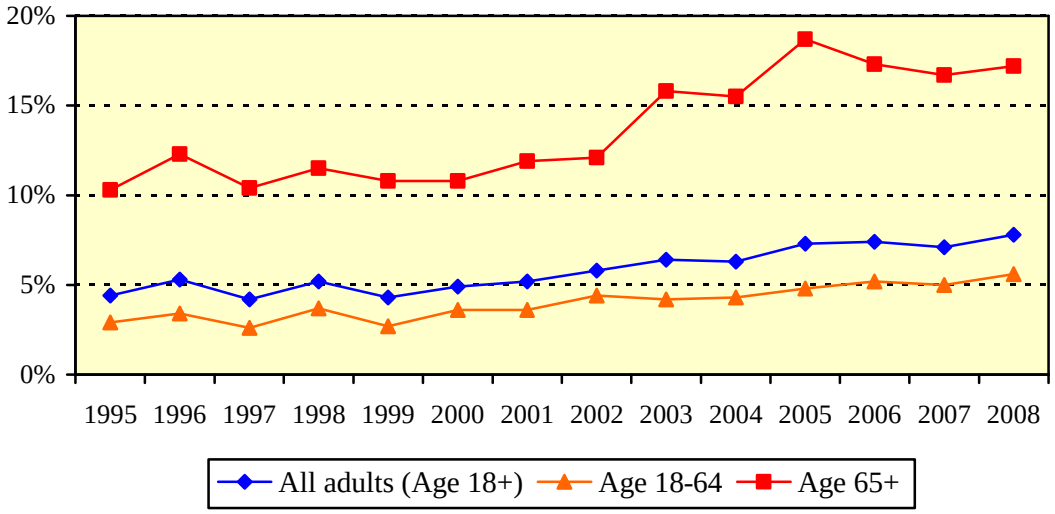
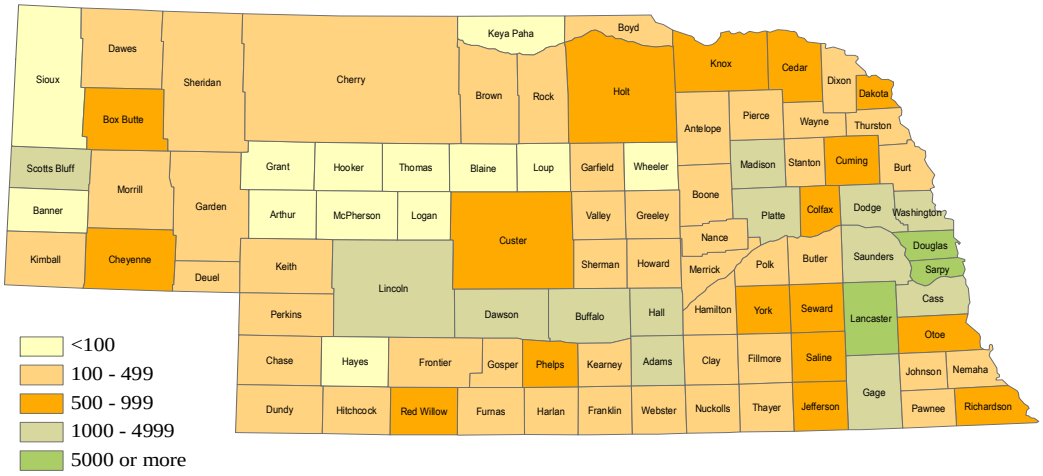


Figure 2. Number of Adults (Age 20+) with Diagnosed Diabetes, by County, Nebraska, 2005
(Source: Centers for Disease Prevention and Control)

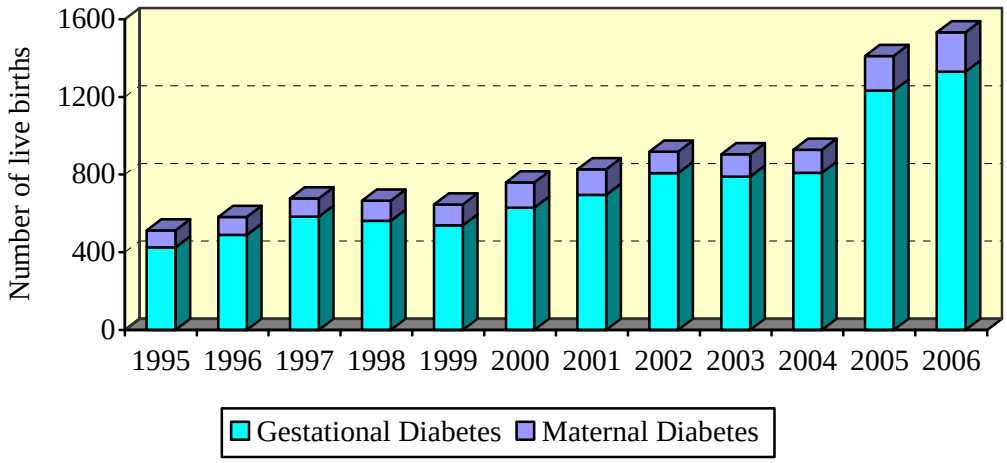


Nebraska BRFSS data also show that men are more likely to have diabetes than women, and that the percentage of adults with diabetes is greatest among those with the least education and the lowest household income. In addition, significant racial and ethnic disparities exist, with African-Americans, Native Americans, and Hispanics in Nebraska all at high risk for developing diabetes. Among adults, the percentage of African-Americans (13.3%) and Hispanics (12.6%) who have been diagnosed with diabetes is almost twice as high as the percentage for whites (7.2%), according to data (age-adjusted) from the 2007 and 2008 BRFSS. Among Nebraska's Native Americans, diabetes is even more common, with more than one in four (26.0%) adults reporting that they have it.

Both the number and rate of cases of gestational diabetes have about tripled in Nebraska during the past decade *(see Figure 3),* although revisions to the Nebraska birth certificate in 2005 may be responsible for some of this increase. The number of babies born to Nebraska women with gestational diabetes rose from 425 in 1995 to 1,329 in 2006. These figures represent 1.8% of the state's live birth total for 1995 and 5.0% for 2006. During the present decade (2000-2006), Nebraska women with gestational diabetes have given birth to 6,294 babies. Within this cohort, gestational diabetes was more common among Native Americans (6.2%), Asian/Pacific Islanders (5.8%), and Latinas (4.0%) than among either whites (3.2%) or African Americans (2.6%). Prevalence also rose with the age of the mother, with rates about three times higher for women 35 and older compared to women under the age of 25.

The number and rate of cases of maternal (i.e., pre-existing) diabetes has also increased substantially in Nebraska during the past decade *(see Figure 3)*. The number of babies born to Nebraska women with maternal diabetes rose from 88 in 1995 to 204 in 2006. These figures represent 0.38% of the state's live birth total for 1995 and 0.76% for 2006. During the present decade (2000-2006), Nebraska women with maternal diabetes have given birth to 988 babies.

Figure 3. Number of Nebraska Live Births with Gestational and Maternal Diabetes, 1995-2006
(Source: Nebraska vital statistics)



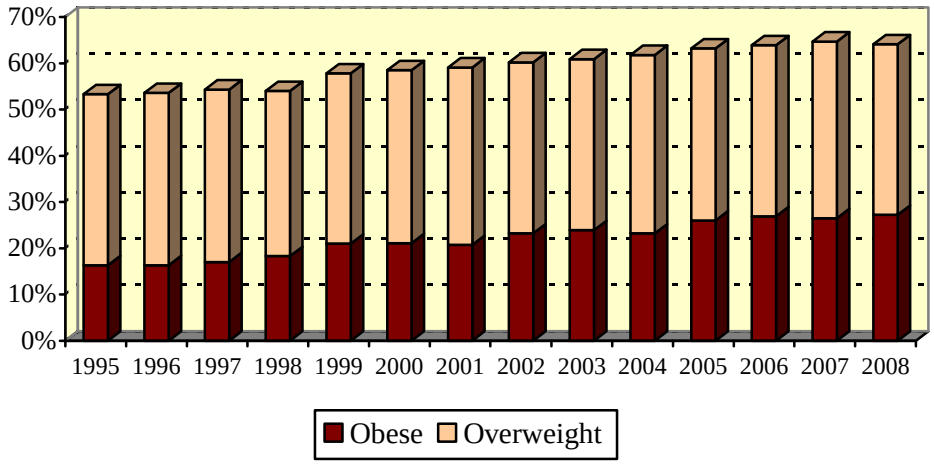
II. Risk Factors

For Type 1 diabetes, there are no known modifiable risk factors that can lower a person's chances of developing the disease. For Type 2 diabetes, however, both obesity and lack of physical activity are significant risk factors, making lifestyle changes such as better nutrition, weight control, and regular physical activity highly advisable. Some estimates suggest that the risk of developing Type 2 diabetes could be reduced by up to 75% through reductions in obesity, while increased physical activity could reduce the risk by up to 50%. For some people who have Type 2 diabetes and are obese, diabetes symptoms will disappear completely if normal weight is restored.

People who have diabetes also suffer an increased risk of developing a number of disabling and life-threatening complications, including heart disease, stroke, kidney failure, blindness, neuropathy (inflammation and degeneration of peripheral nerves), and peripheral vascular disease, which can ultimately lead to amputation of the lower extremities. In addition to obesity and lack of physical activity, high blood pressure (hypertension), cigarette smoking, and high cholesterol are known risk factors for cardiovascular disease, currently the leading cause of death in the United States. High blood pressure is also a risk factor for diabetes-related blindness, kidney disease, neuropathy, and peripheral vascular disease, and also contributes to the progress of these diseases after their onset. Cigarette smoking and high cholesterol are also risk factors for peripheral vascular disease, while smoking can hasten the decline of kidney function among people with diabetes.

The percentage of Nebraska adults who are obese has increased significantly during the past decade *(see Figure 4)*. According to the 2008 BRFSS, 27.2% of Nebraska adults--more than one in four--are obese, compared to 16.3% in 1995, and more than one-half (52.4%) of Nebraska adults who have diabetes are obese. A person is considered obese if their Body-Mass Index (calculated by dividing a person's weight by the squared value of their height) is 30 or greater. When the data are expanded to include overweight (Body-Mass Index = 25-29, which is above healthy weight but below the obese level) as well as obese individuals, the proportion who fit into either category increases to 64.1% for the general population and to 83.7% for people who have diabetes. Regardless of age or gender, people with diabetes are more likely to be either obese or overweight than are people without it.

Figure 4. Percentage of Nebraska Adults (Age 18+) who are Obese or Overweight, 1995-2008
(Source: Nebraska Behavioral Risk Factor Surveillance System)



In contrast to obesity and overweight, measures of physical activity among Nebraska adults have shown some recent signs of improvement. BRFSS data collected in 2008 found that, although nearly one in four (24.6%) Nebraska adults are physically inactive (they reported that they had not participated in any leisure-time physical activities during the past month), this figure is down from the 31.4% recorded in 2001. Similarly, the percentage of Nebraska adults who reported that they had participated in moderate or vigorous physical activity during the past month increased from 34.1% in 2001 to 52.0% in 2007. However, among people with diabetes, there is less physical activity: Nebraska's BRFSS found that 36.2% reported that they had not participated in any leisure-time physical activities during the past month while only 35.9% had participated in moderate or vigorous physical activity. Regardless of age or gender, people with diabetes are less likely to be physically active than are people without diabetes.

Two important risk factors for diabetes complications—high cholesterol and hypertension—currently afflict more than half of all adults in Nebraska who have diabetes. According to the 2007 BRFSS, two-thirds (67.3%) of Nebraska adults with diabetes have been told that they have high blood pressure, 59.1% have been told that they have high cholesterol, and 44.9% have both conditions. Trends during the past decade show significant increases in the prevalence of both of these conditions: in 1997, these figures stood at 45.6% for high cholesterol and 48.7% for hypertension. BRFSS data also show that 13.3% of adults in Nebraska who have diabetes reported in 2008 that they smoked cigarettes. The percentage of Nebraska adults with diabetes who smoke has declined significantly during the past decade.

Over the past several decades, there has been a sharp increase in the proportion of U.S. children who are obese, which in turn has led to a substantial increase in the number of cases of Type 2 diabetes among children and adolescents. According to the National Health and Nutrition Examination Surveys, the prevalence of obesity among children 6-11 years of age increased from 4% in the early 1970s to 17% in 2006. For children 12-19 years of age, the prevalence rate increased from 6% to 18% during the same period. In Nebraska, data collected in 2005 by the Youth Risk Behavior Survey (YRBS) show that almost one in four (24.7%) high school students was either overweight or at risk for becoming overweight

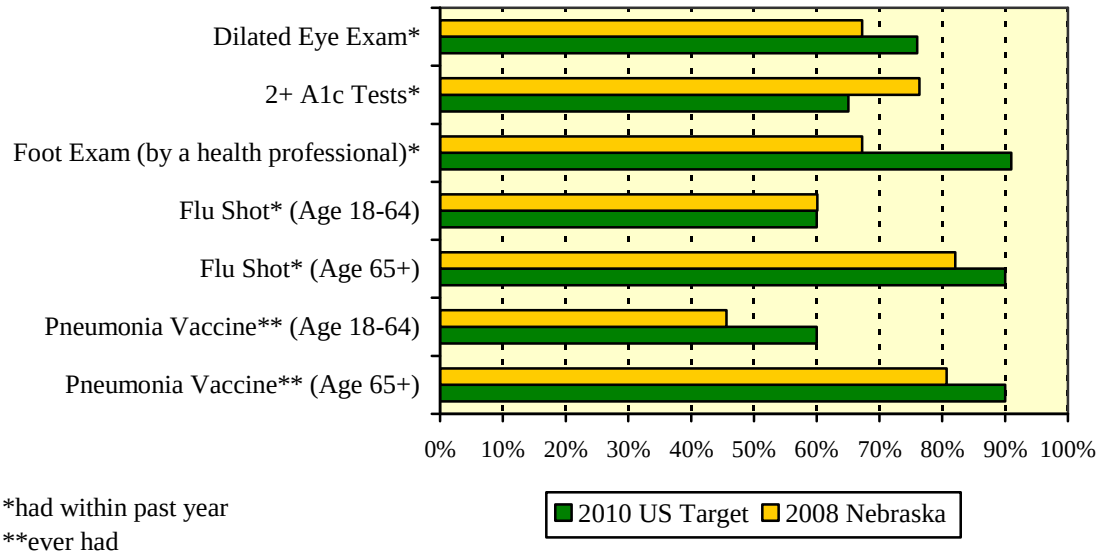
(NOTE: YRBS data use the terms “overweight” and “at risk for becoming overweight” in place of, and as synonyms for, the terms “obese” and “overweight”, respectively).

III. Health Care

Proper care and management of diabetes are important for two reasons: there is at present no cure for diabetes, and many of the adverse health outcomes associated with diabetes are preventable or can be delayed or minimized with appropriate management and treatment. Most diabetes care must be individualized based on the type and severity of diabetes as well as other patient characteristics. Continuing care is crucial in the management of diabetes, and treatment must be evaluated and modified as necessary. Since the majority of diabetes care is self-care, patient education in self-management is essential. Clinical care should also include an initial evaluation, establishment of treatment goals, development of a management plan, and monitoring and treatment of cardiovascular and other complications.

To ensure quality health care for people with diabetes, the Nebraska Diabetes Prevention and Control Program has spearheaded the development of guidelines to help clinicians provide the most effective care for their patients with diabetes. These guidelines, known as the Nebraska Diabetes Consensus Guidelines, are based largely on the recommended standards of care developed by the American Diabetes Association. The Nebraska Diabetes Consensus Guidelines are presented in Appendix A of this document.

Figure 5. Percentage of Nebraska Adults (Age 18+) with Diabetes Who Have Received Preventive Care Services (2008) and US Year 2010 Targets
(Source: Nebraska Behavioral Risk Factor Surveillance System)



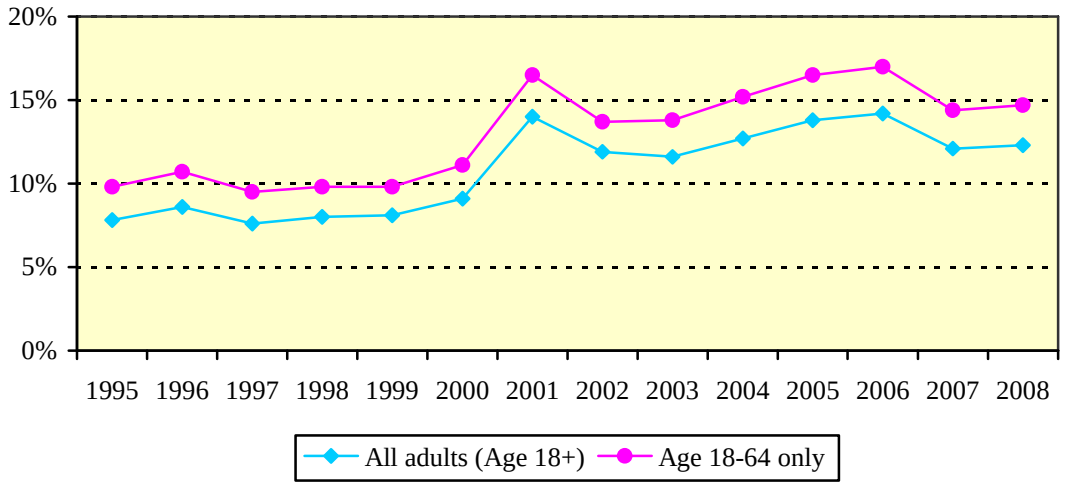
*had within past year
**ever had

In addition to the Nebraska Diabetes Consensus Guidelines, the Division of Diabetes Translation at CDC has developed a set of national objectives that address clinical care for people with diabetes. These objectives include dilated eye exams (recommended annually), A1c measurements (at least two per year), foot exams (annual), influenza vaccination (annual) and pneumococcal vaccination (once). The US Department of Health and Human Services also included these five preventive care services as part of their national objectives for the year 2010, and set specific targets for each one. Data from the 2008 BRFSS show

that Nebraska has already achieved two of the Year 2010 objectives (% of adults with diabetes who have had at least two A1c tests within the past year and % of people 18-64 years old who have had a flu shot within the past year) *(see Figure 5)*. Trends in these data since 2000 suggest that it will be difficult for Nebraska to achieve any of the other national objectives by 2010.

A persistent and growing challenge to providing the recommended level of clinical care to people with diabetes is the increasing number and percentage of people who do not have health insurance. Data from the BRFSS show that, since reaching a decade-low figure of 7.6% in 1997, the proportion of Nebraska adults who do not have health insurance has increased significantly, reaching 12.3% in 2008 (*see Figure 6*). Among adults under the age of 65, the proportion of uninsured is even higher—14.7%. These same figures are 8.1% for all Nebraska adults with diabetes and 13.1% for Nebraska adults with diabetes who are under the age of 65. There are some resources for medical care and treatment that are available to the uninsured in Nebraska, but they can vary widely from place to place and may be facing an increasing struggle to keep up with increasing demand.

Figure 6. Percentage of Nebraska Adults without Health Insurance, 1995-2008
(Source: Nebraska Behavioral Risk Factor Surveillance System)

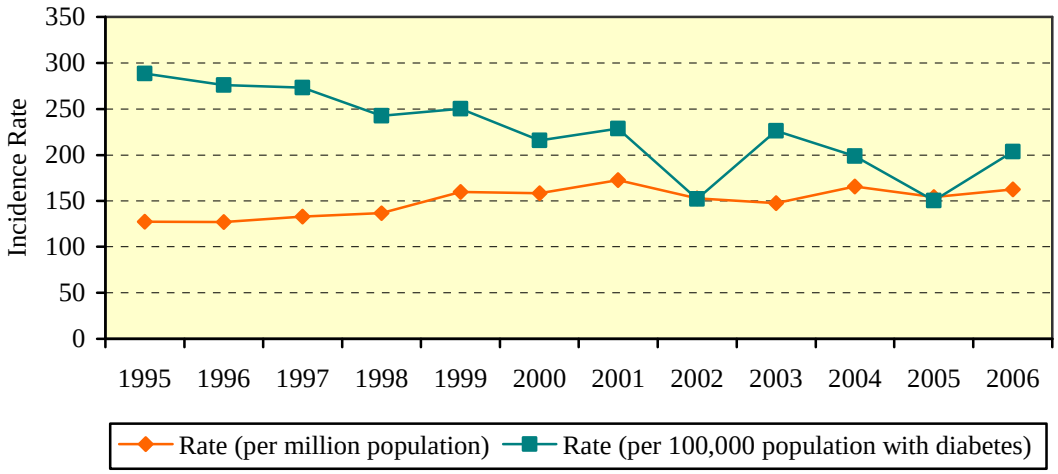


IV. Complications

People with diabetes can experience a number of complications, which can be classified as either acute, long-term, or pregnancy-related. The acute complications of diabetes can occur at any time and can usually be corrected, while the long-term complications may take decades to develop and are often irreversible. The long-term complications of diabetes include cardiovascular disease, microvascular disease, and neuropathy. Microvascular complications include diabetic retinopathy and kidney disease, which if untreated, can lead to blindness and kidney failure (also known as end-stage renal disease, or ESRD). Loss of sensation in the legs and feet due to neuropathy or impeded blood supply can result in peripheral vascular damage that can, in turn, lead to ulcers and amputations of the toes, feet, and legs. Among the acute metabolic complications of diabetes, diabetic ketoacidosis (DKA) is one of the most serious, and can be fatal. DKA is usually confined to people who have Type 1 diabetes, and is the result of insulin insufficiency. A pregnancy complicated by diabetes can have adverse health effects on both the mother and her baby.

Between 2000 and 2006, 1,571 cases of ESRD were diagnosed among Nebraska residents with diabetes. People with diabetes accounted for more than two of every five (43.5%) ESRD cases diagnosed in Nebraska during these years, and people 65 and older accounted for more than half (52.5%) of all new diabetes-related ESRD cases. The number of diabetes-related ESRD diagnoses in Nebraska increased from 162 in 1995 to 246 in 2006, and these numbers translate into incidence rates of 127.3 and 162.6 diagnoses per million population, respectively *(see Figure 7)*. However, when these rates are calculated for just the population that has diabetes, a different trend emerges: the incidence of diabetes-related ESRD in Nebraska declined from 282.2 (diagnoses per 100,000 population with diabetes; age-adjusted to the 2000 US population) in 1995 to 203.7 in 2006 *(see Figure 7)*.

Figure 7. Incidence of Diabetes-Related End-Stage Renal Disease (ESRD) Among Nebraska Residents, 1995-2006
(Source: US Renal Data System)



A large proportion of the cost of diabetes is attributable to inpatient hospital care. During 2006 and 2007, there were 393,475 in-patient hospitalizations in Nebraska (excluding non-Nebraska residents), and 57,346 (14.6%) of them listed diabetes as one of the discharge diagnoses. The average length of stay per diabetes-related hospitalization was 5.0 days, compared to 4.2 days per non-diabetes-related hospitalization. The total length of stay for all diabetes-related hospitalizations was almost 290,000 days. The total charge for all diabetes-related hospitalizations was nearly $1.5 billion, with an average charge of over $26,000, compared to about $19,000 per non-diabetes-related hospitalization. The average cost of a diabetes-related hospitalization was more than double the amount recorded a decade earlier ($12,522, the average for the years 1996-2000), although the average charge for a non-diabetes-related hospitalization increased by a similar rate over the same period.

The number of diabetes-related hospitalizations that occurred in Nebraska during 2006 and 2007 translates into an average annual rate of 151.3 (discharges per 10,000 population; age-adjusted to the 2000 US population), which is an increase from the rate of 110.5 recorded between 1996 and 2000. However, when calculated for just the population with diabetes, these rates change to 206.1 (discharges per 1,000 population with diabetes per year; age-adjusted to the 2000 US population) for the years 1996-2000 and 217.9 for the years 2006-2007.

Over 13,000 of the diabetes-related hospitalizations that occurred in Nebraska during 2006 and 2007—nearly one in four— listed cardiovascular disease (CVD) as the primary (i.e., first-listed) discharge diagnosis. In fact, CVD (which includes both coronary heart disease and stroke) was the most frequent primary discharge diagnosis among diabetes-related hospitalizations. The hospitalization rate for CVD among Nebraska residents who have diabetes has declined in recent years, from 40.8 (discharges per 1,000 population with diabetes per year; age-adjusted to the 2000 US population) during 1996-2000 to 31.8 during 2006-2007.

DKA accounted for 1,031 of the diabetes-related hospitalizations that occurred in Nebraska during 2006 and 2007. DKA accounted for more than one of every four (27.3%) hospitalizations in which diabetes was the primary discharge diagnosis. Almost three-quarters (73.1%) of all DKA hospitalizations involved a person under the age of 45.

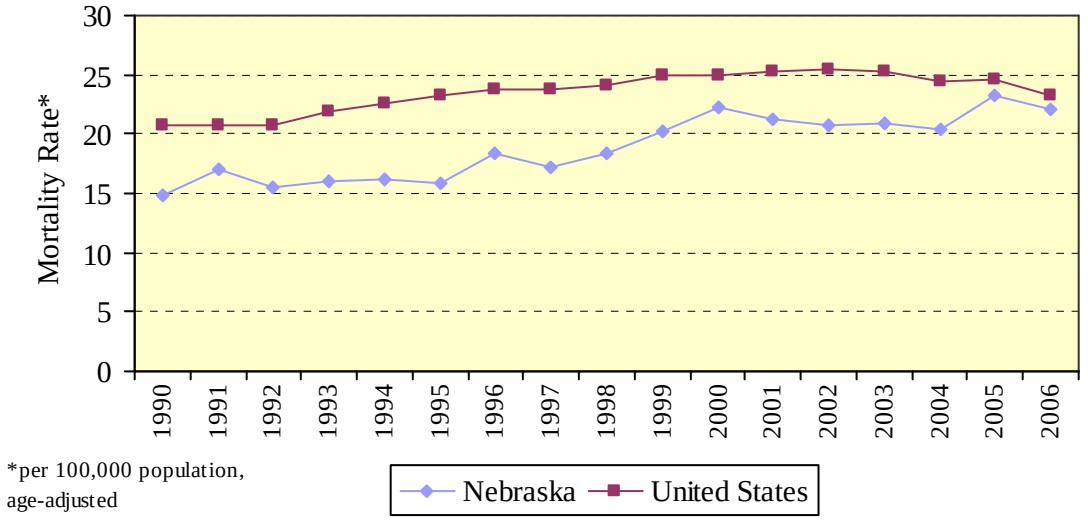
There were 671 lower-extremity amputations (LEAs) performed among Nebraska residents with diabetes during 2006 and 2007, and this number excludes amputations that were the result of trauma. People with diabetes accounted for about 60% of all LEAs that were performed at Nebraska hospitals during these years. People 65 and older accounted for more than half (52.3%) of all diabetes-related LEAs. The average charge per hospitalization that included a diabetes-related LEA was $43,992. The hospitalization rate for LEAs among Nebraska residents who have diabetes has fallen in recent years, from 2.9 (discharges per 1,000 population with diabetes per year; age-adjusted to the 2000 US population) during 1996-2000 to 2.1 during 2006-2007.

V. Mortality

Diabetes has been ranked among the top 10 leading causes of death in the United States since 1932, and it is now the nation's seventh leading cause of death. In recent years, over 70,000 deaths per year throughout the United States have been directly attributed to diabetes, and it has contributed to an additional 230,000 deaths per year. However, since diabetes is listed on the death certificate of less than half of all people who have diabetes at the time of their death, mortality statistics significantly underestimate the impact of the disease. Factors that increase the risk of death for people with diabetes include increasing age, age at onset of diabetes, duration of diabetes, and cardiovascular disease risk factors (smoking, hypertension, high cholesterol, physical inactivity, and obesity).

Between 2000 and 2006, 2,890 Nebraska residents died from diabetes (i.e., diabetes was the underlying, or primary, cause of death listed on their death certificate), making it the state's seventh leading cause of death during these years. The annual number and rate of diabetes deaths in Nebraska increased significantly during the 1990s, but appear to have stabilized during the present decade, with rates consistently lower than the U.S. *(see Figure 8)*. When these rates are calculated for just the population that has diabetes, diabetes mortality in Nebraska has actually declined during the present decade, from 279.7 (deaths per 100,000 population with diabetes; age-adjusted to the 2000 US population) in 2000 to 202.7 in 2006.

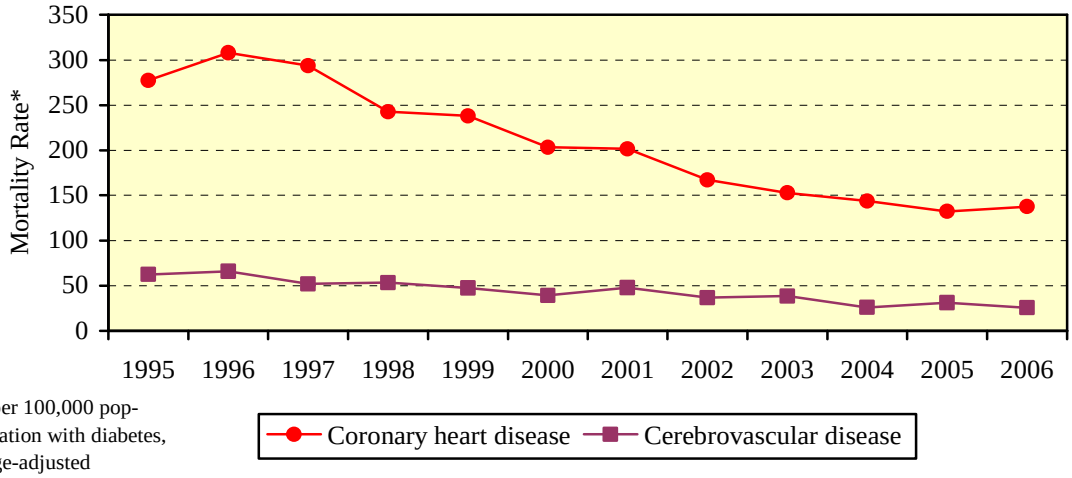
Figure 8. Diabetes Mortality in Nebraska and the United States, 1990-2006
(Source: Nebraska and U.S. vital statistics)



More than three-quarters (79.2%) of Nebraska's diabetes deaths for the years 2000-2006 involved a person 65 years of age or older. Diabetes deaths were more frequent among women than men (by a margin of 1,560 to 1,330), but the mortality risk, as represented by the diabetes mortality rate, was higher for men than for women (24.5 deaths per 100,000 population per year [age-adjusted to the 2000 US population] vs. 19.4). The diabetes mortality rate for the state's African-Americans during 2000-2006 (69.1 deaths per 100,000 population per year, age-adjusted to the 2000 US population) was over three times the rate for non-Hispanic whites (20.7), while the rate for Native Americans (94.7) was almost five times the non-Hispanic white rate. For Hispanics, the diabetes mortality rate (40.2) was almost double the non-Hispanic white rate. However, some of these differences are due to the higher prevalence of diabetes within the African-American, Native American, and Hispanic populations.

In addition to those deaths directly attributed to diabetes, diabetes has contributed to the death of an additional 7,137 Nebraska residents between 2000 and 2006, i.e., diabetes was listed on their death certificate as a contributing, but not the underlying cause of death. Deaths that list diabetes on the death certificate as either the underlying or a contributing cause of death are considered diabetes-related. The diabetes-related mortality rate in Nebraska has increased steadily during the past decade, from 64.0 (deaths per 100,000 population; age-adjusted to the 2000 US population) in 1995 to 72.3 in 2000 to 78.8 in 2006. However, when these rates are calculated for just the population that has diabetes, diabetes-related mortality in Nebraska has actually declined during the past decade, from 811.6 (per 100,000 population with diabetes; age-adjusted to the 2000 US population) in 1995 to 631.4 in 2006. During the years 2000-2006, diabetes-related mortality rates in Nebraska were also higher for African-Americans (175.6 [deaths per 100,000 population per year; age-adjusted to the 2000 US population]), Native Americans (285.4), and Hispanics (104.8) compared to non-Hispanic whites (69.5) and Asian/Pacific Islanders (61.7).

Figure 9. Coronary Heart Disease and Cerebrovascular Disease Deaths in Nebraska Among People With Diabetes, 1995-2006
(Source: Nebraska vital statistics)



Coronary heart disease (CHD) is the leading cause of death among people with diabetes, and 2,742 of the diabetes-related deaths that occurred in Nebraska between 2000 and 2006 listed CHD on the death certificate as the underlying cause of death. During the past decade (1995-2006), annual rates of CHD mortality among Nebraska residents with diabetes have declined significantly, from 277.4 (deaths per 100,000 population with diabetes per year [age-adjusted to the 2000 US population]) in 1995 to 137.6 in 2006 (*see Figure 9*). Like CHD, cerebrovascular disease (better known as stroke) is also the result of atherosclerosis and is related to diabetes, and has also declined significantly in Nebraska during the past decade, from 62.6 (deaths per 100,000 population with diabetes per year [age-adjusted to the 2000 US population]) in 1995 to 25.6 in 2006 (*see Figure 9*). Taken together, CHD and stroke accounted for 28.7% of all diabetes-related deaths in Nebraska in 2006, compared to 46.6% in 1995.