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# The Public Health Burden of Diabetes Mellitus in the United States



## Introduction

Diabetes is a complex, serious, costly, and increasingly common disease (1-4). Diabetes can affect nearly every organ system of the body and is the most frequent cause of blindness among working-age adults; the leading cause of nontraumatic lower-extremity amputation and end-stage renal disease; and a principal cause of congenital malformations, perinatal mortality, premature mortality, and disability. Persons with diabetes are at increased risk for stroke, ischemic heart disease, peripheral vascular disease, and neuropathy. Diabetes is a costly disease in terms of not only the economic burden it imposes on society but also in terms of the human suffering imposed by the disease and its complications. The burden of diabetes and its complications is great, disproportionately affects minority populations and the elderly, and is likely to increase as minority populations grow and the U.S. population becomes older (5-11). Thus, diabetes poses an enormous public health challenge in America.

Public health surveillance of diabetes and its complications is critical for increasing the recognition of the disease, identifying high-risk groups, developing strategies to reduce the economic and human costs of this disease, formulating health care policy, and evaluating progress in disease prevention and control. The Centers for Disease Control and Prevention (CDC) has established an ongoing surveillance system that collects, analyzes, and disseminates national data on diabetes and its complications. The surveillance system uses periodic and representative data from vital statistics, the National Health Interview Survey, the National Hospital Discharge Survey, the National Ambulatory Medical Care Survey, the National Hospital Ambulatory Medical Care Survey, the Behavioral Risk Factor Surveillance System, and the U.S. Renal Data System.

Although they are representative, the data provided by these sources tend to be insufficient for analyzing national trends in diabetes and its complications among most minority populations. This deficiency is unfortunate because data from special surveys and studies reveal that minority populations are disproportionately affected by diabetes (8-11). For example, the 1982-1984 age-adjusted prevalence of diabetes among Puerto Ricans in the New York City area and Mexican Americans in the southwest was more than twice that for non-Hispanic whites (12,13). The 1987 age-adjusted prevalence of diagnosed diabetes among Indian Health Service patients was 2.8 times that for the U.S. population (14). Prevalence among American Indians varies by tribe, and the Pima Indians of Arizona have the highest recorded prevalence (approximately 50% of adults aged  $\geq 35$  years) (15). Furthermore, racial and ethnic minority populations not only are more likely to have diabetes, but also are at greater risk for many of its complications (8-11).

**Table 1.1: United States Resident Population, by Age<sup>a</sup>, 1980.**

Age Group	Total	Whites		Blacks		Other	
		Males	Females	Males	Females	Males	Females
0-4	16457	6923	6571	1248	1228	247	241
5-9	16608	6987	6635	1263	1242	245	237
10-14	18236	7725	7360	1350	1334	238	228
15-19	21104	8971	8634	1503	1506	253	237
20-24	21379	9127	8985	1317	1440	256	254
25-29	19697	8441	8357	1106	1259	254	280
30-34	17753	7650	7663	891	1038	239	272
35-39	14080	6065	6153	671	806	184	199
40-44	11725	5016	5140	572	692	149	156
45-49	11048	4736	4913	519	631	116	133
50-54	11698	5011	5332	508	629	99	119
55-59	11615	4923	5464	470	575	86	97
60-64	10145	4247	4882	389	490	64	74
65-69	8812	3531	4387	334	448	54	59
70-74	6840	2595	3595	236	332	41	40
75-79	4827	1680	2700	154	237	27	29
80-84	2953	937	1784	76	126	12	17
85+	2269	626	1461	54	108	8	13
<b>Total</b>	<b>227,247</b>	<b>95,191</b>	<b>100,017</b>	<b>12,659</b>	<b>14,123</b>	<b>2,573</b>	<b>2,685</b>

<sup>a</sup> In Thousands

## Data Analysis

This report presents data from CDC's diabetes surveillance system. The report contains chapters with figures and tables on diabetes prevalence and incidence, mortality, use of health care services, cardiovascular disease, nontraumatic lower extremity amputation, diabetic ketoacidosis, end-stage renal disease, and disability. In each chapter, the data displayed were limited to specific demographic subgroups for which relatively stable estimates could be obtained. Where possible, we examined trends in diabetes and its complications by age, sex, and race. More than 1 year of data was used for some estimates to improve their precision and reliability. Typically, these estimates were based on 3-year moving averages, where 3 years of data were used to provide an estimate for the middle year. Also, where possible, estimates were provided by state.

In many chapters, we examined the burden of diabetes by using two different methods for calculating rates. First, we calculated rates by using estimates of the resident population of the United States as the denominator. These rates were age-adjusted according to the direct method, and the 1980 U.S. population was the standard (Table 1.1). Second, we calculated rates of diabetes complications and use of health services

by using estimates of the number of persons with diabetes as the denominator. These rates were age-adjusted according to the direct method, and the 1980 U.S. population of persons with diabetes was the standard.

Both types of rates in this report are important but give a different view of the disease. Rates with the U.S. population as the denominator are useful for describing the extent of diabetes and its complications in the whole population. For example, such rates can be used to rank diabetes among the leading causes of death or describe the proportion of the population having diagnosed diabetes. In contrast, rates based on estimates of the number of persons with diabetes as the denominator describe the effect of conditions and complications in the diabetic population rather than in the whole population. By adjusting for the prevalence of diabetes, we can use these rates to compare the risk of mortality and diabetic complications among subgroups of persons with diabetes. For example, such rates can be used to describe the characteristics of persons with diabetes who are at risk for hospitalization, end-stage renal disease, or lower extremity amputation.

This report differs from prior diabetes surveillance reports in three ways. First, most tables have been reformatted so that additional years of data could be accommodated. Second, many chapters contain new tables. Third, with the addition of information on the use of other types of health care services, the chapter on hospitalization now has a broader focus; and its new title, "Use of Health Care Services", reflects this change. Information about the methods used in this report, including the data sources and their limitations, can be found in the Appendix.

## **Results**

### **Prevalence and Incidence**

Diabetes is becoming more common. The number of existing cases (prevalent cases) and new cases (incident cases) of diabetes are increasing and most of this increase is not due to the increasing age of the U.S. population. Trends also show that minority and elderly populations are disproportionately affected by diabetes.

Between 1980 and 1994, the number of persons with diagnosed diabetes increased by 2.2 million, an increase of 39% (Figure 2.1; Table 2.1). In 1994, about 8.0 million persons in the United States (3.1% of the population) reported that they had diabetes mellitus (Figure 2.1; Table 2.8).

Between 1980 and 1994, the age-adjusted prevalence of diagnosed diabetes increased 16% compared with an increase of 21% in the crude prevalence (Figure 2.2; Table 2.8), indicating that less than 25% of the increase in prevalence is due to the aging of the U.S. population. This increase appears to be a recent trend, with about two-thirds of the increase in age-adjusted prevalence having occurred in the 1990s.

The age-adjusted prevalence of diagnosed diabetes was higher among blacks than whites throughout the 1980s and early 1990s and was highest among black females (Figure 2.3; Tables 2.11-2.14). The rate of increase between 1980 and 1994 in age-adjusted prevalence was highest among black males (29% increase) and lowest among white females (9% increase).

The age-specific prevalence of diabetes in 1992-1994 increased with age until age  $\geq 75$  years (Figure 2.4). Prevalence was higher for blacks than for whites in each of the age

groups, and the prevalence of diabetes was highest for black females for all age groups except ages 65-74. Between 1980 and 1994, the largest increase in age-specific prevalence, an increase of 34%, was seen in those aged <45 years (Table 2.8).

Age-adjusted prevalence of diagnosed diabetes among adults in 1994 varied by state and, in general, was lowest in the western states (Figure 2.5; Tables 2.17). Mississippi had the highest age-adjusted prevalence among adults (6.0%), nearly twice the prevalence in Montana (3.1%) which was the lowest prevalence.

The incidence of diabetes increased in the early 1980s, leveled off in the middle of the decade, and then increased sharply in the 1990s (Figure 2.7; Table 2.23). In 1994, the age-adjusted incidence of diabetes (3.51 per 1,000 population) was 49% higher than the incidence in 1980 (2.36 per 1,000 population). In the 1990s, the number of new cases of diabetes averaged 748,000 per year (Figure 2.6; Table 2.18). With these cross-sectional data, it is impossible to determine whether this increased incidence is due to a true increase in disease incidence, increased case ascertainment, or a combination of these factors.

## **Mortality**

### **Mortality in the general population**

Diabetes remains a leading cause of mortality, and deaths are increasing. Increased death rates are seen for all ages and races, and the highest rates are seen in minority populations, and older Americans.

In 1994, diabetes was the 7th leading cause of death in the United States (Table 3.1). When leading causes of death were examined by race, diabetes ranked as the 7th leading cause among whites, blacks, Chinese, and Filipinos; as the 6th leading cause among Japanese; as the 5th leading cause among Hawaiians; and as the 4th leading cause among American Indians (Table 3.2). Regardless of race, diabetes ranked higher as a leading cause of death among females than among males and was the 4th leading cause of death among females who were black, American Indian, Hawaiian, or Filipino. Similar trends are seen among persons of Hispanic origin; diabetes ranked as the 7th leading cause of death overall and as the 4th leading cause of death among females (Table 3.3). Also in 1994, both age-adjusted diabetes death rates (based on diabetes as the underlying cause of death) and diabetes-related death rates (based on diabetes as any listed cause of death) were higher among American Indians, blacks, and persons of Hispanic origin than among whites, with black females having the highest rates (Figures 3.9, 3.10; Tables 3.4, 3.5)

The annual number of deaths for which diabetes was the underlying cause increased from 34,851 in 1980 to 56,692 in 1994 (Figure 3.1; Table 3.8). Throughout most of the 1980s, the age-adjusted diabetes death rate remained relatively constant (Figure 3.2; Table 3.15). However, in 1989 (the year a new standard death certificate was implemented in the United States), the age-adjusted diabetes death rate increased 14% and continued to increase in the 1990s, although at a slower rate (11% increase between 1989 and 1994). By 1994, the age-adjusted diabetes death rate was 27% higher than in 1980 (19.5 per 100,000 vs 15.3 per 100,000, respectively).

The annual number of diabetes-related deaths (deaths for which diabetes was recorded as any cause) increased from 135,931 in 1980 to 182,261 in 1994 (Figure 3.3; Table 3.22). In contrast to the age-adjusted diabetes death rate, the age-adjusted diabetes-

related death rate did not display a large increase in 1989 and only increased 4% between 1980 and 1994 (Figure 3.4; Table 3.29).

Between 1980 and 1994, age-adjusted diabetes death rates and diabetes-related death rates were higher among males than females and male rates increased at a greater rate (Figures 3.5, 3.6; Tables 3.16, 3.17, 3.30, 3.31). Among the four race-sex groups examined (white and black males and females), black females had the highest rates, but the greatest rate of increase was seen for black males (Figures 3.7, 3.8; Tables 3.18-3.21, 3.32-3.35). Among black males, diabetes death rates increased at a greater rate among those aged  $\geq 45$  years and diabetes-related death rates increased at a greater rate among those aged  $\geq 65$  years.

## **Mortality in the diabetic population.**

When the prevalence of diabetes is adjusted for by using estimates of the diabetic population in calculating death rates, differences in diabetes death rates and in diabetes-related deaths rates among whites and blacks decrease notably (Figures 3.20-3.21; Tables 3.43-3.46, 3.50-3.53). This finding indicates that a substantial proportion of the disparity in death rates in the general population resulted from the greater prevalence of diabetes among blacks. Diabetes death rates in the diabetic population remained higher for blacks than for whites, however, and were highest for black males. In 1994, black males also had the highest diabetes-related death rates, crossing over the rates for white males in the early 1990s.

In contrast to age-adjusted diabetes death rates in the general population that increased 27% between 1980 and 1994, corresponding death rates in the diabetic population only increased 11% (Figure 3.14; Table 3.40). Similarly, in contrast to diabetes-related death rates in the general population that increased 4% between 1980 and 1994, corresponding death rates in the diabetic population actually decreased 9% (Figure 3.15; Table 3.47), indicating that diabetes-related deaths are declining among persons with diabetes.

Age-adjusted diabetes death rates in both the general population and the diabetic population increased in 1989, which may be attributed, in part, to the 1989 revision of the U.S. Standard Death Certificate (16). However, the continued increase in diabetes death rates in the general population after 1989 compared with the lack of increase in the diabetes death rates among the diabetic population, suggests that the increasing prevalence of diabetes explains the increasing rates in the general population.

## **Use of Health Care Services**

The use of health care services by persons with diabetes is high (17,18) and a large proportion of the cost of diabetes has been attributed to inpatient hospital care (2). As the number of persons with diabetes increases, the health care services used by persons with diabetes also will increase.

### **Inpatient hospital care.**

In 1994, there were 502,000 hospital discharges with diabetes as the primary diagnosis (i.e., first-listed diagnosis)(Figure 4.1; Table 4.3) and 3.5 million diabetes-related discharges (i.e., discharges listing diabetes as one of seven discharge diagnoses)(Figure 4.2; Table 4.5). Diabetes-related discharges accounted for 24.7 million days of hospital stay.

Among persons with diabetes, the age-adjusted hospital discharge rates with diabetes as the primary diagnosis and the average length of stay of these discharges began decreasing in 1983 (the year Medicare's prospective reimbursement system was implemented) but leveled off in the 1990s (Figure 4.8; Tables 4.4, 4.21). These hospital discharge rates were highest among persons aged <45 years. This age group also had the lowest rate of decrease between 1980 and 1994 (a 32% decrease for those aged <45 years and about a 47% decrease for those aged ≥45 years)(Figure 4.10; Table 4.21). Between 1980 and 1994, the decrease in age-adjusted discharge rates per 1,000 diabetic population was greater among whites (54%) than among blacks (42%)(Figure 4.11; Tables 4.24, 4.27) and greater among white females (58%) than among white males (49%)(Tables 4.25, 4.26).

Although hospital discharge rates for diabetes as the primary diagnosis were highest among persons aged <45 years, rates of diabetes-related hospital discharges per 1,000 diabetic population increased with age (Figure 4.12; Table 4.28). In contrast to the trends in the discharge rates based on diabetes as the primary diagnosis, trends in the age-adjusted rates of diabetes-related discharges were less clear. The diabetes-related discharge rates per 1,000 diabetic population increased in the early 1980s, decreased in 1985, increased in the late 1980s, and leveled off in the 1990s (Figure 4.9; Table 4.28). For persons aged ≥65 years, diabetes-related hospital discharge rates increased by about 25% between 1980 and 1994, while rates for persons aged <45 years decreased by 13% (Figure 4.12; Table 4.28). Among those aged <45 years, black males were the only race-sex group whose rates increased (Tables 4.31-4.34). Overall, black males also had the highest increase in diabetes-related hospital discharges, with a 27% increase in age-adjusted rates (Figure 4.13; Tables 4.31-4.34).

## **Physician contacts**

In 1993, persons with diabetes reported that they made almost 121 million contacts with physicians (Figure 4.14; Table 4.35), averaging 15.9 contacts per person (Figure 4.15; Table 4.42). About half of these contacts (63 million) were office visits to physicians and averaged 8.3 visits per person (Figures 4.16; Tables 4.49, 4.52). The age-adjusted average number of physician contacts and physician office visits per person were higher among females (17.1 contacts and 9.9 visits) than among males (14.3 contacts and 6.8 visits)(Tables 4.43, 4.44, 4.53, 4.54). Between 1980 and 1993 the age-adjusted number of physician contacts and office visits per person increased at a greater rate among females (increase of 36% in contacts and 46% in office visits) than among males (increase of 9% in contacts and 13% in office visits).

In 1993, physicians reported diabetes as one of three diagnoses recorded in a total of 23.4 million office-based visits by ambulatory patients (Figure 4.19; Table 4.55). Persons with diabetes averaged 3.1 ambulatory, office-based visits per person (Figure 4.20).

## **Hospital outpatient visits**

In 1992, diabetes was recorded as one of three diagnoses for almost 2.2 million hospital outpatient visits (Table 4.58). Rates of hospital outpatient visits were lowest in persons aged ≥65 years(Figure 4.21). This was true regardless of sex, but females had much higher rates of hospital outpatient visits than males (37.5 vs 19.2 per 100 persons with diabetes) (Figure 4.22; Table 4.58).

## **Emergency room visits**

In 1992, diabetes was recorded as one of three diagnoses for 887,000 emergency room visits (Table 4.59). About 12% of persons with diabetes had a diabetes-related emergency room visit and the highest rate of visit was among persons aged <45 years who had more than twice the rate of the two older age groups (Figure 4.23).

## **Cardiovascular Disease**

Major cardiovascular disease (CVD) is a significant cause of morbidity and mortality among persons with diabetes (19,20). Although death rates for CVD have declined in the last 15 years, hospital discharges for this disease continue to increase.

### **Mortality**

In 1994, about 44% of all diabetes-related deaths had CVD listed as the underlying cause of death (n=80,271)(Figure 5.1; Table 5.1). Of the deaths attributed to CVD, 59% (n=47,379) were caused by ischemic heart disease (IHD), and 15% (n=11,873) by stroke (Figure 5.1; Tables 5.1, 5.8, 5.15).

Between 1980 and 1994, age-adjusted death rates for CVD declined 28% (from 1,311.8 to 938.7 per 100,000 persons with diabetes)(Figure 5.2; Table 5.1). Similarly, age-adjusted death rates for IHD and stroke declined 33% and 39%, respectively (Tables 5.8; 5.15). The decline in death rates for CVD, IHD, and stroke were apparent among all ages but decreased the least among persons aged <45 years (Figure 5.3; Tables 5.1, 5.8, 5.15). Among the four race-sex groups examined, white males had the largest decrease in age-adjusted death rates for CVD, IHD, and stroke but also had the highest CVD and IHD death rates (Figure 5.4; Tables 5.4-5.7, 5.11-5.14, 5.18-5.21). Black males had the smallest decrease in death rates for CVD, IHD, and stroke.

### **Inpatient hospital care**

In 1994, about 33% of all diabetes-related hospital discharges had CVD as the primary discharge diagnosis (n=1,144,000)(Figure 5.5; Table 5.22). Age-specific rates of hospital discharge for CVD, IHD, and stroke increased with age; persons aged >75 years were almost 10 times as likely to be hospitalized for CVD in 1994 as persons aged <45 years (Figure 5.7; Tables 5.22, 5.26, 5.30).

Age-adjusted rates of hospital discharge for CVD, IHD, and stroke as the primary diagnosis among persons with diabetes increased between 1980 and 1994, and CVD had the largest increase ( 41%) (Figure 5.6; Tables 5.22, 5.26, 5.30). The rate of increase in age-adjusted rates of hospital discharge for CVD, IHD, and stroke were greater among blacks than among whites (Figure 5.8; Table 5.25, 5.29, 5.33).

## **Nontraumatic Lower Extremity Amputation**

Lower extremity disease is more common among persons with diabetes than among persons without the disease (21,22). More than half of all nontraumatic lower extremity amputations (LEAs) occur in persons with diagnosed diabetes, who represent only 3% of the U.S. population (23). This report shows that LEA remains a significant complication for persons with diabetes and that blacks and the elderly are disproportionately affected.

Between 1990 and 1994, the number of diabetes-related hospital discharges with LEA as a reported procedure averaged 56,000 per year (Figure 6.1; Table 6.1). In 1994, these discharges accounted for 984,000 days of hospital stay, for an average length of stay of 14.7 days (Figure 6.2; Table 6.1). Between 1980 and 1994 the average length of stay for LEA discharges decreased almost 60% (from 35.8 days to 14.7 days).

The age-adjusted rate of hospital discharge with LEA was relatively stable from 1980 to 1982, increased 46% in 1983 (the year Medicare's prospective reimbursement system was implemented), and then leveled off (Figure 6.3; Table 6.4). LEA rates increased with age (Figure 6.4; Table 6.4), and 55% of diabetes-related amputations occurred among persons aged  $\geq 65$  years. Age-adjusted LEA rates were higher among males than among females (Figure 6.5; Table 6.5) and among blacks than whites (Figure 6.6; Table 6.6).

## Diabetic Ketoacidosis

Diabetic ketoacidosis (DKA) is an acute metabolic complication of diabetes that is related to a deficiency in insulin (24). DKA may require hospitalization for treatment and increases the use of health care services and the cost of diabetes. This report finds that DKA continues to be more problematic for blacks than for whites.

### Inpatient hospital care.

In 1994, DKA was the primary diagnosis for 89,000 hospital discharges and a listed diagnosis for 113,000 hospital discharges (Figure 7.1; Tables 7.1, 7.4). The average length of stay for a primary diagnosis of DKA increased with age (Figure 7.2), decreased more than 40% between 1980 and 1994, and averaged 4.5 days in 1994 (Figure 7.2; Table 7.1).

Age-adjusted rates of hospital discharge for DKA as the primary diagnosis and as a listed diagnosis per 1,000 persons with diabetes increased from 1980 to 1984 and decreased thereafter (Figure 7.4, Tables 7.13, 7.16). Hospital discharge rates for DKA decreased with age (Figure 7.5; Table 7.13, 7.16). In 1994, the hospital discharge rate for DKA as the primary diagnosis was more than 20 times higher for persons aged  $<45$  years than for persons aged  $\geq 65$  years.

Hospital discharge rates for DKA were similar for males and females (Figure 7.6; Table 7.14, 7.17) but higher for blacks than for whites (Figure 7.7; Tables 7.15, 7.18). In 1994, the age-adjusted rates of hospital discharge for DKA as the primary diagnosis among blacks was 2.3 times that of whites (15.7 vs 6.8 per 1,000 diabetic population). Trends over time also differed, with blacks having higher rates in 1994 than in 1980 and whites having lower rates in 1994 than in 1980.

### Mortality

The number of deaths with DKA as the underlying (DKA deaths) and any listed cause of death (DKA-related deaths) varied little between 1980 and 1994 (Figure 7.8; Tables 7.19, 7.26). Age-adjusted death rates per 100,000 diabetic population for DKA and DKA-related deaths declined between 1980 and 1987, increased in 1988 and 1989, and then began decreasing once more in 1990 (Figure 7.10; Table 7.33, 7.40). Overall,

both the age-adjusted DKA death rate and the DKA-related death rate were 34% lower in 1994 than in 1980.

The highest DKA death rates were among persons aged  $\geq 75$  years, followed by persons aged  $< 45$  years (Figure 7.11; Table 7.33). Among the four race-sex groups examined, DKA death rates were highest among black males, followed by black females and then by whites (Figure 7.12; Tables 7.36-39). In 1994, the age-adjusted DKA death rate for black males was almost twice that for white males (37.9 vs 20.3 per 100,000 diabetic population). Similar trends are seen in DKA related death rates (Tables 7.43-7.46).

## End-Stage Renal Disease

Diabetes is the leading cause of end-stage renal disease, i. e., kidney failure requiring dialysis or kidney transplant for survival (25,26). Diabetes accounts for more than a third of all new cases in the United States and persons with diabetes are the fastest growing group of recipients for kidney dialysis or transplantation.

The number of new cases of end-stage renal disease attributable to diabetes (ESRD-DM) increased from 7,017 in 1984 to 19,013 in 1993 (Figure 8.1; Table 8.1). Between 1984 and 1993, the age-adjusted incidence of ESRD-DM per 100,000 persons with diabetes more than doubled (from 118.0 to 249.2) (Table 8.20). This increase represents an underestimate because an unexplained undercount of ESRD incidence occurred in 1993 (26).

The age-adjusted incidence of ESRD-DM per 100,000 persons with diabetes was greater for blacks than for whites (Figure 8.4). In 1994, the incidence among black males was more than twice the incidence among white males (511.6 vs 220.4) and among black females was more than twice that among white females (439.1 vs 184.0) (Figure 8.4; Tables 8.23-8.26).

The rate of increase in ESRD-DM incidence per 100,000 persons with diabetes increased with age (Figure 8.5; Table 8.20). Between 1984 and 1993, incidence increased 5% for persons aged  $< 45$  years, more than 100% for persons aged 45-64 years, more than 200% for persons aged 65-74 years, and more than 300% for persons aged  $\geq 75$  years. Although persons with diabetes aged  $< 45$  years had the highest incidence in 1984, by 1993 persons aged 45-74 had higher rates than those aged  $< 45$  years.

These surveillance data do not let us determine whether this increase in ESRD-DM among persons with diabetes is due to increased incidence of disease, increased use of treatment, increased recognition of the etiologic role of diabetes in ESRD, or a combination of these factors.

## Disability

Rates of disability are substantially higher among persons with diabetes than among persons without this disease (27). The consequences of disability among persons with diabetes include increased use of health care services, unemployment, work absenteeism, and decreased quality of life. Although this report finds little change in rates of limitation of activity between 1980 and 1994, the absolute number of persons with

diabetes who were limited in activity increased.

Approximately half of all persons with diabetes (4.1 million in 1994) reported that they were limited in activity (Figure 9.1; Table 9.1) and more than 60% attributed their limitation to diabetes (Table 9.8). Overall, the age-adjusted rate of being limited in activity varied little between 1983 and 1994 (Table 9.1), but the number of persons who were limited increased from 3.1 million in 1983 to 4.1 million in 1994. In general, age-adjusted rates of being limited in activity were higher for blacks than for whites and higher for females than for males (Figure 9.2; Tables 9.4-9.7).

In 1994, 39% of persons with diabetes reported being limited in their major activity (Table 9.11), and 23% reported being unable to perform this activity (Table 9.16). Between 1983 and 1994, differences by race in the age-adjusted prevalence of being limited in major activity and in being unable to perform major activity decreased (Figures 9.3, 9.4; Tables 9.14, 9.15, 9.19, 9.20).

In the 1990s, the number of restricted-activity days among persons with diabetes averaged 39 days per year; 18 of which were bed days (Tables 9.25, 9.30). The average number of restricted-activity days and bed days were greater among blacks than among whites (Figure 9.7; Tables 9.28, 9.29, 9.33, 9.34).

## Conclusions

Diabetes is a common disease. In 1994, over 8 million people in the United States (3.1% of the population) had been diagnosed with this disease. Between 1980 and 1994, diabetes became more common. The number of persons with diagnosed diabetes increased by 2.2 million and in the 1990s the number of new cases averaged 748,000 per year. Between 1980 and 1994, the age-adjusted prevalence of diabetes increased by 16% and the age-adjusted incidence increased by 49%. Most of the increase in both prevalence and incidence occurred in the 1990s. It is unknown whether the increased incidence of diabetes is due to increased incidence of disease, increased disease ascertainment, or both. Regardless of the reasons for the increase, effective intervention strategies are urgently needed for the primary prevention of diabetes. Currently, clinical trials are under way to determine whether type 2 diabetes (the most prevalent form of diabetes, accounting for 90%-95% of diabetes) and type 1 diabetes can be prevented.

In addition to being a common disease, diabetes is a complex, serious, and costly disease. Diabetes can effect nearly every body organ. Microvascular (e.g., kidney) and macrovascular (e.g., IHD) complications are common and can be devastating. In 1994, diabetes was the 7th leading cause of death in the United States and contributed to the deaths of over 182,000 persons. In 1994, diabetes also contributed to 3.5 million hospital discharges, and about half of all persons with diabetes reported being limited in activity. Furthermore, between 1980 and 1994 diabetes has become increasingly more serious and costly in terms of death, human suffering and disability, and use of health care services. Between 1980 and 1994, diabetes-related deaths per year increased from about 136,000 deaths to about 182,000 deaths. Hospitalizations increased from 2.2 million discharges to 3.5 million discharges. Hospitalizations for diabetes-related amputations increased from 36,000 to 67,000. New cases of ESRD-DM increased from about 7,000 cases to more than 19,000 cases. Persons with diabetes who were limited in activity increased from 3.1 million persons to 4.1 million. Hospital discharges for CVD increased from 573,000 to more than 1.1 million.

Major CVD accounted for a large proportion of diabetes-related deaths (44%) and diabetes-related hospitalizations (33%). Although there have been no long-term clinical trials of the effect of cardiovascular risk factor reduction on morbidity and mortality in the population with diabetes, it is possible that a substantial proportion of mortality and morbidity related to diabetes could be prevented by reducing or preventing cardiovascular risk factors. Furthermore, a recent study provided the first evidence from a clinical trial that lowering cholesterol reduces the risk of recurrent myocardial infarction among persons with a history of diabetes and coronary heart disease (28). Other efforts to reduce CVD among persons with diabetes should promote exercise, weight control, smoking prevention and cessation, hypertension prevention and blood pressure control, lipid and glycemic control, and elimination of barriers to preventive care and treatment.

Diabetes is the leading cause of renal failure, accounting for more than one-third of all new cases (26). In 1993, diabetes was responsible for more than 19,000 new cases of ESRD, and the rate of new cases doubled between 1984 and 1993. In addition to the intervention efforts outlined above for reducing CVD, annual monitoring for early markers of renal disease should be undertaken to prevent or slow the progression of ESRD.

Minority populations share a disproportionate burden of diabetes compared to the majority population (8-11). Blacks and other racial/ethnic minorities are more likely than whites to develop diabetes and to be at greater risk for many of the complications of the disease. Blacks, American Indians, and persons of Hispanic origin had higher diabetes death rates than whites. Compared with whites, blacks had higher rates of hospital discharges with diabetes and DKA as the primary diagnoses, DKA death rates, hospital discharges involving an LEA, ESRD-DM incidence, and disability. Whether this increased risk of mortality and complications among minority populations reflects more severe disease, barriers to health care services (including preventive care services), or a combination of these and other factors remains undetermined. Our surveillance data and other data sources highlight the need to intensify prevention efforts among blacks, Hispanics, American Indians, and other minorities who disproportionately suffer from the burden of diabetes and its complications.

Diabetes is a common, complex, serious, and costly disease. The human suffering and economic burden of diabetes on the U.S. population is substantial and growing. Many Americans are affected by diabetes, by either having the disease themselves or a friend or loved one with the disease. The human suffering caused by diabetes may be reduced by effective, targeted interventions. This report has tracked and identified trends in diabetes and its complications. These public health surveillance data will provide vital information to formulate an effective public health response.

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