

Chapter 27

Diabetes-Related Hospitalization and Hospital Utilization

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SUMMARY

Based on the National Hospital Discharge Survey (NHDS), ~2.8 million hospitalizations in 1990 listed diabetes as one of the discharge diagnoses, accounting for 24.5 million hospital days. The most frequently listed primary diagnosis in these hospitalizations was diseases of the circulatory system (33%), followed by diabetes (15%). Diabetes was the primary discharge diagnosis for ~420,000 hospitalizations. Of all discharges in which diabetes was listed as a diagnosis in the NHDS, the proportion represented by diabetes as the primary diagnosis declined from 29% in 1980 to 15% in 1990. The decrease may be largely due to Medicare's implementation of a prospective payment system with diagnosis-related groups (DRGs) for reimbursement and to more strict hospital admissions criteria for persons with diabetes. The number of hospital discharge records that listed diabetes as one of the discharge diagnoses increased 12% during 1980-84 and remained relatively stable in 1984-90. In the 1990 NHDS, the number of discharges with diabetes as any listed diagnosis per 100 estimated persons with diabetes increased with age, from 29.4 per 100 at age <44 years to 76.6 per 100 at age ≥75 years. The age-adjusted number of hospitalizations per 100 people with diabetes, for diabetes as any listed diagnosis, increased 11.7% during 1980-90.

Based on the 1989 National Health Interview Survey (NHIS), in which a special questionnaire on diabetes was administered, 23.8% of all adults with diabetes reported being hospitalized in the previous year. This increased with age from 19.8% at age 18-34 years to 29.6% at age ≥75 years. For all adults, persons with diabetes were three times more likely to report being

hospitalized in the previous year than persons without diabetes (23.8% versus 7.8%). Among persons with non-insulin-dependent diabetes mellitus (NIDDM), those treated with insulin were 40%-80% more likely to report having been hospitalized at least once in the past year than persons with NIDDM who were not treated with insulin. For subjects with insulin-dependent diabetes mellitus (IDDM) age 18-44 years, 17.2% reported being hospitalized at least once in the previous year. The proportion of diabetic women who reported being hospitalized in the past year was similar to the proportion of diabetic men. There were few differences among whites, blacks, and Mexican Americans in the proportion who reported being hospitalized. Having complications of diabetes was clearly associated with hospitalization. The proportion of diabetic adults who were hospitalized at least once in the past year increased consistently from 12.0% for persons reporting no complications to 33.7% for persons reporting ≥3 complications. Multiple hospitalizations were common. Of all adults with diabetes, 15.5% reported one hospitalization, 5.4% reported two hospitalizations, and 2.9% reported ≥3 hospitalizations. The proportion who reported ≥2 hospitalizations was similar for adults with IDDM (8.4%), insulin-treated NIDDM (9.4%), and NIDDM not treated with insulin (7.6%).

Average length of stay (LOS) in the hospital was similar for data from the NHDS and the NHIS. For diabetes as the primary diagnosis in the 1990 NHDS, average LOS was 7.8 days; for diabetes as any listed diagnosis, average LOS was 8.6 days. In the 1989 NHIS, average LOS was 8.3 days.

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INTRODUCTION

Persons with diabetes use health care services more frequently than persons without diabetes. This higher rate of use is related to treatment and metabolic control as well as to micro- and macrovascular complications associated with diabetes. This chapter uses national survey data to describe rates and trends of diabetes-associated hospitalization and factors associated with self-reported hospitalization among persons with diabetes.

SOURCES OF DATA

NATIONAL HOSPITAL DISCHARGE SURVEY

The NHDS is conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). NHDS has operated continuously since 1965 and collects data on a sample of hospital discharges from a sample of short-stay, nonfederal hospitals in the United States. For example, in 1990, data were abstracted from the medical records of ~266,000 patients discharged from 474 short-stay nonfederal hospitals¹. This sample of discharges represented ~1% of all discharges from short-stay, nonfederal hospitals in the United States in 1990. Data collected include information on patients' age, race, sex, and LOS, up to seven diagnoses (one primary and up to six secondary diagnoses), and up to four surgical procedures. Medical data are coded according to the *International Classification of Diseases, 9th Revision, Clinical Modification (ICD9-CM)*².

This chapter presents data previously published by the CDC³ based on the 1980-90 NHDS for hospitalizations in which diabetes (ICD9-CM code 250) was listed as the primary (first-listed) diagnosis and as the primary and/or secondary (any listed) diagnosis. Certain other conditions listed on these hospital discharges were ascertained by their ICD9-CM codes: diabetic ketoacidosis (DKA), 250.1; diseases of the circulatory system, 390-459; stroke, 430-434 and 436-438; ischemic heart disease (IHD), 410-414; major cardiovascular disease, 360-448; diseases of the respiratory system, 460-519; digestive system, 520-579; diseases of the genitourinary system, 580-629; injury and poisoning, 800-999; and lower extremity non-traumatic amputations, procedure code 84.1. Data on the sampled discharges were extrapolated by statistical techniques to represent all U.S. discharges.

Hospital discharge rates based on the NHDS were calculated by dividing the estimated number of U.S. hospitalizations listing diabetes by the estimated number of persons in the United States who have diagnosed diabetes³. Estimates of the prevalence of diabetes were derived using self-reported data from the 1980-90 NHIS.

LIMITATIONS OF HOSPITAL DISCHARGE DATA

■ Underreporting of Discharges of People with Diabetes

Some have questioned the validity of hospital discharge data to assess the burden of hospitalization associated with diabetes. Of all hospitalizations of people with diabetes, it is estimated that ~40% do not have diabetes listed on their hospitalization discharge record⁴. This finding is based on the First National Health and Nutrition Examination Survey Epidemiologic Follow-up Survey (NHEFS), in which 389 people with diagnosed diabetes in 1971-75 were studied again in 1982, and information was obtained from the hospitals they were patients at during the 10-year period. The authors concluded that if hospital discharge records are used to identify hospitalizations of persons with diabetes, the health care burden associated with hospitalizations may be underestimated by 40%. This estimate presumes that every hospitalization for diabetic persons should have diabetes listed as a comorbid diagnosis. In the NHDS, the purpose of coding secondary diagnoses is to record "all diagnoses that affect the current hospital stay"⁵. It is not unreasonable to assume that persons with diabetes may be hospitalized for reasons unrelated to their diabetes. During a 6-year followup in 1975-80 (prior to introduction of the Medicare prospective payment system) of a cohort of diabetic patients in Rochester, MN, 74% of hospitalizations of patients with IDDM were considered to be related to diabetes⁶. For persons with NIDDM, nearly 40% of hospitalizations were considered to be related to diabetes.

Some studies of hospital discharges use only discharges in which diabetes was listed as the primary diagnosis. Only a portion of NHDS hospital discharges that list diabetes classify it as the primary diagnosis. This proportion declined from 29% in 1980 to 15% in 1990. Thus, analyses based on diabetes as the primary discharge diagnosis in the 1990 NHDS will include only ~15% of all hospitalizations that listed diabetes.

■ Coding Bias

The conclusion from the NHEFS study⁴ suggests there is coding bias in listing diabetes as an associated comorbid condition in hospital discharge records. Bias in the coding of hospital discharge data has been evaluated⁷⁻⁹. One study found that there is a bias in coding comorbid conditions on hospital discharge records, particularly for chronic conditions such as diabetes and hypertension, but the bias is most often observed for patients who die in the hospital⁸. Coding bias was independent of the number of coding spaces on the discharge abstract. In another study, the diagnoses and procedures listed on the original discharge abstract were compared with those listed on a re-abstract of the same record, and the effect of additional coding spaces on coding of comorbid conditions was assessed⁹. It was found that chronic diagnoses tended to be dropped when abstracts were truncated to fewer than five coding spaces because acute complications take precedence. Diabetes tended to be underreported in patients who died, compared with those who survived; sensitivity of the original abstraction was 58% for patients who died in the hospital, compared with 83% for those who survived⁹.

■ Race Classification

Race-specific discharge data derived from the NHDS are particularly problematic because a substantial proportion of discharges are missing racial classification. In 1990, race was unknown for 20% of all hospital discharges in the NHDS¹. The reliability and validity of race coded on hospital discharge data in New York state has been assessed¹⁰. For discharges in which race was known, race misclassification was relatively uncommon and nondifferential. However, this study did not assess whether there was variation by race/ethnicity in the initial assignment of persons to the categories of "race unknown" and "race not specified."

■ Multiple Hospitalizations

Since the NHDS is a sample of hospital discharges and not individuals, NHDS hospital discharge rates for diabetes-related diseases and procedures do not reflect rates per person; that is, persons who are hospitalized more than once for the same condition are counted more than once when NHDS data are used. This may be particularly true for DKA, as one study reported that 36% of DKA-associated hospitalizations occurred among persons who had at least one previous admission for DKA during a 3-year period¹¹. Based on the 1989 NHIS (see Appendix 27.7), multiple hospital admissions in a year were reported by 8.3% of adults with diagnosed diabetes and single

admissions by 15.5%.

■ Medicare Changes

It is important to note that in 1983 Medicare instituted a prospective payment system that influenced hospitalization practices and disease reporting on hospital discharge records. In addition, increased enrollment in health maintenance organizations, increased cost sharing, and mandatory second-opinion programs for elective procedures may have influenced hospitalization rates for privately insured patients¹². However, findings from a community-based study in Olmstead County, MN suggested that the impact of prospective payment on hospital average LOS for a variety of chronic diseases in 1980 versus 1987 may be offset by increases in the probability of re-hospitalization of the elderly¹³.

NATIONAL HEALTH INTERVIEW SURVEY

The NHIS is an annual cross-sectional household interview survey of a representative sample of ~120,000 people in the U.S. civilian, noninstitutionalized population. It has been conducted annually by the NCHS since 1957. The survey has a multistage probability design, and its methods and quality control have been described¹⁴⁻¹⁶. The survey provides information on the health of the U.S. population, including information on the prevalence and incidence of disease, extent of disability, and use of health care services.

Interviews are conducted by trained interviewers from the U.S. Census Bureau and response rates have been 95%-98%. The NHIS includes a core questionnaire that remains unchanged from year to year and additional questionnaires on special health topics that vary annually. The core questionnaire includes questions about demographic characteristics, hospitalization, disability, and physician visits, among other topics. Questions about hospitalization include whether respondents were overnight patients in a hospital during the past year, how many times they were hospitalized in the past year, and how many nights they were in the hospital for each hospitalization. Hospitalizations for deliveries have been excluded from the data presented in this chapter.

In 1989, the total interviewed sample age ≥ 18 years for the basic questionnaire was 84,572 persons from 45,711 households¹⁷. All adults age ≥ 18 years who were known to have diabetes were ascertained, and a special questionnaire on diabetes was administered. In this questionnaire, physician-diagnosed diabetes was verified and information was obtained on diagno-

sis of diabetes, duration of diabetes, use of insulin and oral agents, medical care, and personal health practices. IDDM was defined as body mass index ≤ 27 for men and ≤ 25 for women, age at diagnosis ≤ 30 years, and continuous insulin treatment since diagnosis¹⁸. Approximately 5% of subjects were classified as IDDM by these criteria. All other persons with physician-diagnosed diabetes were considered to have NIDDM¹⁸.

LIMITATIONS OF INTERVIEW DATA

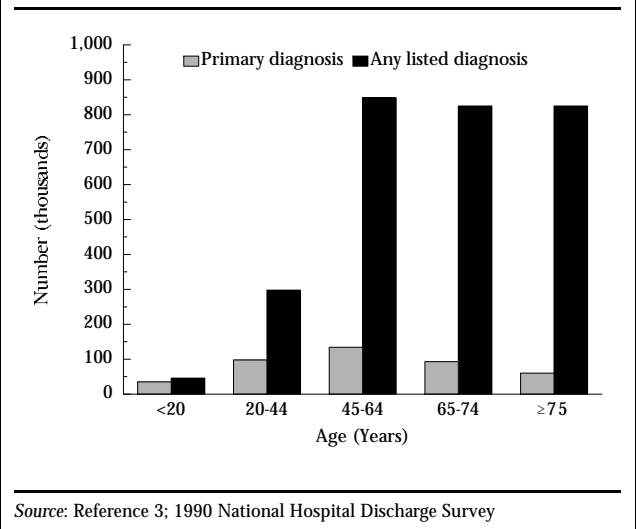
Definitive studies have not been performed to assess the accuracy and completeness of answers to questions about hospitalization. It is possible that respondents to the 1989 NHIS may have over- or underestimated the frequency of hospitalizations in the past year. The validity of a self-report of diabetes has been evaluated. A number of studies indicate excellent agreement between self-report and medical records concerning a person's diabetes status¹⁹⁻²³. Further, a study of the Rochester, MN population found that almost all persons with diagnosed diabetes met National Diabetes Data Group criteria for diabetes²⁴. The NHIS has had response rates to the core questionnaire of 95%-98% over the years of this survey. However, a proxy respondent, who is generally a spouse or other responsible household adult, answers questions in the core questionnaire for sample persons not available at the time of the interview or who are unable to answer for themselves (e.g., children, the very elderly, those who are mentally incompetent). In 1989, for persons identified to have diabetes, 78% responded for themselves to the core questionnaire and the remaining 22% had information provided by a proxy respondent¹⁸. For the diabetes supplemental questionnaire, nonresponse was 4.5%, and all persons responded for themselves (no proxy response was allowed)¹⁸.

HOSPITAL DISCHARGE DATA

1990 HOSPITAL DISCHARGE DATA

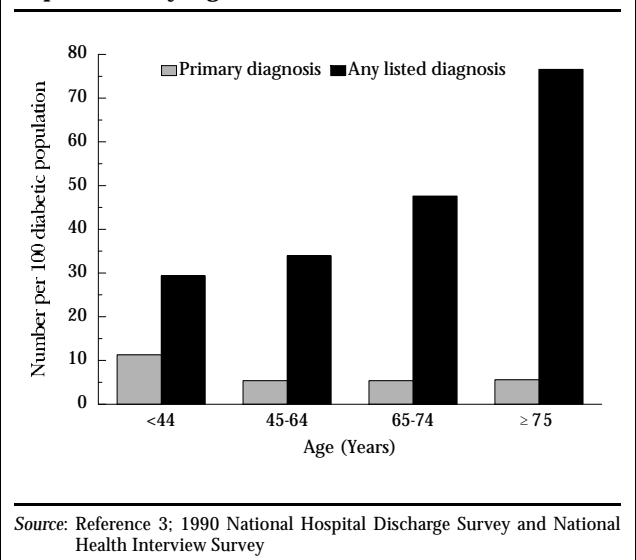
Based on the NHDS, there were ~420,000 hospitalizations in the United States in 1990 that recorded diabetes as the primary diagnosis on the hospital discharge record³. In ~2.8 million hospitalizations, diabetes was recorded as a primary or secondary (any listed) diagnosis; these hospitalizations accounted for 9% of all hospitalizations in the United States and 24.5 million hospital days³. Numbers and rates of discharges that listed diabetes varied by age. About 68% of NHDS hospitalizations in 1990 with diabetes as primary diagnosis occurred in persons age ≥ 45 years (Figure

Figure 27.1
Number of Hospital Discharges with Diabetes as Primary or Any Listed Diagnosis, by Age, U.S., 1990



27.1). For hospitalizations with diabetes as any listed diagnosis, 89% were for persons age ≥ 45 years. The hospital discharge rate for diabetes as the primary diagnosis (computed as the number of discharges with diabetes as primary diagnosis per 100 estimated persons with diabetes) was more than two times greater for persons age < 45 years than for older age groups (Figure 27.2). The hospitalization rate for diabetes as any listed diagnosis increased with age and was 1.6-2.6 times greater for persons age ≥ 75 years, compared with younger age groups.

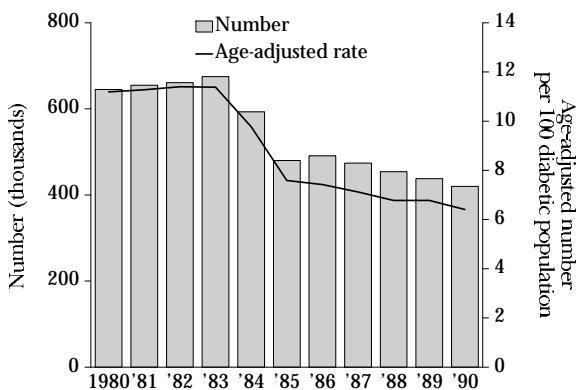
Figure 27.2
Number of Hospital Discharges with Diabetes as Primary or Any Listed Diagnosis per 100 Diabetic Population, by Age, U.S., 1990



TIME TRENDS IN HOSPITAL DISCHARGES LISTING DIABETES

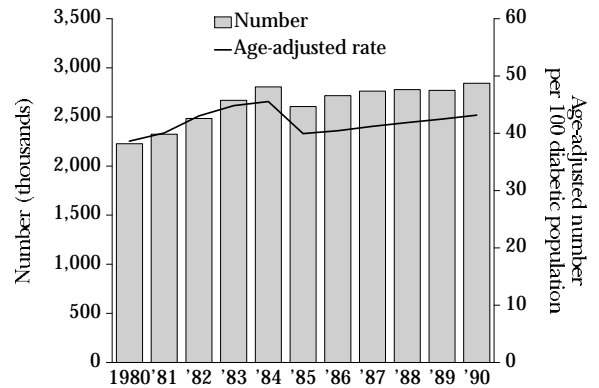
Of all discharges that listed diabetes as a diagnosis in the NHDS, the proportion represented by diabetes as the primary diagnosis declined from 29% in 1980 to 15% in 1990³. The number of hospital discharge records with diabetes listed as the primary diagnosis increased 4.7% in 1980-83 (645,000 versus 675,000), but decreased 37.8% in 1983-90 (675,000 versus 420,000) (Figure 27.3). The number of hospitalizations with diabetes as the primary diagnosis decreased most dramatically between 1983 and 1985. This decrease may be largely due to Medicare's implementation of a prospective payment system with DRGs for reimbursement. In 1985-90, the number of hospitalizations with diabetes as the primary diagnosis declined by 12.5%. This may be related to more strict hospital admissions criteria for persons with diabetes. The declines were consistent for blacks and whites³. The age-adjusted rate of hospitalization for diabetes as the primary discharge diagnosis remained relatively unchanged in 1980-83; between 1984 and 1990, the age-adjusted rate decreased 34.4% (Figure 27.3). The number of hospitalizations with diabetes as any listed diagnosis increased 27% during 1980-84 (from ~2.2 million in 1980 to ~2.8 million in 1984) and remained relatively stable in 1984-90 (Figure 27.4). The age-adjusted rate for diabetes as any listed diagnosis increased 11.7% during 1980-90. Appendix 27.1 provides details of these data.

Figure 27.3
Time Trends in the Number of Hospital Discharges with Diabetes Listed as the Primary Diagnosis and Age-Adjusted Number per 100 Diabetic Population, U.S., 1980-90



Source: Reference 3; 1980-90 National Hospital Discharge Surveys and National Health Interview Surveys

Figure 27.4
Time Trends in the Number of Hospital Discharges with Diabetes as Any Listed Diagnosis and Age-Adjusted Number per 100 Diabetic Population, U.S., 1980-90

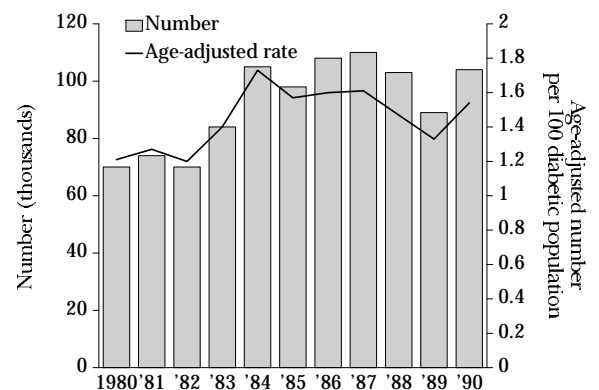


Source: Reference 3; 1980-90 National Hospital Discharge Surveys and National Health Interview Surveys

HOSPITAL DISCHARGES LISTING COMPLICATIONS OF DIABETES

Acute metabolic decompensation is a common cause of hospitalization of people with diabetes. Based on the NHDS in 1980, ~70,000 hospitalizations listed DKA as a discharge diagnosis (Figure 27.5). In 1990, ~104,000 hospitalizations listed DKA. The age-ad-

Figure 27.5
Time Trends in the Number of Hospital Discharges with Diabetic Ketoacidosis as Any Listed Diagnosis and Age-Adjusted Number per 100 Diabetic Population, U.S., 1980-90



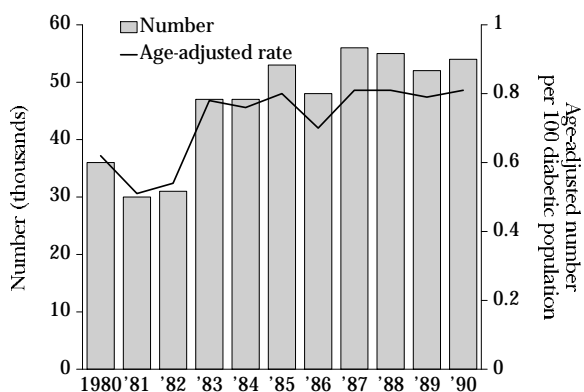
Source: Reference 3; 1980-90 National Hospital Discharge Surveys and National Health Interview Surveys

justed number of hospital discharges listing DKA was 1.21 per 100 persons with diabetes in 1980. In 1990, the rate was 1.54, representing a 27% increase.

Despite progress in diabetes management in the past several years, the most common macrovascular complication of diabetes continues to be cardiovascular diseases. Of all hospital discharges in 1990 that listed diabetes, the most frequently listed primary diagnoses were diseases of the circulatory system (32.6% of the discharges); followed by diabetes (14.8%); diseases of the digestive (8.6%), respiratory (8.5%), and genitourinary (5.9%) systems; and injury and poisoning (5.8%); all other conditions comprised the remaining 23.8%³.

Diabetes is the leading cause of nontraumatic lower extremity amputations (LEAs) (see Chapter 18 for a detailed discussion). The relative risk of LEA for persons with diabetes is ~15 times that of persons without diabetes^{25,26}. An estimated 50%-60% of all nontraumatic LEAs occur in persons with diabetes²⁵⁻²⁷. Based on the 1980 NHDS, there were ~36,000 hospital discharges listing both diabetes and LEA; in 1990, there were ~54,000 such discharges (Figure 27.6). The number of discharges listing both diabetes and LEA was similar in 1980-82, increased ~45% in 1983, and remained relatively stable in 1983-90. Implementation of Medicare's prospective payment system may have influenced whether diabetes and LEA are listed on hospital records. The age-adjusted rate of LEAs increased between 1980 and 1983 and remained relatively stable in 1983-90 (Figure 27.6).

Figure 27.6
Time Trends in the Number of Hospital Discharges that List Both Nontraumatic Lower Extremity Amputation and Diabetes, and Age-Adjusted Number per 100 Diabetic Population, U.S., 1980-90



Source: Reference 3; 1980-90 National Hospital Discharge Surveys and National Health Interview Surveys

Cardiovascular disease (CVD) is the major cause of morbidity and mortality in diabetes (see Chapters 19 and 20). In 1980, ~77,000 hospital discharges listed stroke as the primary diagnosis and diabetes as a secondary diagnosis (Appendix 27.1). In 1990, this number increased 71% to ~132,000. The age-adjusted rate in 1990 reflects a 45% increase compared with 1980 (1.94 discharges per 100 persons with diabetes versus 1.34 per 100). In 1980, ~245,000 hospitalizations with ischemic heart disease as the primary diagnosis and diabetes as a secondary diagnosis were recorded (Appendix 27.1). In 1990, this number increased to ~355,000. The age-adjusted hospital discharge rate was 28% higher in 1990 than in 1980 (5.45 per 100 persons with diabetes versus 4.25 per 100). Trends in major CVD (which includes stroke, ischemic heart disease, hypertension, and atherosclerosis) as the primary diagnosis are similar to the observed trends for stroke or IHD alone. The number of hospitalizations that listed major CVD as the primary diagnosis and diabetes as a secondary diagnosis increased from ~573,000 in 1980 to ~896,000 in 1990 (Appendix 27.1). Age-adjusted rates for major CVD increased 37% during this period.

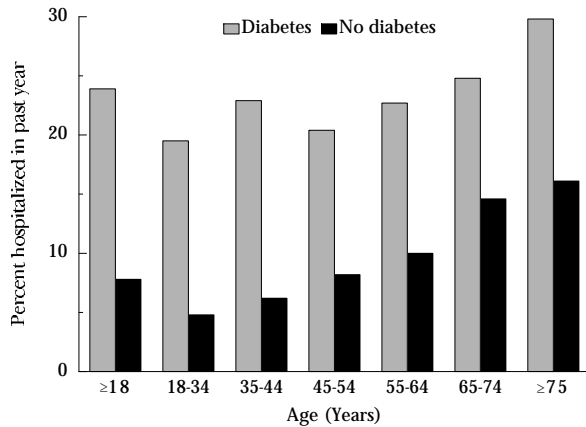
HOSPITAL USE BY ADULTS WITH DIABETES

In the core questionnaire of the 1989 NHIS, all respondents were asked about hospitalizations in the past year; hospitalizations involving delivery have been excluded from the data in this chapter. A special supplemental questionnaire about diabetes was asked of all adults age ≥18 years who were identified and confirmed as having physician-diagnosed diabetes¹⁷. The supplemental questionnaire was used to categorize diabetic subjects as having IDDM, insulin-treated NIDDM, or NIDDM not treated with insulin¹⁸ (see Sources of Data, above).

PROPORTION OF ADULTS HOSPITALIZED IN THE PAST YEAR

Figure 27.7 and Appendix 27.2 show the proportion of adults with and without diagnosed diabetes who reported being hospitalized at least once during the past year. The proportion increased from 19.8% at age 18-34 years to 29.6% at age ≥75 years. In every age group, persons with diabetes were substantially more likely to report having been hospitalized. For age ≥18 years, persons with diabetes were three times more likely to report being hospitalized in the previous year than persons without diabetes (23.8% versus 7.8%). This differential was greatest at age 18-34 years, where

Figure 27.7
Percent of Diabetic and Nondiabetic Adults Who Report Being Hospitalized in the Past Year, by Age, U.S., 1989



Source: 1989 National Health Interview Survey

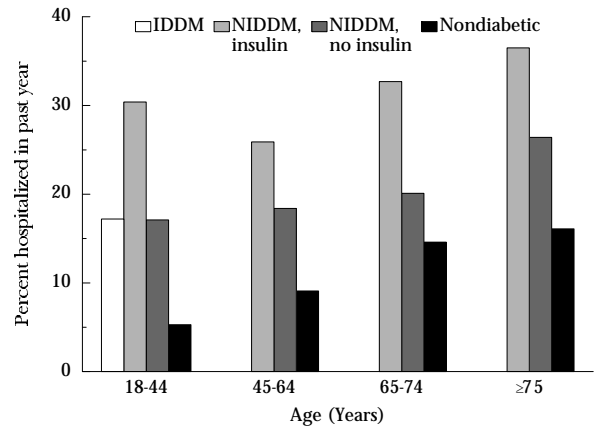
rates for people with diabetes were four times higher than for nondiabetic adults, and decreased with age such that at age ≥75 years the diabetic rates were only 1.8 times the nondiabetic rates.

With increasing age, the proportion of nondiabetic adults who reported being hospitalized in the past year increased 3.3-fold, from 4.8% at age 18-34 years to 16.1% at age ≥75 years. However, for diabetic adults the rise in the proportion hospitalized was less marked, increasing 1.5-fold from 19.8% at age 18-34 years to 29.6% at age ≥75 years.

HOSPITALIZATION OF ADULTS WITH IDDM AND NIDDM

Among persons with NIDDM, those who were treated with insulin were more likely to report having been hospitalized at least once in the past year than persons with NIDDM who were not treated with insulin (Figure 27.8, Appendix 27.2). Hospitalization rates were 40%-80% higher for insulin-treated NIDDM, depending on age. The small sample size of IDDM subjects permitted analysis only for age 18-44 years; the hospitalization rate was 17.2% for this group. The proportion who reported being hospitalized was substantially lower for nondiabetic subjects than for diabetic subjects in each age group.

Figure 27.8
Percent of Adults Who Report Being Hospitalized in the Past Year, by Diabetes Status and Age, U.S., 1989

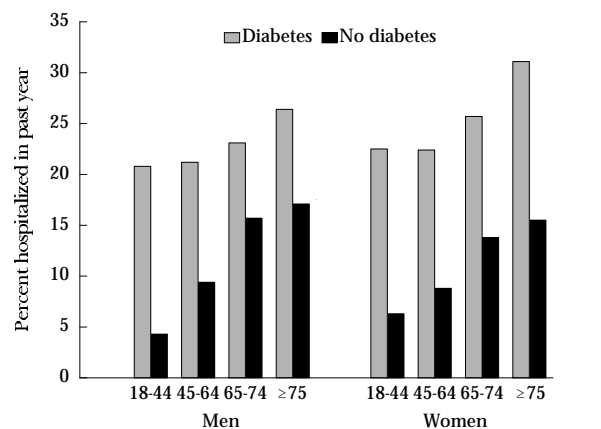


Source: 1989 National Health Interview Survey

PROPORTION HOSPITALIZED, BY SEX AND RACE

Figure 27.9 shows 1989 NHIS data on the proportion of diabetic and nondiabetic men and women who reported being hospitalized at least once during the past year. The differential in hospitalization rates between diabetic and nondiabetic adults, seen in Figure 27.7, is found for both men and women. The proportion of diabetic women who reported being hospitalized in the past year was 6%-18% greater, depending on age, than the proportion of diabetic men. In contrast, for adults without diabetes, a higher proportion

Figure 27.9
Percent of Adults Who Report Being Hospitalized in the Past Year, by Sex and Age, U.S., 1989



Source: 1989 National Health Interview Survey

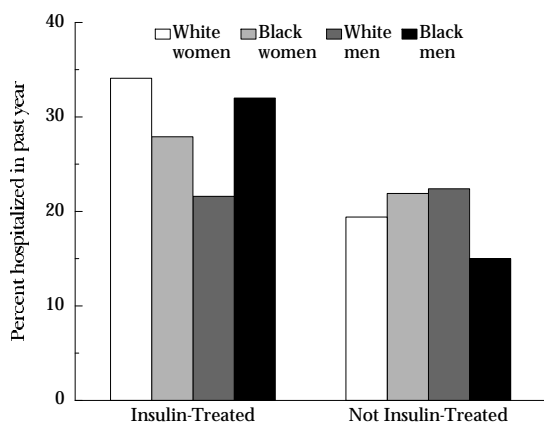
of men than women at age ≥ 45 years reported being hospitalized (Figure 27.9).

Detailed information on hospitalization for diabetic whites, blacks, and Mexican Americans based on the 1989 NHIS is shown in Appendix 27.2. There were few differences by race/ethnic group in the proportion who reported being hospitalized. Rates for diabetic men age ≥ 18 years were 21.5% for non-Hispanic whites, 23.9% for non-Hispanic blacks, and 27.6% for Mexican Americans; for women, the rates were 24.7%, 25.1%, and 27.1%, respectively. Within each age group, the proportion who reported being hospitalized in the previous year was similar for white and black men and diabetic women (Appendix 27.3). Among black and white adults with NIDDM, rates were higher for those treated with insulin than for those not treated with insulin (Figure 27.10).

HOSPITALIZATION, BY COMPLICATIONS AND DURATION OF DIABETES

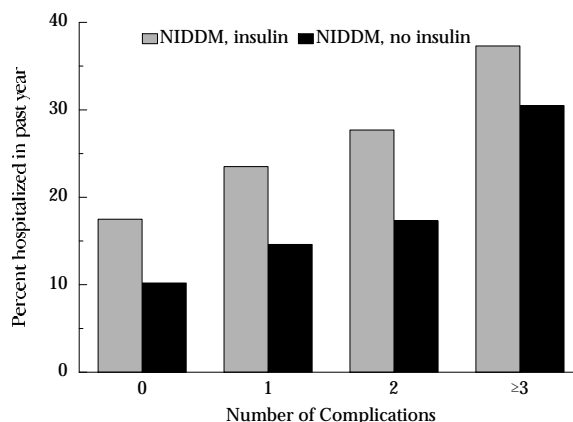
Having complications of diabetes was clearly associated with hospitalization. Among insulin-treated NIDDM, the proportion who were hospitalized at least once in the past year increased consistently from 17.5% for those reporting no complications to 37.3% for those reporting ≥ 3 complications (Figure 27.11). A similar trend was observed for NIDDM not treated with insulin, for whom the proportion hospitalized ranged from 10.2% for persons reporting no complications to 30.5% for persons reporting ≥ 3 complications. Appendix 27.4 provides details of these data

Figure 27.10
Percent of White and Black Men and Women with NIDDM Who Report Being Hospitalized in the Past Year, by Insulin Treatment, U.S., 1989



Source: 1989 National Health Interview Survey

Figure 27.11
Percent of Adults with NIDDM Who Report Being Hospitalized in the Past Year, by Number of Diabetes Complications, U.S., 1989



Source: 1989 National Health Interview Survey

and information on IDDM and all adults with diabetes.

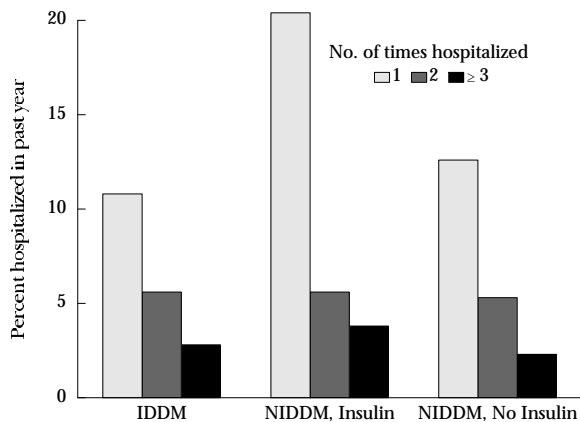
In contrast to the association with complications of diabetes, duration of diabetes was only slightly related to whether diabetic adults were hospitalized. As shown in Appendix 27.5, the proportion of adults with NIDDM who reported being hospitalized in the past year increased from 21.4% of those with < 5 years duration of diabetes to 29.5% of those with > 15 years of diabetes. The lack of relationship with duration of diabetes was found for both insulin-treated NIDDM and NIDDM not treated with insulin (Appendix 27.6)

MULTIPLE HOSPITALIZATIONS OF ADULTS WITH DIABETES

Figure 27.12 and Appendix 27.7 show information on the proportion of adults with diabetes according to the number of hospitalizations in the past year, based on the 1989 NHIS. Of all adults with diabetes, 15.5% reported one hospitalization, 5.4% reported two hospitalizations, and 2.9% reported ≥ 3 hospitalizations. The proportion who reported ≥ 2 hospitalizations was similar for adults with IDDM (8.4%), insulin-treated NIDDM (9.4%), and NIDDM not treated with insulin (7.6%).

The frequency of multiple hospitalizations was related to the number of diabetes complications. For diabetic adults who reported ≥ 3 complications of diabetes, 14.1% reported multiple hospitalizations in the past year. In contrast, 2.1% of diabetic adults who reported

Figure 27.12
Percent of Adults with NIDDM Who Report Being Hospitalized in the Past Year, by Number of Hospitalizations, U.S., 1989



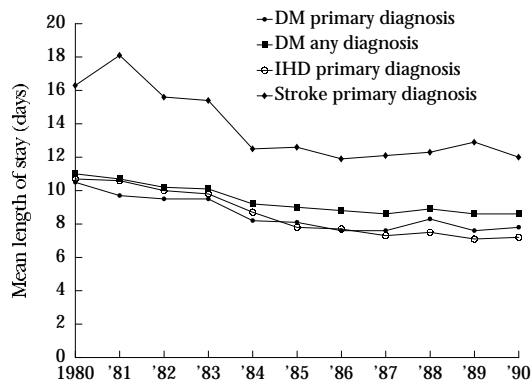
Source: 1989 National Health Interview Survey

no complications of diabetes had multiple hospitalizations (Appendices 27.8 and 27.9). Duration of diabetes was not strongly related to multiple hospitalizations. For example, for insulin-treated NIDDM, 10.7% of those with diabetes duration >15 years reported ≥2 hospitalizations in the past year, compared with 8.7% of those with duration <5 years (Appendix 27.10).

LENGTH OF HOSPITAL STAY

For a number of years, the average LOS as measured using NHDS data has been decreasing in the United States. Based on NHDS discharges with diabetes as the primary diagnosis, the average LOS decreased by 26% (from 10.5 days to 7.8 days) between 1980 and 1990 (Figure 27.13). For diabetes as any listed diagnosis, the average LOS declined 22% (from 11 days to 8.6 days) during this period. For NHDS discharges with stroke listed as a primary diagnosis and diabetes as a secondary diagnosis, a 26% decrease was observed (16.3 days to 12 days) (Figure 27.13). The average LOS for discharges with IHD as the primary diagnosis and diabetes as a secondary diagnosis declined 33% between 1980 and 1990 (from 10.7 days to 7.2 days) (Figure 27.13). For discharges that listed DKA, the average LOS declined 21% (from 7.6 days to 6.0 days)³. The average LOS for LEA declined 42% between 1980 and 1990 (35.8 days to 20.6 days)³. Decreases in average LOS were consistent across all demographic subgroups³. In NHDS data, average LOS was strongly associated with age, and LOS increased

Figure 27.13
Time Trends in the Average Length of Stay for Hospital Discharges Listing Diabetes, U.S., 1980-90

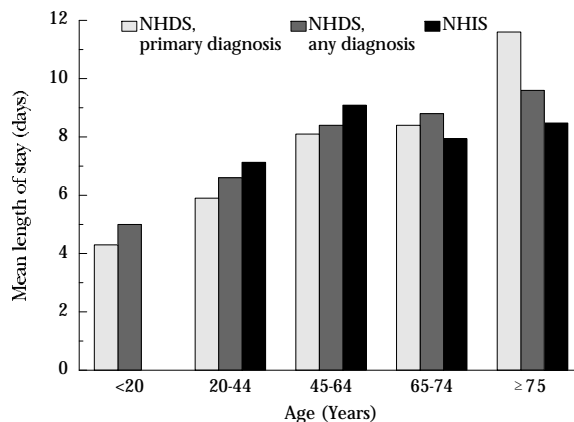


DM, diabetes mellitus; IHD, ischemic heart disease.

Source: Reference 3; 1980-90 National Hospital Discharge Surveys

with age whether diabetes was listed as a primary discharge diagnosis or as any listed diagnosis³. With the exception of discharges at age ≥75 years, few differences were observed in average LOS between discharges with diabetes listed as the primary diagnosis and those with diabetes as any listed diagnosis in the 1990 NHDS (Figure 27.14, Appendix 27.11). For discharges at age ≥75 years, LOS was 21% greater when diabetes was listed as the primary diagnosis.

Figure 27.14
Average Length of Stay for Hospital Discharges Listing Diabetes in 1990 and as Reported by Adults with Diabetes in 1989



NHDS, National Hospital Discharge Survey; NHIS, National Health Interview Survey.

Source: Reference 3, 1990 National Hospital Discharge Survey; 1989 National Health Interview Survey

In the 1989 NHIS, all adults who reported being hospitalized in the previous year were asked how many nights they were in the hospital for each hospitalization. The average LOS for all diabetic adults age ≥ 20 years was 8.3 days. There was little variation by age (Figure 27.14). For adults without diabetes, mean LOS was 6.5 days, increasing from 5.2 days at age 20-44 years to 8.7 days at age ≥ 75 years (Appendix 27.12).

COSTS OF HOSPITALIZATION

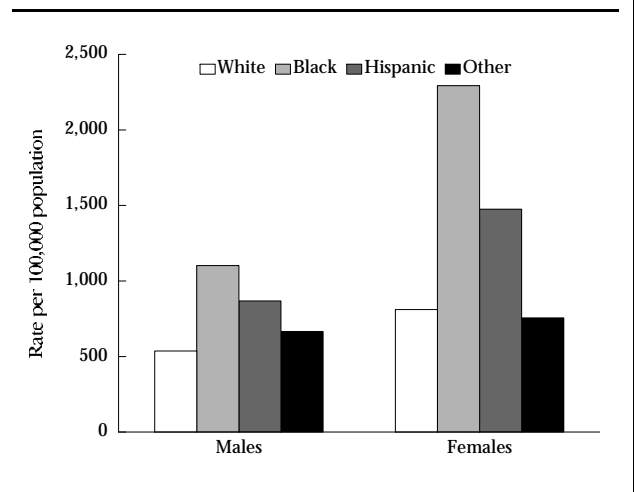
Costs associated with hospital care for diabetes in 1992 were estimated to be \$37.2 billion, which represented 82% of the estimated direct cost of diabetes²⁸. These costs were based on 1990 NHDS hospital discharges listing diabetes and Medicare data files, and these underestimate diabetes hospitalizations. An estimate has also been derived from the 1987 National Medical Expenditure Survey, in which a sample of people with confirmed diabetes were evaluated for all medical expenditures; the data were extrapolated to 1992²⁹. About 64% of expenditures for people with confirmed diabetes were incurred in inpatient settings, and these hospitalizations were estimated to cost ~\$55 billion. Total per capita annual health care expenditures were estimated to be more than four times greater for persons with confirmed diabetes compared with persons without diabetes. Total costs for diabetes accounted for an estimated 11.9% of total U.S. health care expenditures²⁹. These costs are shared by federal, state, and local governments and other providers of health care delivery. The economic impact of diabetes, including costs of hospitalizations, is discussed in detail in Chapter 30.

STATE-BASED HOSPITAL DISCHARGE DATA

The CDC supports several state-based surveillance systems to assess diabetes-related mortality and morbidity. A number of these provide insight into the burden of diabetes-related hospitalization shared by state and local governments and the disproportionate prevalence of diabetes complications among racial and ethnic minorities.

In California during 1983-87, 1,005,292 hospitalizations listed diabetes on the discharge record (an average of 201,058 per year). These accounted for 8% of all hospitalizations not related to pregnancy³⁰. These cost an estimated \$1.55 billion per year, or an average of \$7,719 per discharge. Figure 27.15 shows the age-

Figure 27.15
Age-Adjusted Number of Hospital Discharges Listing Diabetes per 100,000 Population, California, 1983-87



Source: Reference 30

adjusted number of hospital discharges listing diabetes in California by sex and race/ethnicity per 100,000 total population (rather than per estimated diabetic population), excluding hospitalizations related to pregnancy and birth. The rates varied by sex and race/ethnicity, and this probably reflects the differential prevalence of diabetes in the population by sex and race. Rates were higher for females than for males; the highest hospitalization rate was for black females (2,293 per 100,000), followed by Hispanic females (1,475 per 100,000), black males (1,102 per 100,000), and Hispanic males (868 per 100,000).

In North Carolina, there were 62,952 hospital discharges that listed diabetes in 1989, an increase of 7% from the previous year³¹. Hospitalizations listing diabetes accounted for 7% of all hospital stays in 1988 and 1989. During this period, the age-adjusted number of hospital discharges listing diabetes was 868 per 100,000 total population for females and 803 per 100,000 for males. These estimates exclude hospitalizations related to gestational diabetes. The total and average LOS for hospitalizations that listed diabetes increased after age 40 years for both males and females. On average, females were hospitalized for diabetes-related causes 55% more total days than males, and the difference increased with increasing age. While the total and average LOS and total inpatient charges were higher for females of every age group, the average charges per stay were consistently higher for males than for females. One explanation may be that males were more likely to have more costly complications than females³¹. This may be particularly true for complications related to CVD.

CONCLUSION

Diabetes continues to be the leading cause of preventable blindness, end-stage renal disease, and nontraumatic LEAs in the United States. Individuals with diabetes have higher rates of hospitalization and hospital care compared with persons without diabetes. Costs associated with the hospital care of persons with diabetes were estimated at \$55 billion in 1992. Recent studies have shown that comprehensive clinical management of diabetes has significant impact on diabetic complications³². Preventing the complications associated with diabetes that result in hospitalization could have a substantial impact on the resources of a health care system. In spite of recognized

limitations, NHDS, NHIS, and state-based hospitalization and race/ethnicity data together provide a useful picture of the hospitalization experience of persons with diabetes.

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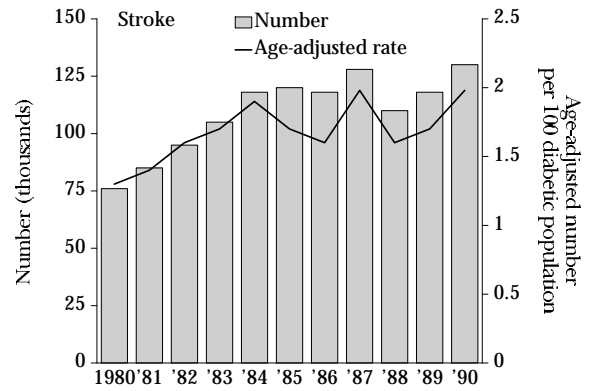
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APPENDICES

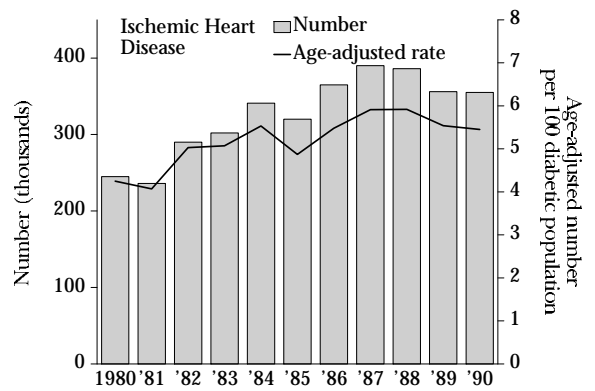
Appendix 27.1

Time Trends in the Number of Hospital Discharges Listing Diabetes, DKA, and Diabetes with Nontraumatic LEA, Stroke, IHD, or Major CVD, and Age-Adjusted Number per 100 Diabetic Population, U.S., 1980-90

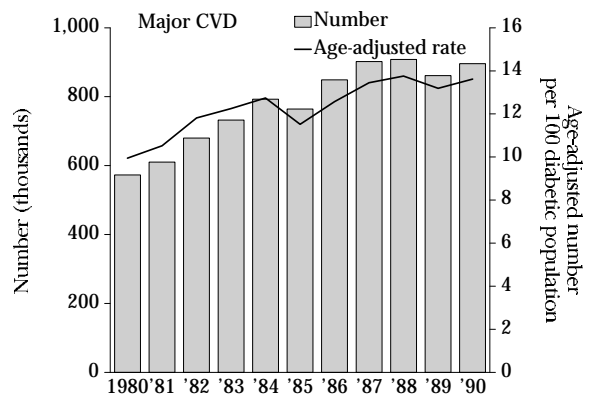
Year	Diabetes as any listed diagnosis		Diabetes as primary diagnosis		DKA as any listed diagnosis	
	No.	Rate	No.	Rate	No.	Rate
1980	2,227	38.64	645	11.19	70	1.21
1981	2,324	40.05	655	11.28	74	1.27
1982	2,484	43.02	661	11.40	70	1.20
1983	2,669	44.82	675	11.38	84	1.40
1984	2,806	45.53	593	9.77	105	1.73
1985	2,605	39.95	480	7.59	98	1.57
1986	2,716	40.44	491	7.42	108	1.60
1987	2,762	41.20	474	7.12	110	1.61
1988	2,778	41.86	454	6.78	103	1.47
1989	2,770	42.48	438	6.78	89	1.33
1990	2,842	43.17	420	6.41	104	1.54



Year	Nontraumatic LEA as primary diagnosis		Stroke as primary diagnosis		IHD as primary diagnosis	
	No.	Rate	No.	Rate	No.	Rate
1980	36	0.62	77	1.34	245	4.25
1981	30	0.51	87	1.49	236	4.07
1982	31	0.54	93	1.62	290	5.03
1983	47	0.78	105	1.75	302	5.07
1984	47	0.76	116	1.82	341	5.53
1985	53	0.80	118	1.74	320	4.87
1986	48	0.70	117	1.68	365	5.48
1987	56	0.81	128	1.85	390	5.91
1988	55	0.81	114	1.68	386	5.92
1989	52	0.79	121	1.79	356	5.54
1990	54	0.81	132	1.94	355	5.45



Year	Major CVD as primary diagnosis	
	No.	Rate
1980	573	9.95
1981	610	10.52
1982	680	11.81
1983	732	12.25
1984	793	12.74
1985	764	11.52
1986	849	12.57
1987	902	13.45
1988	908	13.76
1989	861	13.19
1990	896	13.62



DKA, diabetic ketoacidosis; LEA, lower extremity amputation; IHD, ischemic heart disease; CVD, cardiovascular disease. Number shown in thousands, rate shown as age-adjusted number per 100 estimated persons with diabetes. DKA data are for DKA as any listed diagnosis; LEA data are for all hospitalizations listing LEA and diabetes together; data for stroke, IHD, and major CVD include only discharges in which these conditions were the primary diagnoses and diabetes was a secondary diagnosis.

Source: Reference 3; 1980-90 National Hospital Discharge Surveys

Appendix 27.2

Percent of Adults Who Report Being Hospitalized at Least Once in the Past Year, U.S., 1989

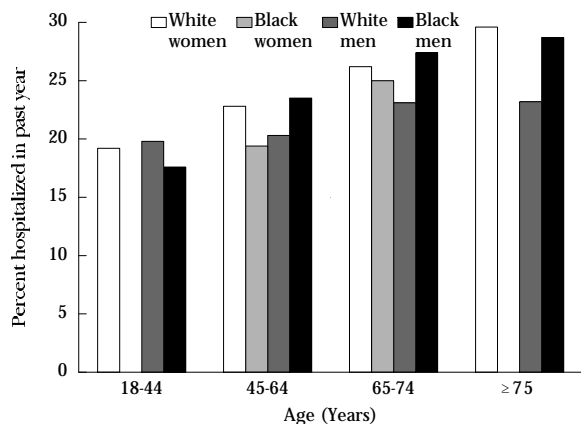
	IDDM	NIDDM, using insulin	NIDDM, not using insulin	All diabetic adults	Nondiabetic	Total
All ages	19.2	29.9	20.2	23.8	7.8	8.2
18-34	18.5	29.7	11.1	19.8	4.8	4.9
35-44	14.7	30.8	19.3	23.2	6.2	6.4
45-54		27.4	15.7	20.4	8.2	8.6
55-64		25.1	20.2	22.8	10.0	10.7
65-74		32.7	20.1	24.6	14.6	15.4
≥75		36.5	26.4	29.6	16.1	16.9
18-44	17.2	30.4	17.1	21.8	5.3	5.4
45-64		25.9	18.4	21.8	9.1	9.6
65-74		32.7	20.1	24.6	14.6	15.4
≥75		36.5	26.4	29.6	16.1	16.9
All men	18.6	25.9	20.6	22.3	7.2	7.5
18-44	18.4			20.8	4.3	4.4
45-64		25.6	18.3	21.2	9.4	9.9
65-74		23.3	23.3	23.1	15.7	16.2
≥75			25.1	26.4	17.1	17.6
All women	19.8	32.7	19.9	24.9	8.3	8.8
18-44	15.9	30.6	18.1	22.5	6.3	6.4
45-64		26.1	18.5	22.4	8.8	9.3
65-74		39.0	17.8	25.7	13.8	14.8
≥75		40.1	26.9	31.1	15.5	16.5
All non-Hispanic whites	17.9	28.8	20.7	23.3	8.1	8.4
18-44	15.5	27.1	17.2	19.5	5.2	5.3
45-64		24.3	19.0	21.6	9.5	9.9
65-74		33.3	20.8	24.9	15.1	15.8
≥75		32.6	25.5	27.6	16.1	16.8
All non-Hispanic white men	15.8	21.6	22.4	21.5	7.6	7.9
18-44	15.0			19.8	4.2	4.3
45-64		21.7	19.4	20.3	10.2	10.6
65-74		21.1	24.6	23.1	15.8	16.3
≥75		12.0	27.8	23.2	17.9	18.1
All non-Hispanic white women	20.4	34.1	19.4	24.7	8.4	8.9
18-44		24.2	16.0	19.2	6.1	6.2
45-64		26.6	18.6	22.8	8.8	9.3
65-74		42.7	17.9	26.2	14.5	15.4
≥75		40.9	24.4	29.6	15.1	16.0
All non-Hispanic blacks		29.6	19.3	24.6	7.2	8.0
18-44				27.3	6.2	6.4
45-64		26.9	14.1	21.1	7.1	8.5
65-74		29.2	22.5	25.7	10.5	13.1
≥75				32.9	18.5	20.2
All non-Hispanic black men		32.0	15.0	23.9	5.4	6.2
18-44				17.6	4.6	4.8
45-64		31.7		23.5	3.5	5.2
65-74				27.4	15.9	17.3
≥75				28.7	12.6	14.6
All non-Hispanic black women		27.9	21.9	25.1	8.7	9.5
18-44					7.5	7.7
45-64		24.1	13.3	19.4	10.1	11.1
65-74			21.7	25.0	6.0	9.8
≥75					21.7	23.3
All Mexican Americans			19.1	27.3	5.6	6.2
All Mexican-American men				27.6	5.5	6.0
All Mexican-American women				27.1	5.7	6.4

Table excludes hospitalizations for deliveries; blanks indicate data that are statistically unreliable; diabetes is based on a self-report of physician diagnosis of diabetes; IDDM determined from age at diagnosis <30 years, body mass index ≤27 for men and ≤25 for women, and continuous insulin use since diagnosis of diabetes; all other diabetic subjects were considered to have NIDDM.

Source: 1989 National Health Interview Survey core questionnaire, diabetes supplement, and diabetes risk factor supplement

Appendix 27.3

Percent of Adults with Diabetes Who Report Being Hospitalized in the Past Year, by Sex, Race, and Age, U.S., 1989



Source: 1989 National Health Interview Survey

Appendix 27.4

Percent of Adults with Diabetes Who Report Being Hospitalized at Least Once in the Past Year, by Number of Reported Complications, U.S., 1989

Type of diabetes	No. of Complications			
	0	1	2	≥3
IDDM	7.6	18.4	22.5	33.1
NIDDM, insulin-treated	17.5	23.5	27.7	37.3
NIDDM, not insulin-treated	10.2	14.6	17.3	30.5
All adults with diabetes	12.0	17.9	21.1	33.7

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes; IDDM determined from age at diagnosis <30 years, body mass index ≤27 for men and ≤25 for women, and continuous insulin use since diagnosis of diabetes; all other diabetic subjects were considered to have NIDDM; complications include self-reported amputation, symptoms of sensory neuropathy (pain, tingling, numbness), retinopathy, foot sores that do not heal, proteinuria, kidney disease, hypertension, angina, stroke, glaucoma, and cataract.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

Appendix 27.5

Percent of Adults with Diabetes Who Report Being Hospitalized at Least Once in the Past Year, by Duration of Diabetes, U.S., 1989

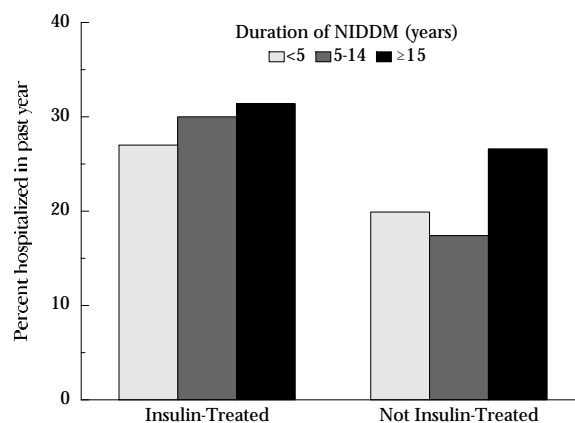
Type of diabetes	Duration of diabetes (years)		
	<5	5-15	>15
NIDDM, insulin-treated	27.0	30.0	31.4
NIDDM, not insulin-treated	19.9	17.4	26.6
All adults with NIDDM	21.4	22.7	29.5

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes; IDDM determined from age at diagnosis <30 years, body mass index ≤27 for men and ≤25 for women, and continuous insulin use since diagnosis of diabetes; all other diabetic subjects were considered to have NIDDM; duration of diabetes was calculated as years since diagnosis of diabetes.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

Appendix 27.6

Percent of Adults with NIDDM Who Report Being Hospitalized in the Past Year, by Duration of Diabetes and Insulin Treatment, U.S., 1989



Source: 1989 National Health Interview Survey

Appendix 27.7

Percent Distribution of Adults with Diabetes, by Type of Diabetes and Number of Hospitalizations in the Past Year, U.S., 1989

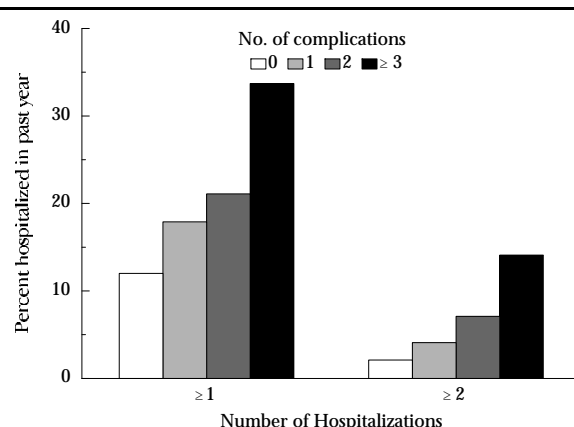
Type of diabetes	No. of hospitalizations			
	0	1	2	≥3
IDDM	80.8	10.8	5.6	2.8
NIDDM, insulin-treated	70.1	20.4	5.6	3.8
NIDDM, not insulin-treated	79.8	12.6	5.3	2.3
All NIDDM	76.0	15.7	5.4	2.9
All adults with diabetes	76.2	15.5	5.4	2.9

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes; IDDM determined from age at diagnosis <30 years, body mass index ≤27 for men and ≤25 for women, and continuous insulin use since diagnosis of diabetes; all other diabetic subjects were considered to have NIDDM.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

Appendix 27.9

Percent of Adults with Diabetes Who Report Being Hospitalized in the Past Year, by Hospitalization Frequency and Complications, U.S., 1989



Source: 1989 National Health Interview Survey

Appendix 27.8

Percent Distribution of Adults with Diabetes, by Number of Complications and Number of Hospitalizations in the Past Year, U.S., 1989

No. of diabetes complications	No. of hospitalizations		
	0	1	≥2
0	88.0	9.9	2.1
1	82.1	13.8	4.1
2	78.9	14.0	7.1
≥3	66.3	19.6	14.1

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes; complications include self-reported amputation, symptoms of sensory neuropathy (pain, tingling, numbness), retinopathy, foot sores that do not heal, proteinuria, kidney disease, hypertension, angina, stroke, glaucoma, and cataract.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

Appendix 27.10

Percent Distribution of Adults with Diabetes, by Duration of Diabetes and Number of Hospitalizations in the Past Year, U.S., 1989

Type of diabetes	No. of hospitalizations		
	0	1	≥2
IDDM			
All durations	80.8	10.8	8.4
NIDDM, insulin-treated			
Duration <5 years	73.1	18.2	8.7
Duration 5-15 years	70.0	20.7	9.3
Duration >15 years	68.7	20.7	10.7
All durations	70.1	20.4	9.4
NIDDM, not insulin-treated			
Duration <5 years	80.2	12.1	7.8
Duration 5-15 years	82.6	12.2	5.2
Duration >15 years	73.4	15.8	10.8
All durations	79.8	12.6	7.6

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes; IDDM determined from age at diagnosis <30 years, body mass index ≤27 for men and ≤25 for women, and continuous insulin use since diagnosis of diabetes; all other diabetic subjects were considered to have NIDDM.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

Appendix 27.11

Number of Hospitalizations and Average Length of Hospital Stay, by Age, U.S., 1990

Age (years)	Diabetes as primary diagnosis		Diabetes as any listed diagnosis	
	No.	LOS	No.	LOS
<20	35	4.3	46	5.0
20-44	98	5.9	298	6.6
45-64	134	8.1	848	8.4
65-74	93	8.4	825	8.8
≥75	60	11.6	825	9.6

Number shown in thousands; LOS, average length of stay in days.

Source: Reference 3; 1990 National Hospital Discharge Survey

Appendix 27.12

Mean Length of Stay per Hospitalization for Adults with Diabetes Who Report at Least One Hospitalization in the Past Year, U.S., 1989

Age (years)	Diabetes (mean days)	No diabetes (mean days)
≥20	8.33	6.49
20-44	7.13	5.15
45-64	9.09	6.05
65-74	7.94	8.45
≥75	8.48	8.69

Table excludes hospitalizations for deliveries; diabetes is based on a self-report of physician diagnosis of diabetes.

Source: 1989 National Health Interview Survey core questionnaire and diabetes supplement

