

## Healthcare Use by Veterans Treated for Diabetes Mellitus in the Veterans Affairs Medical Care System

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**Objectives:** To estimate the burden of comorbid conditions and to describe patterns of inpatient and outpatient service use by veterans with diabetes mellitus.

**Study Design:** Retrospective cohort study of 33 481 veterans conducted by means of secondary analysis of Department of Veterans Affairs (VA) healthcare utilization databases.

**Patients and Methods:** The cohort was constructed by enrolling all veterans treated in the VA medical care system who had their initial VA hospitalization for diabetes mellitus between 1992 and 1997. To estimate the typical annual pattern of service use for diabetes mellitus, 1997 utilization rates per person-year were analyzed based on cohort members surviving into 1997. Data on comorbid conditions were obtained from outpatient and inpatient contacts.

**Results:** The 3 most prevalent coexisting conditions were hypertension (73.4%), ischemic heart disease (35.2%), and alcohol or drug abuse disorders (29.5%). In 1997, the typical cohort member followed for 12 months had 6 primary care visits, 16 other visits for tests or consultations, and 1.3 unscheduled visits for emergency or urgent care and spent approximately 8 days in the hospital. One-year survival was 94.0%.

**Conclusions:** In the VA medical care system, beneficiaries with diabetes mellitus have an extremely heavy burden of comorbidities, face a significant risk of dying in a given year (approximately 6% in this population), and are heavy users of hospital and outpatient services.

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1980 in all sex and race groups, in contrast to declining death rates for other major killers such as heart disease and stroke.<sup>1,3</sup> Diabetes mellitus disproportionately affects minorities.<sup>4</sup> The prevalence of this disease among blacks is twice that of whites at all ages.<sup>1</sup> Twenty-two percent of Mexican Americans older than 65 years report that they have diabetes mellitus, a rate comparable to that in blacks.<sup>5</sup> Death rates from diabetes mellitus are higher in blacks and Hispanics than in whites and show a strong inverse relationship with family income levels.<sup>1</sup>

Although quite a bit is known about the epidemiologic features of diabetes mellitus in the United States, less is known about the epidemiologic features of medical care for diabetes mellitus in the United States. Aggregate statistics from the National Center for Health Statistics indicate that in 1996, the nation's approximately 8 million diabetic individuals had 503 000 hospital stays for diabetes mellitus (average length of stay, 6.3 days) and 18.9 million ambulatory care visits for diabetes mellitus.<sup>1</sup> In the third National Health and Nutrition Examination Survey, conducted between 1988 and 1994, approximately 1 in 4 of the 1480 people with type 2 diabetes mellitus reported being hospitalized in the previous 12 months, and 80% to 90% stated

Diabetes mellitus is a major cause of morbidity and mortality throughout the world and is the seventh leading cause of death in the United States.<sup>1</sup> In 1995, costs for treating diabetes mellitus and its complications approached \$48 billion.<sup>2</sup> Diabetes mellitus affects 64 per 1000 Americans aged 45 to 64 years, 133 per 1000 aged 65 to 74 years, and 117 per 1000 older than 75 years.<sup>1</sup> Despite advances in treatment, diabetes mellitus-related mortality rates have been increasing since

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that they had had 2 or more visits with physicians in the previous year.<sup>6</sup> Another study documented substantial unexplained geographic variations during the 1990s in per-person hospital and clinic use by people with diabetes mellitus treated in the medical care system of the Department of Veterans Affairs (VA).<sup>7</sup>

In this article, we (1) describe the demographic and clinical characteristics of a national cohort of 33 481 veterans with diabetes mellitus treated in the VA medical care system, (2) present risk-adjusted inpatient and outpatient utilization rates at the individual level for 1997, and (3) report 1-year survival rates.

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## METHODS

### Design and Data Sources

This is a retrospective cohort study based on secondary analysis of VA healthcare databases. The study was approved by the institutional review board of Baylor College of Medicine and the Research and Development Committee of the Houston Veterans Affairs Medical Center. Data sources for this study consisted of 3 patient-level databases maintained by the VA medical care system: the Patient Treatment File, which contains records on all VA hospital stays in the system; the Outpatient Clinic File, which contains records on all services provided to outpatients by VA staff; and the Death File, which contains data on veterans' deaths regardless of whether they occur in a VA facility or elsewhere. The Death File is known to have data for more than 90% of deceased veterans.<sup>8</sup> The accuracy of the data in the Patient Treatment File is considered comparable to that of Medicare Part A files.<sup>9</sup> Because it is a newer database, less is known about the accuracy of the data in the Outpatient Clinic File, and no published reports exist, to our knowledge, of the diagnostic data it contains.

The VA medical care system cares for approximately 4 million beneficiaries (veterans but not their dependents) by means of a nationwide system of hospitals, hospital-based outpatient clinics, and community-based clinics. The provision of medical services in the VA has been structured around a primary care model since the mid-1990s,<sup>10</sup> with each beneficiary assigned to a primary care practitioner who is charged with overseeing and coordinating all outpatient (and in some VA medical centers, inpatient) services for patients in his or her panel. The VA databases contain limited information on the use

of non-VA services; therefore, non-VA use was not tabulated in this study. Some VA beneficiaries are known to use care in non-VA sectors as well as in VA sectors.<sup>11</sup> This means that the utilization data in this study underestimate, by an unknown amount, the total levels of healthcare use by our cohort members.

### Cohort-Building Strategy

Most VA beneficiaries with diabetes mellitus have type 2, since the onset of diabetes mellitus in childhood would have precluded military service. To maximize the probability that patients were entered into this longitudinal study at a uniform point in their disease, we enrolled patients into the cohort at the time their diabetes mellitus first caused a problem severe enough to require inpatient treatment. Enrollment into the diabetes mellitus cohort was based on a VA hospital admission for an acute diabetes mellitus-related condition (diagnosis-related groups 294 and 295 listed as the reason for admission). Patients were eligible for enrollment if they (1) had a VA hospital stay for diabetes mellitus between 1992 and 1997 and (2) had not had a stay for diabetes mellitus or 8 other serious illnesses (chronic obstructive pulmonary disease, pneumonia, angina, heart failure, renal failure, schizophrenia, bipolar disorder, or major depressive disorder) in the 2 years before their initial VA admission for diabetes mellitus. (Patients with these conditions were the subject of a study of variations in the use of VA services.<sup>7</sup> These conditions were selected because of their high prevalence in VA beneficiaries. A patient could be enrolled in only 1 of these cohorts: no duplication across cohorts was permitted.) The hospital stay on which enrollment was based is called the enrollment hospitalization. These requirements for enrollment slant the cohort toward the more severe end of the disease spectrum and mean that it does not include people with mild diabetes mellitus treated solely in the ambulatory care sector.

Once enrolled, cohort members stayed in the cohort until death, until the end of the observation period (the end of fiscal year 1997 [September 30, 1997]), or until 2 consecutive years elapsed without any contact with the VA medical care system. Presumably, because they were not listed as deceased in VA files, the latter patients switched to non-VA care. A total of 33 481 individuals were members of the cohort in fiscal year 1997 (October 1, 1996, to September 30, 1997), the year for which utilization and survival rates are presented.

### Utilization Measures

Utilization rates were computed for 1997. The intensity of hospital use was measured by analyzing bed-day rates, which accumulate the number of days spent in the hospital regardless of the number of stays. The intensity of use of outpatient services was measured by analyzing rates of primary care visits (defined as visits to medical clinics with the capability to provide comprehensive, longitudinal care for diabetes mellitus), visits for testing and consultation (ie, visits to ancillary services for tests, to physician consultants such as surgeons or ophthalmologists, and to nonphysician consultants such as dietitians), and urgent care visits (unscheduled visits to the emergency department). To compute visit rates, the more than 200 clinic codes ("stops") in the VA outpatient files were categorized into 3 mutually exclusive and exhaustive groups. A visit was defined as a day on which a patient received services from 1 of the 3 clinic groups. If on a single day the patient had multiple encounters within the same category of clinic (eg, a blood test, a chest radiograph, and a consultation with a dietitian), this was counted as 1 visit. Visits to VA pharmacies to pick up medications were not counted.

To account for the fact that patients entered and left the cohort at different times and hence had unequal opportunity-times to use services, person-time rather than head count was used as the denominator for utilization rates. For as long as a patient was in the cohort, he or she contributed events and time at risk for events. Days spent in the hospital were deducted from time at risk for outpatient visits.

### Risk Adjustment and Statistical Analysis

To accumulate a large enough cohort from which to draw stable estimates, patients could have met the criteria for cohort enrollment as early as 1992 or as late as 1997. We chose the most recent year, 1997, as the basis for a "snapshot" of typical utilization patterns. Risk adjustment was necessary because there could have been temporal shifts between 1992 and 1997 in the demographic characteristics of the VA beneficiary population as well as in clinical complexity and hospitalization thresholds during the observation period. These shifts could have affected the utilization and survival rates.

The covariates we used to risk adjust the utilization and survival rates are those known from previous research to affect utilization, survival, or both, and they were obtained from cohort members' enrollment hospitalizations. Covariates were updated after every 2 years the patient spent in the

cohort using data from the most recent hospital stay. Age was updated yearly. We used a risk-adjustment approach developed by Wray et al<sup>12-14</sup> that adjusts for differences in physiologic reserve and social support (age, race, and marital status) as well as type and complexity of disease burden (count of comorbidities and which of 8 body systems is affected by comorbidity). We also included in the models a variable indicating year of entry into the cohort (longer tenure presumably means more advanced disease), a marker for socioeconomic status (VA "means test" category), and a proxy for access to non-VA services (a variable indicating whether a living patient had gone 2 consecutive years without any contact with the VA system during his or her stay in the cohort).

Analysis of covariance<sup>15</sup> was used to adjust the utilization measures for the patient factors described previously. The data have a hierarchical structure<sup>16</sup> (patients are nested within medical centers, medical centers within VA-integrated service hospitals), and, therefore, patient and medical center were random effects in the model and VA network was a fixed effect.

We analyzed 1-year survival rates using a proportional hazards model, which accounts for patients who were censored, that is, those who survived the study period and whose future date of death is unknown. These rates look at the cohort's experience over time and are not tied to a particular event such as a hospitalization.

### Comprehensive Data on Clinical Comorbidities

Beginning in fiscal year 1997 (October 1, 1996), the VA Outpatient Clinic File began to capture up to 10 diagnoses for each outpatient contact. (Before that date, diagnostic data had been available for inpatient stays only.) This change in the database afforded us the opportunity to obtain comprehensive data on the prevalence of coexisting conditions in people with diabetes mellitus treated in the VA medical care system. We estimated the prevalence of 15 serious conditions (*International Classification of Diseases, Ninth Edition*, codes available on request) by (1) identifying all patients who would have met the criteria for entry into the diabetes mellitus cohort during the 24-month period of fiscal years 1998 and 1999 (October 1, 1997, through September 30, 1999) and (2) using diagnostic codes found in the 1st through 10th slots on all outpatient contacts and inpatient stays for those patients during that period. We did not analyze utilization data

on these patients, and they were not members of our original diabetes mellitus cohort.

RESULTS

Demographic and Clinical Characteristics

Table 1 gives the demographic and clinical characteristics of the cohort. Almost all participants were

men, and about two thirds were white. By 1997, members had been part of the cohort for an average of almost 4 years, and 46% were 65 years or older. Discharge abstracts of the enrollment hospitalization indicated that for approximately 20% of the 3557 people who met the entry criteria in 1997, the stay had been for an acute complication of diabetes mellitus such as diabetes ketoacidosis (n = 483), hyperosmolar nonketotic coma (n = 167), or other coma (n= 33). In the remaining 80%, the discharge diagnosis simply listed the 3-digit ICD-9-CM code for "diabetes mellitus" as the primary reason for hospitalization. Nearly two thirds of the cohort had 1 or more conditions other than diabetes mellitus listed on 1 or more of their hospital discharge abstracts.

The VA Outpatient Clinic File was enhanced to capture outpatient diagnoses as of October 1, 1997. We conducted a supplementary analysis to obtain comprehensive information on the prevalence of specific coexisting conditions. To have a large enough group of patients so that stable estimates could be derived, we formed a group consisting of the 6737 VA beneficiaries who would have met the criteria for new enrollment into the diabetes mellitus cohort during the 24-month period of fiscal years 1998 and 1999. We supplemented diagnoses listed on hospital discharge abstracts with diagnoses listed on records of outpatient encounters. The prevalence of 11 serious comorbidities in these patients is given in Table 2. The 3 most prevalent conditions were hypertension, ischemic heart disease, and alcohol or drug abuse, affecting 73.4%, 35.2%, and 29.5% of patients, respectively.

Risk-Adjusted Utilization and Survival Rates

Nearly 40% of the cohort was hospitalized 1 or more times in 1997 (Table 3), and almost three quarters of those hospitalized had multiple stays. From a per-person-year viewpoint, in 1997, the "average" cohort member followed for 12 months had 6 primary care visits, 16 other visits for tests or consultations, and 1.3 unscheduled visits for emergency or urgent care and spent approximately 8 days in the hospital (Table 3). Risk-adjusted 1-year survival in 1997 was 94.0%.

DISCUSSION

This study documents, at the person level, the patterns and intensity of the use of health services by VA beneficiaries with diabetes mellitus. The typical person in this national cohort spent more than 31 days

Table 1. Characteristics of 33 481 Members of the VA Diabetes Mellitus Cohort, 1997

Characteristic	Value
Years in cohort, mean ± SD	4.0 ± 2.2
New members entering in 1997, No.	3557
New members whose defining diagnosis was an acute complication of diabetes mellitus, No. (%)*	683 (19.2)
Members who died, No.	2278
Members dropped because of no contact with the VA system, No.†	3241
Age, mean ± SD, y	61.1 ± 12.6
Age category, No. (%)	
<45 y	3526 (10.6)
45-54 y	7396 (22.1)
55-64 y	7142 (21.3)
65-74 y	10 760 (32.1)
≥75 y	4649 (13.9)
Men, No. (%)	33 083 (98.8)
Race, No. (%)	
Non-Hispanic white	20 826 (62.2)
Non-Hispanic black	10 169 (30.4)
Hispanic	1724 (5.2)
Other	762 (2.3)
Married, No. (%)	17 034 (50.9)
Members with coexisting conditions listed on hospital discharge abstracts, No. (%)	
0	13 141 (39.9)
1-2	16 333 (48.8)
3-4	3639 (10.9)
>4	368 (1.1)

VA indicates Department of Veterans Affairs.

\*Diabetic ketoacidosis (*International Classification of Diseases, Ninth Edition*, code 250.1), hyperosmolarity (250.2), or other coma (250.3).

†Cohort members known to be alive but who had no contact with the VA system for 2 years were dropped from the cohort because we assumed that they switched to non-VA care.

in 1997 obtaining medical care—approximately 8 days of inpatient care and 23 days of outpatient services of some sort. Our cohort is slanted toward the more severe end of the disease spectrum because eligibility for enrollment depended on having an initial hospital stay for diabetes mellitus. Nevertheless, our utilization findings are comparable to those of 2 other studies that reported person-level utilization data. A 1992-1995 study<sup>17</sup> of 7931 Alabama Medicaid beneficiaries younger than 65 years showed that, per year, the average patient spent approximately 5 days in the hospital, had 15 office visits with a physician, and had 9 other outpatient visits for services such as ambulatory surgery or dialysis. In a highly selected sample of 1738 diabetic patients drawn from a northwestern US HMO, the number of outpatient visits per person per year in the early 1990s ranged from 9.8 to 13.0, depending on the type of hypoglycemic therapy.<sup>18</sup>

This study also documents the heavy burden of comorbidities borne by people with diabetes mellitus. Because VA outpatient databases began to capture diagnoses in late 1996, we could obtain comprehensive data on coexisting conditions from outpatient as well as inpatient records. A remarkable 73.4% of diabetic patients in this cohort had hypertension. In the third National Health and Nutrition Examination Survey sample of people with diabetes mellitus, the prevalence of hypertension was 65.9% in whites, 71.4% in non-Hispanic African Americans, and 53.8% in Mexican Americans.<sup>6</sup> We also documented a high prevalence of alcohol or drug abuse disorders (29.5%) and psychosis (23.3%), conditions that make it more difficult for patients to sustain diabetes mellitus self-management behaviors. Data are not available on the prevalence of these conditions in other populations of people with diabetes mellitus.

The typical person in this diabetes mellitus cohort faced a probability of approximately 1 in 20 of dying before the end of 1997 (adjusted for demographic characteristics, tenure in the cohort, and coexisting conditions). Several studies<sup>19,20</sup> have now documented that type 2 diabetes mellitus reduces life expectancy by 4 to 8 years.

This study lacks clinical detail because accessible national VA databases do not yet include data on the

**Table 2.** Prevalence of Coexisting Conditions in the 6737 Patients Meeting Cohort Entry Criteria During October 1, 1997 to September 30, 1999\*

Condition (ICD-9 Code)	Cohort Members With Condition, %
Hypertension (401-405)	73.4
Ischemic heart disease (410-414)	35.2
Alcohol or drug abuse (291, 292, 303-305)	29.5
Psychosis (290, 294-299)	23.3
Cerebrovascular disease (430-438)	20.9
Cancer (nonskin) (140.0-172.9, 174-175.9, 179-195.8, 196.0-199.1, 200-208.9, 238.6, 273.3, V10.0-V10.9)	17.0
Lung cancer (162)	2.3
Colorectal cancer (153,154)	1.9
Prostate cancer (185)	6.4
Renal insufficiency or failure (403.11, 403.91, 404.12, 585, V45.1, V24.0, V56.0, V56.8)	7.8
Liver disease (070.32-070.33, 070.54, 571.0, 571.2-571.6, 571.8-571.9, 572.3, 572.8, V42.7)	7.3
Hemiplegia or other paralytic syndrome (342, 344)	7.2
Posttraumatic stress disorder (309.81)	7.2
HIV infection (042)	1.3

\*Includes data from outpatient visits and inpatient stays. ICD-9 indicates *International Classification of Diseases, Ninth Edition*.

actual content of care (eg, prescriptions, tests and test results, consultations, and adherence to clinical guidelines). The VA's National Performance Data Center, reporting findings from the VA's External Peer Review Program, in which non-VA contractors review a national random sample of clinical charts against explicit quality-of-care criteria, found in 1997 that 90% of VA beneficiaries with diabetes mellitus had a foot examination, 69% had a sensory examination of the lower extremities, 69% had a retinal examination, and 85% had measurement of their hemoglobin A<sub>1c</sub> level. (The National Performance Data Center is part of the Office of Quality and Performance, VA Headquarters.) Also, we did not compute costs in this study. The VA National Center for Cost Containment found that in 1998, per-patient pharmacy expenditures related to glycemic control in diabetic VA beneficiaries were \$160 for patients taking oral agents, \$279 for patients using insulin, and \$501 for those taking oral agents as well

**Table 3.** Hospital and Clinic Utilization, VA Diabetes Mellitus Cohort, 1997

Characteristic	Value
Members with $\geq 1$ hospitalizations, No. (%)	13 006 (38.9)
Hospital stays by cohort members, No.	22 653
Hospital stays per person hospitalized, No.	1.74
Average length of hospital stay, d	10.4
Risk-adjusted bed-days per person-year, No.	7.9
Risk-adjusted primary care visits per person-year, No.	6.1
Risk-adjusted testing and consultation visits per person-year, No.	16.3
Risk-adjusted urgent care visits* per person-year, No.	1.3

VA indicates Department of Veterans Affairs.

\*Minor or major emergency department visits.

as insulin (VA pharmacy costs include glucose monitoring supplies).<sup>21</sup>

Although our cohort is the largest cohort of people with type 2 diabetes mellitus reported to date and includes adults of all ages with diabetes mellitus, it has unique attributes that may limit the generalizability of our findings. Most patients were men, and it should be noted that veterans who use the VA medical care system tend to be poorer than other veterans and the general population.

Reading our findings, one is struck by how many contacts with the healthcare system a VA beneficiary with diabetes mellitus has to make every year. Payers are concerned with the monetary costs of heavy utilization, but the indirect costs and opportunity costs associated with so many contacts must be an enormous burden on the patient and family. Further research is needed, for diabetes mellitus and other chronic conditions, to determine the mix of outpatient and inpatient services and the primary care revisit intervals<sup>22</sup> that lead to the best outcomes for patients.

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