

COMMON REASONS FOR HOSPITALIZATION IN URBAN DIABETES PATIENTS

Objectives: Determine principal reasons for hospitalization in a predominantly urban, African American diabetes patient population.

Design: Data for outpatients with a diagnosis of diabetes were abstracted from electronic records. The number of hospitalizations from 1998 through 2001 was determined after linking our dataset with a statewide discharge dataset. Principal diagnoses were grouped into 18 multilevel diagnostic classes using the Agency for Healthcare Research and Quality's Clinical Classifications Software.

Patients: A total of 6505 unique patients had 20,344 discharges from 1998 through 2001; 92% were listed as African Americans and 61% as women.

Main Outcome Measures: Frequency of each multilevel diagnostic class and the most commonly occurring diagnoses.

Results: The most common multilevel diagnostic classes were "diseases of the circulatory system" (29.0% of all discharges) and "endocrine, nutritional, and metabolic; immunity disorders" (17.1%). The five most commonly occurring unique diagnoses were "congestive heart failure," "diabetes with ketoacidosis or uncontrolled diabetes," "coronary atherosclerosis," "diabetes with other manifestations," and "pneumonia, organism unspecified." Nearly 16% of all discharged patients had diagnoses related to infection. The five most frequent diagnoses related to infection were "pneumonia, organism unspecified," "urinary tract infection, site not specified," "infection and inflammation, internal prosthetic device," "cellulitis and abscess of leg," and "postoperative infection."

Conclusions: In this predominantly urban, African American diabetes patient population, potentially preventable hospitalizations involving diseases such as congestive heart failure and diabetes occur with high frequency. Better understanding of the risk factors underlying these hospitalizations—particularly those involving modifiable metabolic variables—requires further investigation. (*Ethn Dis.* 2006; 16:391–397)

Key Words: African Americans, Diabetes Mellitus, Hospitalization

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INTRODUCTION

Diabetes mellitus is a major cause of illness in the United States.¹ The prevalence has risen over the past decade, and diabetes now affects $\approx 7\%$ of the US population.^{2,3} Both the national prevalence and the global prevalence of diabetes are expected to increase; by the year 2030, the number of affected individuals is projected to be >30 million in the United States alone.⁴

People with diabetes have an increased risk of hospitalization compared to people without diabetes.⁵ In 2001, diabetes was listed as the principal diagnosis in 562,000 hospital discharges in the United States and was a codiagnosis in more than 4 million discharges.^{6,7} In 1997, diabetes was the fourth leading co-morbidity associated with any US hospitalization.⁸ Nearly one third of diabetes patients may require two or more hospitalizations in a given year,⁹ and inpatient stays account for the largest proportion of direct medical expenses incurred by people with the disease.^{10,11}

Compared with Whites, minority populations, particularly African Americans, are more severely affected by diabetes, with higher disease prevalence,² worse glycemic control,^{12,13} and more complications.^{14,15} African Americans with diabetes also have higher rates of hospitalization than

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Whites^{16,17}; however, an examination of the specific reasons for hospitalization in this group has not been reported. The development of strategies to enhance care and improve inpatient resources for African Americans with diabetes must begin with a better understanding of the types of diagnoses that result in a hospital stay. Therefore, we analyzed hospital discharge data in a cohort of urban diabetes patients composed primarily of African Americans and determined the principle reasons for hospitalization.

METHODS

Patient Population

The analysis focused on patients who received care through an adult outpatient diabetes clinic affiliated with a large, urban public health system. This health system serves a two-county area and comprises a large hospital and several community-based primary care sites throughout the region. On the basis of previous inpatient studies^{18,19} and analyses from various outpatient sites,^{20–23} the diabetes patients served by the health system typically lack health insurance, are indigent, mostly have type 2 diabetes, and are predominantly African American.

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Table 1. Multilevel diagnosis categories used in the Clinical Classifications Software

Class Code	Description
1	Infectious and parasitic diseases
2	Neoplasms
3	Endocrine, nutritional, and metabolic; immunity disorders
4	Diseases of the blood and blood-forming organs
5	Mental disorders
6	Diseases of the nervous system and sense organs
7	Diseases of the circulatory system
8	Diseases of the respiratory system
9	Diseases of the digestive system
10	Diseases of the genitourinary system
11	Complications of pregnancy, childbirth, and puerperium
12	Diseases of the skin and subcutaneous tissue
13	Diseases of the musculoskeletal system/connective tissue
14	Congenital anomalies
15	Certain conditions originating in the perinatal period
16	Injury and poisoning
17	Symptoms, signs, and ill-defined conditions and factors influencing health status
18	Residual codes, unclassified, all E codes

Modified from Elixhauser et al,⁸ Elixhauser and McCarthy,²⁹ Elixhauser et al,³⁰ and Elixhauser et al.³¹

The diabetes clinic is staffed by nurse educators, dietitians, podiatrists, and endocrinologists and is located adjacent to the public hospital. In 1991, the Diabetes Patient Tracking System (DPTS) was established to electronically track longitudinal demographic, pharmacologic, and metabolic parameters for all patients receiving care at the clinic. The DPTS data have been analyzed to characterize the demographic, socioeconomic, and care outcomes of the patient population.^{20,24-27} Recent results show that the race/ethnicity of the diabetes patient population has remained 90% African American over a 10-year period.²⁸

Abstraction of Hospital Discharge Data

Data for all unique patients seen in the diabetes clinic from 1991 through 2001 were abstracted from the DPTS. When determining reasons for hospitalization in our diabetes patient population, we could not assume that all patients receiving outpatient care in the system would necessarily seek admission to the affiliated hospital. To capture information on hospitalizations outside the public hospital system, we linked patient data abstracted from the

DPTS to hospital discharge data available through the Georgia Hospital Association (GHA).

The GHA is a nonprofit, state trade association composed of member health systems and hospitals. The GHA is a contributing partner to the Agency for Healthcare Research and Quality’s Healthcare Cost and Utilization Project Nationwide Inpatient Sample. Most of Georgia’s nonfederal hospitals report discharge data to the GHA. The GHA began to accrue full calendar-year data in 1998; therefore, our data for discharges begin with that year.

After linking our outpatient diabetes file with GHA records, a final data set was returned that contained the following main fields: patient age at admission, sex, race/ethnicity, International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis codes, length of stay, admission source, discharge disposition, type of health insurance, and whether the discharge occurred from our public hospital.

Diagnostic Clustering

To organize the large number of ICD-9-CM codes into meaningful diagnostic clusters, we used the Agency for

Healthcare Research and Quality’s Clinical Classifications Software (CCS).^{8,29-31} Electronic files containing the translation of ICD-9-CM diagnosis codes into CCS categories were downloaded,³¹ and the principal discharge diagnoses were mapped to these categories.

The CCS is a tool for clustering patient diagnoses into a manageable number of clinically meaningful categories. Clinical Classifications Software (CCS) consists of two related classification systems: the single-level CCS classifies similar illnesses and conditions into 260 mutually exclusive categories, and the multilevel CCS classifies the single-level CCS categories into a hierarchical system with 18 diagnostic groups (Table 1).^{8,29-31}

Data Analysis

Data were analyzed in the aggregate from 1998 through 2001. We reported discharge diagnoses according to the multilevel classification scheme because unique diagnoses were listed under each category and could be counted. The frequency of occurrence of each multilevel diagnosis category was determined, and the most common unique condition under each class was calculated. We also report the five most commonly occurring individual diagnoses overall.

Although the multilevel CCS classification scheme includes a separate grouping for infections (Table 1), we found that some diagnoses denoting infections were distributed among other multilevel categories. Because diabetes can increase the risk of certain infectious diseases,³² we wanted to develop a comprehensive overview of diagnoses with an infectious cause underlying the hospitalization. All unique diagnoses clearly labeled as an infection were identified, counted, and aggregated to determine the frequency of hospitalizations that had an infectious cause as the principle diagnosis. The multilevel class “infectious and parasitic diseases” (Table 1) includes a unique identifier for “immunizations and screening for

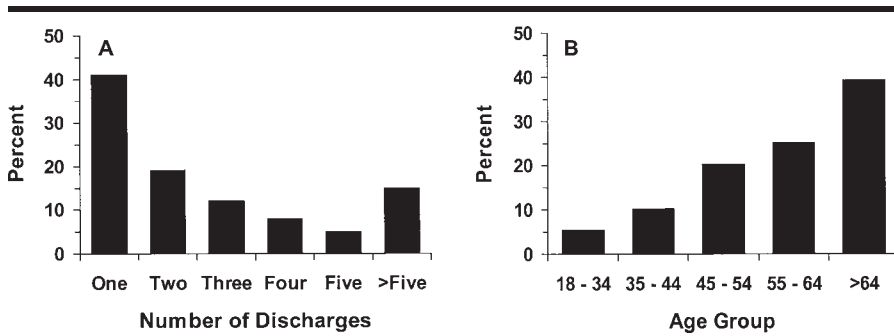


Fig 1. A, Percentage of discharged patients who were discharged 1, 2, 3, 4, 5, or more than 5 times during 1998–2001. B, Percentage of discharged patients by age group

infectious disease,” which was not included in the counts of diagnoses attributed to infections.

RESULTS

General Discharge Characteristics

Of the 14,620 unique patients identified in our DPTS, 6505 patients were hospitalized between 1998 and 2001, for a total of 20,344 discharges. Of the

discharged patients, 61% were listed as women and 92% as African Americans; average age was 56 years and average length of stay was 6.7 days. Most hospitalized patients were admitted through an emergency department (59%) or through a physician office or clinic (38%); 84% of discharged patients returned to their homes. Most hospitalized patients were covered under Medicare (48%) or commercial insurance (22%); 16% were on Medicaid or were Medicaid eligible; and 13% were listed as self-pay.

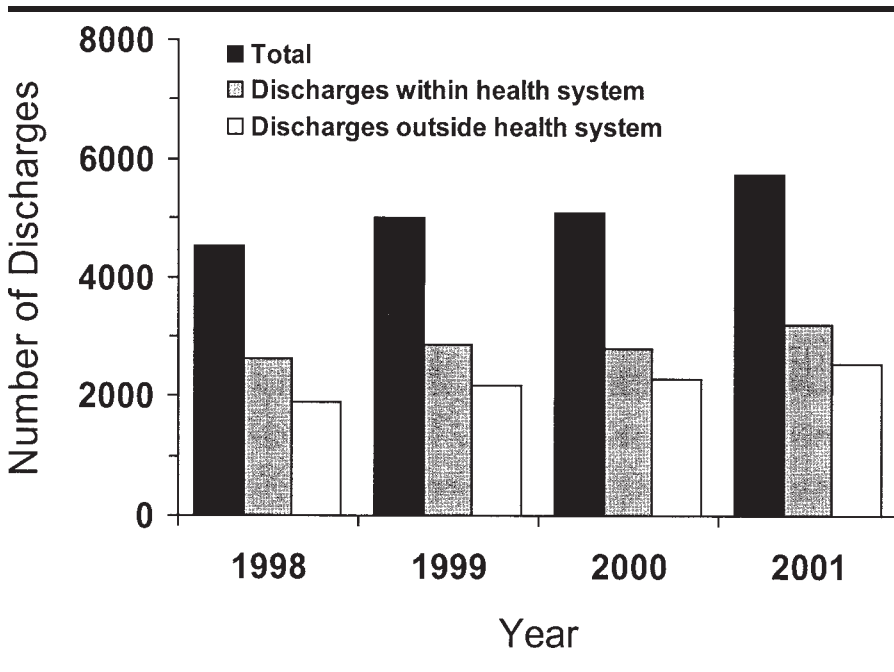


Fig 2. Number of discharges according to year and whether the patient was discharged from the affiliated hospital (“discharges within health system”) or from a nonaffiliated hospital (“discharges outside health system”)

Forty-one percent of patients had only one documented discharge, 19% had two, 12% had three, 8% had four, 5% had five, and the remainder (15%) had more than five (Fig 1 A). The percentage of discharged patients increased with older age (Fig 1 B). Overall, 44% of hospitalizations were in facilities other than the public hospital. The number of hospitalizations according to year and whether the patient was discharged from the affiliated hospital is shown in Figure 2.

Frequency of Diagnoses by Multilevel Categories

We successfully mapped 20,215 of the 20,344 discharges (99%) to multilevel diagnostic categories (Table 2). Diagnoses were represented in all categories except category 15, “certain conditions originating in the perinatal period”; the lack of cases in category 15 reflects the clinic population (all adult) from which the sample was drawn. The prevalences of categories 14 and 18 were very low (.059% and .33%, respectively) and were not analyzed further. The five most common multilevel diagnoses were category 7, “diseases of the circulatory system” (29.0%); category 3, “endocrine, nutritional, and metabolic; immunity disorders” (17.1%); category 8, “diseases of the respiratory system” (9.4%); category 9, “diseases of the digestive system” (8.4%); and category 16, “injury and poisoning” (7.5%). The most common diagnoses within the multilevel groups are listed in Table 3.

Most Common Unique Diagnoses

The most commonly listed unique principal diagnosis was “congestive heart failure” (1888 discharges) (Fig 3 A), followed by “diabetes with ketoacidosis or uncontrolled diabetes” ($n=1448$), “coronary atherosclerosis” ($n=757$), “diabetes with other manifestations” ($n=677$), and “pneumonia, organism unspecified” ($n=676$).

Table 2. Frequency of multilevel diagnosis categories for discharges from 1998 to 2001

Multilevel Class Description	Discharges	
	No.	%*
Diseases of the circulatory system	5869	29.0
Endocrine, nutritional, and metabolic; immunity disorders	3465	17.1
Diseases of the respiratory system	1894	9.4
Diseases of the digestive system	1705	8.4
Injury and poisoning	1525	7.5
Diseases of the genitourinary system	1159	5.7
Mental disorders	760	3.8
Neoplasms	708	3.5
Symptoms, signs, and ill-defined conditions and factors influencing health status	688	3.4
Infectious and parasitic diseases	564	2.8
Diseases of the skin and subcutaneous tissue	509	2.5
Diseases of the musculoskeletal system/connective tissue	442	2.2
Diseases of the nervous system and sense organs	352	1.7
Complications of pregnancy, childbirth, and puerperium	294	1.4
Diseases of the blood and blood-forming organs	202	1.0
Congenital anomalies	67	.33
Residual codes, unclassified, all E codes	12	.06

* Percentages are the proportion of total mapped discharges (N=20,215). Totals do not equal 100% because of rounding.

A total of 3201 discharges (≈16% of all mapped discharges) had a diagnosis related to an infection. The five most common unique diagnoses were “pneumonia, organism unspecified” (n=676), “urinary tract infection, site not specified” (n=355), “infection and inflammation, internal prosthetic device” (n=239), “cellulitis and abscess of leg”

(n=166), and “postoperative infection” (n=160) (Fig 3 B).

DISCUSSION

Population studies have revealed marked disparities in diabetes prevalence, complications, and metabolic

control; African Americans are particularly affected.^{2,12-15} These differences also extend to hospitalization risk: hospitalization rates are higher among African Americans than Whites.^{16,17} Hospitalizations for certain conditions, such as diabetes, congestive heart failure, and pneumonia, are regarded as potentially avoidable; the greater frequency of hospitalizations for these conditions among African Americans has been linked to patient socioeconomic status.^{17,33-35} Little is known, however, about the principal reasons for hospitalization among African Americans with diabetes and how many of these patients are hospitalized for potentially avoidable conditions.

We linked our outpatient records with a larger statewide hospital dataset to obtain a comprehensive overview of discharges occurring in a predominantly urban African American patient population. Our approach of linking with a larger database demonstrated that a substantial number of hospitalizations would not have been included in our analysis if our institution-specific discharge records alone had been examined. Our observations suggest that hospitalizations are a substantial burden

Table 3. Most common discharge diagnosis in each multilevel category

Class Code*	Class Subcode	Description	Discharges	
			No.†	%‡
1	1.3.1	HIV infection	143	25.3
2	2.16.1	Benign neoplasm of uterus	72	10.2
3	3.3.1	Diabetes with ketoacidosis or uncontrolled diabetes	1448	41.8
4	4.1.3.7	Anemia, unspecified	48	23.8
5	5.5.1	Paranoid schizophrenia	107	14.1
6	6.4.2	Convulsions	94	26.7
7	7.2.11.1	Congestive heart failure	1888	32.2
8	8.1.1.3	Pneumonia, organism unspecified	676	35.7
9	9.9.1	Acute pancreatitis	246	14.4
10	10.1.2.1	Acute renal failure	359	31.0
11	11.3.6	Diabetes or abnormal glucose tolerance complicating pregnancy	131	44.5
12	12.1.1.5	Cellulitis and abscess of leg	166	32.6
13	13.1	Infective arthritis and osteomyelitis	125	28.3
16	16.10.1.3	Other complications of internal prosthetic device	357	23.4
17	17.2.1	Rehabilitation care, fitting of prostheses, and adjustment of devices	259	37.6

* See Table 1 for definitions of class codes.

† See Table 2 for category totals.

‡ Percentages are the proportion of total discharges in each category.

HIV=human immunodeficiency virus.

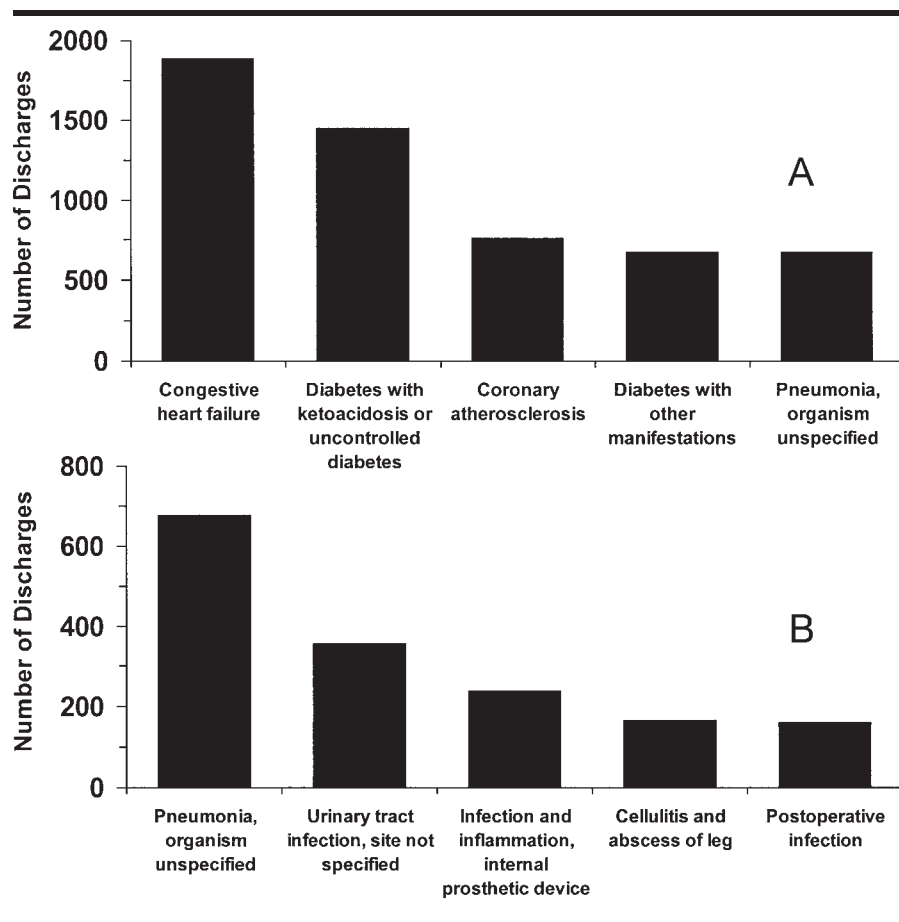


Fig 3. A, The five most common unique discharge diagnoses. B, The five most common discharge diagnoses due to infection

for this patient population. We found that a large number of discharges occurred over the four-year span analyzed. Nearly 60% of the patients had two or more discharges documented during the study period. The average length of stay of 6.7 days was nearly one day longer than the reported national average of 5.8.⁷

Cardiovascular diseases, especially congestive heart failure and coronary atherosclerosis, emerged as dominant reasons for hospitalization in this patient cohort. Factors that increase the risk of a cardiovascular disease hospitalization among diabetes patients have been examined only on a limited basis. For instance, preexisting albuminuria increased the risk of hospitalization for congestive heart failure in a recent longitudinal study of type 2 diabetes

patients.³⁶ Among a cohort of African Americans that included patients with and without diabetes studied at the same institution where our data were derived, the risk of hospitalization for congestive heart failure was increased with female sex, prior history of angina, and use of certain medications such as calcium channel blockers.³⁷ Our DPTS contains detailed metabolic data, including information on glycemic control, lipids, and albuminuria, and should allow a later analysis of which variables may contribute to a greater risk of hospitalization for cardiovascular disease in this urban diabetes population.

Two unique diabetes-related diagnoses—"diabetes with ketoacidosis or uncontrolled diabetes" and "diabetes with other manifestations"—were among the most common discharge

Our observations suggest that hospitalizations are a substantial burden for this patient population.

diagnoses in our study. Although findings have not been consistent,³⁸ higher hemoglobin A1C levels and hypertension have increased the risk of hospitalization among diabetes patients.^{39,40} In a previous investigation involving our hospital, omission of insulin was a key explanation underlying hospitalization for diabetic ketoacidosis.¹⁸ As with cardiovascular disease, certain modifiable metabolic risk factors may increase the risk of hospitalization among African Americans with diabetes.

The prevalence of certain infectious diseases has been reported to be higher among diabetes patients.³² Pneumonia was among the top five unique reasons for hospitalization in our dataset. To develop a more complete overview of the frequency of hospitalizations due to infections, we counted and aggregated the individual codes clearly labeled as related to an infection. Even after doing so, infections as a group ranked third behind "diseases of the circulatory system" and "endocrine, nutritional, and metabolic; immunity disorders."

The high frequency of occurrence of pneumonia in our data is concerning. Recent data indicate that rates of pneumococcal vaccination among diabetes patients remain below national targets.⁴¹ The most common pneumonia in our analysis is not specified, but our finding indicates that public health efforts must continue to increase awareness among practitioners and patients about the need for appropriate vaccination to reduce morbidity from the condition.

Although the strength of our study is that it provides new data on reasons for hospitalization among a predominantly

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African American diabetes patient population, the types and frequencies of hospital discharges may not be the same in other urban settings. In addition, our cohort included patients who received care through a specialty diabetes program, so reasons for hospitalization may be different for individuals who have never obtained medical services from such a clinic. The sorts of hospital diagnoses in our data may not apply to other minority groups with diabetes, such as Hispanics. For instance, a recent study examining the prevalence of cardiovascular diseases in an ethnically diverse, urban, diabetes patient population indicated less heart disease among Hispanics,⁴² so a lower frequency of discharged patients with a cardiovascular disease diagnosis may be in that population.

Finally, the intent of this analysis was to establish the reasons for hospitalization in a predominantly African American patient population rather than to determine differences between hospitalized and nonhospitalized patients. Such a study, however, would be of interest, particularly in a minority diabetes population such as the one analyzed here, which is at higher risk for hospitalization.^{16,17} The detailed database available to us in the form of the DPTS will allow future analysis to better define the demographic and metabolic features that predispose these patients to need a hospital stay.

Our data indicate that most discharged patients in this population had potentially preventable causes of hospitalization, such as heart disease and diabetes. This information should lead to a more intensive effort to better understand the variables that predispose to hospitalization and to develop interventions in the outpatient setting to reduce hospitalization risk. Finally, the data provide guidance to the health system as to what diagnoses among inpatients may require dedicated resources for outcome studies and the improvement of care.

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