DISPARITIES IN DIABETES-RELATED HOSPITALIZATIONS: RELATIONSHIP OF AGE, SEX, AND RACE/ETHNICITY WITH HOSPITAL DISCHARGES, LENGTHS OF STAY, AND DIRECT INPATIENT CHARGES

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Objective: To identify any differences in hospitalization rates of diabetes patients by age, sex, or race/ethnicity.

Design: A cross-sectional study of Georgia hospital discharge data between 1998 and 2001.

Patients/Participants: Patients with a principal discharge diagnosis of diabetes.

Main Outcome Measures: Adjusted hospitalization data (discharge rates, length of stay, direct charges) reported as standardized rates per 10,000 person-years, standardized rate differences, and standardized rate ratios, compared by age, sex, and race/ethnicity.

Results: Diabetes was the principal diagnosis in 50,301 discharges (average age, 51 years; length of stay, 5.1 days; median total charge, $5893). Persons ≥60 years old had higher discharge rates, longer stays, and higher charges than persons 18–29 years old. Women had fewer hospitalizations, shorter stays, and lower charges than men. Non-Hispanic Blacks had more than three times as many hospitalizations, markedly longer stays, and higher charges than non-Hispanic Whites. Hispanics with diabetes had lower hospitalization rates, shorter stays, and lower charges than Whites.

Conclusions: Differences by age, sex, and race/ethnicity in hospital discharge rates, lengths of stay, and charges exist for diabetes inpatients. Further study should examine potential causes (severity of disease, comorbidity, and differential access to preventive care) of these disparities. (*Ethn Dis*. 2006;16:126–131)

Key Words: Diabetes, Disparities, Hospitalizations

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INTRODUCTION

Diabetes mellitus is a major cause of illness in the United States.[1] More than 7% of the US population is affected by diabetes, and its prevalence is increasing.[2] By the year 2030, the number of persons with diabetes in the United States is projected to have increased from ≈17 million to >30 million.[3] The greatest anticipated increases are expected to occur among Blacks and the elderly.[4]

Hospitalizations are a major contributor to healthcare costs borne by diabetes patients. In 2001, 562,000 hospital discharges in the United States listed diabetes as the principal diagnosis (average length of stay [LOS], 5.7 days), and more than four million discharges had diabetes as any listed diagnosis.[5,6] Nearly one third of diabetes patients may require two or more hospitalizations in a year,[7] and inpatient stays represent their largest medical expense.[8,9] With the prevalence of diabetes expected to rise, inpatient stays will likely remain a major contributor to disease-related costs.

Disparities in diabetes are well established. Women have more self-reported diabetes, and the prevalence of diabetes rises with increasing age.[2,10] Minority populations typically bear a larger diabetes burden compared with that of Whites; they have a higher prevalence,[2] worse glycemic control,[11–13] and more complications.[1,14] Diabetes increases the risk of hospitalization compared with persons without diabetes,[15] but only a limited number of studies have examined demographic differences in hospitalizations among the diabetes population.[7,16,17] Because inpatient care is emerging as a priority in diabetes care,[18] characterizing the heterogeneity within the hospitalized diabetes patient population may allow healthcare systems to better plan resource allocation and assess effectiveness of interventions. We analyzed a statewide hospital discharge dataset to examine the relationship of age, sex, and race/ethnicity with the rates of diabetes-associated hospitalizations, lengths of stay, and direct inpatient charges.

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METHODS

Description of Data Source

Hospital discharge data were obtained from the Georgia Discharge Data Set. This dataset is maintained by the Georgia Hospital Association, a state nonprofit trade association composed of member health systems and hospitals. The Georgia Hospital Association is a contributing partner to the Agency for Healthcare Research and Quality's

Healthcare Cost and Utilization Project Nationwide Inpatient Sample.

Data Extraction

Data on hospital discharges with diabetes listed as a diagnosis were identified in the Georgia Discharge Data Set by using the International Classification of Diseases, 9th revision, Clinical Modification (ICD-9-CM) diabetes-specific code 250.xx.[7,17] Hospitalizations that occurred between 1998 and 2001 were included if patients were ≥18 years of age and not pregnant. Beginning in 1997, all nonfederal hospitals in Georgia began submitting data to the Georgia Hospital Association. Our analysis begins with 1998 because that is the first year the Georgia Hospital Association began to accrue full calendar-year data. Patient age, race/ethnicity, sex, LOS, and total charges were also retrieved. The total charges in the dataset represent the sum of everything a hospital would bill for a claim; it would not include charges for other entities such as physician fees.[19,20]

Data Analysis

For confidentiality reasons, unique patients were not identified in the discharge data, so we could not determine per capita rates. Therefore, we report rates per unit of population time, adjusted to the estimated Georgia population with diabetes.

Results are provided in terms of crude and adjusted data. We report the adjusted hospitalization data as standardized rates (SRs) per 10,000 person-years, standardized rate ratios (SRRs), and standardized rate differences (SRDs). Length of stay (LOS) and direct charges are given as SRs, SRRs, and SRDs and are expressed in terms of the rate per unit of population-time. In adjusted comparisons, we determined the effect of sex while controlling for age and race/ethnicity, the effect of race/ethnicity while controlling for age and sex, and the effect of age while controlling for race/ethnicity and sex. Five different age strata, three different racial/ethnic groups, and both sexes were analyzed. Confidence intervals were not calculated because these data represent a complete enumeration of the hospitalization data for Georgia, and statistical tests of significance are not necessary.

Rates were calculated separately for each age, sex, and race/ethnicity stratum. The rate for a given stratum was the number of hospitalizations (or days or charges) for that stratum divided by the sum of the population of the stratum in 1998, 1999, 2000, and 2001. Rates among each age group were compared with those for 18- to 29-year-olds; women were compared to men, and non-Hispanic Blacks and Hispanics were compared to non-Hispanic Whites. Final comparisons focused only on those discharges for which diabetes was listed as the principal diagnosis.

RESULTS

Overview of Diabetes-Related Discharges

A total of 3,900,337 hospital discharges were reported in Georgia between 1998 and 2001. Of these discharges, 529,027 included diabetes as a diagnosis, constituting nearly 14% of all hospitalizations for the period; 50,301 discharges (1.2% of total discharges) listed diabetes as the first diagnosis, and 478,726 discharges listed diabetes as a codiagnosis (12.3% of total discharges). The percentage of hospitalizations with a diabetes diagnosis by year is shown in Figure 1.

Diabetes Discharges by Age, Sex, and Race/Ethnicity

Among discharges with diabetes as a principal diagnosis, the mean patient age was 51 years, the average LOS was 5.1 days, and the median inpatient charge was $5893; charges were recorded in 98% of the discharges. Fifty-three percent of the diabetes discharges

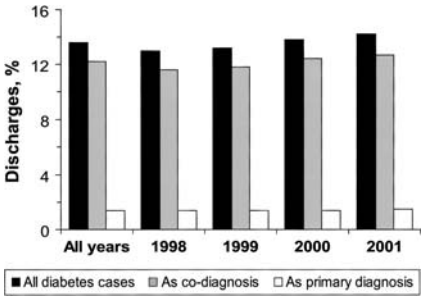

Fig 1. The percentage of hospital discharges with a diabetes diagnosis by year (between 1998 and 2001) in Georgia

were women, 49% were non-Hispanic White, 48% were non-Hispanic Black, and 3% belonged to other groups. Of these other groups, the largest were Hispanic and were included in the analyses. Most patients whose hospitalizations were principally due to diabetes had health insurance. Among the primary payers, 41% were Medicare, 11% were Medicaid, 35% were some type of commercial or other insurance, and 13% were recorded as self-pay (uninsured). The percentage of diabetes discharges coded as self-pay was highest (37%) among Hispanics, whereas 14% of non-Hispanic Blacks and 12% of non-Hispanic Whites were self-pay.

Diabetes hospital discharge rates rose with increasing age (Table 1), such that persons with diabetes who were ≥60 years old had more than five times the rate of persons in the 18- to 29-year-old age group (SRD 41, SRR 5.4). Although they had a greater crude number of hospitalizations, women with diabetes actually had a lower rate (SRD −2, SRR .92) than men in the adjusted analysis.

After adjustment for age and sex (Table 1), non-Hispanic Blacks with diabetes had more than three times as many hospital discharges (SRD 32, SRR 3.2) than their non-Hispanic White counterparts, whereas Hispanics with diabetes had a lower rate (SRD −3, SRR .78). These differences in race/ethnicity were evident within each sex

category. Non-Hispanic Black women had a greater rate of hospitalization than non-Hispanic White women, and Hispanic women had a lower rate of hospitalization discharges. Similar results were observed by race/ethnicity among men (Table 1).

Table 1. Hospitalizations in Georgia (per 10,000 person-years) principally due to diabetes, by age, sex, and race/ethnicity between 1998 and 2001*

Characteristic	Crude Frequency	SR	SRD	SRR
All	50,301	22		
Age group (years)				
18–29	5,250	9	Reference	Reference
30–39	6,853	13	4	1.4
40–49	9,273	19	10	2.1
50–59	9,995	32	23	3.5
≥60	18,930	50	41	5.4
Sex				
Male	23,695	23	Reference	Reference
Female	26,606	21	−2	.92
Race/ethnicity				
Non-Hispanic White	24,572	15	Reference	Reference
Non-Hispanic Black	25,027	46	32	3.2
Hispanic, any	702	11	−3	.78
Race/ethnicity (women)				
Non-Hispanic White	12,405	14	Reference	Reference
Non-Hispanic Black	13,920	47	33	3.3
Hispanic, any	281	12	−3	.8
Race/ethnicity (men)				
Non-Hispanic White	12,167	15	Reference	Reference
Non-Hispanic Black	11,107	45	30	3.1
Hispanic, any	421	11	−4	.76

* Each category adjusted for other variables in table.
SR=standardized rate; SRD=standardized rate difference; SRR=standardized rate ratio.

Differences in Hospital LOS by Age, Sex, and Race/Ethnicity

Average LOS for patients with diabetes was longer among older age groups. Differences in LOS were greatest (SRD 279) and 10-fold higher (SRR 10) among persons ≥60 years old compared with discharges among patients in the 18- to 29-year-old age group (Table 2). Average LOS was slightly less among women than men (SRD −11, SRR .91). Differences in LOS by race/ethnicity were similar to the patterns observed in hospitalization rates (Table 2). Average LOS among non-Hispanic Blacks was almost 3.5 times as long as that of non-Hispanic Whites (SRD 179, SRR 3.4), whereas Hispanics were hospitalized for fewer days (SRD −16, SRR .78). These ethnic or racial differences were seen within each sex category: non-Hispanic Black women had a longer LOS than non-Hispanic White women, and Hispanic women had a shorter LOS. Similar results were observed when the LOS for male patients was compared by race/ethnicity (Table 2).

Differences in Hospital Charges by Age, Sex, and Race/Ethnicity

Similar differences by age, sex, and race/ethnicity were observed for direct inpatient charges as were observed for discharge rates and LOS (Table 3). Patients ≥60 years old had the highest rate of hospital charges (SRD 52, SRR 8.9), and women had a lower rate than men (SRD −3, SRR .86). Non-Hispanic Blacks with diabetes incurred significantly higher charges than non-Hispanic Whites with diabetes (SRD 33, SRR 3.1), whereas Hispanics had lower charges (SRD −3, SRR .79). Non-Hispanic Black women had higher inpatient charges than non-Hispanic White women, and Hispanic women had lower charges; the pattern for Hispanic men was similar.

DISCUSSION

Hospitalizations account for a substantial portion of the morbidity and economic impact of diabetes.[5–7,9] The status of inpatient diabetes care is receiving increasing attention in the US healthcare delivery system.[18] Interventions to improve inpatient care will likely be more effective with a better understanding of the demographic differences present within the population of patients with diabetes who are hospitalized. Our analysis of diabetes hospitalizations within a statewide hospital discharge dataset identified demographic differences in hospital discharge rates, LOS, and direct inpatient charges.

Discharge rates, LOS, and charges were all higher among successive age groups in our dataset. Thus, hospitals will need to consider advancing age as a variable when planning interventions designed to optimize inpatient care of patients with diabetes. Women with diabetes had lower adjusted rates of hospitalization, LOS, and charges compared with men. The prevalence of diabetes has typically been reported as being higher in women than in men,[10] and previous data indicate that more women than men with diabetes report being hospitalized.[15] We cannot say why women with diabetes in our sample had a lower rate of hospitalization than men. The observation that women in this dataset had lower rates for LOS and for charges might suggest that women may have a less-complicated hospital course than men.

Table 2. Hospital lengths of stay (days per 10,000 person-years) in Georgia for persons admitted principally for diabetes, by age, sex, and race/ethnicity between 1998 and 2001*

Characteristic	Crude LOS (1000 days)	SR	SRD	SRR
Total	267	115		
Age group (years)				
18–29	18	31	Reference	Reference
30–39	29	54	23	1.7
40–49	46	93	62	3
50–59	57	184	153	5.9
≥60	117	310	279	10
Sex				
Male	125	121	Reference	Reference
Female	142	110	−11	.91
Race/ethnicity				
Non-Hispanic White	129	75	Reference	Reference
Non-Hispanic Black	134	254	179	3.4
Hispanic, any	3	59	−16	.78
Race/ethnicity (women)				
Non-Hispanic White	64	73	Reference group	Reference group
Non-Hispanic Black	76	263	190	3.6
Hispanic, any	1	59	−14	.8
Race/ethnicity (men)				
Non-Hispanic White	65	77	Reference group	Reference group
Non-Hispanic Black	58	244	167	3.2
Hispanic, any	2	58	−19	.76

* Each category adjusted for other variables in table.
LOS=length of stay; SR=standardized rate; SRD=standardized rate difference; SRR=standardized rate ratio.

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Minority populations, especially Blacks, have a higher prevalence of diabetes, worse glycemic control, and more complications than do White patients with diabetes.[1,2,11–14] Ethnic or racial differences in our data also suggest disparities in how diabetes affects hospitalizations among Blacks. Compared with non-Hispanic Whites with diabetes, non-Hispanic Blacks had markedly higher rates of hospital discharges, LOS, and inpatient charges. Previous reports have noted higher discharge rates for diabetes among Blacks compared with Whites, but these reports did not examine other variables such as LOS or charges.[16,17,21]

The observed differences between Blacks and Whites in our data may have a socioeconomic basis. Hospitalization for diabetes is often considered preventable if timely and effective treatment is delivered in an outpatient setting.[21–23] However, when essential healthcare services are inaccessible, patients have an increased risk of being hospitalized for chronic diseases such as diabetes, and minority populations face greater barriers to obtaining needed medical services.[21–25] Studies by others have identified socioeconomic factors that are associated with greater risk for hospitalization for several categories of chronic illnesses among minority populations, including diabetes.[21–23] The differences between Blacks and Whites that we identified in our hospital discharge data may be another consequence of the preexisting disparities in socioeconomic status and access to health care.

Hispanics also have a high prevalence of diabetes, and they represent one of the fastest growing demographic groups in the United States.[2,26] The rate of hospital discharges for Hispanics with diabetes has been reported to be higher than that for Whites with diabetes.[17] Hence, our finding of a lower rate of hospitalization among Hispanics with diabetes than among Whites was unexpected. In general, little is known about the hospitalizations of Hispanics with diabetes, and their numbers in our sample were so small that definite conclusions cannot be made.

Nonetheless, a number of factors may explain the lower rates of hospitalizations for Hispanics compared with Whites with diabetes in our data. For instance, hospitalization rates among Hispanics could vary by geographic regions within the country. Just as poor access to ambulatory care services may account for the higher rate of hospitalizations among non-Hispanic Blacks, barriers to healthcare access could also explain the lower hospitalization rates we detected among Hispanics. Compared with other ethnic or racial groups, a greater proportion of Hispanics face barriers to healthcare access. Hispanics tend to lack health insurance more often (almost 40% in this dataset were self-pay), and language barriers often impede their access to medical services.[24] Recent migration into the region may also be accompanied by unfamiliarity with the local healthcare system and where to seek acute care. Barriers to accessing health care may have been so profound among Hispanics in this sample that hospitalization was not sought even when needed.

Table 3. Hospital charges (dollars per person-year) for persons in Georgia admitted principally for diabetes, by age, sex, and race/ethnicity between 1998 and 2001*

Characteristic	Crude Charges (million $)	SR	SRD	SRR
Total	525	23		
Age group (years)				
18–29	37	7	Reference	Reference
30–39	60	11	5	1.7
40–49	93	19	12	2.9
50–59	116	37	30	5.7
≥60	219	59	52	8.9
Sex				
Male	254	25	Reference	Reference
Female	271	21	−3	.86
Race/ethnicity				
Non-Hispanic White	265	15	Reference	Reference
Non-Hispanic Black	254	48	33	3.1
Hispanic, any	7	12	−3	.79
Race/ethnicity (women)				
Non-Hispanic White	126	14	Reference	Reference
Non-Hispanic Black	142	49	34	3.4
Hispanic, any	3	13	−2	.89
Race/ethnicity (men)				
Non-Hispanic White	139	15	Reference	Reference
Non-Hispanic Black	112	44	29	2.9
Hispanic, any	4	11	−5	.69

* Each category adjusted for other variables in Table.
SR=standardized rate; SRD=standardized rate difference; SRR=standardized rate ratio.

Our study has some limitations that require discussion. First, we did not have unique patient identifiers. The unit of analysis was discharges; thus, readmission rates could not be determined. This limitation is often true of studies investigating diabetes hospitalizations.[15,16,20] Second, inaccurate reporting of diabetes in hospital data may occur because of factors such as coding bias or failure to recognize the disease.[15,27] For example, inconsistencies in hospital coding data for race/ethnicity have been identified.[28] Hispanics are a diverse group with different places of origin, and inconsistencies or inaccuracies in coding of their race/ethnicity may have resulted in underreporting of discharges in that group. Recent data suggests that patients with diabetes in the hospital are often not recognized and therefore are not coded with that diagnosis.[27] Finally, our study included analysis of a discharge dataset only from Georgia, and these results cannot be generalized to other states or nationally; a broader analysis of a national sampling of discharges might confirm age, sex, and racial or ethnic differences.

When examining our hospital data, we analyzed discharges in which diabetes was the principle diagnosis. As our data show, people with diabetes are hospitalized for reasons unrelated to their diabetes (slightly more than 12% of discharges in our data had diabetes listed as a co-diagnosis). We could have included the diabetes co-diagnoses in our analysis. However, the purpose of our study was to examine differences among persons hospitalized primarily for diabetes. Including persons with diabetes admitted for general medical or surgical reasons not attributable to diabetes (eg, trauma, elective surgical procedures, rehabilitation) would simply add noise to the data and reduce the differences.

The differences we found in hospital discharge rates, LOS, and charges within a population of diabetes patients suggest that marked differences in these variables exist among age groups and racial or ethnic categories. Healthcare systems should be cognizant that specific groups (eg, older patients, non-Hispanic Blacks) with diabetes are at greater risk for hospitalization and thus the resulting economic impact (longer LOS and higher charges) may be greater. Awareness of these differences should facilitate the development of quality improvement programs to specifically target these higher-risk persons in the hospital setting.

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