IDENTIFICATION OF DIABETIC COMPLICATIONS AMONG MINORITY POPULATIONS

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Objective: In consideration of the increasing prevalence of diabetes, multiple factors related to levels of long-term glycemic control, and complex causes of racial disparities across a variety of chronic conditions, patterns of admissions and complications related to diabetes by ethnicity were explored to develop a more clear understanding of underlying causes of disparities.

Method: Using the 2003 National Inpatient Sample, we analyzed the correlation between the primary diagnosis and the likelihood that the condition represented poorly controlled diabetes or a diabetes-related complication.

Results: Minorities were more likely to be admitted through the emergency department and for a condition directly related to diabetes progression. Further, minorities were more likely to be admitted for acute hyperglycemia and acute hypoglycemia.

Conclusion: Interventions that address root causes of disparities related to diabetes and other conditions, such as care-seeking behaviors and ease of access to primary care providers, are keys to eliminating ethnic disparities. (*Ethn Dis*. 2008;18:136–140)

Key Words: Diabetes, Diabetic Complications, Hospital Admissions

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INTRODUCTION

Given the increasing prevalence of type 2 diabetes associated with the growing prevalence of obesity, studies that evaluate the effectiveness of the healthcare system for meeting the needs of diverse populations are critical to improving outcomes and limiting unnecessary morbidity. Approximately 19 million Americans have diabetes at a direct cost of $40 billion.[1,2] While research on disparities across diverse ethnic groups and conditions has shown varying causes potentially related to the type of disease considered,[3] in-depth research on type 2 diabetes outcomes at the national level is sparse.[4,5]

Further, limited research on type 2 diabetes has been conducted on national samples or correlated ethnicity with stage of disease progression. Although findings from multiple studies on disparities describe several contributing factors, including care-seeking behaviors, access to ambulatory care as opposed to reliance on the emergency department, and emphasis on health promotion,[6,7] relatively few studies have evaluated a disease in which several of these factors can concurrently exert an influence. Since care outcomes for type 2 diabetes have multiple determining factors, including adherence to recommended lifestyle changes,[8,9] adherence to medications,[10–12] consistency of follow up,[13] and locus of control,[14,15] racial and ethnic disparities that occur with respect to diabetes care may have root causes associated with any of them. Therefore, by examining patterns of care for type 2 diabetes by ethnicity, we sought to describe disparities, evaluate potential multifactorial causes, and create an agenda for eliminating disparities that can improve outcomes across a wide variety of chronic conditions. To the extent that root causes underlying disparities associated with diabetes mirror root causes associated with disparities across the spectrum of chronic conditions, policies that modify the healthcare system to improve diabetes-related disparities could reduce disparities in other areas as well.

By examining patterns of care for type 2 diabetes by ethnicity, we sought to describe disparities, evaluate potential multifactorial causes, and create an agenda for eliminating disparities that can improve outcomes across a wide variety of chronic conditions.

METHODS

Data

We abstracted adult discharges from the cross-sectional 2003 National Inpatient Sample (NIS), representing 20% of US community hospitals, defined by the American Hospital Association. The community hospitals are nonfederal, short-term, general, and other specialty hospitals. Short-term rehabilitation hospitals, long-term hospitals, psychiatric hospitals, and alcoholism/chemical dependency treatment facilities are excluded. The NIS data are collected by the Hospital Cost and Utilization Project, sponsored by the Agency for Healthcare Research and Quality. Based on the International Classification of Diseases, 9th Edition, Clinical Modification

(ICD-9-CM) diagnostic codes, we included data on all discharges with type 2 diabetes or code 250.02 (regardless as to whether this diagnosis was primary, secondary, tertiary, etc).

We applied several exclusion criteria. First, we excluded non-adult discharges (age <18 years) and discharges with pregnancy complications, as well as other diseases of the skin and subcutaneous tissue, because those patients had different clinical presentations. Second, we excluded discharges that were transferred to another hospital to avoid double counts in the NIS data. Third, we excluded discharges with missing values. In order to obtain the national total estimate, original case weights in the NIS dataset were re-weighted by multiplying an adjuster that equaled the total weight of original cases divided by total weights after the exclusions.[16] As a result, 787,836 discharges were included as our final sample, and the weighted number for the national total estimate was 5,237,918.

Measures

Because diabetes is an ambulatory sensitive condition and some emergency department visits and hospitalizations are preventable,[17] our first dependent variable, a dichotomous variable, was hospital admission through the emergency department. Our second dichotomous dependent variable was the principle diagnosis that belonged to those conditions that were virtually always associated with diabetes, such as diabetes hyperosmolar coma, diabetes with renal disease, and diabetes with peripheral circulatory disorders. Those conditions were identified through the ICD-9-CM codes used by other studies.[3] The third and fourth dichotomous dependent variables were admissions for acute hypoglycemia and hyperglycemia, respectively, because patients with poor control would be more likely to be admitted with acute hyperglycemia and patients with inadequate access to care may be less likely to be admitted with acute hypoglycemia since hypoglycemia is unlikely to occur in the absence of medical treatment. Similarly, those two conditions were also identified by using the ICD-9-CM codes.[3]

We hypothesized that minority patients would have care patterns consistent with higher levels of diabetic progression, similar to findings of adverse outcomes from chronic conditions from other studies.[18,19] Further, we hypothesized that minorities would be more likely to require hospital admissions for both acute hypoglycemia and hyperglycemia suggesting a pattern of care that was more reactive rather than proactive.[3]

The primary independent variable was the patient's self-reported race/ethnicity, categorized as White, African American, Hispanic, or Asian/Pacific Islander. Because of the relatively small sample size, Native American race was included in the analysis but related results were not reported because results were not stable and might not be reliable. In addition, other races (eg, unknown race or multiple races) were included in the analysis, but their results were not reported because the results were less informative with regard to the focus of this paper.

Statistical Analysis

We conducted multiple logistic regression and hierarchical modeling, using the SAS software package (SAS Institute, Inc., Cary, NC). In the hierarchical model, the patient was level one and the hospital was level two. A set of covariates were controlled. First, since cardiovascular and some other medical co-morbidities are positively associated with diabetic adherence, while depression is negatively associated with diabetic adherence,[20] we controlled for cardiovascular co-morbidities as well as other co-morbidities (eg, congestive heart failure, depression, diabetes, and hypertension) as defined by the Agency for Healthcare Research and Quality co-morbidity list.[21]

We controlled for sociodemographics, including age, sex, health insurance status, and median income level. To expand age to a meaningful interval, we divided it into six categories: 18–44, 45–54, 55–64, 65–74, 75–84, and ≥85 years of age. Insurance status was categorized as Medicare, Medicaid, uninsured, privately insured including health maintenance organizations and prepaid health plans, and other insurance categories (eg, worker's compensation, the Civilian Health and Medical Program of the Uniformed Services, the Civilian Health and Medical Program of the Department of Veterans Affairs, Title V, and other government programs). The median income by zip code of patient's residence, available in the NIS data, was divided into four quartiles: ≤$36,000, $36,000–$44,999, $45,000–$59,999, and ≥$60,000.

Finally, we controlled for hospital characteristics, such as hospital bed size (small, medium, and large), teaching hospital status, urban/rural location as defined by the American Hospital Association, and geographic region (Northeast, Midwest, South, and West).

RESULTS

Regardless as to whether type 2 diabetes was the principle diagnosis or any of the secondary diagnoses, percentages of discharges with type 2 diabetes were higher for both African Americans (20.4%) and Native Americans (20.4%) than for Whites (15.7%) (Table 1). When restricted to the principal diagnosis only, the percentages were 1.1% for White, 2.5% for African American, 1.5% for Hispanic, and 2.0% for Native American.

Minority patients were, on average, younger than White patients and had higher percentages of women, Medicaid coverage, and patients who were uninsured (Table 2). Minorities also had higher percentages of admissions through the emergency department with

Table 1. Type 2 diabetes as a percentage of a total number of hospital discharges, 2003*

	All Patients	White	African American	Hispanic	Asian	Native American	Other Race
Weighted number of discharges	5,850,980	3,851,917	838,737	822,184	147,362	12,541	178,239
% type 2 diabetes as principle or secondary diagnosis	16.2	15.7	20.4	15.2	14.8	20.4	13.3
% type 2 diabetes as principle diagnosis only	1.4	1.1	2.5	1.5	0.9	2.0	1.2

* All numbers were calculated before applying the exclusion criteria.

Table 2. Patients' sociodemographic and hospitalization characteristics by race/ethnicity, 2003*

	All Patients†	White	African American	Hispanic	Asian
Total sample					
Weighted national total	5,237,918	3,377,560	898,607	682,252	134,162
Sociodemographic characteristics					
Age at admission, mean (SE), years	66.7 (.15)	68.5 (13)	62.2 (.21)	64.2 (.45)	68.4 (.53)
Age group					
18–44	3.7	2.6	6.3	5.3	2.6
45–54	9.0	7.3	13.9	11.1	6.3
55–64	17.4	15.5	22.2	19.4	15.3
65–74	23.0	22.0	24.3	24.9	24.4
75–84	27.4	29.5	21.2	25.3	30.2
≥85	19.6	23.0	12.1	14.0	21.2
Female	54.0	51.9	61.1	55.5	52.1
Insurance status					
Medicare	64.2	68.8	57.1	54.6	59.8
Medicaid	9.7	5.7	15.6	20.1	15.1
Private insurance	20.9	21.7	20.2	16.8	20.6
Uninsured	3.1	2.0	4.7	5.3	2.3
Other insurance	2.1	1.9	2.3	3.3	2.2
Median income by zip code of residence					
≤$36,000	32.9	24.9	53.1	50.1	14.1
$36,000–$44,999	26.2	28.2	22.7	22.0	28.5
$45,000–$59,999	24.0	26.8	15.7	19.4	24.2
≥$60,000	16.9	20.1	8.5	8.5	33.2
Hospital Care					
Admission through ED	61.1	57.2	69.8	68.4	64.2
Admission directly related to diabetes	4.5	3.7	6.4	5.7	4.3
Hospital Size					
Small	11.9	12.5	9.6	9.2	9.2
Medium	27.0	26.6	23.8	31.0	31.2
Large	61.1	61.0	66.6	59.9	59.6
Admission in teaching hospital	41.8	37.7	58.3	43.2	42.1
Admission in rural hospital	12.2	16.8	8.1	6.1	7.5
Hospital region					
Northeast	27.2	29.9	27.2	20.5	11.7
Midwest	13.5	17.2	13.2	1.1	1.7
South	41.7	38.2	50.9	41.7	9.2
West	17.6	14.8	8.6	36.7	77.4
Outcome					
Length of stay, mean (SE), days	5.6 (.06)	5.4 (.05)	5.9 (.11)	5.7 (.10)	6.4 (.27)
Total cost, mean (SE), $‡	9261 (203)	8888 (171)	9094 (284)	10367 (485)	12862 (1043)
Acute hyperglycemic condition	.20	.16	.60	.24	.22
Discharge status equals death	3.0	3.1	2.7	2.7	4.4

SE = standard error, ED = emergency department.
*Data are expressed as percentages unless otherwise indicated. All variables were statistically significant at the level of $P<.001$ across the racial groups.
†Includes Native American and unknown ethnicity.
‡Total cost was converted from total charges based on the Agency for Healthcare Research and Quality cost-charge-ratios.

All minorities had longer average lengths of stay, incurred higher costs, and had higher percentages of acute hyperglycemic conditions and acute hypoglycemic conditions than did Whites.

Table 3. Relationship between race/ethnicity and hospital care, 2003 National Inpatient Sample

	Odds Ratio (95% Confidence Interval)		
	African American	Hispanic	Asian
Response Variable			
Admission through emergency department	1.62 (1.60–1.64)	1.33 (1.31–1.36)	1.33 (1.28–1.38)
Admission directly related to diabetes	1.73 (1.68–1.78)	1.48 (1.44–1.54)	1.12 (1.04–1.21)
Acute hyperglycemic condition	2.90 (2.59–3.25)	1.38 (1.18–1.61)	1.51 (1.08–2.10)
Acute hypoglyemic condition	1.62 (1.55–1.69)	1.24 (1.18–1.30)	1.15 (1.03–1.75)

the diagnosis related to diabetes. All minorities had longer average lengths of stay, incurred higher costs, and had higher percentages of acute hyperglycemic conditions and acute hypoglycemic conditions than did Whites. Compared to Whites, African Americans, Hispanics, and Asians were more likely to be admitted through the emergency department. Finally, compared with Whites, all minority groups were more likely to be admitted in association with an acute hypoglycemic condition.

DISCUSSION

Minority groups were more likely to be admitted through the emergency department with a diagnosis directly related to diabetes, acute hyperglycemia, and acute hypoglycemia than were Whites. This finding is supported by literature showing that challenges to proactive diabetic management tend to be greater in minority populations; these challenges include limited health literacy, which may decrease ability to comply with lifestyle and medication recommendations,[22,23] reduced access to preventive healthcare visits,[24] and barriers to accessing medications.[23,24] The increased utilization of the emergency department among minority patients with type 2 diabetes for unrelated conditions is also consistent with literature showing greater emergency department utilization among minority patients for nonemergency conditions, including diabetes.[17,25]

Our findings are also consistent with the literature showing delays in seeking care among minority populations.[26] For patients who delay care seeking or who do not have ready access to a primary care physician, the presenting symptom is more likely to be related to the diabetes being out of control as a result of delayed care for the underlying condition, which makes the primary diagnosis more likely to be reflective of acute hyperglycemia. In addition, as our results show that minority patients were younger than their White counterparts, the earlier disease onset may contribute to poorer outcomes in minorities, which merits further research. As relates to the higher frequency of admissions for acute hypoglycemic conditions, this finding may represent a more reactive pattern of care or inconsistent lifestyle modifications as opposed to a consistent, planned approach, which also merits further research.

All findings—higher frequency of acute hyperglycemic conditions, acute hypoglycemic conditions, and diabetic long-term complications—suggest that minority patients access care later in the course of illness and at lower-intensity levels than their White counterparts, which creates greater short- and long-term vulnerability. This conclusion is consistent with literature showing delays in care-seeking behavior among minority patients[27] and our data showing higher levels of emergency department utilization among minority patients. Primary areas for policy intervention include promotion of social marketing strategies that encourage earlier care seeking behavior among minorities, ongoing health maintenance during times when acute illness is not present, and consistent messages promoting appropriate changes related to diet and exercise.

Several limitations to this study are noted. The NIS data did not allow us to examine readmission, and information about ambulatory care could not be traced through the linkage with other datasets. Nevertheless, other studies on disproportionate readmission among minorities with diabetes reported consistent and complementary results.[28] In addition, since 7 of the 37 states did not provide race information, we adjusted the weights for the estimate of the national total, assuming that the 7 states that did not report ethnicity were consistent with the 30 states that did in terms of demographic patterns. Finally, the NIS dataset does not allow us to link data to individual patients, which prevents us from conclusively demonstrating that delay in accessing care was a primary cause of the lower frequency of tier two diagnoses among minorities.

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Statistical expertise: Shen
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