Racial and Ethnic Disparities in the Pharmacologic Management of Diabetes Mellitus Among Long-Term Care Facility Residents

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Objective: To evaluate the prevalence of racial and ethnic disparities of antidiabetic treatment among residents of long-term care facilities in five states.

Research Design and Methods: Retrospective, cross-sectional study of 50,427 elderly nursing home residents with diabetes in New York, South Dakota, Kansas, Mississippi, and Ohio between 1993 and 1997.

Results: Thirty to fifty percent of residents received no antidiabetic medications. After adjusting for sociodemographic characteristics, comorbid conditions and diabetes severity, Blacks and Hispanics had lower rates of antidiabetic medication use than Whites, while Asians had slightly higher rates. For Native Americans the results were mixed, little disparity was seen when compared with Whites observed among New York nursing home residents, and while in South Dakota Native Americans had significantly lower rates of antidiabetic medication use than Whites.

Conclusion: Although lack of information on glycemic control and non-medical treatments do not allow us to comment on quality of diabetes care, more research is needed to understand why some nursing homes residents are less likely to receive antidiabetic medication. (*Ethn Dis*. 2005;15:205-212)

Key Words: Antidiabetic Medications, Diabetes, Elderly, Long-Term Care, Nursing Homes Racial Disparities, Race/Ethnicity

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Introduction

Diabetes mellitus continues to be a major source of illness and death in the United States. More than 10 million Americans have the disease, and its prevalence increases with age.[1] In fact, the 1987 National Medical Expenditure Survey found that one in five nursing home residents had diabetes.[2] Moreover, published literature has well-documented racial and ethnic disparities in the prevalence, morbidity, mortality, and treatment of diabetes.[3,4] African Americans and Hispanics have the highest prevalences, while Asian Americans have the lowest. Prevalences for Native Americans varied significantly with geography.[5] The prevalence of diabetes has been predicted to increase significantly in coming decades,[6,7] with the largest increases predicted for Hispanics and non-Hispanic Blacks.[6]

Complications of diabetes as well as hospitalization[8] and possibly death[9,10] may occur more frequently among racial and ethnic minorities. Although some studies of diabetes complications show increased rates for Asian Americans,[11] overall very few studies have been conducted.[2] To date, higher rates of complications such as end stage renal disease, retinopathy, nephropathy, and neuropathy have been documented in African Americans, Native Americans, and Hispanics when compared with Whites.[11–13] For example, a study by Harris and colleagues found that African Americans had a risk of developing retinopathy three times that of Whites after adjusting for sex, glycosolated hemoglobin, blood pressure, and type of antidiabetic treatment.[14] A recent study of preventable hospitalizations found that although Asians with diabetes had hospitalization rates approximately one half those of Whites, the hospitalization rates for African Americans and Hispanics with diabetes were 1.5 to 5 times higher than those of Whites.[8] Finally, diabetes may account for a significant proportion of observed racial disparities in mortality. An analysis by Wong and colleagues concluded that diabetes explained 8.5% of the overall disparity between African Americans and Whites in potential life-years lost.[4]

In addition to the effect on health, diabetes has a significant economic impact. Direct and indirect expenditures attributable to diabetes totaled $132 billion in 2002.[6] Individuals with diabetes on Medicare have healthcare expenditures 70% higher than those who did not have diabetes.[15] Recent improvements in insulin delivery systems and the introduction of new antidiabetic agents offer physicians and patients new choices for diabetes management. However, a recent study by our group suggests that 47% of residents with diabetes in long-term care received no antidiabetic medications, and African Americans were less likely than their White counterparts to receive antidiabetic medications.[16] While some patients may have their diabetes adequately controlled through diet and exercise, others may not be receiving necessary care. In this report we examine the racial differences in pharmacologic treatment of diabetes in a previously understudied group, nursing home residents.

Methods

The Institutional Review Board of Brown University approved this study.

A recent study of preventable hospitalizations found that . . . the hospitalization rates for African Americans and Hispanics with diabetes were 1.5 to 5 times higher than those of Whites.[8]

The Sage Database

Data were obtained from the SAGE (Systematic Assessment of Geriatric Drug Use via Epidemiology) database, described elsewhere in detail.[17,18] In summary, SAGE is an integrated database that includes information obtained through the Healthcare Financing Administration's Case-Mix Reimbursement and Quality Demonstration Project. Nursing home staff at all Medicare- and Medicaid-certified nursing homes in Kansas, Maine, Mississippi, Ohio, New York, and South Dakota have evaluated residents using the federally mandated Resident Assessment Instrument, which includes the 350-item Minimum Data Set (MDS).

The MDS includes sociodemographic information, clinical items including physical and cognitive function, and all clinical diagnoses.[19,20] The MDS also includes a comprehensive set of symptoms, syndromes, and treatments being provided, as well as indicators describing the resident's behavior and mood.[19,20] Summary scales have been derived to determine performance for physical function (activities of daily living, or ADL[21]) and cognitive ability (cognitive performance scale, or CPS).[22] The validity of these scales has been corroborated by comparisons to accepted benchmarks.[22,23]

Study Sample

We identified the admission assessment for 493,790 unique residents. From this group, we selected 419,384 residents of states within time periods with reliable MDS and drug data (1993 to 1997 for New York, Kansas, Mississippi, and South Dakota; 1996 for Ohio). Of these, 375,393 residents were ≥65 years of age. Residents missing information on race/ethnicity (N=7,118), sex (N=246), physical function (N=3,927), cognitive function (N=1,310), or insurance coverage (N=1,555) were excluded. Residents living in facilities that systematically recorded drug data (N=340,965) were included. Among these, 66,093 residents (20.1%) had diabetes mellitus documented in the section on the MDS corresponding to active clinical conditions. The diagnosis was based on the physician's judgment by using information from the medical record, including physical exam, medication and other treatment orders, and hospital discharge documentation (if any).[19] The MDS does not include objective measures of glycemic control such as glycosylated hemoglobin (HbA_{1c}) levels and fasting or postprandial plasma glucose concentrations.

Definition of Race/Ethnicity

We conceptualized the term "race" as a social category that reflects the lifelong experiences of being members of a socially-assigned group that experiences economic (eg, disparities in wages or access to health insurance) as well as noneconomic (eg, systematic differences in access to medical care or to medical procedures or treatments) forms of discrimination. The MDS Training Manual[19] instructs facility staff to assign one of the following categories to each resident: American Indian/Alaskan Native; Asian/Pacific Islander; Black, not of Hispanic origin; Hispanic; or White, not of Hispanic origin. The manual states, "Consult resident as necessary. Enter the race/ethnic category within which the resident places self" (MDS Plus Training Manual, chap 6, p 7). Thus, this variable is intended to reflect self-identity, rather than staff perception. Because our analytic strategy required stratification by state, we evaluated contrasts of racial/ethnicity groups when we could identify at least 100 cases from each race/ethnicity group within each state (N=53,093). As such, the final analytic sample permitted the following race/ethnicity categories in each state: Black non-Hispanic and White in Mississippi, Ohio, and Kansas; Native American/Native Alaskan and White non-Hispanic in South Dakota; and Native American/Alaskan Native, Asian/Pacific Islander, Black non-Hispanic, Hispanic, and White non-Hispanic in New York.

Drug Data

Nursing staff recorded data on up to 18 different medications taken by each resident during the seven days preceding the MDS assessment. Data on medications included brand or generic name, dosage, route, frequency of administration, and whether it was given on a standing or an as-needed order.[19,20] Drugs were coded according to the National Drug Code system, and the Master Drug Data Base (MediSpan Inc, Indianapolis, Indiana) was used to translate them into therapeutic classes and subclasses.[18] A resident was considered an antidiabetic medication user if any of the following medications was included on his or her assessment: sulfonylurea, insulin, alpha-glucosidase inhibitor, biguanide, aldose reductase inhibitor, or some other antidiabetic medication. The antidiabetic medicines that became available in the United States after the end of our study could not be evaluated in this study.

Analytic Approach

We initially stratified all analyses by sex, state, and racial/ethnic group. However, because of the similarity of results for men and women, those analyses were collapsed. We compared the distributions of sociodemographic variables, measures of cognitive and physical functioning, co-morbid conditions, and in-

dicators of the severity of diabetes. We estimated the crude difference in the prevalence of receipt of antidiabetic medications within each state. State-specific generalized linear models (using a binary distribution and identity link) provided estimates of the absolute difference in prevalence estimates of the receipt of antidiabetic medications between each of the racial/ethnic groups and White non-Hispanics adjusted by potential confounders. Potential confounders considered were sociodemographic factors, indices of disease severity (eg, activities of daily living, amputation, and visual impairment), and comorbid conditions (eg, hypertension, atherosclerosis, stroke, dementia). Variables whose inclusion resulted in >10% change in the estimate of effect for the race/ethnicity terms were retained in the model. All statistical analyses were performed by using SAS version 8.1 (SAS, Inc., Cary, NC).

RESULTS

Black Non-Hispanic Residents

Table 1 presents the characteristics of our population of Black and White residents in Kansas, Mississippi, New York, and Ohio with diabetes. In general Black residents were younger but did not differ greatly for either sources of admittance or body mass index (BMI). Examining indicators of disease severity, Black residents had higher rates of significant physical or cognitive impairment, blindness, and amputation than Whites. Finally, Black residents tended to higher rates of hypertension, dementia, stroke, and glaucoma and lower rates of congestive heart failure, atherosclerosis, asthma/chronic obstructive pulmonary disease (COPD), depression, and arthritis than White residents.

Despite this clinical picture, Black residents consistently had lower numbers of total medications as well as antidiabetic medications. Black residents had higher rates of insulin use and lower rates of sulfonylurea use than Whites. After controlling for sociodemographics and comorbidity, the prevalence difference of any antidiabetic medication use ranged from −5.1 to −6.4 (Table 3). Rates of use of other antidiabetic medications were too small to evaluate for differences by race/ethnicity.

Asian/Pacific Islander Residents

Table 2 presents the characteristics of our population of Asian/Pacific Islander and White residents in New York with diabetes. Asian residents tended to be younger and have lower BMI, but they had higher rates of significant physical and cognitive impairment. Asian residents had lower rates of CHF, atherosclerosis, dementia, asthma/COPD, and depression than White residents. They did, however, have higher rates of hypertension and stroke. Asian residents were more likely to be receiving zero to five medications than White residents. Asian residents had lower rates of sulfonylurea use and slightly higher rates of insulin use. Overall, after adjusting for severity and comorbidity, Asian residents had slightly higher rates of any antidiabetic medication use than Whites (see Table 3).

Hispanic Residents

Table 2 presents the characteristics of our population of Hispanic and White residents in New York with diabetes. In general, the Hispanic residents were younger, had lower BMI, more physical and cognitive impairment as well as higher rates of both blindness and amputation. Hispanic residents had higher rates of hypertension, dementia, and stroke and lower rates of CHF and atherosclerosis than White residents. Further, Hispanic residents were more likely than White residents to be receiving five or fewer medications. Hispanic residents were less likely to be receiving sulfonylureas and more likely to be receiving insulin than White residents. Overall, after adjusting for sociodemographic characteristics and severity, Hispanic residents were less likely to receive any antidiabetic medication than White residents (Table 3).

Native American/Alaskan Native Residents

Table 2 presents the characteristics of our population of Native American/Alaskan Native and White residents in New York and South Dakota with diabetes. In New York, Native American residents were similar to White residents in terms of age, BMI, cognitive and physical impairment, and rates of blindness and amputation. They did however, have higher rates of hypertension, atherosclerosis, and stroke. Overall, Native American residents in New York facilities had similar distributions of overall number of medications and antidiabetic medications.

In contrast, in South Dakota, Native American residents were younger, had lower BMI, higher levels of ADL impairment and higher rates of amputations than White residents. Similar in terms of many comorbid conditions, Native American residents had lower rates of hypertension and depression. Despite having similar distributions in overall numbers of medications, Native American residents had significantly lower rates of sulfonylurea, insulin or any antidiabetic medication than White residents after adjusting for sociodemographic characteristics and severity (Table 3).

DISCUSSION

Complications of diabetes may manifest as either microvascular (retinopathy, nephropathy, and neuropathy) or macrovascular (hypertension and hyperlipidemia) endpoints or both. While diabetes itself is not a modifiable risk factor for these complications, improved glycemic control has been shown to delay the onset and slow the progression of microvascular complications, such as

Table 1. Comparison of Black, non-Hispanic and White, non-Hispanic residents in long-term care with diabetes mellitus by state

	Kansas		Mississippi		New York		Ohio	
	Black *N*=373 %	White *N*=6520 %	Black *N*=1805 %	White *N*=4020 %	Black *N*=4357 %	White *N*=25,973 %	Black *N*=561 %	White *N*=4049 %
Age category								
65–74	43	23	35	28	42	24	39	26
75–84	37	46	41	48	41	45	43	47
85+	20	30	25	25	18	30	18	26
Admitted from								
Private home	20	23	18	20	7	11	13	16
Acute care hospital	69	65	72	69	88	82	73	68
Body mass index*								
BMI<20	15	12	18	16	20	18	10	10
BMI>30	18	21	22	19	18	16	15	15
ADL impairment								
Moderate	47	56	48	58	36	51	52	60
Dependent	36	22	40	26	56	42	42	29
CPS impairment								
Moderate	40	40	36	33	44	41	53	47
Severe	14	8	17	10	18	11	17	10
Blind	17	9	16	12	18	12	18	13
Amputation*	9	3	8	3	11	6	16	6
Comorbid conditions								
CHF	28	30	24	30	19	28	26	31
Hypertension	56	43	62	53	67	50	66	55
Atherosclerosis	13	15	14	19	21	26	19	19
Dementia	21	17	23	23	31	24	28	24
Stroke	26	20	33	28	36	26	37	29
Parkinson's	4	4	1	4	2	5	3	5
Asthma/COPD	10	13	8	16	8	14	15	17
Depression	30	37	21	29	15	27	37	48
Glaucoma	11	5	5	5	10	7	11	6
Arthritis	12	20	23	24	13	18	19	25
No. of medications								
0–3	17	11	14	8	20	13	6	5
4–5	18	16	20	13	24	18	16	10
6–10	42	50	47	47	45	49	52	48
11+	23	24	20	32	11	20	25	37
Antidiabetic medications								
Any	59	64	61	66	50	55	63	68
Sulfonylurea	23	33	22	29	21	28	24	36
Insulin	40	33	43	41	31	29	44	38
Other	1	<1	<1	0	<1	<1	<1	<1

* Missing data are <5% except for height/weight in Ohio (176 Blacks and 1193 Whites); and amputation in Kansas (52 Blacks and 732 Whites), Mississippi (642 Blacks and 1468 Whites), and Ohio (345 Blacks and 2811 Whites).

ADL = activities of daily living; CPS = cognitive performance scale; CHF = coronary heart failure; COPD = chronic obstructive pulmonary disease.

diabetic retinopathy, nephropathy and neuropathy, and possibly reduce the number of cardiovascular events.[24,25] Diabetes mellitus is also associated with the formation of pressure ulcers.[26,27] Although the late complications of diabetes develop only after approximately 15 years of hyperglycemia,[28] the short-term risks of persistent hyperglycemia include infection[29] and decreased neuropathic pain threshold.[30] Infections of chronic wounds, including foot and pressure ulcers, are a significant impediment to wound healing[29] and frequently lead to hospitalizations. Diabetes accounts for 46% of the 162,500 annual hospitalizations for foot ulcers,[28] at an average cost of $4,595 per episode.[31]

Table 2. Comparison of Asian/Pacific Islander, Hispanic, Native American/Alaskan Native and White, non-Hispanic residents in New York and Native American/Alaskan Native and white non-Hispanic residents in South Dakota in long-term care with diabetes mellitus

	New York				South Dakota	
	Asian *N*=515 %	Hispanic *N*=1342 %	Native American *N*=741 %	White *N*=25,973 %	Native American *N*=171 %	White *N*=2666 %
Age category						
65–74	33	42	26	24	42	22
75–84	47	41	46	46	42	49
85+	20	17	28	30	16	29
Admitted from						
Private home	11	10	12	11	11	15
Acute care hospital	84	83	80	82	75	70
Body mass index						
BMI<20	30	21	18	18	14	10
BMI>30	6	11	17	16	17	22
ADL impairment						
Moderate	36	36	51	51	60	65
Dependent	55	53	42	42	22	17
CPS impairment						
Moderate	51	50	47	41	38	39
Severe	21	18	11	11	5	6
Blind	13	17	13	12	11	9
Amputation	4	10	6	6	15	4
Comorbid conditions						
CHF	18	23	28	28	36	34
Hypertension	62	56	54	50	43	47
Atherosclerosis	21	22	30	26	18	18
Dementia	19	30	25	24	18	13
Stroke	44	29	33	26	24	22
Parkinson's	4	4	5	5	4	4
Asthma/COPD	5	12	12	14	18	16
Depression	14	18	17	27	29	38
Glaucoma	5	8	8	7	6	6
Arthritis	7	10	12	18	21	23
No. of medications						
0–3	20	19	11	13	10	9
4–5	25	24	19	18	22	15
6–10	44	47	48	49	49	50
11+	11	11	22	20	19	25
Antidiabetic medications						
Any	57	53	56	55	54	64
Sulfonylurea	24	23	28	28	19	26
Insulin	31	32	28	29	35	40
Other	0	0	<1	<1	0	<1

ADL = activities of daily living; CPS = cognitive performance scale; CHF = coronary heart failure; COPD = chronic obstructive pulmonary disease.

Uncontrolled hyperglycemia can also result in hospitalization for diabetic ketoacidosis and hyperglycemic hyperosmolar nonketotic syndrome.[32] Improved treatment of diabetes could decrease the number of hospitalizations from all of these complications substantially.

Given the implications of complications from diabetes, diabetes is a disease that requires continuous medical care and self-management. The American Diabetes Association recommends that patients with diabetes receive care from a physician-coordinated team that centers on glycemic control.[33] Unfortunately the major studies on which these recommendations were based were conducted in non-elderly populations, so conclusively stating the impact of tight glycemic control among the elderly is not possible.[24,25] An analysis by Vijan and colleagues,[34] however, attempted to extrapolate the benefit of glycemic control to the elderly patient by using probabilities estimated from type 1 diabetes. They found significant reduction in the risk of retinopathy when improving glycemic control from poor to moderate. A smaller benefit is noted when improving glycemic control from moderate to near normal. Therefore, the American Diabetes Association recommends that providers take into consideration the overall health, ability to implement self-management, and comorbid conditions of patients when establishing target goals.[33] Although the elderly can be treated with the same medications as younger patients, care must be taken in monitoring medication regimens. Comorbid conditions or poorly controlled diabetes may put the elderly patient at higher risk of complications such as hypoglycemia as well as exacerbation of risk of cardiovascular disease or falls.

Numerous studies have found that quality of health care varies according to patients' race/ethnicity, and these disparities often persist in the absence of financial barriers.[35–40] As such, elderly minority individuals with diabetes may be especially vulnerable, given that they may also have had a long history of inadequate access to medical care due to lack of insurance or ability to pay.[41] Further, studies of general medical care found differential use of medical services by race/ethnicity. Specifically, minorities have less access to specialist care.[42] In the case of diabetes, lack of access to

Table 3. Crude and adjusted prevalence differences of any antidiabetic medication use of racial/ethnic compared to White long-term care residents by race/ethnicity and state

Race/Ethnicity	State	Crude Prevalence Difference	Adjusted Prevalence Difference	95% Confidence Interval
Black*	Kansas	−4.9	−5.6	−10.8 to −0.5
	Mississippi	−4.4	−5.1	−7.8 to −2.3
	New York	−5.0	−6.4	−8.0 to −4.7
	Ohio	−5.2	−6.0	−10.2 to −1.7
Native American†	New York	0.4	0.6	−3.0 to 4.2
	South Dakota	−10.4	−11.0	−18.8 to −3.1
Asian‡	New York	2.0	2.6	−1.7 to 6.9
Hispanic†	New York	−2.5	−2.9	−5.6 to −0.1

* Confounders are sociodemographic factors and group 2 comorbid conditions (dementia, Parkinson's, asthma/COPD, depression, glaucoma, and arthritis).
† Confounders are sociodemographic factors and disease severity (blindness, amputation, total number of medications).
‡ Confounders are disease severity (blindness, amputation, total number of medications) and all comorbid conditions.
COPD = chronic obstructive pulmonary disease.

specialist care may mean less likelihood of receiving novel or effective pharmacologic glycemic control.[43,44]

In each of the four states examined, Blacks had lower rates of pharmacologic treatments while in New York, Hispanics had lower rates of treatment than Whites. Findings for Native Americans were mixed, with a slightly higher rate of treatment in New York and significantly lower rate of treatment compared with Whites in South Dakota. In contrast, Asians had a slightly higher rate of antidiabetic medication use than Whites in New York. Although these findings have been confirmed in a previous study in nursing home residents,[16] they are in contrast with other studies. Two studies by de Rekeneire[45] and Glynn[46] found higher rates of any antidiabetic medication use in Blacks, while the Insulin Resistance Atherosclerosis Study[47] found similar rates of treatment as Whites for both Blacks and Hispanics. The contrasting nature of these findings is also reflected in studies of preventive care for people with diabetes. A number of studies have found racial disparities in preventive services like eye examinations,[39] lipid profile measurements,[48] as well as pneumococcal influenza vaccinations.[48] Results from the Commonwealth Fund's Healthcare Quality Survey, on the other hand, found that Blacks were more likely to receive appropriate preventive care (glycohemoglobin and eye exam in past year, cholesterol checked in past two years, and blood pressure checked every six months) than Whites, while Hispanics and Asians were less likely to receive adequate preventive services than Whites.[49]

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A number of limitations should be considered in this study. First, the diabetes diagnosis in MDS does not differentiate between type 1 and type 2 diabetes. We assumed that type 2 represents the overwhelming majority of cases (at least 90%) given the earlier onset and progression of type 1 and the distribution of diabetes among the elderly. Another potential limitation is the data source. Although the Minimum Data Set is an administrative dataset, the diagnoses collected have been documented as having excellent reliability,[18,50] and pharmacologic treatment of diabetes is strongly correlated with a diabetes diagnosis (91%).[50] Further, the prevalence of diabetes in our population (20.1%) is similar to that found in other studies.[51,52]

A third potential limitation is that this study reports on differences in rates of pharmacologic antidiabetic treatment; the results may not be extrapolated to the issue of quality of medical care. Data on glycemic control, length of time since diagnosis, and non-pharmacologic treatments (diet and exercise) were not available. However, a study of community-dwelling older adults by de Rekeneire and colleagues found that glycemic control was worse in Black adults than White adults even after adjusting for prevalence of cardiovascular disease, total cholesterol, body mass index, summary performance measures, insulin use, quality of care, social support, and level of education,[45] which supports the assumption that the disparities in observed rates of pharmacologic treatment were not likely explained by better glycemic control. In contrast, an analysis of the Third National Health and Nutrition Examination Survey found that those ≥65 years had lower rates of HbA_{1c} levels >8%.[53]

Finally, not every elderly person with diabetes is a candidate for aggressive management of glycemic levels. Comorbid conditions, life expectancy, ability for self-management, and risk of diabetic complications like hypoglycemia are all considered when establishing management plans.[33,54,55] This recommendation has been confirmed in a study by Glynn and colleagues,[46] which found rates of antidiabetic medication use significantly lower among those >85 years of age.

Overall levels of antidiabetic therapy varied by race and location in our study but ranged from 50% to 70%—a slight improvement of a similar study conducted during an earlier time period[16] but significantly below that of community based populations. Findings from the Third National Health and Nutrition Examination Survey found that approximately 25% of those ≥65 years of age were not receiving any antidiabetic medications.[53] This low rate of antidiabetic medication use most likely reflects a number of influences, especially the complex medical conditions of elderly nursing home residents as well as treatment practices.

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