Racial and Ethnic Differences in Health Care Access and Health Outcomes for Adults With Type 2 Diabetes

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OBJECTIVE — To evaluate health care access and utilization and health status and outcomes for type 2 diabetic patients according to race and ethnicity and to determine whether health status is influenced by health care access and utilization.

RESEARCH DESIGN AND METHODS — National samples of Caucasians, African-Americans, and Mexican-Americans were studied in the third National Health and Nutrition Examination Survey. Information on medical history and treatment of diabetes, health care access and utilization, and health status and outcomes was obtained by structured questionnaires and by clinical and laboratory assessments.

RESULTS — Almost all patients in each race and ethnic group had one primary source of ambulatory medical care (92–97%), saw one physician at this source (83–92%), and had at least semiannual physician visits (83–90%). Almost all patients ≥65 years of age had health insurance (99–100%), and for those patients <65 years of age, Caucasians (91%) and African-Americans (89%) had higher rates of coverage than Mexican-Americans (66%). Rates of treatment with insulin or oral agents (71–78%), eye examination in the previous year (61–70%), blood pressure check in the previous 6 months (83–89%), and the proportion of hypertension that was diagnosed (84–91%) were similar for each race and ethnic group. Lower proportions of African-Americans and Mexican-Americans self-monitored their blood glucose (insulin-treated, 27 vs. 44% of Caucasians), had their cholesterol checked (62–68 vs. 81%), and had their dyslipidemia diagnosed (45 vs. 58%). African-American and Mexican-American patients had a somewhat higher proportion than Caucasian patients, with HbA_{1c} ≥7% (58–66 vs. 55%), blood pressure ≥140/90 mmHg among those with diagnosed hypertension (60–65 vs. 55%), and clinical proteinuria (11–14 vs. 5%). In contrast, they had better levels of total cholesterol (≥240 mg/dl) (28–30 vs. 34%) and HDL cholesterol (≥45 mg/dl) (46–59 vs. 38%), and African-American and Mexican-American men were less overweight than Caucasian men (BMI ≥30) (34–37 vs. 44%), although the opposite was true for women. LDL cholesterol levels and the proportion of patients who smoked cigarettes or were hospitalized in the past year were similar among all three groups. In logistic regression analysis, there was little evidence that levels of blood glucose, blood pressure, lipids, or albuminuria were associated with access to or utilization of health care or with socioeconomic status.

CONCLUSIONS — There are some differences by race and ethnicity in health care access and utilization and in health status and outcomes for adults with type 2 diabetes. However, the magnitude of these differences pale in comparison with the suboptimal health status of all three race and ethnic groups relative to established treatment goals. Health status does not appear to be influenced by access to health care.

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Abbreviations: ADA, American Diabetes Association; DQIP, Diabetes Quality Improvement Project; HMO, health maintenance organization; NHANES III, third National Health and Nutrition Examination Survey; OR, odds ratio.

A table elsewhere in this issue shows Système International (SI) units and conversion factors for many substances.

In the U.S., there is considerable variation by race and ethnicity in health care access and utilization for a number of diseases and conditions. For example, surgery rates were substantially lower for African-American patients with resectable nonsmall-cell lung cancer than for Caucasian patients, which accounted for the lower survival rate of the African-American patients (1). African-American and Hispanic women were less likely to have mammograms and more likely to present with late-stage breast cancer than Caucasian women (2,3). The use of antiretroviral therapy was significantly less common for African-Americans and Latinos in a national sample of people with AIDS (4). African Americans were less likely to have cardiac procedures, including reperfusion therapy for myocardial infarction, cardiac catheterization, coronary artery bypass graft surgery, and percutaneous transluminal coronary angioplasty (5,6).

For diabetic patients, such variation in health care access and utilization has not been documented. Nevertheless, considerable attention has been garnered by the concept that access and utilization are major determinants of quality of care and health outcomes in diabetes. It is widely believed that diabetes care in the U.S. is suboptimal and that patients with diabetes are not receiving the care known to be beneficial. For example, the Diabetes Quality Improvement Project (DQIP), sponsored by a number of organizations with interest in diabetes, was created to assess the level of care provided to patients with diabetes and to improve the accountability of the health system (7).

It is well established that racial and ethnic differences exist in end-stage clinical outcomes for diabetic patients. Microvascular complications of the eyes, nerves, and kidneys and lower extremity amputations are more common in African-Americans, Hispanic Americans, and Native Americans with diabetes than in non-Hispanic Caucasian patients (8–15). However, these end-stage complications result only after a long duration of diabe-

Table 1—*Characteristics of type 2 diabetic adults, according to race and ethnicity*

	Non-Hispanic Caucasian	Non-Hispanic African-American	Mexican-American
Median age (years)	63.4	59.5*	56.1†
Median duration since diabetes diagnosis (years)	6.4	7.6	5.4
Men	46.0	37.3‡	38.7‡
High school education or more	61.1	42.7†	23.1†
Family income ≥$20,000	58.6	31.5†	35.0†
Mean BMI (kg/m^2)			
Men	29.8	28.3*	29.3
Women	30.8	32.6‡	31.0
Hypertension	65.9	71.4	53.8‡
Dyslipidemia	65.3	62.2	51.2*

Data are %, unless otherwise indicated. *$P < 0.01$, †$P < 0.001$, ‡$P < 0.05$ compared with non-Hispanic Caucasians.

tes and thus occur in patients who were diagnosed and received much of their medical care many years ago. The current contribution of the health care system to these racial and ethnic differences in adverse health outcomes versus the contributions of patient self-care practices and inherent biological and genetic factors is yet undetermined.

To investigate these issues, we analyzed data from the third National Health and Nutrition Examination Survey (NHANES III), in which questionnaire, clinical, and laboratory data on health care access, utilization, and medical outcomes were obtained for a representative sample of type 2 diabetic adults. The outcomes studied were those that are expected to be influenced by recent medical care, such as hyperglycemia, albuminuria, hypertension, and dyslipidemia.

RESEARCH DESIGN AND METHODS— NHANES III was conducted from 1988 to 1994 and included a stratified probability sample of the civilian noninstitutionalized U.S. population, with oversampling of African-Americans and Mexican-Americans. The design and conduct of the survey has been described (16). Participants were interviewed in their homes and were given a standardized set of examinations and laboratory measurements in an examination center. There were 16,993 participants ≥25 years of age, 1,608 of whom reported that they had been diagnosed with diabetes by a physician before the survey. Women with diabetes diagnosed only during pregnancy (n = 105) and subjects with type 1 diabetes, defined as those <30 years of age at diagnosis who had continuous insulin use since diagnosis of diabetes (n = 23), were eliminated from analysis. The remaining 1,480 subjects were considered to have type 2 diabetes and included 590 non-Hispanic Caucasians, 405 non-Hispanic African-Americans, 450 Mexican-Americans, and 35 individuals of other races and ethnicities.

Information on sociodemographic and lifestyle characteristics, diabetes treatment, medical history, and health care utilization was obtained by structured questionnaires. Measurements of height, weight, HbA_{1c}, urine albumin and creatinine, blood pressure, and lipids were made during a separate clinical examination in which 88.2% of the interviewed subjects participated (n = 1,306) (17). Those who were examined did not differ from those who were not examined (16). Measures of functional status and quality of life were not obtained in NHANES III. Hypertension was defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg or taking antihypertensive medication. Dyslipidemia was defined as LDL cholesterol ≥130 mg/dl or treatment with prescribed diet or medication. Definitions of treatment goals and abnormal values for HbA_{1c}, proteinuria, obesity, blood pressure, and blood lipids are those recommended by professional scientific organizations (18–21).

Statistical analyses were carried out using SAS (Cary, NC) with appropriate sampling weights to adjust for the stratified sample design. Standard errors were calculated and tests of statistical significance and logistic regression were performed using SUDAAN (Research Triangle Institute, Research Triangle Park, NC). Logistic regression with usual source of health care, number of physician visits, and any or private health insurance as independent variables was conducted for each race and ethnic group to examine whether there was any influence of these health care variables on health status and outcomes. Education and income were included as independent variables in additional models to determine whether there was any influence of socioeconomic status.

RESULTS— Of all patients, 74.4% were non-Hispanic Caucasian, 15.0% were non-Hispanic African-American, 5.8% were Mexican-American, and 4.8% were of other race and ethnicity. Table 1 compares characteristics of the three main race and ethnic groups. Non-Hispanic Caucasians were older and greater proportions of them were male, had completed high school, and had family income ≥$20,000. Caucasian men were heavier than African-American and Mexican-American men, and African-American women were heavier than Caucasian and Mexican-American women. Non-Hispanic African-Americans had a longer duration since diagnosis of diabetes and a greater proportion had hypertension. Mexican-Americans had the lowest rates of hypertension and dyslipidemia.

Health care access and utilization

Health care access and utilization are shown in Table 2. Almost all patients in each race and ethnic group had one primary source of ambulatory medical care, described as a physician's office, clinic, or health center. Most of these patients consistently saw one specific physician at this source; 83–90% had at least semi-annual visits, and 62–68% had at least quarterly visits. Almost all patients ≥65 years of age had health insurance of some type (private insurance, Medicare, Medicaid, Champus, or Veterans Administration). However, for those patients <65 years of age, Caucasians and African-Americans had higher rates of coverage than Mexican-Americans.

A larger proportion of African-Americans was treated with insulin, but a smaller proportion was treated using oral agents, such that the rates of pharmacological treatment were similar for each

Table 2—*Health care access for type 2 diabetic adults*

Health care access	Non-Hispanic Caucasian	Non-Hispanic African-American	Mexican-American
One usual source of ambulatory medical care	96.7	93.9	91.9
Sees one primary physician at this source	92.4	88.2	83.1
Two or more physician visits in past 12 months	90.3	86.6	83.2
Health insurance			
Age 25–64 years	91.4	88.7	65.9*
Age ≥65 years	99.8	100.0	99.7
Private health insurance			
Age 25–64 years	80.8	62.9*	46.2*
Age ≥65 years	80.3	42.9*	40.9*
Diabetes therapy			
Insulin	25.7	41.6†	25.3
Oral agents	45.7	36.5‡	50.3
Diet alone	28.6	21.9	24.4
Insulin treated, ≥2 injections per day	60.4	42.3†	48.2
Self-monitors blood glucose at least once per day			
Not insulin-treated	5.8	3.9	2.4
Insulin-treated	44.2	26.7†	27.3†
Eye examination in the past year	65.3	70.1	60.8
Blood pressure checked in the past 6 months	88.4	89.4	83.4
Cholesterol checked	80.8	68.1*	61.8*
Hypertension			
Previously diagnosed, taking antihypertensive medication	83.1	84.1	71.3‡
Previously diagnosed, not taking antihypertension medication	6.4	6.8	12.8‡
Undiagnosed	10.5	9.1	15.9
Dyslipidemia			
Previously diagnosed, treated with diet or medication	52.3	40.3‡	40.6‡
Previously diagnosed, not treated with diet or medication	6.2	4.5	4.3
Undiagnosed	41.6	55.3‡	55.1‡

Data are %. Sample sizes for hypertension ($n = 864$) and dyslipidemia ($n = 627$) exclude subjects who do not have these conditions; dyslipidemia data also exclude subjects with triglyceride levels ≥400 mg/dl for whom the Friedewald equation to compute LDL cholesterol is not valid. *$P < 0.001$, †$P < 0.01$, and ‡$P < 0.05$ compared with non-Hispanic Caucasians.

race and ethnic group (Table 2). Approximately half of the patients treated with insulin took two or more injections per day; the rates in African-Americans and Mexican-Americans were lower than those for Caucasians. Self-monitoring of blood glucose was rare among patients who were not treated with insulin. Among insulin-treated patients, a lower proportion of African-Americans and Mexican-Americans self-monitored their blood glucose than Caucasians. About two-thirds of patients had a dilated eye examination during the previous year, and almost all patients had their blood pressure checked within the previous 6 months. Differences by race and ethnicity in these procedures were not statistically significant.

Clinical hypertension was present in 66% of Caucasian patients, 71% of African-Americans, and 54% of Mexican-Americans (Table 1). Of those with hypertension, most were being treated with antihypertensive medication (Table 2). The proportion of hypertension that was untreated or undiagnosed was higher in Mexican-Americans (29%) than in Caucasians (17%) or African-Americans (16%). Dyslipidemia was present in 65% of Caucasians, 62% of African-Americans, and 51% of Mexican-Americans (Table 1). Much of the dyslipidemia was untreated by either diet or medication or was undiagnosed in all three race and ethnic groups (Table 2).

Health status and outcomes

Health status and outcome measures that were expected to be influenced by recent medical care are shown in Table 3. Although some measures were more severe in African-Americans and Mexican-Americans, these differences were often small or not statistically significant. African-Americans and Mexican-Americans had somewhat higher proportions of HbA_{1c} ≥7%, clinical proteinuria, and blood pressure ≥140/90 mmHg among those with diagnosed hypertension. In contrast, they had better levels of total cholesterol and HDL cholesterol than Caucasians, and African-American and Mexican-American men were less overweight than Caucasian men (although the opposite was true for women).

More than half of each group had an HbA_{1c} value >7.0%, the recommended treatment goal for blood glucose control, and one-third of each group had either microalbuminuria or clinical proteinuria (Table 3). Of those whose hypertension had been diagnosed before the survey, more than half of each race and ethnic group were not controlled to the level of <140/90 mmHg, even though 70–80% of these individuals were taking antihypertensive medication. An aggressive approach, including dietary changes and

Table 3—Health status and outcomes for type 2 diabetic adults

Health care outcome	Non-Hispanic Caucasian	Non-Hispanic African-American	Mexican-American
HbA_{1c} ≥7.0%	55.1	58.2	65.5*
BMI ≥30 kg/m^2			
Men	43.5	34.3	37.0
Women	45.5	53.7	48.2
Microalbuminuria	29.6	27.3	26.3
Clinical proteinuria	5.2	13.6†	11.2*
Previously diagnosed hypertension			
Blood pressure <140/90 mmHg	45.2	39.6	34.7
Blood pressure ≥140/90 mmHg	54.8	60.4	65.3
Previously diagnosed dyslipidemia			
LDL cholesterol <130 mg/dl	35.4	23.9	37.9
LDL cholesterol ≥130 mg/dl	64.6	76.1	62.1
Serum total cholesterol (mg/dl)			
<200	31.1	35.7	38.1
200–239	34.5	33.9	33.8
≥240	34.4	30.4	28.1
HDL cholesterol (mg/dl)			
<35	28.9	13.0†	20.1‡
35–45	32.7	28.0	33.9
>45	38.4	59.0†	46.0‡
Triglyceride (mg/dl)			
<200	57.1	74.8†	57.3
200–399	30.8	19.7*	27.9
≥400	12.1	5.5‡	14.8
LDL cholesterol (mg/dl)			
<100	15.4	19.6	21.1‡
100–129	32.8	24.9‡	36.4
130–159	30.6	28.6	26.6
≥160	21.2	26.9	15.9
Lipoprotein(a) >30 mg/dl	20.1	58.8†	21.3
Homocysteine >15 μmol/l	13.9	11.5	6.5‡
Cigarette smoker	18.0	23.9	17.7
Hospitalized in past 12 months	27.1	27.9	22.6

Data are %. The upper limit of normal for HbA_{1c} in the assay system is 6.1%, defined as the mean + 2 SD (5.27 + 0.85%) for the group of people with fasting plasma glucose <110 mg/dl and 2-h postchallenge glucose <140 mg/dl. Samples sizes for previously diagnosed hypertension (n = 618) and previously diagnosed dyslipidemia (n = 302) exclude subjects who have not been diagnosed with these conditions; dyslipidemia data also exclude subjects with triglyceride levels ≥400 mg/dl for whom the Friedewald equation to compute LDL cholesterol is not valid. *$P < 0.01$, †$P < 0.001$, and ‡$P < 0.05$ compared with non-Hispanic Caucasians.

drug therapy, is recommended for diabetic patients who have LDL cholesterol values ≥130 mg/dl. In NHANES III, of those who had previously been diagnosed with dyslipidemia, only approximately one-third had LDL cholesterol <130 mg/dl, although most were being treated with diet and/or medication.

The percentage distributions for total cholesterol, HDL cholesterol, triglycerides, and LDL cholesterol are shown in Table 3. Large proportions of each race and ethnic group had levels that were above normal for each lipid variable. Elevated levels of lipoprotein(a) were found more often in African-Americans than in Caucasians and Mexican-Americans. Rates of homocysteinuria, cigarette smoking, and hospitalization in the previous year were similar among the three groups.

The association of health outcomes, (i.e., good blood glucose control [HbA_{1c} <7.0], absence of albuminuria [albumin-to-creatinine ratio <30 mg/g], controlled hypertension among those known to have hypertension [<140/90 mmHg], and controlled dyslipidemia among those known to have dyslipidemia [LDL cholesterol <130 mg/dl]) and measures of access to health care were examined in logistic regression analyses separately for Caucasians, African-Americans, and Mexican-Americans. With few exceptions, the outcomes for each racial and ethnic group were not significantly associated with having a primary source of ambulatory medical care, the number of physician visits per year, having any type of health insurance, or having private insurance.

The exceptions included the following features. For Caucasians, the 96.7% who had a usual source of ambulatory medical care were more likely to have HbA_{1c} <7.0% than the 3.3% without a usual source of care (odds ratio [OR] 10.4, 95% CI 1.3–84.2). Hypertensive African-Americans with six or more physician visits in the previous year were more likely to have blood pressure <140/90 mmHg than those with less than six visits (OR 1.5, CI 1.2–4.8). The 93% of African-Americans with any type of health insurance were more likely than the 7% without insurance to have HbA_{1c} <7.0% (OR 3.7, CI 1.1–12.5) and to have albumin-to-creatinine ratio <30 mg/g (2.7, 1.1–6.5). African-Americans and Mexican-Americans with private health insurance (56 and 45% of these groups, respectively) were more likely to have albumin-to-creatinine ratio <30 mg/g (OR 1.6, CI 1.1–2.4 and OR 2.1, CI 1.2–3.3, respectively).

Because of the many logistic regressions performed and the wide CIs, the clinical and statistical significance of these few exceptions should be considered with reservation. There was no association of socioeconomic status, measured by levels of education and income, with blood glucose control, hypertension control, lipid control, or albuminuria in Caucasians, African-Americans, or Mexican-Americans, with only one exception: Mexican-Americans with a high school education or more were twice as likely to have normoalbuminuria as those with less than a high school education (OR 2.1, CI 1.1–4.1).

CONCLUSIONS — These data indicate that there are some differences among Caucasians, African-Americans, and Mexican-Americans in health care access and utilization and in health status and outcome measures that are influenced by recent medical care, such as hyperglycemia, albuminuria, hypertension, and dyslipidemia. However, many of the differences are small or are not statistically significant. More importantly, the magnitude of the differences pale in comparison with the suboptimal health status of all three race and ethnic groups relative to current treatment goals for blood glucose, blood pressure, lipids, and albuminuria.

In each race and ethnic group, there were high rates of health care access and utilization, screening for diabetes complications, and treatment of hyperglycemia, hypertension, and dyslipidemia. Nevertheless, in each group, glycemic control was poor; many patients were obese and had albuminuria, and much of the hypertension and dyslipidemia was not controlled. One-fourth of patients had to be hospitalized in the previous year, and one-fifth of patients smoked cigarettes. In logistic regression, there was little evidence in any of the race and ethnic groups that health status and outcomes were influenced by access to or utilization of health care or by socioeconomic status.

As previously discussed (17), it is likely that health outcomes for patients with diabetes are determined by multiple factors, including intractability of diabetes to current therapies, patient self-care practices, physician medical care practices, and characteristics of U.S. health care systems, rather than by the race and ethnicity of diabetic patients.

Only a few previous studies have examined race and ethnic differences in health care for diabetes. For Medicare patients in 1993, rates for quality of care measures were low for all patients. There were small differences between African-Americans and Caucasians in health perception, but not in rates of diabetes complications or ability to perform activities of daily living. African-Americans less frequently had data recorded in their insurance claims showing that HbA_{1c} was measured, an ophthalmic visit was made, lipids were measured, and influenza vaccination was administered, but rates were not different for mammograms or hospitalization follow-up (22). In another study of Medicare records in 1992, race was not a predictor of expenditures for diabetes care (23). In a Michigan health maintenance organization (HMO) in 1991, African-Americans had higher HbA_{1c} and creatinine values, but both African-American and Caucasian patients infrequently received the medical care recommended by the American Diabetes Association (ADA) (24). In a California HMO in 1992, an eight-point prevention score reflecting ADA guidelines for care and rates of diabetes complications did not differ by race (25).

The literature is replete with studies showing that marked benefits to diabetic patients can accrue from reducing risk factors for diabetes complications. Improved glycemic control is associated with long-term health benefits such as decreased incidence of retinopathy, neuropathy, nephropathy, and other end-stage complications (26,27). It is also associated with substantial short-term improvements in quality of life, symptom distress, physical functioning, and economic benefits, including higher retained employment and less absenteeism (28). In contrast, medical care charges increase significantly for increases in HbA_{1c} levels $>7\%$, suggesting that investment in clinical systems to improve diabetes care may benefit both payers and patients (29). The benefits of decreasing blood pressure and lipids are well recognized and include reductions in the risk of micro- and macrovascular disease and death (30–32). Socioeconomic status does not appear to be an important determinant of diabetes complications. Among Hispanics and Anglos in San Antonio, Texas, complications of diabetes were not related to socioeconomic status (33). No association of glycemic control with income or education was found in Caucasians, African-Americans, or Mexican-Americans in NHANES III (34).

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