

Limited Health Care Access Impairs Glycemic Control in Low Socioeconomic Status Urban African Americans With Type 2 Diabetes

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Abbreviations: BMI, body mass index
HbA1c, hemoglobin A1c

Abstract: Limited access to health care is associated with adverse outcomes, but few studies have examined its effect on glycemic control in minority populations. Our observational cross-sectional study examined whether differences in health care access affected hemoglobin A1c (HbA1c) levels in 605 patients with diabetes (56% women; 89% African American; average age, 50 years; 95% with type 2 diabetes) initially treated at a municipal diabetes clinic. Patients who had difficulty obtaining care had higher A1c levels (9.4% vs. 8.7%; $p=0.001$), as did patients who used acute care facilities (9.5%; $p<0.001$) or who had no usual source of care (10.3%; $p<0.001$) compared with those who sought care at doctors' offices or clinics (8.6%). In adjusted analyses, HbA1c was higher in persons who gave a history of trouble obtaining medical care (0.57%; $p=0.04$), among persons who primarily used an acute care facility to receive their health care (0.49%; $p=0.047$), and in patients who reported not having a usual source of care (1.08%; $p=0.009$). Policy decisions for improving diabetes outcomes should target barriers to health care access and focus on developing programs to help high-risk populations maintain a regular place of health care.

Key words: African Americans; diabetes mellitus, type 2; glycemic control; health services accessibility; socioeconomic factors.

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Diabetes mellitus is a growing public health epidemic in the United States. Its increasing prevalence,¹ extensive morbidity,^{2,3} and associated high health care costs⁴ pose an increasing burden on affected individuals, the health care system, and society as a whole. Minority populations are disproportionately affected by diabetes, with a higher disease prevalence,^{1,3} more complications,⁵ and a tendency toward worse glycemic control.⁶ Diabetes morbidity is related to clinical characteristics (e.g., age, duration of diagnosis, or body mass index),^{7,8} but other contributing factors may include variations in socioeconomic characteristics,^{9,10} ecological or environmental influences,¹¹⁻¹⁵ and inequities in health care delivery.¹⁶

Limitations in access to health care have been linked to poor health outcomes in patients with chronic diseases,¹⁷ and the effects of limited access are compounded in minority populations that are more likely to be poor.¹⁸ Variables that affect access, such as the presence of health insurance, have been linked with lower utilization of diabetes preventive services,¹⁹⁻²¹ but their contribution to poor glycemic control is unclear.

Most of the diabetes patients examined here are African American. Historically, we have noted differences between patients in the severity of their glycemic control at the time of their initial visit to our diabetes clinic.⁸ Because hyperglycemia is directly related to risk of diabetes complications, it is important to gain better insight into factors that may contribute to poor glycemic control, particularly in minority patient populations. While some of variables that affect diabetes, such as age, race, and sex, are not modifiable, other possible determinants of glucose control, such as health care access, could be influenced by changes in social policy. To better ascertain the relative contributions of patient characteristics, socioeconomic variables, and health care access to differences in glycemic control, we conducted a study among individuals seeking evaluation and care in our outpatient diabetes clinic.

Methods

Setting and study design. The study was conducted in an outpatient diabetes program affiliated with a large two-county public health system that includes an adjacent hospital and several community primary care sites. The characteristics of the patient population and the clinical program have been described previously.^{8,22-24} The health system delivers care to a predominantly African American population with limited financial resources but at high risk for diabetes-related complications. Endocrinologists, diabetes nurse educators, dietitians, and podiatrists staff the diabetes clinic. Patients are self-referred to the clinic, or referred from local emergency rooms, on discharge from the hospital, or from area clinics.

A survey of consecutive patients presenting for their first visit to the diabetes clinic was conducted between November 2001 and May 2002. The survey was designed by a collaborative group of endocrinologists and diabetes educators, and a pilot test was conducted to ensure that survey questions were understandable. Further clarification of questions was provided if necessary, and patients with low literacy or poor vision received assistance from accompanying family members, friends, or clinic staff members; responses were reviewed and verified on completion. No patient declined to fill out the survey. The Emory University Institutional Review

Board approved the study protocol and questionnaire, and a waiver of informed consent was obtained. New patient intake visits included a comprehensive history and physical examination, laboratory testing, diabetes education, and collection of patient information. All demographic and laboratory data are stored in an electronic database.

Questionnaire. The 26-question survey was designed to obtain data on traditional socioeconomic variables (i.e., marital and employment status, annual individual and household income, education level) and access to health care. Results of portions of the survey have been published elsewhere.^{25–26} Common measures of access were incorporated,^{16, 17} including availability of health insurance coverage, perception of difficulty in obtaining needed medical care and medications, and usual place of medical care.

For purposes of analysis, marital status was categorized as *married* or *not married*. Employment status was classified as *employed*, *unemployed*, *disabled*, or *retired*. Education levels were *elementary or less*, *some high school or high school graduate*, or *some college or college graduate*. Annual individual and household incomes were reported by selecting an income range from a list.

Four health care access-related questions were constructed. First, health insurance status was determined by asking patients if they had coverage at the time of the visit and how long they had been with or without insurance. Second, general perceptions about health care access were evaluated by asking patients if they had experienced trouble obtaining medical care during the preceding 12 months. Patients selected a response from a list of options and were categorized on the basis of their response as *no trouble obtaining medical care*, *had trouble obtaining medical care*, or not having felt the need to seek medical care until recently (*no prior need for care*). Patients who indicated that they had experienced trouble then selected reasons for such difficulty: *couldn't afford the visit*, *no way to get there*, *afraid of losing job if took time off for appointment*, *could not get appointment*, *too busy to go*, or *some other reason*. More than one choice could be selected.

Third, a similarly structured question about access to medications was also included, and responses were similarly classified (*no trouble getting medicine*, *trouble getting medications*, *no prior need for medications*). Perceptions about access to medication were assessed by asking patients if they had experienced trouble obtaining their medications within the previous 12 months. Those who had experienced trouble then selected reasons for having difficulty: *couldn't afford to pay for them*, *no way to get to pharmacy*, *the wait at my pharmacy was too long*, *pharmacy would not fill or refill*, *afraid of losing job if took time off to get medicines*, or *some other reason*. Patients could choose more than one reason.

Finally, we sought to determine where patients historically obtained their medical care (usual place of care) by asking them to select from a list the type of facility that they attended most often for their health problems. Usual place of medical care was categorized as a *doctor's office or clinic*, an *acute care facility* (i.e., emergency department or urgent care center), or no health facility within the past 12 months (*nowhere*).

Statistical analysis. Differences in continuous and categorical variables were assessed using the Student t-test, nonparametric methods, or chi-squared analysis,

as appropriate. For purposes of analysis, factors were grouped into three broad categories: 1) clinical or disease-related variables (age, sex, ethnicity or race, diabetes duration, diabetes type, body mass index, mode of diabetes treatment), 2) socioeconomic characteristics (marital status, employment, educational level), and 3) health care access variables (insurance status, ability to obtain medical care, ability to obtain medications, and usual place of care). Diabetes duration was calculated as the difference between the date of the initial visit and the self-reported date of disease onset.^{8,22-24} Separate multivariate linear regression models were constructed to determine which variables and associated categories had an association with the initial HbA1c levels. Product terms were included in the multivariate linear regression models of effects on HbA1c to test for potential interactions between significant independent variables. Because no interactions were found, interaction terms were excluded from the final regression models. All analyses were performed using StatView statistical software (version 5.0; SAS Institute Inc, Cary, North Carolina).

Results

Clinical/disease characteristics and glycemic control. Data were collected from 605 consecutive patients (averages: age, 50 years; body mass index, 32 kg/m²; diabetes duration, 5.6 years; and HbA1c, 9.1%). Fifty-six percent of the patients were women, 89% were African American, and 95% had type 2 diabetes. Forty-eight percent were being managed with insulin (with or without oral agents), 43% were using oral agents, and 9% were managed with diet alone. HbA1c was higher in older patients (over 50 years of age; $p < 0.001$), in men ($p = 0.03$), and in patients who required insulin ($p < 0.003$), but it did not differ by race, body mass index, or duration of diabetes (not shown).

Socioeconomic profile and glycemic control. Most patients in the sample were not married (Table 1). Nearly one-third had at least some college education, most had either finished high school or had some high school education, and a small number had an elementary school education or less. About one-third reported that they were employed, one-third were unemployed, one-fourth were disabled, and 13% were retired. Most respondents (88%) provided information on individual annual income. Nearly all patients had low incomes: 86% reported incomes of less than \$15,000 per year. Of those who reported household income levels, most said their income was less than \$15,000 per year; however, the response rate to the household income question was low (60% of the sampled population did not provide the requested information). Because of the low response rate to the household income question, and the high frequency of low individual income, these variables were excluded from further analysis.

Patients who were disabled ($p < 0.04$) or retired ($p < 0.001$) had HbA1c values that were significantly lower than those of patients who were employed. Marital status and educational level had no significant relationship to HbA1c levels at the initial visit (Table 1).

Health care access measures and glycemic control. Only one-third of patients had health care insurance (Table 2). Most (69%) of those patients who indicated they were retired said they had health insurance, and 69% of the retirees without coverage

Table 1.**SOCIOECONOMIC CHARACTERISTICS AND HbA1c LEVELS OF 605 PATIENTS WITH DIABETES AT PRESENTATION**

Characteristic	%	HbA1c, % (SE)	p value
Marital status			
Married	24	9.0 (0.2)	Reference group
Unmarried	76	9.4 (0.1)	0.1
Education level			
Elementary or less	14	8.7 (0.2)	Reference group
Some high school or high school graduate	55	9.1 (0.2)	0.18
Some college or more	32	9.3 (0.2)	0.08
Employment status			
Employed	31	9.3 (0.2)	Reference group
Unemployed	31	9.7 (0.2)	0.15
Disabled	25	8.7 (0.2)	0.04
Retired	13	8.0 (0.2)	<0.001

HbA1c = hemoglobin A1c.

were under 65 years of age. Although 44% reported no difficulty getting medical care during the 12 months before their initial visit to the diabetes clinic, 47% said they had trouble, and 10% reported no prior need for care; similar proportions of patients reported having trouble obtaining medications or having no prior need for medications. The most common reason for having trouble obtaining medical care was insufficient funds, cited by 78% of patients, followed by lack of transportation (12%) and inability to take time off from work (10%); 23% of respondents indicated more than one reason for having difficulty receiving care (not shown). Similarly, most patients who had trouble getting medications reported that they could not afford them (72%), whereas 19% reported that the wait at the hospital pharmacy was too long and 5% lacked transportation; 14% had more than one barrier (not shown). Use of a regular source of care (doctor's office or clinic) was reported by 56% of respondents, but 30% indicated that they used only acute care facilities and 13% said they had gone nowhere for care in the previous 12 months.

Health insurance status was not significantly associated with glycemic control (Table 2). The average HbA1c was 8.7% among patients who had no trouble getting medical care (Table 2). Compared with people who reported no problems obtaining medical care, average HbA1c levels were significantly higher in people who said they had experienced trouble (9.4%; $p < 0.001$) and in respondents with no prior need for care (10%; $p < 0.001$). The average HbA1c was 8.9% in persons who said they had no trouble obtaining medication, slightly but not significantly higher in those who

Table 2.**HEALTH CARE ACCESS MEASURES AND HbA1c LEVELS OF 605 PATIENTS WITH DIABETES AT PRESENTATION**

Measure	%	HbA1c, % (SE)	p value
Health insurance coverage			
Yes	34	8.9 (0.2)	Reference group
No	66	9.3 (0.1)	0.08
Access to medical care			
No trouble getting care	44	8.7 (0.1)	Reference group
Trouble getting care	47	9.4 (0.2)	<0.001
No prior need for care	10	10.0 (0.1)	<0.001
Access to medications			
No trouble getting medications	47	8.9 (0.1)	Reference group
Trouble getting medications	44	9.2 (0.2)	0.22
No prior need for medications	9	10.5 (0.4)	<0.001
Usual place of care			
Doctor's office or clinic	56	8.6 (0.1)	Reference group
Acute care facility	30	9.5 (0.2)	<0.001
Nowhere	13	10.3 (0.4)	<0.001

HbA1c = hemoglobin A1c.

had experienced trouble (9.2%; $p=0.22$), and significantly higher in patients who had no prior need (10.5%; $p<0.001$). HbA1c averaged 8.6% in patients who used a doctor's office or clinic, and it was significantly higher in respondents who relied only on acute care facilities (9.5%; $p<0.001$) or had gone nowhere (10.3%; $p<0.001$).

Variables associated with glycemic control. To further evaluate which factors had an important effect on initial HbA1c values, we constructed three separate regression models containing the following categories of variables: 1) clinical or disease factors only, 2) clinical or disease factors plus socioeconomic factors, and 3) clinical or disease factors, socioeconomic factors, and measures of health care access (Table 3).

In model 1 (clinical and disease factors only), younger age and insulin use were associated with higher HbA1c levels (both $p<0.01$) (Table 3; model 1). In model 2 (clinical and disease factors plus socioeconomic factors), an employment status of *disabled* or *retired* was significantly associated with lower HbA1c levels and age was no longer important (Table 3; model 2).

In Model 3 (clinical and disease factors, socioeconomic factors, and measures of health care access combined) employment status was less important than in model 2; however, access to medical care and usual place of care were significantly associated with HbA1c values. A report of having trouble getting care was associated

Table 3.

EFFECT OF CLINICAL FACTORS, TRADITIONAL SOCIOECONOMIC FACTORS, AND MEASURES OF HEALTH CARE ACCESS ON GLYCEMIC CONTROL: MULTIVARIATE ANALYSIS^a

Characteristic	Model 1		Model 2		Model 3	
	β	p value	β	p value	β	p value
Age, years	-0.02	0.01	-0.008	0.44	-0.002	0.82
Insulin	1.32	<0.01	1.28	0.001	1.29	<0.001
Employment^b						
Unemployed			0.42	0.12	0.52	0.05
Disabled			-0.58	0.045	-0.28	0.33
Retired			-0.97	0.02	-0.75	0.06
Access to medical care^c						
Trouble getting care					0.57	0.04
No prior need for care					0.15	0.73
Place of care^d						
Acute care facility					0.49	0.047
Nowhere					1.08	0.009

^aSex, race, diabetes duration, body mass index, marital status, educational level, health insurance status, and access to medications all nonsignificant
Reference groups: ^bemployed, ^cno trouble getting care, ^dusual care at a doctor's office or clinic.

Table 4.
HIGH-RISK CHARACTERISTICS OF DIABETES PATIENTS WITH IMPAIRED ACCESS TO HEALTH CARE

Characteristic	Access to medical care			Usual place of care			p value
	No trouble	Trouble	p value	Doctor or clinic	Acute care	Nowhere	
Age, years	54	47	<0.001	54	46	46	<0.001
Female sex, %	60	57	0.16	62	52	42	0.003
African American race, %	95	82	<0.001	93	91	90	0.12
BMI, kg/m ²	33	32	0.89	33	32	30	0.002
Type 2 diabetes, %	98	94	0.08	97	95	91	0.30
Diabetes duration, y (median)	5.7 (1.8)	6.2 (3.3)	0.44	6.6 (3.3)	4.4 (1)	4.1 (0.2)	<0.001
Insulin use, %	47	48	0.9	46	49	60	0.21
Not married, %	73	79	0.06	73	81	77	0.06
Some college or more, %	23	41	<0.001	53	35	40	0.07
Employed, %	20	40	<0.001	26	35	40	0.01
Lack of insurance, %	47	83	<0.001	54	76	81	<0.001

with an increase in HbA1c by an average of 0.57% ($p=0.04$) compared with having no trouble. Use of an acute care facility was associated with a higher HbA1c of 0.49% ($p=0.047$) and having gone nowhere for care with a higher HbA1c of 1.08% ($p=0.009$) compared with going to a doctor's office or clinic.

Sex, race, diabetes duration, and BMI were not statistically associated with glycemic control in any of the models (all $p>0.1$), while insulin use remained significant in all the models. Marital status, educational level, having health insurance, and access to medications were not associated with HbA1c (all $p>0.1$, not shown); access to medications was not significantly associated with HbA1c even after access to medical care was excluded from the model.

Characteristics of patients with limited health care access. We further examined the characteristics of patients found to be at risk of having poor glycemic control as determined by model 3 (those who reported having trouble accessing medical care and those without a usual source of care) (Table 4). People who reported that they had experienced trouble obtaining medical care were younger, less likely to be African American, more educated, more likely to be employed, and less likely to be insured (all $p<0.001$). Patients who did not have a regular place of care (persons who went either to an acute care facility or nowhere) were younger and more likely to be male, had a lower body mass index and a shorter diabetes duration and were more likely to be employed and less likely to be insured than patients who had a regular source of care (all $p<0.02$).

Discussion

In many chronic illnesses, lower socioeconomic status and limited access to health care are associated with poor outcomes,¹⁷ but the contribution of such factors to glycemic control is not well understood, particularly in minority patient populations that have disparities in health care.²⁷⁻²⁸ Because achieving target blood glucose levels is essential to prevent diabetes complications,²⁹⁻³¹ insight into the factors that contribute to poor glycemic control is necessary so that appropriate interventions can be planned. To obtain a more comprehensive understanding of factors that influence glycemic control in a population that is predominantly African American, we examined the relationship between clinical and disease-related characteristics, socioeconomic variables and measures of health care access with HbA1c measured at the time of the intake visit.

When all variables were included in a regression model, the dominant factors associated with HbA1c levels were related to health care access. Specifically, people who provided a history of problems obtaining medical services and people who did not have a regular source of care demonstrated worse glycemic control at the time of their intake visit. Having a regular provider is recognized as a strong predictor for use of preventive health care services,³² but many Americans who do not have a regular source of care may use an acute care facility or avoid seeking care.³³

Individuals who remain outside the health care system often have not been considered in studies of health care outcomes;¹⁷ our study was designed to gather some information on these people. Our survey distinguished patients who had gone *nowhere* for care from patients who had a regular source of care or who used

an acute care facility. It is possible that the *nowhere* group did not seek care because they felt well (as suggested by those patients who believed they had no prior need for medical care) or because they ignored their symptoms or postponed evaluation until the onset of metabolic decompensation.

Although we did not find a direct association between HbA1c and factors such as health insurance, education, employment, or other socioeconomic characteristics, such variables are likely to affect patients' access to medical care and their choice of where to seek services and could thereby have an indirect impact on glycemic control. Factors reportedly contributing to use of an acute care facility as a regular source of care include low income, lack of insurance, lack of transportation, and low education level.^{34–35} In addition, many of these patients also reported that they had no chronic illness or need for medication and thus had not felt any need for medical attention until recently;^{16, 34, 36} we identified similar patients in our survey.

From a public policy standpoint, our findings reinforce the need to design health systems that facilitate access to health care services. Our data underscore the importance of developing campaigns to increase awareness of the importance of longitudinal care, especially among minority populations at high risk for chronic illness. In addition, programs that increase awareness among populations at high risk for diabetes about the need to obtain periodic health evaluations even if feeling well could identify persons in the early phases of disease, thus allowing for timely interventions.

Our study had some limitations. Our cross-sectional study focused on new patients. This approach allowed us to collect information on a group of people who would have had diverse experiences and backgrounds before any intervention occurred. Despite some socioeconomic similarities (e.g., mostly African American, majority indigent with low individual annual incomes), these patients were nonetheless very heterogeneous, differing in educational level and employment status as well as in their experiences with the health care system.

Examining new patients also allowed us to establish a baseline against which our clinical interventions could be assessed. Our public hospital system does provide discounted care and has a staff of social workers to assist patients in accessing services. These characteristics of the system should help patients overcome some of the barriers identified here. Preliminary data suggest that after participation in the diabetes clinic treatment program, even individuals with a history of problems getting medical care can achieve good glycemic control.³⁷

Although all socioeconomic and health care access data were self-reported, this method is widely accepted in studies investigating the impact of socioeconomic characteristics on diabetes health surveys.^{19–21, 38} The survey was not meant to be an exhaustive list of obstacles, but rather was based on our extensive experience with this patient population as well as what has been reported in the medical literature. In addition, there is a selection bias introduced by the study design, in that the patients who were evaluated were referred for diabetes care and education and therefore may not represent the entire population of diabetes inpatients at this facility or at other institutions.

This study provides new insights into the contributions of clinical or disease characteristics, socioeconomic factors, and measures of health care access to

differences in control of diabetes, a disorder associated with major morbidity, mortality, and cost. Although the medical literature has focused attention largely on clinical and socioeconomic factors and on insurance status in relation to health, our observations show that glycemic control is influenced more strongly by disparities in access to health care, and specifically to perceived access to care and usual place of care. To prevent the debilitating complications of diabetes, to improve quality of life, and to reduce the rising costs associated with this disease, strategies are needed to help the health care system engage high-risk patients such as those in low-income racial and ethnic minority populations. Future studies and health care policy decisions should be directed toward identifying and alleviating barriers to health care access and toward helping high-risk persons establish and maintain regular contact with a health care provider.

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Notes

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