

Minority Status and Diabetes Screening in an Ambulatory Population

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OBJECTIVE—Ethnicity has been identified as a risk factor not only for having type 2 diabetes but for increased morbidity and mortality with the disease. Current American Diabetes Association (ADA) guidelines advocate screening high-risk minorities for diabetes. This study investigates the effect of minority status on diabetes screening practices in an ambulatory, insured population presenting for yearly health care.

RESEARCH DESIGN AND METHODS—This is a retrospective population-based study of patients in a large, Midwestern, academic group practice. Included patients were insured, had ≥ 1 primary care visit yearly from 2003 to 2007, and did not have diabetes but met ADA criteria for screening. Odds ratios (ORs), 95% confidence intervals (CI), and predicted probabilities were calculated to determine the relationship between screening with fasting glucose, glucose tolerance test, or hemoglobin A_{1c} and patient and visit characteristics.

RESULTS—Of the 15,557 eligible patients, 607 (4%) were of high-risk ethnicity, 61% were female, and 86% were ≥ 45 years of age. Of the eight high-risk factors studied, after adjustment, ethnicity was the only factor not associated with higher diabetes screening (OR = 0.90 [95% CI 0.76–1.08]) despite more primary care visits in this group. In overweight patients < 45 years, where screening eligibility is based on having an additional risk factor, high-risk ethnicity (OR 1.01 [0.70–1.44]) was not associated with increased screening frequency.

CONCLUSIONS—In an insured population presenting for routine care, high-risk minority status did not independently lead to diabetes screening as recommended by ADA guidelines. Factors other than insurance or access to care appear to affect minority-preventive care.

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Over the past decade, public awareness of health care disparities in the U.S. has increased. Congress passed the Minority Health and Health Disparities Research and Education Act of 2000, which established the National Center on Minority Health and Health Disparities to study health care inequalities in this country (1). The U.S. Department of Health and Human Services (USDHHS) Healthy People 2010 proposal determined the issue of disparities to be so important that eliminating health care disparities was one of only two comprehensive health goals to be addressed in

the past decade (2). Despite these efforts, the 2008 National Healthcare Disparities Report (NHDR) showed that, in minority groups and the poor, 60% of reported quality measures are not improving. The reasons that health care disparities persist are not always apparent and likely multifactorial but clearly affect patients with a variety of medical conditions, including type 2 diabetes, a disease that has reached epidemic proportions in this country. In multiple studies, ethnicity has been identified as a risk factor not only for having type 2 diabetes but for increased morbidity and mortality with the disease (3).

However, factors, such as lack of both health care insurance and access to care (3,4), which occur at higher rates in minority patients, may contribute to these findings. There are limited data investigating type 2 diabetes case finding in general, with only minimal data including a minority population that is both insured and also presenting for health care. Lower screening rates in such a population would suggest that factors other than insurance and access to care are affecting minority diabetes testing, such as a decreased recognition that minority status itself is a risk factor for type 2 diabetes, poorer systems for ensuring screening in clinics caring for predominantly minority patients, unconscious bias, or patient-specific/cultural factors.

The American Diabetes Association (ADA) has established high-risk ethnicity as one of 10 independent risk factors that should not only trigger diabetes screening in overweight patients < 45 years (5) but should also identify minority patients as a high priority for screening at all ages. We previously performed a retrospective analysis of diabetes screening practices in a large, Midwestern, academic physician group for the 3-year period (1 January 2005–31 December 2007) (6), using the Wisconsin Collaborative for Healthcare Quality (WCHQ) criteria (7). Of eight ADA-identified high-risk factors that could be measured from the data, high-risk minority status was associated with the lowest screening rates (6). In addition, once screened, these patients had a comparatively higher rate of diagnosis, confirming the importance of screening in this group (6). However, the reasons for this lower screening rate are unknown. The proposed study examines whether high-risk minority status triggered diabetes screening independent of other clinical factors in an insured, ambulatory population presenting for primary care.

RESEARCH DESIGN AND METHODS

Background and data

This study was approved by the University of Wisconsin-Madison Health Sciences institutional review board.

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The methods used in this study were adapted from methods described previously (6). In brief, patients included were ≥ 20 years of age on 1 January 2005 and had at least one family practice or internal medicine visit to the physician group in each of the 3 study years, 2005, 2006, and 2007, in addition to a yearly visit in each of the 2 preceding years, 2003 and 2004. A 3-year period from 2005 to 2007 was chosen based on ADA recommendations to screen every 3 years (5). Data from years 2003 and 2004 were used to determine prior diagnosis of diabetes, prediabetes, preexisting comorbidities, and pregnancy and to determine visit eligibility. Patients with any visit for pregnancy in the years 2003 to 2007 were excluded, as were patients who died during the 3-year study period. Patients with two or more outpatient encounters with a diagnosis of diabetes in the years 2003 to 2004 were excluded, as were patients without health care insurance.

Primary data retrieval

Patients' clinical, laboratory, encounter, and demographic information were obtained from the electronic health record of a large, Midwestern, academic physician group as described previously (6). For all patients, data were extracted on age, sex, ethnicity, BMI, evaluation and management (E/M) outpatient encounter data, provider specialty, and laboratory data. In addition, we abstracted fasting plasma glucose (FPG), random glucose (RG), 2-h glucose tolerance test (GTT), and hemoglobin A_{1c} (HbA_{1c}). Glucose laboratory tests were classified as FPG if they were labeled as fasting or were drawn at the same time as a fasting LDL or triglyceride level per institution protocol. These fasting tests, in addition to GTTs and HbA_{1c}, were considered the screening tests for this analysis. Although HbA_{1c} was not an accepted test for diabetes screening during the study years, it was included in our screening profile and used in the sensitivity test since it is known that providers used HbA_{1c} for this purpose because of its recent incorporation into guidelines (5).

Variable definitions

Eight high-risk variables were defined based on the ADA-designated risk factors for screening (5). These factors include ≥ 45 years of age, ethnicity, hypertension, hypercholesterolemia, polycystic ovarian syndrome (PCOS), vascular disease, overweight (BMI ≥ 25 kg/m²), and history of prediabetes. The ADA risk factors of

first-degree family history, physical inactivity, and other clinical conditions associated with insulin resistance could not be obtained. Definitions for high-risk variables were determined based on a combination of one or more factors, including validated International Classification of Diseases, 9th Revision (ICD-9) codes (8), laboratory data, and clinical information, with detailed criteria for each high-risk factor listed previously (6). In brief, diagnosis of hypertension, PCOS, prediabetes, and vascular disease was determined by presence of two validated diagnosis codes on two separate occasions within 2 years by previously established criteria (6). Age was determined as the age as of 1 January 2005; overweight was determined by having two ICD-9 codes by the same criteria above or if last listed BMI was ≥ 25 kg/m²; and hypercholesterolemia was also defined by the presence of two ICD-9 codes or by the presence of abnormal laboratory tests (6). Patients with a listed ethnicity of African American, Latino, Native American, Asian American, or Pacific Islander were designated as high-risk minorities.

Using the defined high-risk factors, the population meeting ADA screening criteria was determined. This included

any patient ≥ 45 years of age or any overweight patient < 45 years with at least one additional high-risk factor (5). The number of eligible patients screened was determined. Because screening for patients < 45 years should be triggered by the presence of at least one high-risk factor in addition to obesity, a separate analysis of patients in this category was conducted.

Statistical analysis

Data were analyzed using Stata version 10.0 (9). Categorical variables were summarized using percentages. Continuous variables were summarized using means and SD. Multivariable logistic regression was used to estimate adjusted odds ratios (ORs), predicted probabilities, and 95% CI for relationships between diabetes screening and patient and visit characteristics. Predicted probabilities were calculated using the margins command in Stata and calculating the effects at the average of the covariates. Predicted probabilities were produced from a fitted logistic regression model where the outcome was whether a subject would receive diabetes screening. Therefore, from this model, one can calculate the probability of receiving diabetes screening at any given level of covariates. Continuous variables were set

Table 1—Baseline patient characteristics of patients eligible for diabetes screening (n = 15,557)*

	Overall population	By risk group		P value
		High risk	Not high risk	
n	15,557	607	14,950	—
High-risk factors†				
Age ≥ 45 years	86	66	87	< 0.001
High-risk ethnic group	4	—	—	—
Hypertension	45	48	45	0.149
Hypercholesterolemia	70	52	71	< 0.001
Polycystic ovarian syndrome	< 1	< 1	< 1	0.703
Prediabetes	< 1	< 1	< 1	0.900
Vascular disease	10	9	11	0.118
Overweight	67	72	67	0.012
Sex				0.256
Male	39	41	39	—
Female	61	59	61	—
Primary care specialty‡				0.003
Internal medicine	46	2	44	—
Family practice	54	2	52	—
Number of visits, mean§				
Primary care visits	9.13 (5.75)	10.78 (6.45)	9.06 (5.71)	< 0.001
Specialty care visits	5.82 (7.10)	5.51 (7.28)	5.83 (7.09)	0.280

*Values represent percentages unless otherwise specified, and numbers in parentheses indicate standard deviations; †high-risk factors generated from the ADA screening criteria, as defined previously (6); ‡primary care specialty determined for each patient by specialty in which the majority, or all, of their primary care visits occurred; §number of primary care, specialty, and total visits is mean number of visits per patient over the time period 1 January 2005–31 December 2007.

at their means. Additional models predicted FPG screening for patients with high-risk and non-high-risk ethnic status and for the subsample of obese patients <45 years with an additional risk factor. As a sensitivity analysis, all multivariable regression models were also run using any glucose-screening test. The presence of prediabetes and PCOS was given in low numbers in the sample and was not used in analyses. *P* values ≤ 0.05 were considered statistically significant.

RESULTS—A total of 15,557 patients were eligible for screening (Table 1). Of these patients, 86% were ≥ 45 years of age. Other than age, the most common high-risk factor was hypercholesterolemia (70%). Sixty-one percent were female, and patients were seen more often by family practice providers (54%) than

by internists (46%). A total of 607 (4%) of patients were high-risk minorities, and minorities had significantly more primary care visits than nonminority patients (10.78 vs. 9.06; *P* < 0.001) between 2005 and 2007. A total of 10,586 (68%) of all eligible patients and 361 (59%) of eligible high-risk ethnicity patients were screened using FPG, GTT, or HbA_{1c}. Of the 10,586 screened patients, 9,999 (94%) had a fasting glucose identified by concurrent LDL or triglyceride draw, 58 (0.5%) had independent FPG, 63 (0.6%) had GTT, and 2,249 (21%) had HbA_{1c}, with many patients having more than one of these tests drawn.

Of the ADA high-risk factors, only high-risk ethnicity was not associated with higher frequency of diabetes screening after adjustment for patient and visit characteristics (OR 0.90 [95% CI 0.76–

1.08]) (Table 2). The predicted probability of screening was 68 and 66% for non-high-risk and high-risk ethnic groups, respectively. The number of primary care visits (OR 0.99 [0.987–1.000]) and specialty visits (OR 1.00 [0.994–1.005]) did not correlate with screening, and patients eligible for screening who had internal medicine primary care providers were as likely to be tested (OR 1.04 [0.97–1.12]) as those who had family practice providers. When comparing screening for patients in non-high-risk and high-risk ethnic groups, after adjustment, age ≥ 45 years (OR 1.55 [1.38–1.74]), overweight status (OR 1.67 [1.54–1.81]), and male sex (OR 1.33 [1.23–1.43]) were significant predictors of screening for non-high-risk patients only (Table 3).

After adjustment, high-risk ethnicity (OR 1.01 [95% CI 0.70–1.44]) and vascular disease (OR 2.25 [0.86–5.91]) were not associated with increased frequency of screening in patients <45 years who met screening criteria by virtue of being obese and having an additional risk factor (Table 4). Male sex significantly predicted screening in this group (OR 1.36 [1.12–1.65]).

In a multivariate regression model examining glucose testing by any method (including random) and adjusting for patient and visit characteristics, high-risk ethnicity similarly was the only ADA-designated high-risk factor that did not lead to significantly higher odds of testing (OR 1.09 [95% CI 0.81–1.47]).

CONCLUSIONS—The main finding of this study is that, in an insured population presenting for yearly primary care visits, minority status is not being identified as an independent risk factor for diabetes screening as recommended by the ADA guidelines (5). This finding is most concerning in obese patients <45 years, because screening in this subpopulation depends on the presence and recognition of risk factors such as high-risk ethnicity. Extensive data demonstrate that minorities are more likely to have diabetes and to suffer comparatively increased morbidity and worse glycemic control (3,10,11), so these screening inadequacies are concerning.

National statistics and numerous studies have demonstrated that health care in minority patients is inferior to care received by nonminority patients (3,12). Although inequalities may be multifactorial in etiology, data have consistently suggested that lower rates of

Table 2—Unadjusted and adjusted ORs, predicted probabilities, and 95% CI for the relationship between patient and visit characteristics and diabetes screening (n = 15,557)

	OR		95% CI for adjusted OR	Predicted probability	95% CI
	Unadjusted	Adjusted			
High-risk factors†					
Age ≥ 45 years					
No	1.00	1.00	—	0.61	(0.59–0.63)
Yes	1.09	1.53*	(1.37–1.70)	0.69	(0.68–0.70)
High-risk ethnic group					
No	1.00	1.00	—	0.68	(0.63–0.69)
Yes	0.68	0.90	(0.76–1.08)	0.66	(0.63–0.70)
Hypertension					
No	1.00	1.00	—	0.65	(0.64–0.66)
Yes	1.53*	1.48*	(1.38–1.60)	0.72	(0.71–0.73)
Hypercholesterolemia					
No	1.00	1.00	—	0.48	(0.47–0.50)
Yes	3.52*	3.59*	(3.33–3.88)	0.76	(0.76–0.77)
Vascular disease					
No	1.00	1.00	—	0.67	(0.67–0.68)
Yes	1.33*	1.33*	(1.17–1.52)	0.73	(0.71–0.75)
Overweight					
No	1.00	1.00	—	0.61	(0.60–0.62)
Yes	1.79*	1.67*	(1.54–1.81)	0.71	(0.71–0.72)
Sex					
Male	1.35*	1.30*	(1.21–1.41)	0.71	(0.70–0.72)
Female	1.00	1.00	—	0.66	(0.65–0.67)
Primary care specialty‡					
Family practice	1.00	1.00	—	0.68	(0.67–0.69)
Internal medicine	1.04	1.04	(0.97–1.12)	0.68	(0.67–0.70)
Number of visits§					
Primary care	0.99	0.99	(0.987–1.000)	0.68	(0.67–0.69)
Specialty care	1.00	1.00	(0.994–1.005)	0.68	(0.67–0.69)

Adjusted for age, minority status, hypertension, cholesterol, cardiovascular disease, overweight, primary care specialty, number of primary care visits, and number of specialty visits. *Significance at *P* < 0.05; †high-risk factors generated from the ADA screening criteria, as defined previously (6); ‡primary care specialty determined for each patient by specialty in which the majority, or all, of their primary care visits occurred; §number of primary care, specialty, and total visits is mean number of visits per patient over the time period 1 January 2005–31 December 2007.

Diabetes case finding in minorities

Table 3—Unadjusted and adjusted ORs and 95% CI for the relationship between patient and visit characteristics and diabetes screening, by high-risk ethnic group status (n = 15,557)†

	Non-high-risk ethnic group (n = 14,950)			High-risk ethnic group (n = 607)		
	Unadjusted OR	Adjusted OR	95% CI for adjusted OR	Unadjusted OR	Adjusted OR	95% CI for adjusted OR
High-risk factors‡						
Age ≥45 years	1.03	1.55*	(1.38–1.74)	1.54*	1.04	(0.66–1.66)
Hypertension	1.51*	1.48*	(1.37–1.59)	2.06*	1.67*	(1.14–2.45)
Hypercholesterolemia	3.42*	3.53*	(3.26–3.82)	5.94*	6.01*	(4.12–8.76)
Vascular disease	1.31*	1.31*	(1.15–1.50)	2.17*	2.04*	(1.003–4.153)
Overweight	1.83*	1.67*	(1.54–1.81)	1.20	1.55	(0.99–2.43)
Sex						
Male	1.36*	1.33*	(1.23–1.43)	1.11	0.85	(0.58–1.23)
Female	1.00	1.00	—	1.00	1.00	—
Primary care specialty§						
Family practice	1.00	1.00		1.00	1.00	
Internal medicine	1.04	1.04	(0.96–1.12)	1.27	1.20	(0.82–1.74)
Number of visits 						
Primary care	0.99	0.99	(0.987–1.000)	1.00	0.99	(0.96–1.02)
Specialty care	1.00	1.00	(0.993–1.004)	1.03*	1.02	(0.99–1.05)

*Significance at $P < 0.05$; †high-risk ethnicities defined as African American, Latino, Native American, Asian American, and Pacific Islander; ‡high-risk factors generated from the ADA screening criteria, as defined previously (6); §primary care specialty determined for each patient by specialty in which the majority, or all, of their primary care visits occurred; ||number of primary care, specialty, and total visits is mean number of visits per patient over the time period 1 January 2005–31 December 2007.

health care insurance and resultant decreased access to care may be the largest contributor to these disparities (13). In 2002, Finegold and Wherry (4) reported that among U.S. adults aged 18–64 years, 20% of African Americans and 40.7% of Hispanics were uninsured compared with 12.4% of Caucasians. These inequalities in insurance coverage certainly contribute to suboptimal minority health care.

Because of the known effects of health care insurance on minority care, the current study includes only insured patients presenting for yearly primary care visits to determine minority-screening practices when health care access was equal. We found that minority and non-minority screening was equivalent. However, although equal care is appropriate for many disease processes, the ADA recommends increased screening in high-risk minority patients, particularly in younger, overweight patients (5). Therefore, even equivalent screening means that minority patients are not being screened in accordance with the ADA guidelines, despite insurance and access being equal. Our minority patients were notably seen more frequently in clinics than nonminorities, indicating that access was even more robust in this subset of patients.

There are possible explanations for these findings. First, providers may not recognize that minority status is equivalent to other stated ADA risk factors for

type 2 diabetes (3). It is notable that the majority of other ADA risk factors included in this study are comorbidities typically treated with lifestyle modification and/or medication. The presence of one of these typical cardiovascular risk factors may be more likely to prompt a provider to seek early detection of other comorbidities, such as diabetes. Second, providers may seek to treat patients of all ethnic groups equally and as a result ignore ethnicity as a risk factor for diseases, such as type 2 diabetes, where minority status should, in fact, play a role in determining care. Third, some providers may screen based on the U.S. Preventive Services Task Force (USPSTF) criteria, which do not factor ethnicity into screening recommendations (14).

Other reports have suggested that unconscious bias may play a role in minority inequalities (15). The Institute of Medicine's 2002 report, "Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare," (16) highlighted the multifactorial nature of disparities, along with the reality that unconscious bias may play a role in unequal care. Although we cannot entirely exclude bias as a contributing factor in this study, we saw no evidence that insured minorities who presented for care had lower rates of screening than nonminorities. It is conceivable, however, that minorities may have more difficulty returning to clinic for what has traditionally been the

test of choice to diagnose diabetes, the fasting glucose. This possibility suggests that minority screening could be improved with the ADA's recent adoption of the HbA_{1c} into diagnostic criteria (5), because this test can be performed in a nonfasting state. Although data have demonstrated that HbA_{1c} may perform differently in certain minority populations (17,18), access to care and return for a fasting laboratory test is also prohibitive for some patients (19). Use of the HbA_{1c} may facilitate greater screening compliance in a population that may be less able to return for a follow-up fasting visit.

There are several limitations to this study. First, although presence of hypercholesterolemia was associated with significantly increased ORs for diabetes screening in the sensitivity analysis, linking glucose to fasting lipid panels increased these ORs, which may have introduced a selection bias. Second, although this study included 15,557 patients, only 607 (4%) had high-risk minority status. Screening practices in this study may not reflect what may occur in a practice with a higher percentage of minority individuals where providers may be more aware of minority screening recommendations. In addition, we could not characterize income in this study. Previous studies have suggested that inequalities in income and education, independent of ethnicity, may affect care

Table 4—Unadjusted and adjusted ORs, predicted probabilities, and 95% CI for the relationship between patient and visit characteristics and diabetes screening in overweight adults aged 20–44 years (n = 2,160)†

	Unadjusted OR	Adjusted OR	95% CI for adjusted OR	Predicted probability	95% CI
High-risk factors‡					
High-risk ethnic group					
No		1.00		0.66	(0.64–0.68)
Yes	0.53*	1.01	(0.70–1.44)	0.67	(0.60–0.74)
Hypertension					
No		1.00		0.62	(0.59–0.65)
Yes	1.36*	1.98*	(1.57–2.50)	0.75	(0.72–0.79)
Hypercholesterolemia					
No		1.00		0.40	(0.34–0.46)
Yes	2.82*	3.94*	(2.94–5.30)	0.71	(0.69–0.74)
Vascular disease					
No		1.00		0.66	(0.64–0.68)
Yes	1.97	2.25	(0.86–5.91)	0.81	(0.67–0.95)
Sex					
Male	1.49*	1.36*	(1.12–1.65)	0.70	(0.67–0.73)
Female		1.00		0.64	(0.61–0.67)
Primary care specialty§					
Family practice		1.00		0.65	(0.63–0.68)
Internal medicine	1.20	1.23	(0.99–1.53)	0.69	(0.66–0.73)
Number of visits					
Primary care	1.00	1.01	(0.99–1.02)	0.66	(0.64–0.68)
Specialty care	1.01	1.01	(0.99–1.03)	0.67	(0.65–0.69)

*Significance at $P < 0.05$; †overweight defined as BMI ≥ 25 kg/m² or overweight or obese per Elixhauser criteria; ‡high-risk factors generated from the ADA screening criteria, as defined previously (6); §primary care specialty determined for each patient by specialty in which the majority, or all, of their primary care visits occurred; ||number of primary care, specialty, and total visits is mean number of visits per patient over the time period 1 January 2005–31 December 2007.

(20), although other studies such as the National Health and Nutrition Examination Survey (NHANES) III demonstrated that income and education were not related to incidence of undiagnosed diabetes (21) or glycemic control. Given this debate, it is less likely that income and education play a role in our results, especially as we controlled for insurance status and included those who had accessed primary care.

Finally, as is the case with all administrative data, we were limited in which variables we were able to include. Some data suggest that factors, such as health care literacy or medical mistrust, may contribute to minority health disparities (3), whereas other reports have not found factors such as mistrust to play a major role (22). The literature has also suggested that minority patients may see less capable providers (23), that providers may treat minorities differently than their non-minority patients, and that minorities may be seen more frequently at clinics with fewer resources and more chaos (24). All of these factors could affect screening and cannot be entirely excluded. Although anecdotal evidence suggests that providers intentionally order fasting lipid panels and fasting glucoses

together, we cannot be entirely certain with administrative data that providers ordering a metabolic panel with a lipid panel did this intentionally to obtain a fasting, screening glucose.

In summary, this study represents a comprehensive analysis of diabetes-screening practices of insured minority patients presenting for yearly primary care visits in an ambulatory setting. Most significantly, this analysis demonstrated that high-risk ethnicity patients, despite higher frequency of clinic visits, are not more likely to be screened compared with nonminority patients with similar risk factors, which is inconsistent with current diabetes screening guidelines. Because minority status confers not only increased risk of having type 2 diabetes but also risk for having increased complications once diagnosed, it is critical that these screening inequalities are identified and eliminated. Although performance of HbA_{1c} may be slightly different compared with nonminorities, use of HbA_{1c} in the minority population may increase screening compliance, as this test does not require a return fasting visit. Increased provider awareness of diabetes-screening guidelines and implementation of plans to remedy these findings may

help eliminate inequalities in diabetes case finding.

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A.S. contributed to the discussion, wrote the manuscript, and reviewed and edited the manuscript. N.P. contributed to the discussion, reviewed and edited the manuscript, and performed the statistical analyses. D.B.C., G.E.F., and S.A.K. contributed to the discussion and reviewed and edited the manuscript. H.M.J. reviewed and edited the manuscript. M.A.S. contributed to the discussion and reviewed and edited the manuscript.

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