QUALITY IMPROVEMENT FOR PREVENTION OF CARDIOVASCULAR DISEASE AND STROKE IN AN ACADEMIC FAMILY MEDICINE CENTER: DO RACIAL DIFFERENCES IN OUTCOME EXIST?

Objectives: We evaluated whether a one-year, multifaceted quality improvement intervention improved adherence to 13 clinical guidelines for lipid screening, hypertension management, and diabetes management among White and African-American adult patients.

Setting: An academic family medicine center.

Participants: Six faculty physicians and a clinical pharmacist participated between July 1, 2002, and June 30, 2003. Data from 2860 patients' electronic medical records were abstracted.

Interventions: Performance reports and lists of patients eligible for each guideline measure were generated. Interventions targeted patients who needed improvement. Statistical analyses used generalized estimating equations to determine the intervention effect.

Results: Significant improvements occurred in blood pressure control for all adults (OR=1.44) and those with hypertension (OR=1.82), measures of total cholesterol (OR=1.10) and high-density lipoprotein cholesterol (OR=1.27) for all patients, and measure of low-density lipoprotein cholesterol (OR=2.01) and blood pressure control (OR=1.71) for patients with diabetes mellitus. Significant decline was seen in measures of blood pressure for all patients (OR=.60). After adjusting for patient demographic factors, provider variability, and comorbidities, race was not associated with the change observed in any of the measures from baseline to follow-up.

Conclusions: Even though a multifaceted intervention can improve process of care measures for Whites and African Americans, further studies are needed to improve outcome measures, especially in African Americans. (*Ethn Dis*. 2006;16:132–137)

Key Words: Cardiovascular Diseases, Computerized Medical Records Systems, Health Care Quality Assurance, Health Care Quality Indicators, Racial Differences

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INTRODUCTION

Racial and ethnic disparities exist in the quality of health care for many diseases, including cardiovascular disease and stroke.[1] Even though African Americans are more likely to have blood pressure monitoring, cholesterol screening, and smoking counseling, coronary heart disease is more prevalent among African Americans than among Whites.[2] Heart disease death rates are higher among African Americans than non-Hispanic Whites. African Americans experience an 80% higher stroke mortality and a 50% higher heart disease mortality than the general population.[3] For patients with diabetes, the risk of heart disease doubles, and the risk of stroke is five times that of patients without diabetes.[4] African Americans and Hispanics have higher rates of hospitalizations for diabetes and its complications than non-Hispanic Whites.[2] Since African Americans have a 60% higher rate of diabetes than non-Hispanic Whites, African Americans are especially vulnerable for diabetes-related cardiovascular disease. Ethnic and racial disparities have been found in diabetic and cardiovascular quality-of-care process measures. African Americans with diabetes are less likely than Whites to have had a low-density lipoprotein (LDL) cholesterol check in the past two years, more likely than Whites to have poor cholesterol control, and more likely than Whites to have poor blood pressure control.[5,6] Also, African Americans were more likely to have worse diabetes control.[6] African-American women with heart disease were more likely than White women to have poor blood pressure control and poor lipid control.[7] Audit, feedback, and multifac-

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eted interventions improve the practice of healthcare professionals and increase adherence to practice guidelines for clinical care processes and disease management, particularly in prescribing and test ordering.[8–11] However, we do not know whether these activities will work equally effectively in minority populations. Amid the emphasis to increase adherence to quality care guidelines among all people at risk for cardiovascular disease and stroke, additional efforts must be encouraged for minority populations.

The study was a one-year prospective evaluation of a multifaceted quality improvement intervention to improve adherence with 13 quality indicators relevant to the primary and secondary prevention of cardiovascular disease and stroke among White and African-American adult patients. The primary study questions were whether the improvement intervention would result in greater adherence to the guidelines over the intervention period and whether any differences observed were associated with race.

METHODS

The study was conducted between July 1, 2002, and June 30, 2003, within the academic practice of six family medicine faculty members at the Department of Family Medicine, Medical University of South Carolina. The study was nested in a larger study sponsored by the Agency for Healthcare Research and Quality (AHRQ), which assessed whether a multimethod quality improvement intervention was more effective than a less-intensive intervention for improving adherence with quality indicators to prevent cardiovascular disease and stroke in selected primary care practices of the Practice Partner Research Network (PPRNet).[12,13] The study was approved by the institutional review board of the Medical University of South Carolina.

Clinical data were abstracted from the electronic medical records (EMR) of all active adult patients assigned to the participating physicians. A patient was considered "active" if he/she had been seen in the practice within the previous three years. Member practices of PPRNet abstract data quarterly from their EMR, Physician Micro System's (PMSI) Practice Partner Patient Records software, by using the PPRNet data abstract utility developed and maintained by PMSI. The data from the PPRNet data abstract utility maintains a unique, but anonymous identifier for each patient. To obtain the identity of each patient for the study, additional data were exported directly from the EMR with its built-in export functions. Data from the two sources were linked in SAS (Statistical Analysis System, SAS Institute, Cary, NC). Statistical process control charts that displayed performance on each of the 13 study indicators were generated in SAS, and patient lists were printed using Microsoft Access (Microsoft Corp., Redmond, Wash).

Clinical Study Indicators

The 13 clinical study indicators included five hypertension measures,[3] two measures related to hyperlipidemia,[14] and six measures for diabetes mellitus.[15,16] The hypertension indicators were the proportion of adults with measurement of blood pressure within a year, the proportion of patients with diagnosis of hypertension for at least three blood pressure measurements >140/90, the proportion of most recent blood pressure measurements <140/90 among all adults, the proportion of patients with hypertension with measurement of blood pressure within three months, and the proportion of most recent blood pressure measurements <140/90 among patients with hypertension. The indicators for hyperlipidemia were the proportion of adults with measure of total cholesterol within five years and the proportion of adults with measure of high-density lipoprotein (HDL) cholesterol within five years. Among patients with diabetes mellitus, the indicators were the proportion with measurement of glycosylated hemoglobin within a year, the proportion with measurement of LDL cholesterol within two years, the proportion with measurement of blood pressure within three months, the proportion of most recent glycosylated hemoglobin values <7%, the proportion of most recent LDL cholesterol values <100 mg/dL, and the proportion of most recent blood pressure measurements <130/85.

Intervention

The quality improvement intervention combined physician feedback of EMR patient audit with specific patient, physician, and clinical pharmacist collaboration. The addition of the clinical pharmacist in the quality improvement intervention enhanced the intervention by educating physicians and patients and modifying the processes of care and disease therapies.

The quality improvement interventions varied by physician, depending on the physician's practice style and patients' needs. In general, the intervention consisted of periodic assessment of physician performance on the guideline indicators, deliberate physician review of the guidelines, enhanced use of the features of the EMR, and additional patient contact.

Assessment of Physician Performance and Practice Guideline Review

At baseline (July 2002) and at two additional times in the year (November 2002 and February 2003), each physician received performance reports and lists of their patients that were eligible for each clinical guideline. Performance reports were in the form of statistical process control charts that evaluated significant trends in adherence over time. The patient list included the date and value of the patient's last clinical measure (ie, blood pressure, glycosylated hemoglobin). One of the authors (SK), a clinical pharmacist, met with the physicians individually, if they desired, after each practice audit and patient list was distributed to review the practice guidelines and determine appropriate actions for patients not adherent to the guideline. She shared ideas among physicians of successful strategies. Together the physician and pharmacist eliminated patients on the list who were receiving care from other physicians, who were deceased, or had moved. Those patients remaining on the lists were identified for follow-up intervention. Final audit and assessment of adherence was performed as of June 2003.

Enhanced EMR Use

Since the EMR is used in every examination room in the practice, the intervention extended the use of the features of the EMR beyond that to which the physicians were accustomed. Examples of further uses of the EMR included physician review of the patient's chart before scheduled appointments to assess recent lab results or to consider alternate approaches to therapy, point-of-care physician reminders for services due or due soon, and generation of patient letters based on clinical criteria. The clinical pharmacist also reviewed the EMR charts of nonadherent patients and suggested alternative approaches to therapy.

Additional Patient Contact

Additional patient contact occurred through patient outreach, ie, letters or telephone calls to patients requesting them to schedule appointments. At physician request, the clinical pharmacist met with patients for individualized patient-education sessions, for example, dietary counseling or reinforcement of blood sugar monitoring skills for diabetic patients. Also, when requested, the pharmacist participated in clinic visits with physicians and made recommendations of therapy adjustments.

Table 1. Baseline characteristics of the patient population

Characteristic	White $n=1{,}474$	African American $n=1{,}386$	Total $N=2{,}860$
Female* % (*n*)	32 (928)	36 (1017)	68 (1945)
Age, y (mean ± SD)	46.2 ± 16.1	45.4 ± 17.7	45.8 ± 16.8
Hypertension diagnosis* % (*n*)	8 (234)	17 (489)	25 (723)
Diabetes mellitus diagnosis* % (*n*)	2 (65)	6 (171)	8 (236)

* Statistically significant differences ($P<.05$) between races at baseline. Categorical variables compared with chi-square test; continuous variables compared with *t* test.

For at least one physician (coauthor CT) the intervention included changing the process of monitoring her patient populations with the conditions studied. Before scheduled visits, she reviewed the EMR, noting tests that were due. Letters and laboratory order slips were mailed to patients with instructions to have the tests performed before the next visit. Then at the visit, the test results were reviewed with the patient, and any necessary changes in therapy were made immediately. She gave patient-education handouts to all patients with diabetes and explained the treatment goals. She increased the frequency of visits for patients not at goal. She referred these patients to the clinical pharmacist for counseling and education. For resistant patients, she re-emphasized the goals for their condition and encouraged them to select one goal on which to work in attempt to increase their willingness to change their behavior.

Statistical Analysis

Baseline comparisons between races were performed by using *t* tests for continuous variables and chi-square tests for categorical variables. Analyses comparing the prevention measures pre- and postintervention were performed by using the technique of generalized estimating equations (GEE). The SAS genmod procedure was used to test whether the changes that occurred in each dependent variable were significantly different between racial groups. The primary independent variables of interest included a time effect (pre- or postintervention), the patient's race (White vs African American), and the interaction between time and patient's race. Covariates included patient age, sex, the patient's primary provider, and existing morbidities of hypertension and diabetes mellitus. Analyses were adjusted for these covariates. Secondary analyses focused on comparisons in each of the clinical measures between Whites and African Americans, after accounting for the effect of the intervention over time.

RESULTS

A total of 2860 adult patients were active for the entire intervention period. Table 1 shows baseline characteristics and comparisons by race. African Americans were much more likely to have diagnoses of hypertension and diabetes than Whites ($P<.05$, chi-square test). White and African-American patients were distributed similarly among the six primary care providers.

Table 2 lists the study measures at each time point for both race groups. Among the 13 clinical measures, 7 showed significant changes over time. Measures with significant improvement over time included blood pressure control for all adults (odds ratio [OR]=1.44) and for those with hypertension (OR=1.82), measures of total cholesterol (OR=1.10) and HDL cholesterol (OR=1.27) for all patients, and measure of LDL cholesterol (OR=2.01) and blood pressure control (OR=1.71) for patients with diabetes mellitus. A significant decline was observed in measures of blood pressure

Table 2. Percent adherence of clinical measures for studied conditions

		Intervention Effect Follow-up vs Baseline					
		White Patients		African-American Patients			
Condition	Study Measure†	July 1, 2002 % (*n*)	July 1, 2003 % (*n*)	July 1, 2002 % (*n*)	July 1, 2003 % (*n*)	Adjusted Odds Ratio‡	95% Confidence Interval
Hypertension[3]	Measurement of BP in prior 12 months for all active patients ≥18 y	60.4 (1474)	48.9 (1474)	69.9 (1386)	61.6 (1386)	.60*	(.55–.66)
	Recorded diagnosis of hypertension for three systolic BP>140 or diastolic BP>90	68.0 (75)	67.4 (86)	84.6 (221)	87.0 (184)	1.28	(.98–1.66)
	Proportion of most recent measurements in past year <140/90 for all patients	74.0 (891)	74.8 (721)	57.6 (969)	64.3 (854)	1.44*	(1.25–1.66)
	Measurement of BP in prior three months for patients with hypertension	45.6 (206)	44.0 (234)	56.7 (443)	52.1 (489)	.83	(.68–1.01)
	Proportion of most recent measurements in past year <140/90 for patients with hypertension	42.3 (175)	52.0 (177)	30.9 (395)	45.7 (398)	1.82*	(1.47–2.24)
Hyperlipidemia (general population)[14]	Measure of total cholesterol in prior 60 months patients ≥18 y	45.4 (1474)	49.5 (1474)	50.2 (1386)	52.7 (1386)	1.10*	(1.05–1.16)
	Measure of HDL-C in prior 60 months patients ≥18 y	34.7 (1474)	40.3 (1474)	35.2 (1386)	41.3 (1386)	1.27*	(1.20–1.34)
Diabetes mellitus[15,16]	Measurement of $HgbA_{1c}$ in prior 12 months	67.2 (58)	55.4 (65)	78.8 (156)	80.7 (171)	.84	(.58–1.23)
	Measurement of LDL-C in prior 24 months	51.7 (58)	70.8 (65)	51.9 (156)	67.2 (171)	2.01*	(1.52–2.65)
	Measurement of BP in prior three months	50.0 (58)	46.1 (65)	74.4 (156)	69.0 (171)	.75	(.52–1.09)
	Proportion of most recent measurements with $HgbA_{1c}$ level <7% past year	33.3 (39)	39.0 (36)	31.7 (123)	34.1 (138)	1.06	(.72–1.56)
	Proportion of most recent measurements with LDL-C <100 mg/dL past two years	53.3 (30)	45.7 (46)	40.7 (81)	35.7 (115)	.80	(.53–1.21)
	Proportion of most recent measurements <130/85 past year	29.8 (47)	44.4 (45)	24.5 (147)	3.1 (156)	1.71*	(1.13–2.57)

* Statistically significant ($P<.05$).
† Study measures are adapted from referenced published reports.
‡ Overall time effect of intervention.
OR<1 implies decreasing trend over time; OR>1 implies increasing trend over time; ORs were adjusted for age, patient sex, race, provider, diagnoses of hypertension and diabetes mellitus.

for all patients (OR=.60). Measures that showed no difference during the study period included the recorded diagnosis of hypertension for three or more blood pressure measurements >140/90 (OR=1.28), measurement of blood pressure within three months for patients with hypertension (OR=0.83) and diabetes mellitus (OR=0.75), the measurement of glycosylated hemoglobin within a year for patients with diabetes mellitus (OR=0.84), control of glycosylated hemoglobin (OR=1.06), and LDL-cholesterol control for patients with diabetes mellitus (OR=0.80). After using the GEE models to adjust for patient age and sex, comorbid hypertension and diabetes mellitus, and provider variability, the changes over time observed among White patients were not different from any of the changes observed among African-American patients.

Secondary analyses found significant differences between races for 8 of the 13 measures. On average, African Americans had greater odds than Whites of having had their blood pressure measured in the last year (OR=1.27; 95% confidence interval [CI] 1.09–1.46), have blood pressure measured in the previous quarter for patients with hypertension (OR=1.45; CI 1.08–1.95) and have blood pressure measured in the previous quarter (OR=2.30; CI 1.363.88), have a diagnosis of hypertension for three elevated blood pressures (OR=4.12; CI 2.30–7.38), and have $HgbA_{1c}$ measured in the last year for patients with diabetes mellitus (OR=1.79; CI 1.06–3.31). Despite greater frequency of blood pressure measurement, African Americans had lesser odds than Whites to have controlled blood pressure for all adults (OR=0.58; CI .47–.71) and for patients with hypertension (OR=0.61; 95% CI .44–.86), and lesser odds for LDL-cholesterol control for patients with diabetes mellitus (OR=0.51; CI .26–.98). No differences between races were found for measurement within five years for total cholesterol (OR=1.08; CI .91–1.28) or HDL cholesterol (OR=0.92; CI .77–1.09), LDL-cholesterol measurement within two years for patients with diabetes mellitus (OR=0.86; CI .47–1.56), glycosylated hemoglobin control (OR=0.74; CI .37–1.48) or blood pressure control (OR=0.59; CI .31–1.11) for patients with diabetes mellitus.

DISCUSSION

This study found that a year-long quality improvement intervention among adult patients of academic faculty family practice physicians could improve the adherence of patients to clinical guidelines for hypertension and stroke, hyperlipidemia, and diabetes mellitus. Adherence increased for 6 of 13 guidelines and decreased for one guideline over the year-long intervention period. African Americans had greater adherence than Whites to five guidelines and less adherence for three guidelines. However, after adjusting for patient characteristics, primary provider, and comorbidities, the study found no association between differences in adherence to guidelines over the year intervention and patient race.

The seven guidelines that did not improve may be because patients were not seen often enough or at all in the practice during the year of the study. Three of the seven guidelines that did not improve were measures of blood pressures taken within specified time periods. Additional outreach strategies to patients and additional patient contact may improve adherence to those guidelines.

Despite the finding that African Americans had better adherence to guidelines for blood pressure measurement and diagnosis of hypertension for three elevated blood pressures, Whites had better blood pressure control. Similarly, Whites had better LDL-cholesterol control for patients with diabetes mellitus. These findings are consistent with previous studies that found poor blood pressure control and LDL-cholesterol control among Black Americans with diabetes, even with as intensive treatment as Whites.[5,6] In contrast, this study found no difference between the races for $HgbA_{1c}$ control in patients with diabetes, even though African Americans were more likely to have $HgbA_{1c}$ measurements.

Adherence increased for 6 of 13 guidelines and decreased for one guideline over the year-long intervention period.

The study had several limitations. An academic faculty family practice center may not be representative of a typical family practice setting. The availability of clinical pharmacist expertise and other academic resources would be rare in a private practice setting; thus, the interventions possible in this setting may not be possible in other environments, which makes the results ungeneralizable. An additional limitation is that the study intervention lasted only 12 months. This time may not have been sufficient for return visits for some patients who were not adherent with the clinical guidelines. Also, even though the clinical pharmacist spent four hours a week on the project, the amount of time she and some of the physicians could devote to the study made it impossible to reach all the patients nonadherent for some of the guideline measures. Even when point-of-care reminders were in the patient's EMR chart, at least one physician (CT) desired more time during the clinical encounter to accomplish all the suggested actions.

The inclusion of a control group of comparable physicians could have strengthened the study. However, a true, uncontaminated control group of physicians in this environment was not feasible because of resource sharing within the practice. Since no special emphasis on caring for minority patients existed in the practice during the year, we believe the improvements in the measures are due to the study intervention.

The findings of this study agree with those reported in the National Healthcare Disparities Report (NHDR) in that

African Americans had higher rates than Whites of blood pressure measurements. However, this study went further to discover that even though blood pressure was measured more frequently, blood pressure control for African Americans was poorer than that of Whites. Similarly, as the NHDR reported generally small racial differences in receipt of diabetes services but significant differences in outcomes, this study specifically found no significant difference between White and African-American patients with diabetes mellitus in the rate of measurement of LDL cholesterol in the prior two years but found worse LDL-cholesterol control among African Americans with diabetes. Efforts must be directed at developing and implementing additional treatment strategies to improve the clinical outcomes of these patients. Of specific importance is determining which components of the intervention are most effective in improving adherence to the guidelines. In addition, more research should be done to assess other differences in clinical guideline measures in minority populations.

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