

Quality of Cardiovascular Care in an Internal Medicine Resident Clinic

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Abstract

Background Attainment of treatment goals derived from evidence-based practice guidelines can be a useful measure of the quality of cardiovascular care. To date, there are few studies of the quality of care provided in a resident continuity clinic, as measured by success in meeting nationally defined guidelines for control of cardiovascular risk factors. There also is limited information regarding the quality of care in resident continuity clinics serving multiethnic uninsured/underinsured populations. This study assessed the efficacy of residents in internal medicine in attaining evidence-based, guideline-defined treatment goals for control of hypertension, dyslipidemia, and hyperglycemia in an uninsured/underinsured multiethnic population.

Methods In a cross-sectional study of patients treated exclusively by residents (with faculty supervision) between July 1 and December 31, 2005, data were abstracted from the medical records of 628 consecutive patients (mean age, 55.6 years; 62% female; 61.3% non-white; 55.5% uninsured) with hypertension,

hyperlipidemia, and/or diabetes mellitus. Quality measures were the proportion of diabetic and nondiabetic patients who met guideline-defined treatment goals for hypertension, dyslipidemia, and hyperglycemia in diabetic patients.

Results Goal attainment overall was 44.9% for high blood pressure, 55.7% for dyslipidemia, and 43.3% for hemoglobin A_{1c} for diabetic patients. There was no relationship between age, gender, race/ethnicity, insurance, or body weight to attainment of hypertension, dyslipidemia, or hemoglobin A_{1c} goals in diabetic and nondiabetic cohorts from multivariate analysis. Risk factor control rates were higher in this study than in comparable educational programs.

Conclusion An internal medicine resident continuity clinic can provide high-quality care that meets guideline-defined cardiovascular risk factor control goals in a racially and ethnically diverse, underinsured/uninsured, low-income population in a community-based academic medical center.

Introduction

Quantification of adherence to evidence-based practice guidelines has been shown to be useful in the assessment of the quality of care.¹ There is substantial evidence that reduction of modifiable risk factors for coronary heart disease, such as high blood pressure, elevated serum lipids, and hyperglycemia, decreases the risk of experiencing a cardiovascular disease (CVD) event, and lessens risk of coronary heart disease mortality.²⁻⁴ Yet survey data suggest that broad achievement of guideline-defined risk factor goal

levels remains a largely unfulfilled objective.^{5,6} Achievement of guideline-defined treatment goals derived from evidence-based practice guidelines for control of hypertension, hyperlipidemia, and diabetes has been shown to be a valid indicator of the quality of health care.⁷⁻⁹

There are few cross-sectional analyses of the quality of care delivered in an internal medicine resident clinic, as evidenced by the level of attainment of guideline-derived CVD risk factor goals.¹⁰ There are also limited data on the attainment of guideline-defined CVD risk factor control rates analyzed by demographics (age, gender, race, and ethnicity), insurance status, or body weight in ambulatory care continuity clinics.

The aims of this study were (1) to assess the quality of care provided exclusively by residents (supervised by faculty) in internal medicine by an established quality measure (ie, attainment of guideline-defined risk factor control rates) and (2) to determine differences in the control of cardiovascular risk factors by demographics (race, ethnicity, age, and gender), body weight, and insurance status.

Setting and Clinic Redesign

The setting for our study was the Family Health Center at the Jersey Shore University Medical Center, a suburban

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community-based, university-affiliated regional academic medical center in central New Jersey. The clinic functions as a primary care and “safety net” clinic, and serves a primarily low-income, uninsured or underinsured, racially and ethnically diverse patient population, drawn largely from economically and socially challenged individuals from the local community and adjacent towns on the New Jersey Shore. Internal medicine residents attend the clinic 1 half-day once or twice weekly and are exclusively responsible for the care of their own panel of patients. Residents independently deliver patient care under the supervision of internal medicine faculty.

Redesign of the ambulatory care educational experience in the resident continuity clinics between 2002 and 2005 focused on curricular enhancements, educational improvements, more efficient clinic processes, faculty development, increased quality and quantity of faculty and staff, and improvements in the clinic structure, procedures, and policies. The time allocated to resident outpatient continuity experience was increased from 4 to 6 hours weekly, and a new appointment system was implemented to ensure that patients would more consistently see the same resident. An evidence-based ambulatory care curriculum was established and daily didactic clinic conferences were instituted, with particular emphasis on treatment and prevention of chronic disease. The number of faculty preceptors in clinic was increased, and the faculty-to-resident ratio was changed from 1:5 to 1:3.

A multidisciplinary integrated clinic team, with regular participation by resident physicians, faculty, and nursing staff, was also established. The team, supervised by internal medicine faculty experienced in ambulatory care, focused not only on delivering high-quality health care, but also on providing evidence-based and guideline-driven resident education. A trained social worker, dietician, and nurse practitioner, each skilled in facilitating the care of patients with hypertension, dyslipidemia, and diabetes, were important components of the team. Because of inconsistency and unpredictability of adequate supplies of medication “samples” from a small number of pharmaceutical companies, the practice of providing “no cost” drug samples to patients who did not have health insurance or sufficient financial resources to readily obtain medications was discontinued. Inexpensive generic medications were preferentially prescribed and patients with limited financial resources were assisted in obtaining affordable medications from sources in the community and through drug assistance programs for indigent, uninsured, and underinsured patients.

Methods

A postgraduate year-3 medical resident and a member of the internal medicine faculty experienced in medical record review and data collection abstracted data from the paper medical records of 923 consecutive patients attending clinic

sessions between July 1 and December 31, 2005. Data from the medical records of 628 patients treated exclusively by residents (with faculty supervision) and meeting the inclusion criteria were abstracted and recorded on standardized data collection forms. The inclusion criteria required: (1) age over 18 years, (2) continuous enrollment in the internal medicine resident continuity clinic for more than 1 year, (3) seen at least twice in the clinic during the 12 months prior to data collection, and (4) diagnosis and treatment of one or more of the following conditions: hypertension (high blood pressure, HBP), defined as a history of HBP greater than 140/90 and/or treatment with antihypertensive agents; dyslipidemia (LDL), defined as a history of low-density lipoprotein greater than 100 mg/dL and/or treatment with lipid-lowering diet and/or medications, or diabetes mellitus, defined as a history of hyperglycemia (hemoglobin [Hb] A_{1c} ≥ 7), and/or treatment with diet, oral medications, or insulin. These forms served as a guide for the medical record review by 2 reviewers, a general medicine faculty member with experience in medical record review, and a third-year medical resident trained in medical record review by this faculty member. The most recent blood pressure, lipid levels, HbA_{1c}, as well as age, gender, race/ethnicity (by self-designation), insurance status, body weight (classified according to the National Heart Lung and Blood Institute system),¹¹ and comorbidities were obtained from the medical record.

Throughout the year prior to data collection, all patients in the study cohort received pharmacologic and lifestyle modification therapy for each specific risk factor (statins for hyperlipidemia, antihypertensive medications for HBP, and hypoglycemics for diabetes mellitus). The records of patients who did not have any of the index conditions or whose medical records were unavailable were excluded from analysis. The quality, accuracy, and completeness of data extracted from review of medical records were assessed by repeat abstraction of a random secondary sample of medical records by one of the researchers. With repeat abstraction, data from initial abstraction were matched to the reabstracted data. Inaccurate or missing data were obtained and/or corrected, which resulted in high-quality data abstraction.

Outcome Measures

Rates of attainment of guideline-defined treatment goals were extracted from the medical record and a computerized database. Blood pressure (HBP), dyslipidemia (LDL), and, in diabetic patients, HbA_{1c} levels were determined from the most recent measurement documented in the patient record. The proportion of patients that met recommended national guideline-defined treatment goals was determined for HBP (<140/90 mmHg for nondiabetic patients or <130/80 mmHg for diabetic patients),¹² dyslipidemia (LDL <160, <130, or ≤100 mg/dL, depending on risk factors)¹³ and diabetes (HbA_{1c} <7%).¹⁴ Analysis of goal attainment for

HbA_{1c} was determined for diabetic patients only. Blood pressure and LDL goal attainment were measured in the entire cohort of study patients. Differences in attainment of blood pressure and LDL goals related to gender, race/ethnicity (self-designation), body weight, and health insurance status were analyzed in diabetic and nondiabetic patients.

The study was reviewed and approved by the institutional review board of the Jersey Shore University Medical Center.

Statistical Analysis

Data were summarized by using mean $\pm$ SD or percentage (%). The chi-square test or Fisher exact test was used to compare proportions between or among groups, depending on the expected count in each classification. Multiple logistic models were used to assess the association between attainment of risk factor goals and variables of interest while controlling for other patient characteristics. All reported *P* values are 2-sided. Statistical significance was defined as *P* $\leq$.05.

Results

Demographic and clinical characteristics of study patients are shown in the TABLE. Of the entire cohort of 628 patients, 319 were diabetic and 309 were nondiabetic. The mean age was 55.6 $\pm$ 11.4 years. More than half the patients were women, nearly half were African American, and the majority were uninsured. Obesity was relatively common in the study cohort (57% had a body mass index $\geq$ 30 kg/m²), with 14% of patients being of normal weight. Nearly one-third (30.9%) of the patients were smokers. The prevalence of vascular disease in the entire cohort was coronary disease, 17.2%; cerebrovascular disease, 7.5%; and peripheral vascular disease, 2.9% of patients. Attainment of treatment goals for HBP, LDL, and HbA_{1c} and goal attainment by age, gender, race/ethnicity, insurance status, and body weight for diabetic and nondiabetic patients are shown in the FIGURE. Goal attainment for the entire cohort was 44.9% for HBP, 55.7% for LDL, and 43.3% for HbA_{1c} for diabetic patients.

HBP Goal Attainment

Overall, attainment of the HBP goal was less among diabetic than nondiabetic patients (34.5% of diabetic patients vs 55.7% of nondiabetic patients, *P* < .0001) (FIGURE). No difference in HBP goal attainment by age, gender, race/ethnicity, or insurance status was observed within diabetic or nondiabetic cohorts. In diabetic patients, HBP goal attainment varied by body weight, with goal attainment in patients of normal weight 53.1% higher than in all categories of obesity. The HBP goal attainment was significantly lower in obese (body mass index $\geq$ 30) diabetic patients (*P* = .003) compared with nonobese patients. In

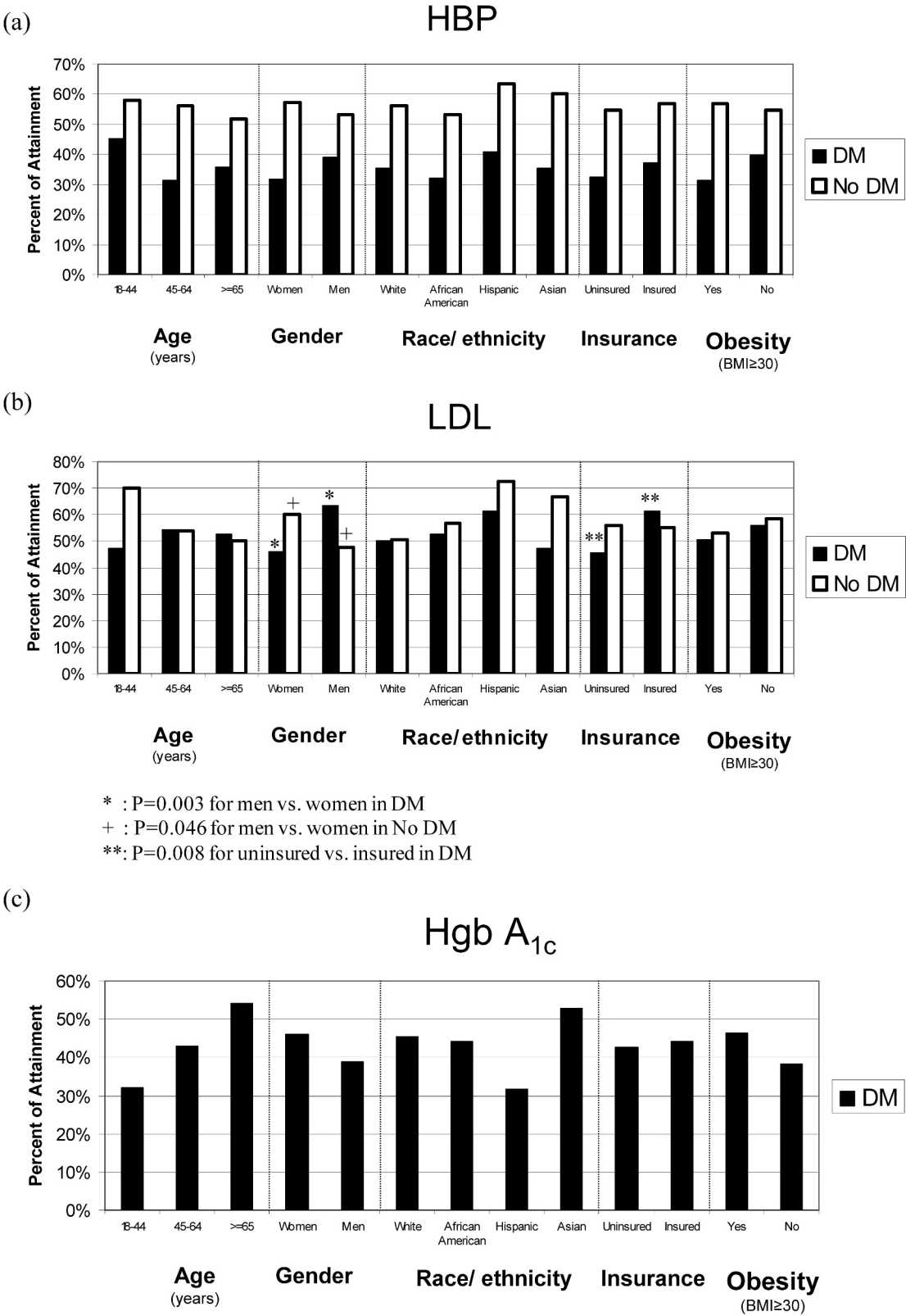
TABLE	PATIENT CHARACTERISTICS
Number of patients enrolled	628
Age, y (mean $\pm$ SD)	55.6 $\pm$ 11.4
Gender	
Male	236 (37.6%)
Female	392 (62.4%)
BMI (mean $\pm$ SD)	32.4 $\pm$ 8.8
Weight status (BMI, kg/m ²)	
Underweight (<18.5)	7 (1.1%)
Normal weight (18.5–24.9)	88 (14.0%)
Overweight (25–29.9)	175 (27.9%)
Obesity class 1 (30–34.9)	150 (23.9%)
Obesity class 2 (35–39.9)	98 (15.6%)
Extreme obesity class 3 ($\geq$ 40)	110 (17.5%)
Race	
Non-Hispanic White	243 (38.7%)
African American	287 (45.7%)
Hispanic	66 (10.5%)
Asian	32 (5.1%)
Insurance	
Medicare	113 (18%)
Medicaid	154 (24.5%)
Private	14 (2.2%)
Uninsured	347 (55.3%)
Comorbidities	
Diabetes	319 (50.7%)
Coronary artery disease	108 (17.2%)
Cerebrovascular disease	47 (7.5%)
Peripheral vascular disease	18 (2.9%)
Abdominal aortic aneurysm	2 (0.3%)
Smoking history	194 (30.9%)
Obesity (BMI $\geq$ 30)	358 (57%)

Abbreviation: BMI, body mass index.

nondiabetic patients there were no differences in HBP goal attainment according to body weight.

LDL Goal Attainment

The LDL goal attainment was similar in diabetic and nondiabetic patients. In diabetic patients, attainment of LDL goals was comparable across all age strata. Younger



FIGURE

ATTAINMENT OF TREATMENT GOALS FOR BLOOD PRESSURE, HYPERLIPIDEMIA (LDL), AND HEMOGLOBIN (HGB) A_{1c}

(<44 years) nondiabetic patients attained LDL goal levels more often than older nondiabetic patients; however, the difference was not statistically significant ($P = .07$). In diabetic patients, differences in attainment of target control levels for LDL were observed for gender, with men more likely to attain goal levels than women; this finding was reversed for nondiabetic patients. In diabetic patients with medical insurance, attainment of LDL goal levels was higher than in uninsured patients. There was no difference in attainment of LDL goal by age, race/ethnicity, or body weight in diabetic or nondiabetic patients.

HbA_{1c} Goal Attainment

In diabetic patients, the HbA_{1c} goal was attained in 43.3% of patients. Attainment of HbA_{1c} goal was more common in older compared with younger diabetic patients; however, the difference did not achieve statistical significance ($P = .06$). There also was no difference in attainment of goal HbA_{1c} level related to gender, race/ethnicity, or insurance status. No significant difference in HbA_{1c} goal attainment was observed among obese diabetic patients. In the small number of normal-weight diabetic patients, 18.8% attained HbA_{1c} goal levels.

Overall Goal Attainment

All 3 risk factor goals were attained in 6.6% of diabetic patients. Using a logistic regression model, controlling for age, gender, race/ethnicity, smoking, body weight, and comorbidities, greater attainment of recommended HBP levels was found only in nondiabetic patients compared with diabetic patients (odds ratio, 2.26; 95% confidence interval: 1.62–3.15; $P < .0001$). Attainment of LDL and HbA_{1c} goal levels was not associated with age, gender, race/ethnicity, smoking, body weight, or comorbidities by logistic regression model. However, nonsmokers were more likely to attain LDL goal than smokers (odds ratio, 1.57; 95% confidence interval: 1.09–2.25; $P = .01$).

Discussion

Cardiovascular disease remains a major cause of death in the United States. Control of HBP, hyperlipidemia, and diabetes has been shown to reduce the risk of cardiovascular morbidity and mortality. Although guidelines for control of cardiovascular risk factors have been developed and widely disseminated by national organizations,^{12–14} control of CVD risk factors remains an elusive goal. In our study, rates of attainment of guideline-defined treatment goals were higher than those achieved in previous studies in academic teaching programs,¹⁵ academic medical centers,¹⁰ urban academic medical centers,¹⁶ or reported in studies of regional¹⁷ and national¹⁸ populations. Goal attainment for our overall cohort was 44.9% for HBP, 55.7% for LDL, and 43.3% for HbA_{1c} in diabetic patients. In a study of diabetic patients managed by physicians in training in a municipal hospital, the goal for systolic blood pressure control was met in only

25% of patients, the LDL goal in 25%, and the HbA_{1c} goal in 39%.¹⁵

McFarlane and colleagues¹⁶ studied achievement of guideline-defined treatment goals for HBP, LDL, and HbA_{1c} in patients with diabetes and HBP attending urban academic municipal and Veterans Administration medical centers in Detroit, Michigan, and Brooklyn, New York. They found that 26.6% were at goal HBP levels, 35.5% at goal LDL levels, and 26.7% of diabetic patients were at goal HbA_{1c} level, lower rates of risk factor target achievement than in the current study. A study of the quality of diabetes care in a national sample of 30 academic medical centers¹⁰ also reported lower rates of attainment of risk factor goals than our results. Our data also compare favorably with findings from the report by Molenaar et al,¹⁷ who studied the rates of treatment and control of risk factors in a population sample from a community-based cohort of normal-weight, overweight, and obese diabetic individuals from the Offspring and Third Generation cohort of the Framingham Heart Study. When attainment of goal risk factor levels are assessed for all 3 risk factors, 6.6% of diabetic patients in the current study were at goal levels for all 3 risk factors, compared with 3.2% in the Detroit/Brooklyn cohorts¹⁶ and 1.6% in the Framingham population.¹⁷

In the current study, there was a statistically significant difference in the rate of LDL goal attainment according to gender, with diabetic women attaining the LDL goal less often than men. This finding is consistent with the results of the Multi-Ethnic Study of Atherosclerosis in which women were 9% less likely to achieve LDL cholesterol levels (<130 mg/dL).¹⁹ In contrast with the Multi-Ethnic Study of Atherosclerosis data, where the rate of attainment of HBP control was lower in women than in men, our study found no gender difference in attainment of goal blood pressure. The current study also showed a statistically significant difference in LDL goal attainment according to insurance status, with insured diabetic patients attaining the LDL goal more often than uninsured diabetic patients. These findings contrast with those of Fowler-Brown et al,²⁰ who did not find any differences by insurance status in the degree of lipid control in patients enrolled in the Atherosclerosis Risk in Communities Study in whom hyperlipidemia had been diagnosed.

Differences in attainment of LDL control targets in diabetic women and the uninsured suggest that control of LDL levels in diabetic women, especially the uninsured, may require particular attention clinically. The present study did not reveal any influence of age or race on attainment of HBP or HbA_{1c} goals, suggesting that diabetic and nondiabetic patients in this study had appropriate access to care, and that residents addressed CVD risk factor control without racial or age bias. The higher rates of risk factor control in our study may be explained by the relatively younger age of our study population compared with populations from

Veterans Administration hospitals or urban academic settings.¹⁶ Even though our clinic population was socially and economically disadvantaged, the degree of social deprivation was probably less than that in low-income, uninsured/uninsured multiethnic populations in larger urban population centers. The high rates of risk factor control in our diabetic and nondiabetic study cohort, despite a high proportion of African American, female, obese, and uninsured patients, may serve as a hypothesis for generating data for future studies.

Limitations of Study

Our study has several limitations, including the cross-sectional nature that analyzes the relationship of clinical and demographic variables to rates of attainment of risk factor goals at a single point in time, which may not be indicative of risk factor control levels over time. The number of clinic visits per patient over several months or years was not quantified, although patients at significant risk for CVD (with diabetes, HBP, or dyslipidemia) were customarily seen by their resident physician at 3- to 4-month intervals. Our study was carried out in a single suburban community medical center and the findings may not generalize to internal medicine programs in medical schools and/or in larger population centers. Baseline information was not collected, and the association between prior clinic redesign and the main quality measures—levels of attainment of guideline-derived risk factor goals—is based on causal inference. However, the temporal chronology of quality assessment and clinic redesign was appropriate, with quality measurement following clinic redesign. Because patients in this study received a variety of pharmacologic treatments prior to medical record review, data on the impact of specific treatment regimes on risk factor control were not collected.

Conclusion

Our study provides information on the rates of achievement of cardiovascular risk factor control in a medical resident continuity clinic serving a racially and ethnically diverse, economically challenged population, in an environment analogous to many community-based internal medicine training programs in medical centers serving smaller cities and towns. The comparatively favorable risk factor control rates attained in the current study suggest that attainment of evidence-based cardiovascular risk factor targets is an achievable objective for internal medicine training programs.

Our findings also provide insight into the multiple prerequisites for high-quality ambulatory care delivered by internal medicine residents to multiethnic underinsured/uninsured suburban communities. These findings offer evidence that residents in an internal medicine continuity clinic can meet evidence-based practice guidelines and performance standards of high-quality health care in a

racially and ethnically diverse, underinsured/uninsured, low-income population in a suburban academic medical center.

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