

# DIABETES MANAGEMENT BY RESIDENTS IN TRAINING IN A MUNICIPAL HOSPITAL PRIMARY CARE SITE (IPCAAD 2)

**Purpose:** Since diabetes is largely a primary care problem but we know little about management by residents in training—the primary care practitioners of the future—we examined surrogate outcomes reflective of their performance.

**Methods:** A seven-week observational study was conducted in a typical training site—a municipal hospital internal medicine resident “continuity” (primary care) clinic in a large, academic, university-affiliated training program. We evaluated control of glucose, blood pressure, and lipids; screening for proteinuria; and use of aspirin relative to national standards.

**Results:** Five hundred fifty-six (556) patients were 72% female and 97% African-American, with mean age 63 years, duration of diabetes 12 years, and BMI 34 kg/m<sup>2</sup>. Patients were managed largely with diet alone (22%) or oral agents alone (40%); 7% used oral agents and insulin in combination, and 30% insulin alone. Hemoglobin A<sub>1c</sub> (mean 8.2%) was above goal (<7.0%) in 61% of patients. Low density lipoprotein cholesterol (mean 128 mg/dL) was above goal (<100) in 76% of patients, but high density lipoprotein (mean 53 mg/dL) was at goal in 46%, and triglycerides (mean 138 mg/dL) were at goal in 85%. Diastolic pressure (mean 75 mm Hg) was at goal (<85) in 77% of patients, but systolic pressure (mean 143) was at goal (<130) in only 25% of patients. An average of only 53% of the patients had urine protein screening per 12 months, and use of aspirin was documented for only 39% of patients.

**Conclusions:** Patients with type 2 diabetes in a typical internal medicine resident primary care clinic frequently do not achieve national standard of care goals. Since skills and attitudes developed in residency are likely to carry over into later practice, local diabetes educators may need to work with medical faculty to develop new interventions to improve post-graduate medical education in diabetes management. (*Ethn Dis.* 2005;15:649–655)

**Key Words:** Diabetes, Training

From the Divisions of Endocrinology and Metabolism (CM, DZ, CC, IE, DG, CB, GW, LP) and General Medicine (JD, CW, WB), Department of Medicine; Emory University School of Medicine; Department

Christopher D. Miller, MD; David C. Ziemer, MD;  
Joyce P. Doyle, MD; Curtiss B. Cook, MD; Imad M. El-Kebbi, MD;  
Daniel L. Gallina, MD; Clyde Watkins Jr, MD;  
Catherine S. Barnes, RN, PhD; Genene D. Walker, MPH;  
Robert H. Lyles, PhD; Vicki S. Hertzberg, PhD;  
William M. McClellan, MD, MPH; William T. Branch Jr, MD;  
Lawrence S. Phillips, MD

## INTRODUCTION

The Improving Primary Care of African Americans with Diabetes (IPCAAD) study is a randomized, controlled trial that attempts to translate endocrinologist approaches to the primary care setting by implementing a novel partnership between specialists and generalists.<sup>1</sup> The underlying hypothesis is that endocrinologist-supported interventions—computerized reminders and/or feedback on performance—will improve the care of diabetes patients that the endocrinologists do not see. The IPCAAD study targets management of ethnic minority patients in a large municipal hospital primary care site. The study of patients in such sites is of particular importance because they are major bases for training primary care residents and they often involve diabetes educators who play key roles both in instructing patients and in upgrading the diabetes awareness and the related skills of both the medical staff and physicians in training. To gain understanding of the care delivered by

of Biostatistics, Emory University School of Public Health (RL, VH); Georgia Medical Care Foundation (WM); Atlanta, Georgia. Dr. Cook is now based at the Mayo Clinic Scottsdale, Scottsdale; Arizona.

Address correspondence and reprint requests to Lawrence S. Phillips, MD; General Clinical Research Center; Emory University Hospital, Room GG-23; 1364 Clifton Road; Atlanta, GA 30322; 404-712-4722; 404-727-5563 (fax); medlsp@emory.edu

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internal medicine residents, we conducted a seven-week baseline observational study in the medical clinic of Grady Memorial Hospital in Atlanta, where the urban locale and predominantly African-American patient population are typical of many resident continuity clinics across the United States.

## RESEARCH DESIGN AND METHODS

### Study Site

The IPCAAD study was reviewed and approved by the Emory institutional review board and is based in the general medical clinic at Grady Memorial Hospital, a primary care clinic where ~23% of patients have diabetes.<sup>2</sup> The clinic has ~60,000 patient visits per year and is staffed by residents, nurse practitioners, physician assistants, and attending physicians; diabetes edu-

cation is provided by dietitians and pharmacists who interact with the medical staff and are available to instruct patients in diet, use of insulin, etc. Approximately two thirds of the patients are cared for by internal medicine residents who attend the clinic one-half day per week throughout their three years of postgraduate training; this study focuses on the patients of residents supervised by faculty from the Division of General Medicine at Emory University School of Medicine – a typical large, academic, university-affiliated training program. In a recent assessment, ~140 residents averaged 29 years of age, were 70% male, and were 34% postgraduate year 1, 37% postgraduate year 2, and 29% postgraduate year 3.

### Accrual

Clinic staff routinely triage patients by asking them whether they have ever been told that they have diabetes or “high sugar,” an expression familiar to patients in the southeastern United States.<sup>3</sup> If patients answer in the affirmative, they are directed to research assistants who determine eligibility (age 18–85 years, nonpregnant, no dementia or other psychiatric disorder, type 2 diabetes [non-insulin-using and/or off insulin for at least one month since diagnosis and/or have never had an episode of severe hypoglycemia]), measure vital signs, and obtain baseline demographic information and time since the previous meal. Since the interventions are directed at physicians rather than patients, informed consent is not obtained, and all eligible patients are included. Although this strategy limits risk of selection bias, we had no way to include patients with undiagnosed diabetes. Blood pressure is measured in the sitting position with a Critikon Dinamap Vital Signs Monitor 8280 (Tampa, Fla) and capillary glucose with the MediSense Precision PCx Point-of-Care System (Abbott Laboratories, Bedford, Mass). Based on standard-of-care guidelines,<sup>4</sup> the re-

search assistants also fill out requests for laboratory studies (hemoglobin [Hb] A<sub>1c</sub> if not obtained in the past three months and serum creatinine, fasting lipid profile, and spot urine albumin/creatinine ratio if not measured within the past year) and recommend that the HbA<sub>1c</sub>, creatinine, and microalbumin/creatinine ratio be obtained on the day of the visit and the lipid panel within two weeks; all requests must be approved by residents. Once all information is compiled, the research assistant enters the data into a registry. These procedures are followed regardless of the study arm to which the patient is assigned.

### Patient Registry

The Diabetes Patient Tracking System is a shared network database that contains demographic, laboratory, clinical, and medication information on all new patients presenting to the Grady Diabetes Clinic since April 15, 1991, as well as Grady Medical Clinic study patients during visits since July 1, 1999. While clinical laboratory results and appointment information are transferred electronically, other information is entered by hand. A data entry interface provides reminders if key information is missing and flags outliers and potential errors during manual entry. Individual checks demonstrated that the electronic downloads of laboratory information were accurate and complete, but use of over-the-counter medications such as aspirin may have been underreported.

### Design

Instead of using process measures,<sup>5</sup> we assessed management by comparing performance at the time of accrual with national standards of care as published by the American Diabetes Association (ADA) and in effect at the time of patient accrual,<sup>6</sup> which were specifically recommended as treatment goals in lectures given to the residents. These measures included glucose control, lev-

els of cardiovascular risk factors (blood pressure and lipids), and documentation of use of aspirin. To assess process, we determined the frequency of testing prior to accrual (measurement of HbA<sub>1c</sub>, lipids, and quantitative excretion of urine protein [24-hour urine protein, albumin, or spot urine albumin/creatinine ratios]) for the 537 patients who had data in one or more of these categories. We could not obtain information from the Grady databases to assess whether or not patients had had dilated eye examinations, and limited resources did not permit chart abstraction to determine whether or not patients' feet had been examined.

### Analysis

All data were retrieved from the study database which was initially developed in FoxPro 2.6 and converted to Oracle software. We selected a convenience sample consisting of all patients with type 2 diabetes accrued into the IPCAAD study over a seven-week period from October to December, 1999. Demographic and medication information and blood pressure were based on data obtained at the time of enrollment. To assess process, we determined whether HbA<sub>1c</sub>, lipid profile, and/or quantitative excretion of urine protein had been measured since January 1, 1999, and the day before accrual, and we normalized the results to a yearly rate. To assess the effect of management, baseline glucose and lipid data included values through the date of accrual to reflect assessments before initiation of the study interventions. When more than one set of values was available, the tests performed closest to the date of the patient's enrollment in the study were used. Continuous values were expressed as mean  $\pm$  standard error. When appropriate, distributions were compared to data from the National Health and Nutrition Examination Survey (NHANES) III survey.<sup>7</sup> Statview 5.0 (Cary, NC) was used for all analyses.

## RESULTS

The Grady patient population is urban, many patients lack health insurance, and many patients have household incomes below the federal poverty line.<sup>8</sup> Diabetes is a common problem in the Grady Medical Clinic; 2,250 of 7,278 unique patients (30.9%) seen in January–March, 2000 were identified with a recorded 250.xx International Classification of Diseases, Ninth Revision (ICD-9) code (indicating a diagnosis of diabetes) on at least one of their visits during 1998–2000, and a parallel analysis indicated identification of diabetes in 29.3% of 7,792 unique patients seen in January–March, 2001. The actual numbers might be larger if some diabetes patients had visits in which the diabetes code was not recorded, but the recent assessments are consistent with the 23% of patients who self-identified as having diabetes during a survey in 1996.<sup>2</sup>

The 556 patients accrued into the IPCAAD Study in October–December, 1999 were an average of  $63.4 \pm 0.7$  years of age (range 20–90 years), 72% were female, and 97% were African American. Patients had BMI  $33.7 \pm 0.3$  kg/m<sup>2</sup> and average duration of diabetes  $12.4 \pm 0.4$  years. Nearly all patients had had measurement of HbA<sub>1c</sub> prior to accrual; 508 patients had at least one measurement over a 10.5-month period, and total determinations averaged 3.4 measurements per patient per year. However, assessment of lipids was less common (448 patients and a rate of 92% of the patients per year), and quantitative urine protein screening was infrequent (260 patients and a rate of 53% of the patients per year). At the time of accrual, the patients had average HbA<sub>1c</sub>  $8.2 \pm 0.1\%$ , total cholesterol  $205 \pm 2$  mg/dL, triglycerides  $138 \pm 4$  mg/dL, high-density lipoprotein (HDL) cholesterol  $53.3 \pm 0.8$  mg/dL, and low-density lipoprotein (LDL) cholesterol  $128 \pm 2$  mg/dL. Their systolic blood

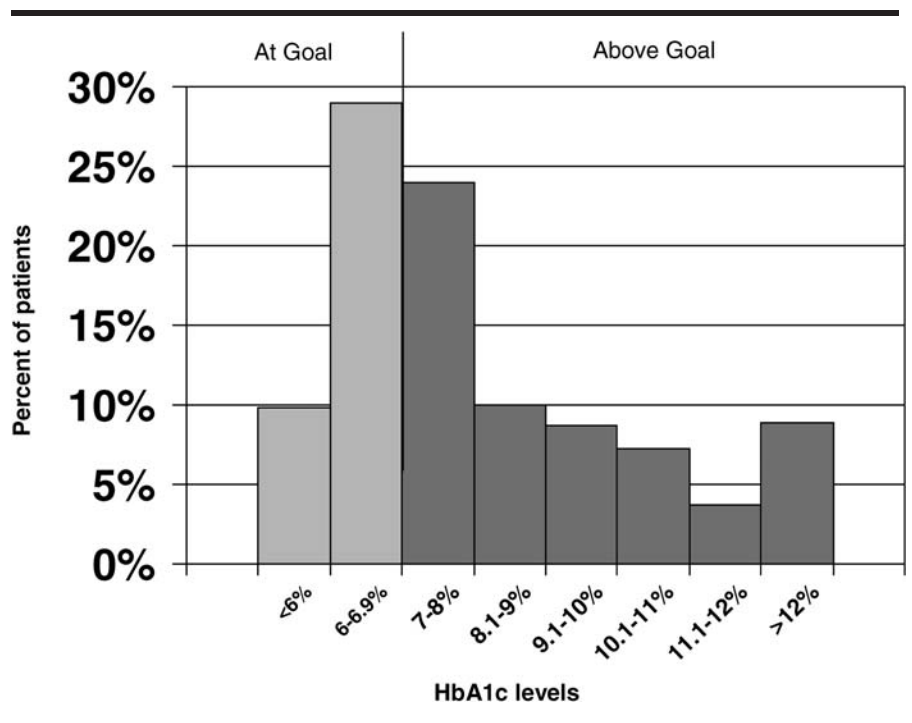
pressure averaged  $143 \pm 12$  mm Hg, and their diastolic pressure was  $75.2 \pm 0.6$ .

Hyperglycemia was managed in 22% of the patients with diet alone, 40% with oral agents alone, 8% with insulin and oral agents combined, and 30% with insulin alone. HbA<sub>1c</sub> averaged  $7.0\% \pm 0.2\%$  in patients managed with diet alone,  $8.1\% \pm 0.2\%$  in patients using oral agents alone,  $9.5\% \pm 0.4\%$  in patients using insulin in combination with oral agents, and  $8.8\% \pm 0.2\%$  in patients using insulin alone; higher HbA<sub>1c</sub> levels are also typical of insulin-treated patients in diabetes specialist settings.<sup>9</sup> The HbA<sub>1c</sub> levels in all other groups of patients were significantly higher than values in patients managed with diet alone ( $P < .01$ ).

Figure 1 shows the distribution of HbA<sub>1c</sub> levels. Only 10% of medical clinic patients had HbA<sub>1c</sub>  $<6\%$ , and HbA<sub>1c</sub> was  $<7.0\%$ , the ADA goal,<sup>6</sup> in 39% of patients. HbA<sub>1c</sub> exceeded 9% in 29% of medical clinic patients.

The distribution of lipid levels in medical clinic patients is shown in Figure 2. Overall, 46.7% of the patients were using a lipid-directed medication (45.8% a hydroxy-methylglutaryl coenzyme A [HMG-CoA] reductase inhibitor, 1.3% a bile acid-binding resin, 0.5% a fibric acid derivative, and 0.2% nicotinic acid [some used more than one medication]). However, only 25% of the patients had LDL cholesterol  $<100$  mg/dL, the ADA goal<sup>4</sup> (Figure 2A). Although low HDL cholesterol is less common in African Americans than it is in Caucasian patients with diabetes,<sup>10</sup> HDL was above ADA goals in only 46% of the patients (Figure 2B). African-American patients also tend to have low triglycerides compared to Caucasians,<sup>10</sup> and triglycerides were below the ADA goal in 85% of the patients; many had triglyceride levels  $<100$  mg/dL (Figure 2C).

Figure 3 shows the distribution of blood pressure levels in medical clinic



**Fig 1. Distribution of HbA<sub>1c</sub> levels in Grady Medical Clinic patients. The American Diabetes Association (ADA) goal of HbA<sub>1c</sub>  $<7\%$  is indicated by a vertical line, and HbA<sub>1c</sub> levels which exceed this goal are indicated by darker shading**

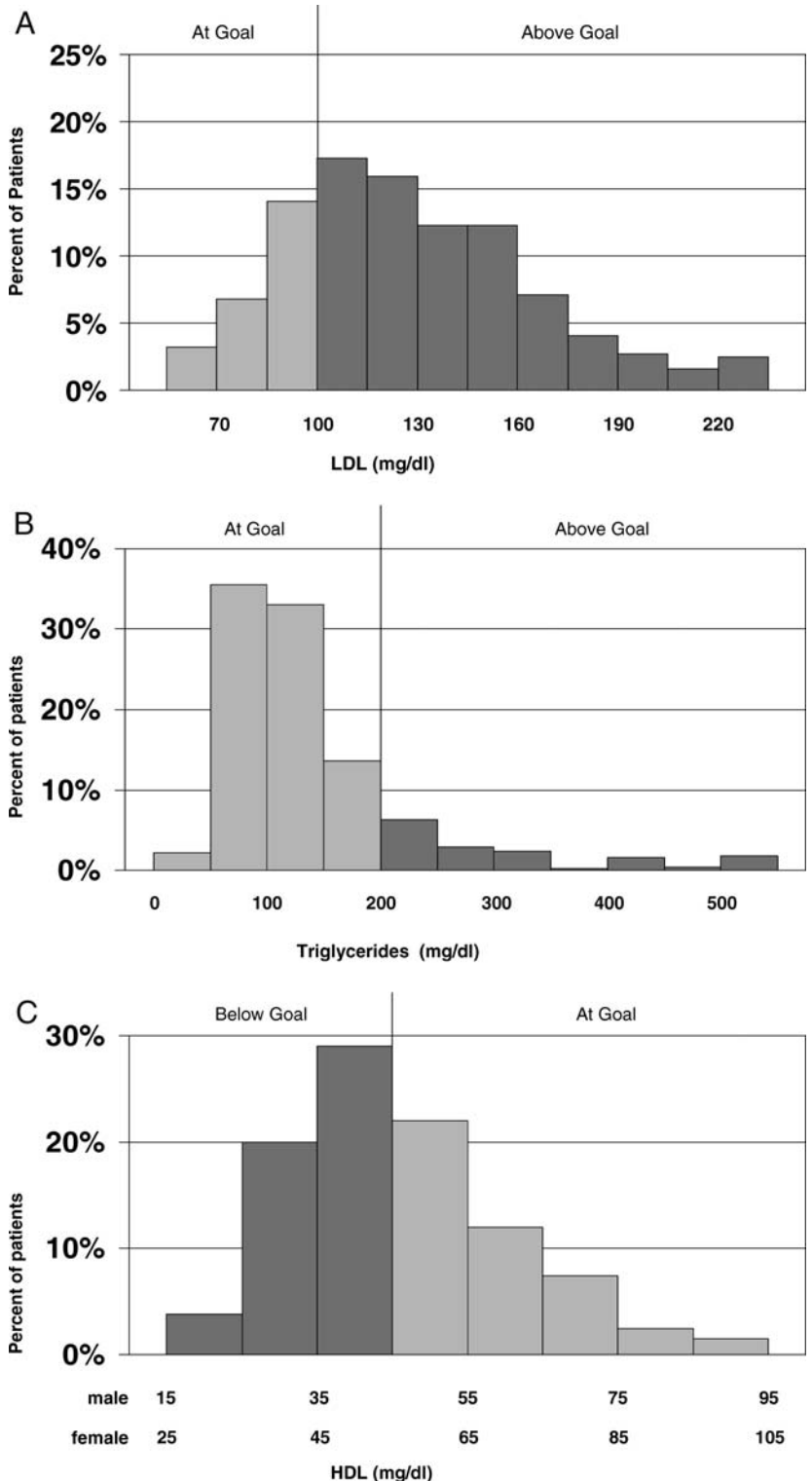


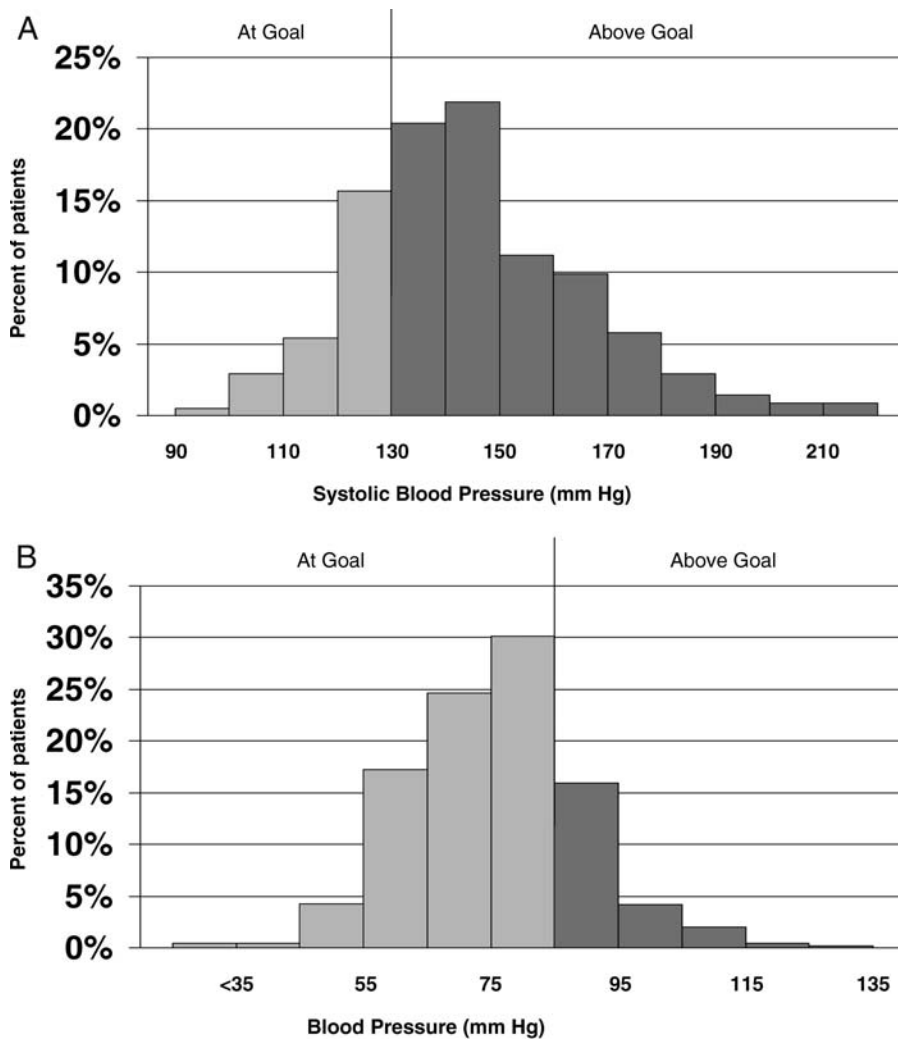
Fig 2. Distribution of lipid levels in Grady Medical Clinic patients: A) LDL cholesterol, B) triglycerides, C) HDL cholesterol. In each case, the ADA goal is indicated by a vertical line, and values which are beyond the goal are indicated by darker shading

patients. Overall, 89% were using medication that was potentially antihypertensive (75% an angiotensin-converting enzyme inhibitor or angiotensin-receptor blocker, 41% a calcium-channel blocker, 23% a beta-adrenergic receptor blocker, 13% an alpha-blocker, and 49% a diuretic). However, only 25% of patients had systolic pressure <130 mm Hg, the ADA goal,<sup>4</sup> while 77% of patients had diastolic pressure <85, the ADA goal when the study was initiated.

At the time of accrual, use of aspirin was documented on visit encounter records for only 39% of the patients.

## DISCUSSION

We found that diabetes was a common problem in the Grady Medical Clinic. This finding was not unexpected, since the population is predominantly older and African-American, and many patients are overweight; aging, obesity, and African-American ethnicity are all known to increase the prevalence of type 2 diabetes.<sup>11</sup> However, although some process indicators of performance (such as measuring HbA<sub>1c</sub> and lipids) were relatively good compared to national survey data,<sup>12,23</sup> we also found that management of many patients did not meet current standards for care. The HbA<sub>1c</sub> goals were met in only 39% of patients, and LDL cholesterol and systolic blood pressure goals in only 25%; in contrast, HDL cholesterol was at goal in 51% of patients, triglycerides in 85%, and diastolic blood pressure in 77%. Only 47% of patients had urine protein screening 12 months before accrual, and use of aspirin was documented for only 39% of patients. Compared to the patients with previously diagnosed diabetes in the NHANES III study,<sup>7</sup> slightly fewer medical clinic patients were managed with diet alone and oral agents alone, but more used insulin with or without oral agents. However, the average



**Fig 3.** Distribution of blood pressure in Grady Medical Clinic patients: A) systolic, B) diastolic. In each case, the ADA goal is indicated by a vertical line, and values which are beyond the goal are indicated by darker shading

HbA<sub>1c</sub> of 8.2% in the medical clinic patients was higher than the 7.6% average reported in NHANES III. Failure to meet goals for control of glucose, lipids, and blood pressure increases the risk of both microvascular and macrovascular complications, with attendant costs.

Characteristics of our patient population may have contributed to poor metabolic control. Other studies of the Grady population indicate that many patients have incomes below the poverty line,<sup>8</sup> and many have decreased functional health literacy, despite reports of an average of 11 years of formal

education.<sup>13</sup> The level of education and income are relevant because such factors have been related to diabetes control and complications<sup>14,15</sup> and risk of incident diabetes in population studies,<sup>16</sup> and they contribute to the effect of race on diabetes complications.<sup>17</sup> Since Grady is subsidized by local counties to provide care at reduced cost, patient expense should not limit care in the municipal hospital environment. However, patients must pay for transportation to the health center, and many are asked to copay for drugs, office visits, and other care; Grady patients frequently cite cost as a factor

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that limits their adherence to therapeutic recommendations. Notwithstanding these problems, Grady Diabetes Clinic patients have similar limitations of poverty and literacy but exhibit HbA<sub>1c</sub> levels that are good by national standards.<sup>18</sup>

Our findings confirm and extend observations in a preliminary survey of diabetes management in the Grady Medical Clinic, which found in that HbA<sub>1c</sub> in 140 patients surveyed in 1996 averaged 8.5%.<sup>2</sup> Most other examinations of diabetes care delivered by physicians in training are older,<sup>5,19-21</sup> but a more recent study of 87 patients in a general medicine clinic noted average HbA<sub>1c</sub> of 9.0%, systolic blood pressure of 139 mm Hg, and LDL cholesterol of 137 mg/dL<sup>22</sup>; we found lower HbA<sub>1c</sub> and LDL but higher blood pressure. Our findings may also be compared with descriptions of management in other primary care sites. Process measures in our study were superior to those in a recent survey of Medicare beneficiaries,<sup>23</sup> which showed that a median of 71% had HbA<sub>1c</sub> measurements within a one-year period, and 57% had a lipid profile within two years. Klein et al<sup>24</sup> found that glycated hemoglobin averaged 9.3% in 885 patients followed for 4 years (normal range 4.6%–7.9%), and Sadur et al<sup>25</sup> found that HbA<sub>1c</sub> fell from 9.6% to only 9.3% in 74 control

patients followed for five months in a health maintenance organization (HMO). Moreover, even when a new therapy is initiated, therapeutic targets may not be achieved: Hayward et al<sup>26</sup> reported that HbA<sub>1c</sub> fell from 9.3% to 8.4% over one year in 735 patients started on insulin in a large staff-model HMO but did not improve much more in patients followed for another year. In combination, these surveys indicate that elevated glucose levels are not uncommon in patients with diabetes managed in other primary care sites, and contrast with better achievement of standard of care goals in specialized diabetes clinics.<sup>9</sup>

Our study has several limitations. It is possible that use of aspirin was underreported, and we were unable to assess the frequency of foot examinations or dilated eye examinations. The duration of disease was self-reported and might have been underestimated, which would lead to a greater underlying  $\beta$ -cell defect<sup>27</sup> and more difficulty in achieving good control. Grady patients might come to diagnosis relatively late in their natural history, as suggested by the high prevalence of microalbuminuria found in patients who have been diagnosed for less than a year.<sup>28</sup> It is possible that limitations in care result in part from ethnic differences between the patients (predominantly African American) and their providers (predominantly Caucasian),<sup>29,30</sup> but recent analyses suggest that ethnic disparities in care can occur even when patients and providers have the same ethnicity,<sup>31,32</sup> and we found no evidence for ethnic differences in diabetes control in African-American patients managed by endocrinologists at the Emory Clinic, where the providers are all Caucasian.<sup>33</sup> Finally, even if limitations in diabetes management in the Grady Medical Clinic are similar to those in other primary care sites, the underlying causes may not be the same, since Grady physicians are all residents in training who are supervised by faculty

members and exposed routinely to guidelines for care; such exposure may have led to the relatively good process performance<sup>34</sup> but had less effect on achieving therapeutic goals.

In conclusion, the IPCAAD survey of a large municipal hospital residency training program primary care site in Atlanta has revealed that diabetes is a common problem, but goals for control of glucose, lipids, and blood pressure are often not met; urine protein screening is infrequent; and few patients appear to be using aspirin. Since levels of HbA<sub>1c</sub>, LDL cholesterol, and systolic blood pressure are high even though many patients are receiving pharmacologic therapy, more intensive therapy is needed. We believe that our findings are typical of other residency training sites, and local diabetes educators and medical faculty must work together to develop interventions to enhance residents' diabetes-management skills if diabetes care in the United States is to be improved. Developing such interventions is the primary objective of the IPCAAD study, which will partner generalists with endocrinologists in an attempt to enhance diabetes management in the primary care setting.

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#### AUTHOR CONTRIBUTIONS

*Design and concept of study:* Ziemer, Doyle, Cook, El-Kebbi, Gallina, Barnes, Hertzberg, McClellan, Branch, Phillips

*Acquisition of data:* Miller, Ziemer, Cook, El-Kebbi, Gallina, Watkins, Barnes, Walker, Hertzberg

*Data analysis and interpretation:* Miller, Ziemer, Doyle, Cook, El-Kebbi, Gallina, Watkins, Barnes, Walker, Lyles, Hertzberg, McClellan, Branch, Phillips

*Manuscript draft:* Miller, Ziemer, Barnes, Walker, Hertzberg, Branch, Phillips

*Statistical expertise:* Ziemer, Hertzberg

*Acquisition of funding:* El-Kebbi, Phillips

*Administrative, technical, or material assistance:* Ziemer, Doyle, Cook, El-Kebbi, Gallina, Watkins, Barnes, Walker, McClellan, Branch, Phillips

*Supervision:* Ziemer, Watkins, Barnes, Walker, Phillips