

Quality of Care for Diabetic Patients in a Large Urban Public Hospital

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OBJECTIVE — We compared diabetes quality-of-care indicators for patients receiving medical treatment in three practice settings of the same hospital.

RESEARCH DESIGN AND METHODS — A cross-sectional medical record review for patients receiving care between 1 July 2000 and 30 June 2001 was conducted. Records were abstracted from three practice settings: the Diabetes Clinic (DIABETES), a general medicine clinic staffed by internal medicine residents (RESIDENT), and a general medicine clinic whose providers were medical school faculty physicians (FACULTY). Record review ($n = 791$) yielded data on diabetes indicators that were derived primarily from the Diabetes Quality Improvement Project.

RESULTS — There were significant differences between the DIABETES, RESIDENT, and FACULTY clinics for the percentages of patients with HbA_{1c} testing (94 vs. 92 vs. 76%, $P < 0.001$), HbA_{1c} >9.5% (31 vs. 36 vs. 43%, $P < 0.05$), nephropathy assessment (79 vs. 67 vs. 58%, $P < 0.001$), lipid assessment (86 vs. 79 vs. 76%, $P < 0.050$), LDL <130 mg/dl (54 vs. 44 vs. 43%, $P < 0.05$), blood pressure <140/90 mmHg (63 vs. 55 vs. 49%, $P < 0.025$), eye examinations (64 vs. 50 vs. 31%, $P < 0.001$), foot examinations (97 vs. 55 vs. 24%, $P < 0.001$), ACE inhibitor treatment (66 vs. 69 vs. 35%, $P < 0.001$), and aspirin treatment (71 vs. 59 vs. 15%, $P < 0.001$).

CONCLUSIONS — There is considerable variation in diabetes management in different primary care settings of the same hospital. Although management in all settings was suboptimal, the results attained by the patients in the Diabetes Clinic represent minimal achievable goals for all diabetic patients in this hospital.

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Diabetes is a serious and costly public health problem that is increasing at an alarming rate. Among U.S. adults, diagnosed diabetes increased 49% from 1990 to 2000. Similar increases are expected in the next decade and beyond (1). Although research has yielded substantial knowledge of effective treatment strategies to prevent or delay diabetes complications, a wide gap exists between

current and desired practices (2,3). An issue of growing concern among U.S. health care systems is how to improve this situation and to deliver high-quality care while controlling costs.

Barriers at multiple levels impede health care systems' ability to deliver high-quality care, particularly for uninsured and underinsured patients. Barriers may be patient-oriented (e.g., financial

limitations, poor self-care behaviors), provider-oriented (e.g., lack of knowledge about guidelines, lack of time with patients), and system-oriented (e.g., lack of specialty care services, long patient wait-time for services). Incorporating specific features designed to facilitate care for patients within health care systems may potentially reduce many of these barriers. For example, diabetes centers with interdisciplinary team approaches (4,5), diabetes flow sheets (6), nonphysician providers (7–9), diabetes self-management education (10), and disease-management approaches (11,12) have all been shown to improve diabetes outcomes.

Approximately three-quarters of uninsured patients with a usual source of care report a traditional fee-for-service setting as that source (13). However, there is evidence that patients in community health clinics, which are more able to implement these system-level changes, may receive higher quality care than patients treated in private physician offices (14,15). The first step toward implementing an effective diabetes quality improvement program in any health care system is to evaluate that system's preexisting diabetes services. This provides a particular challenge for large health care systems in which patients receive care in multiple settings. Variation in care has been shown to occur in different settings within the same system (16).

We evaluated diabetes care in our hospital, which is a large urban system serving primarily a medically indigent population. Primary care for most diabetic patients is provided in one of three settings: a diabetes clinic, a general medicine clinic staffed by internal medicine residents, and a general medicine clinic staffed by medical school faculty physicians. We hypothesized that quality of diabetes care would vary between clinics and that the highest quality care would be in the diabetes clinic, which incorporates a disease-management approach.

RESEARCH DESIGN AND METHODS

Exemption from review for this study was obtained from the Tulane University Health Sciences Center

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Abbreviations: DIABETES, the Diabetes Clinic; FACULTY, a general medicine clinic whose providers were medical school faculty physicians; DQIP, Diabetes Quality Improvement Project; MCLNO, Medical Center of Louisiana—New Orleans; PRP, Provider Recognition Program; RESIDENT, a general medicine clinic staffed by internal medicine residents.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—Clinic characteristics

	DIABETES	RESIDENT	FACULTY
Total number of patient visits 2000–2001	3,372	21,619	21,673
Percentage of patients with diagnosed diabetes	100	37*	33†
Patient characteristics	Newly diagnosed diabetic patients All MCLNO type 1 diabetic patients Complicated patients referred from other primary care areas Patients with hospitalizations or emergency department visits for problems with glycemic control	General medicine	General medicine
Provider characteristics	Nurse practitioners Endocrine fellows Medical students Internal medicine residents Clinical pharmacists	Internal medicine residents	Staff physicians with medical school faculty appointments
Supervising physicians	Endocrinology faculty	Internal medicine faculty	Not applicable

*Based on review of 219 consecutive records November 1999; †based on review of 94 consecutive records November 1999.

Institutional Review Board. We conducted a cross-sectional medical record review of records for diabetic patients receiving care between 1 July 2000 and 30 June 2001 at the Medical Center of Louisiana (MCLNO). Data were collected as part of the hospital's ongoing diabetes quality improvement effort. Data for diabetes indicators were abstracted from ~50 records from each of four clinics on a quarterly basis ($n = 791$). The clinics included 1) the Diabetes Clinic (DIABETES); 2) a clinic staffed by hospital staff physicians with faculty appointments at either Tulane University or Louisiana State University (LSU) Medical School (FACULTY); 3) a clinic staffed by medicine residents from Tulane University Medical School; and 4) a clinic staffed by medicine residents from LSU Medical School. The two resident clinics were held in the same location, and there were no significant differences between them for any of the indicators. The resident clinics were therefore considered a single practice setting, and results for the two clinics were combined (RESIDENT).

Hospital characteristics

Medical Center of Louisiana is the state's largest public facility. Approximately one in five Louisianians receive medical care at MCLNO, which also trains ~70% of the state's primary care physicians. In the 2000–2001 fiscal year, MCLNO had 30,278 inpatient admissions, 339,330

clinic visits, and 161,107 emergency room visits. Total collections were \$408 million (Uncompensated Care Fund \$312 million, Medicaid \$39 million, Medicare \$28 million, commercial/self-pay \$19 million, other \$9 million).

Provider, patient, and clinic characteristics

Most diabetic patients at MCLNO receive primary care in the DIABETES, RESIDENT, or FACULTY clinic. A general description of the providers and patients of these three settings is outlined in Table 1. MCLNO policy is to schedule each patient to be followed in only one of these clinics. The only exception is that a small percentage of patients are comanaged in the DIABETES clinic as well as another primary care clinic. This occurs when a primary care physician requests assistance in managing a difficult case of a diabetic patient who has significant medical issues not directly related to diabetes (e.g., chronic obstructive pulmonary disease). Some patients are followed in multiple clinics because of scheduling errors. When this is detected, follow-up to one of the clinics is canceled. We do not have any data regarding the frequency in which patients receive concurrent care in multiple clinics.

The majority of type 2 diabetic patients at MCLNO are randomly assigned to receive primary care in either the RESIDENT or FACULTY clinic, both of which are continuity clinics. In the resident

clinic, internal medicine residents are supervised by faculty from their respective medical schools. Each resident sees approximately four to five patients per half-day session. Physicians in the FACULTY clinic have been trained in either family medicine or internal medicine. All have faculty appointments with Tulane University or LSU Medical School and most work only part-time in the clinic. Many also have private medical practices in the community. Each FACULTY clinic physician sees approximately six to seven patients per half-day session.

All type 1 diabetic patients and some type 2 diabetic patients at MCLNO also receive primary medical care in the DIABETES clinic, which is a specialty clinic that requires referral from the emergency department or one of the other primary care clinics. Most of the patients referred to this clinic meet one of the following criteria: 1) newly diagnosed diabetes, 2) type 1 diabetes, 3) diabetes that is difficult to control by the primary care physician, or 4) a hospitalization or emergency department visit for a glycemia-related problem. Medical care in DIABETES is more heterogeneous than RESIDENT and FACULTY clinics, and most patients are seen by a different provider at each visit. Family nurse practitioners provide continuity care for approximately one-third of the patients. Approximately one-third of patient visits are with medical students, and one-third of visits are with house staff

Table 2—Comparison of clinical characteristics

	DIABETES	RESIDENT	FACULTY	DIABETES vs. RESIDENT vs. FACULTY
	Value of indicator (% of records with data for variable)	Value of indicator (% of records with data for variable)	Value of indicator (% of records with data for variable)	P
Number of records reviewed	45	87	67	
Age (years)	49 ± 1.5 (100)	53 ± 1.4 (100)	56 ± 1.4* (100)	0.010
Female (%)	76 (100)	77 (100)	65 (100)	1.000
African American (%)	84 (100)	87 (100)	89 (100)	1.000
Systolic blood pressure (mmHg)	133 ± 2.4 (100)	139 ± 2.8 (100)	144 ± 2.6* (100)	0.062
Diastolic blood pressure (mmHg)	82 ± 1.6 (100)	80 ± 1.5 (100)	77 ± 1.4* (100)	0.073
HbA _{1c} (%)	8.8 ± 0.33 (98)	9.0 ± .31 (87)	8.2 ± 0.34 (70)	0.253
LDL (mg/dl)	129 ± 6.9 (80)	137 ± 4.4 (75)	133 ± 5.9 (67)	0.582

Data are means ± SEM. * $P < 0.025$ vs. DIABETES.

physicians (endocrine fellows and internal medicine residents). Clinical pharmacists evaluate and make treatment recommendations for many for the patients in the DIABETES clinic. Faculty endocrinologists supervise all providers. Students, house staff, and faculty are from both Tulane University and LSU Medical Schools. Each nurse practitioner sees approximately six to seven patients per half-day session. House staff and students, depending on their level of training, each see approximately two to eight patients per half-day session.

Medical record eligibility

Records were identified as eligible if they met the following three criteria: 1) at least one ICD-9-CM diagnosis of diabetes (17) (250.xx); 2) at least one visit to the clinic during the defined quarter; and 3) at least one additional visit to the clinic within the 12 months preceding the current visit. Each quarter the Hospital Information System Department generated a list of eligible patients from each clinic. Quality Improvement Department staff randomly selected records from the list for review. The record reviewer manually confirmed eligibility of each record.

Data collection

Where applicable, abstractions were performed according to the instructions of the Diabetes Quality Improvement Project (DQIP) (18). A trained registered nurse from the Quality Improvement Department collected the majority of data. A Diabetes Center nurse assisted with some of the reviews. Training occurred over a

1-year period preceding the period of this study. Initially, 100% of record abstractions were reviewed by the Diabetes Program Medical Director. Agreement between the Medical Director and the abstractors had reached almost 100% before the present data were collected. Reliability checks were periodically performed throughout the period of the study by having selected records reviewed by the Medical Director and/or the Quality Improvement Department supervisor. No significant differences were noted. Inter-rater reliability was not formally assessed.

Measurements of quality of care

The indicators of quality of care include process measures as well as intermediate outcomes. Most of the measures of quality of care were based on measures from the DQIP (18). Modification of some of the measures was made to facilitate medical record review. DQIP criteria were used to allow these data to be compared with other published data. The MCLNO Diabetes Program supported and promoted the more rigorous American Diabetes Association goals for blood pressure, HbA_{1c}, LDL cholesterol, and frequency of HbA_{1c} measurements. Indicators assessed in the study were as follows: percentage of patients with a blood pressure measurement recorded at each visit, percentage of patients receiving ≥ 1 glycohemoglobin (HbA_{1c}) test/year, HbA_{1c} >9.5%, HbA_{1c} <7%, assessment for nephropathy in the last year, at least one lipid profile in the last year, LDL <130 mg/dl, LDL <100 mg/dl, blood pressure <140/90 mmHg, a dilated eye examination or retinal imag-

ing during the last year, and a documented foot examination in the last year. During the last two quarters of the study period, the medical records were also reviewed to determine the percentage of patients prescribed an ACE inhibitor and/or aspirin.

Data analysis

The χ^2 test was used to assess differences between categorical variables. Continuous variables are expressed as mean ± SEM. Differences between continuous variables were tested by ANOVA, with the Fisher's PLSD test when appropriate. Analyses were performed using SAS statistical software (SAS Institute, Cary, NC). The level of significance used was $P < 0.050$.

RESULTS— Because these data were collected as part of the hospital's quality improvement process, the data were recorded in a way that categorized them according to the criteria described above. Raw data from the abstractions were available for approximately one-quarter of the records ($n = 199$). This allowed determination of the demographic data and more specific clinical values shown in Table 2. Patients in all clinics were predominantly female and African American. The patients in the DIABETES clinic were somewhat younger than the RESIDENT and FACULTY clinics (49 ± 1.5 vs. 53 ± 1.4 vs. 56 ± 1.4 years, $P = 0.01$), likely reflecting the fact that this clinic treats both type 1 and type 2 diabetes, as opposed to only type 2 in the other clinics. There were no statistically significant differ-

Table 3—Diabetes indicators

	Clinics			P			
	1 DIABETES	2 RESIDENT	3 FACULTY	1 vs. 2	2 vs. 3	1 vs. 3	2 vs. 3
Number of records reviewed	191	400	200				
Percentage of patients receiving a blood pressure measurement at each visit	100	100	100	1.000	1.000	1.000	1.000
Percentage of patients receiving ≥ 1 HbA _{1c} test/year	94	92	76	0.001*	1.000	0.001*	0.001*
Percentage of patients with the highest risk HbA _{1c} (i.e. HbA _{1c} >9.5%)	31	36	43	0.050*	1.000	0.025*	0.10
Percentage of patients with HbA _{1c} <7.0%	24	30	24	0.200	0.200	1.000	0.200
Percentage of patients assessed for nephropathy in the last year	79	67	58	0.001*	0.010*	0.001*	0.050*
Percentage of patients receiving a lipid profile once in the last year	86	79	76	0.050*	0.050*	0.025*	1.000
Percentage of patients with an LDL <130 mg/dl	54	44	43	0.050*	0.025*	0.050*	1.000
Percentage of patients with an LDL <100 mg/dl	24	23	19	1.000	1.000	1.000	1.000
Percentage of patients with blood pressure <140/90 mmHg	63	55	49	0.025*	0.010*	0.010*	0.200
Percentage of patients receiving a dilated eye exam in the last year	64	50	31	0.001*	0.010*	0.001*	0.001*
Percentage of patients receiving a well-documented foot exam in the last year	97	55	24	0.001*	0.001*	0.001*	0.001*

*Significant.

ences among the three clinics for blood pressures, HbA_{1c} values, or LDL values. It is important to note, however, that LDL and HbA_{1c} were not measured for all patients during the period reviewed. The control of the patients with missing data is unknown.

Percentage rates for adherence with the diabetes care indicators are shown in Tables 3 and 4. There were statistically significant differences between DIABETES versus RESIDENT versus FACULTY for most of the indicators, including glycohemoglobin testing (94 vs. 92 vs. 76%, $P < 0.001$), HbA_{1c} >9.5% (31 vs. 36 vs. 43, $P < 0.050$), nephropathy assessment (79 vs. 67 vs. 58%, $P < 0.001$), lipid assessment (86 vs. 79 vs. 76%, $P < 0.050$), LDL <130 mg/dl (54 vs. 44 vs. 43%, $P < 0.050$), blood pressure <140/90 mmHg (63 vs. 55 vs. 49%, $P < 0.025$), eye examinations (64 vs. 50 vs. 31%, $P <$

0.001), foot examinations (97 vs. 55 vs. 24%, $P < 0.001$), and prescription of ACE inhibitors (66 vs. 69 vs. 35%, $P < 0.001$) and aspirin (71 vs. 59 vs. 15%, $P < 0.001$). There were no significant differences among the three groups for frequency of blood pressure measurement, HbA_{1c} <7.0%, or LDL <100 mg/dl.

CONCLUSIONS— We have shown that diabetes indicators vary considerably in different practice settings of a large urban hospital serving primarily medically indigent patients. Although indicators were suboptimal in all settings, the most favorable results were observed in the Diabetes Clinic. An unexpected finding was that records for patients followed in the clinic staffed by faculty physicians had the lowest values for most of the indicators.

Intermediate results were observed in the clinic staffed by internal medicine residents.

The results of this study are consistent with other published data (2,3,15,19–21). Indicators in the faculty clinic were similar to published rates of care for uninsured and low-income patients (15,20), as well as for health plan average data reported by the National Committee for Quality Assurance (18). Indicators in the Diabetes Clinic compare favorably to published data from the third National Health and Nutrition Examination Survey (NHANES III) and the Behavioral Risk Factor Surveillance System (BRFSS) (2), Medicare (3), and another urban academic medical center (19). Diabetes Clinic indicators met all of the goals for process indicators specified by the Diabetes Provider Recognition Program (PRP), i.e., 100% for blood pressure testing (97% PRP), 94% for HbA_{1c} testing (93%

Table 4—Patients prescribed ACE inhibitors and aspirin

	Clinics			P			
	1 DIABETES	2 RESIDENT	3 FACULTY	1 vs. 2	2 vs. 3	1 vs. 3	2 vs. 3
Number of records reviewed	91	200	100				
Percentage of patients prescribed ACE inhibitors	66	69	35	0.001*	1.000	0.001*	0.001*
Percentage of patients prescribed aspirin	71	59	15	0.001*	0.100	0.001*	0.001*

*Significant.

PRP), 79% for nephropathy testing (73% PRP), 86% for lipid testing (85% PRP), 64% for eye examinations (61% PRP), and 97% for foot examinations (80% PRP) (18). However, goals for intermediate outcomes, i.e., blood pressure, LDL, and HbA_{1c} control, were not met. This may be attributable to the fact that these indicators are more dependent on patient-related factors, such as ability to pay for medications and testing supplies. Whatever the explanation for these findings, if improvements in clinical outcomes (e.g., heart attacks) are to be achieved, it is imperative that health care systems develop effective strategies to improve these intermediate outcomes.

Patients in the Diabetes Clinic were most likely to receive surveillance and care according to guidelines. This occurred despite the fact that a significant amount of care was provided by the least experienced providers (i.e., medical students), there was little continuity of care with individual providers, and the patients included the more complicated diabetic cases. This study did not address what specific factors contributed to this finding. We believe that the greater adherence with guidelines in the Diabetes Center is attributable to a disease management approach to diabetes care, the involvement of an interdisciplinary team of health care providers, active participation by nonphysician providers, and the use of management flow sheets, all of which have been shown to improve diabetes outcomes (4–12). Furthermore, care was supervised by endocrinologists, which has been reported to improve care according to guidelines (22).

Our study has multiple important limitations. First of all, the hospital's quality improvement department collected the data, and inter-rater reliability was not formally assessed. Patient characteristics were only available for some records, and comorbidities were not abstracted from any of the records. Information regarding foot examinations and prescription of ACE inhibitors and aspirin was determined solely by record review. If these were not accurately documented, they may not reflect actual practices. Another limitation of the study is that process measures and intermediate outcomes rather than clinical outcomes (e.g., blindness, amputation, renal failure, cardiovascular disease, and death) were the end points for this study (23). Finally, no in-

formation was available concerning patient satisfaction or quality of life, which are important characteristics of diabetes management.

In summary, we have shown that patients treated in three different practice settings in a large urban public hospital differ significantly in their adherence with diabetes practice guidelines. Indicators in all clinics were suboptimal, despite the fact that patients were seen at a relatively slow pace (one to two patients per hour), compared with many health plans. The fact that indicators in the Diabetes Clinic compare favorably with published data for funded patients supports the proposition that medical indigency does not necessarily preclude diabetes management according to industry standards.

Large hospital systems must take the practice setting into account when assessing the quality of diabetes care that is provided. We consider the results achieved by the Diabetes Clinic to be minimal attainable goals for all patients receiving care in our hospital. Based on the results of this study, we have implemented pilot programs that specifically target areas with low levels of adherence to diabetes practice guidelines.

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