

Improving Diabetes Care in Midwest Community Health Centers With the Health Disparities Collaborative

MARSHALL H. CHIN, MD, MPH¹
SANDY COOK, PHD¹
MELINDA L. DRUM, PHD¹
LEI JIN, MA, MS¹
MYRIAM GUILLEN, BA¹

CATHERINE A. HUMIKOWSKI, BA¹
JULIE KOPPERT, RNC, BSN, CDE²
JAMES F. HARRISON, MD³
SUSAN LIPPOLD, MD, MPH⁴
CYNTHIA T. SCHAEFER, RN, CS⁵

OBJECTIVE — To evaluate the Diabetes Health Disparities Collaborative, an initiative by the Bureau of Primary Health Care to reduce health disparities and improve the quality of diabetes care in community health centers.

RESEARCH DESIGN AND METHODS — One year before- after trial. Beginning in 1998, 19 Midwestern health centers undertook a diabetes quality improvement initiative based on a model including rapid Plan-Do-Study-Act cycles from the continuous quality improvement field; a Chronic Care Model emphasizing patient self-management, delivery system redesign, decision support, clinical information systems, leadership, health system organization, and community outreach; and collaborative learning sessions. We reviewed charts of 969 random adults for American Diabetes Association standards, surveyed 79 diabetes quality improvement team members, and performed qualitative interviews.

RESULTS — The performance of several key processes of care assessed by chart review increased, including rates of HbA_{1c} measurement (80–90%; adjusted odds ratio 2.1, 95% CI 1.6–2.8), eye examination referral (36–47%; 1.6, 1.1–2.3), foot examination (40–64%; 2.7, 1.8–4.1), and lipid assessment (55–66%; 1.6, 1.1–2.3). Mean value of HbA_{1c} tended to improve (8.5–8.3%; difference –0.2, 95% CI –0.4 to 0.03). Over 90% of survey respondents stated that the Diabetes Collaborative was worth the effort and was successful. Major challenges included needing more time and resources, initial difficulty developing computerized patient registries, team and staff turnover, and occasional need for more support by senior management.

CONCLUSIONS — The Health Disparities Collaborative improved diabetes care in health centers in 1 year.

Diabetes Care 27:2–8, 2004

D iabetes care is a critical issue for the ~3,000 federally funded community health center delivery sites that provide primary care for 11 million medically underserved Americans (1,2). Nationally, African Americans and patients

From the ¹Departments of Medicine and Health Studies, Diabetes Research and Training Center, The University of Chicago, Chicago, Illinois; ²Midwest Cluster Health Disparities Collaborative, Kenton, Ohio; ³North Woods Community Health Center, Minong, Wisconsin; ⁴Health Resources and Services Administration, Chicago, Illinois; and the ⁵Department of Nursing and Health Sciences, University of Evansville, Evansville, Indiana.

J.F.H. is currently affiliated with South Lane Medical Group, Cottage Grove, Oregon, and S.L. is currently affiliated with the Centers for Disease Control City of Chicago Tuberculosis Program, Chicago, Illinois.

Address correspondence and reprint requests to Marshall H. Chin, MD, MPH, University of Chicago, Section of General Internal Medicine, 5841 South Maryland Ave., MC 2007, Chicago, Illinois 60637. E-mail: mchin@medicine.bsd.uchicago.edu.

Received for publication 15 May 2003 and accepted in revised form 15 September 2003.

Abbreviations: BPHC, Bureau of Primary Health Care; HLM, hierarchical linear model; PDSA, Plan, Do, Study, Act.

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

© 2004 by the American Diabetes Association.

of lower socioeconomic status suffer disproportionately high morbidity from diabetes (3), and racial disparities in the quality of diabetes care are prevalent (4). Since community health centers are vanguard providers of indigent patients, interventions in the health-center setting are of particular interest to clinicians, administrators, and policymakers seeking to improve the care of the most vulnerable patients with diabetes (5–7).

Providers in all settings frequently do not meet diabetes quality-of-care standards as outlined by the American Diabetes Association (8). Suboptimal care has been found in academic medical centers (9), private doctors' offices (10), managed care organizations (11), Medicare providers (4), and the Indian Health Service (12). Because health centers have fewer resources and more vulnerable patients (13), it might be assumed that their performance on these standards of care might be lower. However, rates of adherence to the standards in health centers have been as high as other providers or even better despite the extra challenges (14–17). Nonetheless, evidence suggests that diabetes care needs to be improved in all settings.

In 1998, the Bureau of Primary Health Care (BPHC), the part of the Health Resources and Services Administration that oversees all federally funded health centers, began a major 6-year Health Disparities Collaborative designed to reduce health disparities and improve the quality of care in health centers. The initiative aims for rapid quality improvement through the Institute for Healthcare Improvement's Breakthrough Series methodology (18), the MacColl Institute for Healthcare Innovation's Chronic Care Model (19), and regional or national learning sessions. The focus of the first year was diabetes quality improvement. We aimed to evaluate the effectiveness of the initiative after the first year and to identify facilitators and barriers to quality improvement.

RESEARCH DESIGN AND METHODS

Description of the Health Disparities Collaborative and Breakthrough Series methodology

In 1998, the Bureau of Primary Health Care invited federally funded community health centers to apply to be part of a Diabetes Collaborative quality improvement process. The initiative was national, but much of the implementation was performed at a regional level. In the Midwest, 22 health centers applied. A committee of clinicians, administrators, and representatives of the BPHC selected 20 centers based upon criteria including an adequate number of patients with diabetes, sufficient computer resources, electronic mail capability, and commitment of leadership. Each health center was expected to form a diabetes quality improvement team that would meet regularly with the support of senior administrative leadership. Each center would also create a registry of patients with diabetes to help track clinical care. One center dropped out at the beginning of the project, leaving nineteen centers.

Model for improvement: rapid Plan, Do, Study, Act cycles

A rapid change process called Plan, Do, Study, Act (PDSA) was introduced into each health center. This model, developed by the Institute for Healthcare Improvement, adapts elements of continuous quality improvement into a process designed to improve the quality of care at an accelerated pace. Following the establishment of a major aim for improving the quality of care, the elements of this process are as follows: 1) Plan—define an intervention to help the center achieve the major aim. The key element to planning involves the dissection of the intervention into small, measurable, and accomplishable steps; 2) Do—implement the intervention on a small scale; 3) Study—analyze the effects of the intervention; and 4) Act—based on the study data, revise the intervention. The emphasis is on rapid PDSA cycles that have quick turnaround times. Thus, the number of patients upon which an individual PDSA cycle is performed may be too small for change to reach statistical significance, but the goal is to have enough patients to determine practically if the intervention is working or requires revision.

Chronic Care Model

The MacColl Chronic Care Model aims to create practical, supportive interactions between an informed, activated patient and a proactive, prepared clinical team. The model posits that multiple dimensions must be addressed if care is to be improved. The health system and organization of care must be improved, and community resources must be tapped. Specific targets for quality improvement are patient self-management, delivery system redesign, decision support, clinical information systems, leadership and health system organization, and community outreach.

Breakthrough Series process

The Institute for Healthcare Improvement provided initial instruction at a national learning session, and then regional cluster coordinators and institute staff (0.4 full-time equivalent) assisted through telephone conference calls, a computer listserve, feedback on required monthly progress reports, and three regional meetings. Monthly progress reports from the centers were expected to include aims, descriptions of rapid PDSA cycles, and reports of adherence to selected diabetes quality-of-care standards. At the regional learning sessions, team members and administrators from all 19 health centers met to learn quality-improvement techniques and share lessons among themselves.

Goals

The BPHC asked all health centers to perform at least two HbA_{1c} tests at least 3 months apart over the year for 90% of their target population. Health centers were also asked to pick other specific goals of their own choice as targets for quality improvement. Health centers were asked to start with a subset of their center's population and then spread the intervention to other patients. By the end of the year, most health centers had targeted all of their diabetic patients at their given site.

Data collection

We analyzed a variety of data for triangulation and increased validity of findings. We concentrated on process and outcome measures along both clinical and organizational lines. In a brief 1-year evaluation period, it may be difficult to see significant improvement in outcomes. However, the collaborative could be considered successful if we found im-

provement in intermediary processes expected to lead to better outcomes. The University of Chicago Institutional Review Board approved the study, and informed consent was obtained.

Chart review. We used a preexisting chart review instrument developed by a team from The University of Chicago and the MidWest Clinicians' Network to describe patient demographics and evaluate process-of-care measures based on the clinical recommendations of the American Diabetes Association (20). The chart review instrument was accompanied by a codebook, and each center was instructed in the chart abstraction process. Each center was asked to identify patients with diabetes through administrative records and *International Classification of Diseases, Clinical Modification, 9th edition* diagnostic code 250.x or patient registries (21), and to then perform chart review on 80 patients with diabetes (confirmed by chart review), aged 18–75 years and chosen by random number generator, or on all diabetic patients aged 18–75 years if their center had fewer than 80. Pregnant women were excluded. Each center abstracted data from the year before the collaborative (1998) and the year of the collaborative (1999). When possible, the same patients' charts were abstracted in 1998 and 1999. If a patient analyzed in 1998 was no longer seen at the health center in 1999, then another randomly chosen diabetic patient's chart was abstracted in 1999 so that close to 80 patients per center per year were analyzed. The average number of chart audits per center was 69 in 1998 and 79 in 1999. On average, 72% of the patients whose charts were audited in 1998 were followed up in 1999. To check on the reliability of the chart review, a random 5% sample of charts was reaudited by the health centers for the major American Diabetes Association process-of-care variables. The overall agreement of items was 84% with an average κ statistic of 0.65 (22).

Provider surveys. Toward the end of the first year of the collaborative, we mailed a survey to members ($n = 106$) of each health center's diabetes collaborative team. Nonrespondents were mailed two more copies of the survey and were then telephoned with a subset of the questions if they still had not responded. The survey addressed overall evaluation of the collaborative, quality improvement models and tools, education and assistance, commu-

nication, team functioning (23), diffusion and continuation of activities, time, costs, administrative support, and demographic information. Questions developed by the research team generally were rated on a five-point Likert-type scale.

Semistructured telephone interviews of team leaders, team members, and nonteam members. We conducted semistructured telephone interviews with team leaders and team members, inquiring about the nature of the intervention, program implementation at each health center, overall assessment, facilitators and challenges to the intervention, and spread of the initiative. Team leaders were interviewed twice (in August 1999 and April/May 2000), and random team members were interviewed once (in April/May 2000). We also conducted similar interviews during the latter period with at least one randomly selected nonteam member at each health center in order to gauge the awareness of the intervention by other clinic staff and its diffusion throughout the health center. Interviews were audiotaped.

Analytical plan

Adherence to American Diabetes Association Clinical Practice Recommendations. We performed descriptive statistics on patient demographic characteristics and compared the rates at which the processes-of-care standards were met from 1998 to 1999. The primary measures of the quality of care were eight major process measures and one outcome measure: 1) at least one measurement of HbA_{1c}, 2) two measurements of HbA_{1c} at least 3 months apart, 3) dilated eye examination, 4) diet intervention, 5) dental care, 6) foot care or foot education, 7) lipid assessment, 8) urine microalbumin assessment, and 9) the absolute value of HbA_{1c} (20).

The unit of analysis was the measure in a given year for an individual patient, so that individual measures were nested within patients and patients were nested within health centers. To incorporate correlation between measures on the same patient and between patients in the same health center, we used hierarchical regression (24–26). For HbA_{1c}, which was approximately normally distributed, we fit hierarchical linear models (HLMs) with patient and health center as random effects, using HLM statistical software, version 5. The eight process measures were

dichotomous variables, which indicated whether a particular process of care had been performed, and were analyzed in HLM using hierarchical logistic regression, again with patient and health center as random effects. We performed two sets of outcome analyses. In the primary analyses, only patients present in both 1998 and 1999 are included. In the second set, patients present in either 1998 or 1999 are analyzed.

Survey

Survey results were tabulated by conceptual domain. Selected items, such as usefulness and burden of patient registry were also cross-tabulated. Both summary scales and individual items were included. The summary scales represent selected conceptual domains and include frequency and usefulness of communication between the team and collaborative, team interpersonal relations, team efficacy, usefulness of the Chronic Care Model components, intent to continue collaborative activities, and costs of participation in terms of time and effort. These multi-item scales were constructed as equally weighted averages. Items were reverse coded as needed to conform to a positive versus negative response scale. Reliability analysis indicated good internal consistency of the scales (Cronbach's α 0.65–0.92) (27). To enhance comparability to individual items, summary scales were recoded to correspond to the original one- to five-point Likert scale using midpoints as cutpoints between levels (e.g., 4.5 as the cutpoint between “agree” and “strongly agree”).

Seventy-nine team members returned surveys, for a response rate of 75%. All 19 participating community health centers had three or more respondents (range 3–8, median 5). Ninety-three (88%) team members either returned a written questionnaire or answered the telephone survey. After verifying that the telephone responses were consistent with responses on the larger questionnaire, the data from the two sources were pooled.

Interviews

Two investigators independently listened to each audiotape or read each transcription to ensure the validity and reliability of the theme analysis.

RESULTS

Patient population

The patient demographic characteristics in 1998 and 1999 from the chart review were almost identical, differing by $\leq 3\%$ in any category of any variable. Approximately two-thirds (64%) were women, one-third (1998: 33%; 1999: 32%) were African American, and 22% were Hispanic. About half (47 and 46%, respectively) were between 51 and 65 years of age, and one-quarter (24 and 22%) were 41–50 years old. About 90% (88 and 90%) had type 2 diabetes, and approximately one-third (34 and 33%) were taking insulin or insulin and an oral agent. One-fourth (24 and 23%) had Medicare insurance, one-fourth (26 and 24%) had Medicaid insurance, and about one-quarter (27 and 28%) were self-pay, usually on a sliding-fee schedule. Thirty-seven percent of the health centers were rural. On average, each center had 398 patients with diabetes (range 74–987).

Interventions

Most health centers performed at least 30 different interventions over the course of the year. Examples of frequently performed interventions for each element of the Chronic Care Model are below.

- Community: collaborate with community organizations for health center's population (89%).
- Patient self-management support: self-management tool or goal sheet to track a patient's progress (63%).
- Delivery system redesign: group cluster visits (63%).
- Decision support: diabetes flow sheet (100%).
- Computer information systems: used patient registry to follow up on examination and laboratory data (37%).

Adherence to American Diabetes Association Clinical Practice Recommendations

The proportions of patients for whom each of the major processes of care were performed increased significantly from 1998 to 1999, as determined by chart review (Table 1). Rates of HbA_{1c} measurement, eye examination referral, dietary counseling, foot examination, dental referral, lipid assessment, and urine microalbumin assessment all improved, with ORs ranging from 1.28 to 2.92 for

Table 1—Comparison of diabetes processes and outcomes from 1998 to 1999

Processes and outcomes	1998	1999	OR/Differences (95% CI)	P
Matched patients* (n = 969)				
One HbA _{1c} measurement	80	90	2.10 (1.58–2.80)	<0.001
Two HbA _{1c} measurements, at least 3 months apart	37	54	2.04 (1.47–2.85)	<0.001
Eye exam referral	36	47	1.57 (1.08–2.28)	0.02
Dietary counseling/referral to nutritionist	51	57	1.28 (0.95–1.74)	0.10
Foot exam/referral to podiatrist	40	64	2.68 (1.77–4.05)	<0.001
Dental referral	7.2	18	2.92 (1.71–4.96)	0.001
Lipid assessment	55	66	1.58 (1.11–2.25)	0.02
Urine microalbumin assessment	13	25	2.33 (1.44–3.77)	0.001
HbA _{1c} value (%)	8.51	8.32	−0.19 (−0.41 to 0.03)	0.09
All patients† (n = 1,628)				
One HbA _{1c} measurement	80	90	2.43 (1.80–3.30)	<0.001
Two HbA _{1c} measurements, at least 3 months apart	38	54	1.90 (1.43–2.54)	<0.001
Eye exam referral	36	47	1.55 (1.08–2.23)	0.02
Dietary counseling/referral to nutritionist	49	58	1.42 (1.03–1.96)	0.04
Foot exam/referral to podiatrist	40	64	2.70 (1.84–3.94)	<0.001
Dental referral	6.7	17	2.94 (1.87–4.64)	<0.001
Lipid assessment	55	67	1.62 (1.18–2.23)	0.005
Urine microalbumin assessment	12	25	2.47 (1.50–4.06)	0.001
HbA _{1c} value (%)	8.52	8.40	−0.12 (−0.36 to 0.11)	0.30

Data are % unless otherwise indicated. *Patients present in both 1998 and 1999 chart reviews; †all patients with available chart reviews.

patients present in both 1998 and 1999 chart reviews. The mean value of HbA_{1c} decreased slightly ($P = 0.09$).

Evaluation of the collaborative

Survey respondents indicated a high level of support for the collaborative. About 95% of respondents agreed or strongly agreed that the collaborative was worth the effort and was successful (Table 2), and >80% intended to continue collaborative activities. Both the Chronic Care Model and the PDSA system were generally thought to be helpful, although 11% of respondents did not find the PDSA system useful. Teams generally worked well together. Regarding diffusion, 79% of respondents noted that patients or nonteam coworkers had commented on changes initiated by the team.

Areas that were most challenging concerned time and the related burden of data collection and report generation. Most respondents spent 1–5 h per week on collaborative activities, and 38% spent 6–10 h or more. Thirty-one percent of respondents, distributed among 15 of the 19 participating community health centers, reported inadequate time to work on collaborative activities. Most respondents agreed that they received support from their health center's administration, but only ~41% agreed that the administra-

tion had supplied release time from other duties for collaborative activities. A large majority of respondents considered the monthly reports and patient registry useful but also burdensome. Significant team member and clinic staff turnover was reported by about half of the respondents.

Overall, in interviews team leaders and team members were very proud of their accomplishments. Major perceived successes included improved diabetes care (e.g., lower HbA_{1c}, more self-management, better community linkages), better adherence to standards, more comprehensive care, increased awareness among patients and providers, development of patient registries and tracking systems, cluster clinics in which patients receive multiple aspects of care in one joint session, and networking with other health centers. The Chronic Care Model and rapid PDSA cycle models were useful, although many centers used the PDSA cycles qualitatively as opposed to quantitatively. Most nonteam members were aware of the collaborative intervention and thought that it had improved the system of diabetes care at their health centers.

Team leaders and members noted the need for more staff, time, and technical support, as well as for more supplies and educational materials for patients. About one-third of the centers expressed a desire for more senior support, and several centers re-

ported that they wished there was someone in a position of authority to encourage provider adherence with the program. A front-line champion was usually needed in addition to senior management support.

Many centers initially had difficulties with developing their computerized patient registry systems. Some respondents also expressed a preference for clear direction, clear terminology, and many concrete examples. They wanted a clear structure, but valued their autonomy.

CONCLUSIONS— The BPHC's Health Disparities Collaborative is the most ambitious effort to date to improve the quality of diabetes care in community health centers. Breakthrough Series concepts drawn from tenets of continuous quality improvement, chronic disease management, and collaborative learning have become increasingly popular in recent years, but evaluation of these techniques has been limited (18,28).

Wagner et al. (18) tested the Diabetes Collaborative approach in a group of 23 health care organizations, of which 7 were safety net providers. They noted that many teams reported improvements in several goals, including measurement of HbA_{1c} and actual HbA_{1c} level. Community health centers had some of the largest gains. Wagner et al. primarily used qual-

Table 2—Evaluation of Breakthrough Series by diabetes quality improvement team members

	Strongly disagree	Disagree	Neither	Agree	Strongly agree	n		
Overall								
The Diabetes Collaborative was worth the effort.		1	4	43	52	93*		
Participation in the Diabetes Collaborative was successful.		1	5	41	52	92*		
Will continue Diabetes Collaborative model and interventions. (5 items)		1	18	65	16	79		
Models and tools								
PDSA System was used to implement change, useful, will continue to use. (3 items)	1	10	18	53	18	78		
Chronic Disease Model								
● Chronic Disease Model used as conceptual guide, useful, will continue to use. (3 items)			9	72	19	79		
● Diabetes Collaborative helpful in improving elements of Chronic Disease Model in CHC (6 items)		3	11	57	29	79		
Data in monthly reports useful to clinic.		6	12	64	18	90*		
Patient registry useful. (2 items)	0	4	5	52	36	78		
Education and assistance								
Institute for Healthcare Improvement training helpful.			9	65	27	79		
Institute for Healthcare Improvement training clear.		10	24	53	13	79		
Midwest Cluster Coordinator helpful. (2 items)		4	5	47	44	79		
Team learned from other CHCs in Midwest Cluster.		5	14	63	18	79		
Communication within Collaborative. (6 items)			25	65	10	79		
	Very inaccurate	Mostly inaccurate	Slightly inaccurate	Uncertain	Slightly accurate	Mostly accurate	Very accurate	n
Team functioning								
Team functioning (14-item scale)			4	14	28	39	15	79
	Never	Rarely	Occasionally	Sometimes	Fairly often	Almost always	Always	n
Team role								
Individual role clarity (4 items)		1		15	38	41	5	79
Mission clarity (4 items)			3	10	28	49	10	79
			Strongly disagree	Disagree	Neither	Agree	Strongly agree	n
Team interpersonal relations								
Team interpersonal relations (7 items)				1	31	57	10	79
Team efficacy (3 items)			1	3	20	61	15	79
			1	2	3	4	5	n
Collaborative atmosphere/consensus at meetings: (2 items) (atmosphere: 1 = tense/confrontational, . . . , 5 = relaxed/collaborative) (consensus: 1 = never, seldom, sometimes, often, 5 = always)				4	1	41	54	78

Continued

ity improvement data and methods for their study and suggested that more rigorous research and program evaluations needed to be done. Our study adds important information. It was designed to be

a research evaluation and, thus, included rigorous data from multiple data sources and statistical techniques that adjusted for clustering of patients within centers. Our data also allowed us to describe some of

the facilitators and barriers to the intervention in more detail. Our study includes a broader range of health centers and is therefore more generalizable to all types of community health centers.

Table 2—Continued

Meetings and hours of work	Monthly		Biweekly		Weekly		n
	0%	20%	40%	60%	80%	100%	
Frequency of team meetings	30		42		29		77
Average attendance of respondent: percent of meetings	6	6	6	9	39	33	79
Hours per week on collaborative	1–5	6–10	11–15	16–20	≥21		n
	62	24	10		4		78
	Strongly disagree	Disagree	Neither	Agree	Strongly agree		n
Costs of Diabetes Collaborative participation							
Data collection burdensome (2 items)			5	18	53	24	79
Adequate time to work on Diabetes Collaborative (3 items)	1	30	39	28	1		79
Support							
Administrative support	2	5	8	45	40		93*
Nonteam coworker support			8	21	60	12	78
Time away from other duties by administration to work on collaborative	13	22	23	36	5		77
General institutional environment							
Significant team member/clinic staff turnover during collaborative (2 items)	8	19	22	32	20		79
Diffusion							
Patients/nonteam coworkers commented on changes initiated by team (2 items)			22	62	17		78

Data are % unless otherwise indicated. *Includes telephone respondents.

Many health centers felt that they needed more resources to free staff time for the project. In addition, more resources may be needed to provide some services, such as dilated eye examinations. The delay in finding an efficient and common electronic patient registry impeded many centers from quickly identifying their population and starting desired interventions. The Chronic Care Model was universally thought to be useful. In comparison, the rapid PDSA methodology received less support, although it was still viewed favorably overall.

The proper balance of structure and autonomy needs to be found. The Breakthrough Series is a general model, but many health centers wanted a menu of concrete model interventions to choose from. By the end of the first year, different options were being presented, such as the learning sessions in which health centers could share model programs. Templates for basic infrastructural components, such as the patient registry, were provided. Buy-in from senior management was critical and variable, and subsequent Diabetes Collaborative efforts have facilitated this through explicit expectations and commitments from senior management and through training of both leaders and staff regarding this issue. A champion

of the Breakthrough Series at each center was critical.

Our study has several limitations. Chart review examines charting practices that may not wholly represent the actual care provided. We may have underestimated the effect of the Breakthrough Series because we took a random sample of patients' charts from each center. To the extent that a health center did not target all of its patients with diabetes at their site for interventions, random chart audit may underestimate the effects of the intervention. However, virtually all health centers reported that they had targeted all of their diabetic patients for interventions by the latter months of the initiative. An additional limitation existed because some of the patients targeted during the latter months of the year had a relatively short time to benefit from the intervention. Longer follow-up is needed to determine the full and lasting effects of the intervention. Also, not every health center targeted each of the individual American Diabetes Association standards for quality improvement. Thus, our analysis of pooled data from each health center about each quality standard may be a conservative estimate of the Breakthrough Series' effect.

While our 75% survey response is high for a provider survey (29), nonrespondent bias is still possible. However,

through telephone follow-up of nonrespondents to the written survey, we obtained an 88% response rate to several of the most important global evaluation questions of the Diabetes Collaborative. Given that the results of the telephone respondents were similar to those from the subsample of the 75% of providers answering the written questionnaire, we felt that bias was minimal.

In addition, our study is nonrandomized. Conceivably, secular changes unrelated to the intervention may have led to the improvement in diabetes care. However, this is unlikely as the Diabetes Collaborative was by far the dominant influence between the 2 years of data measurement.

Our study of the first year of the initiative indicates that the Breakthrough Series is a promising intervention to improve processes of diabetes care. In addition, since this first experience implementing a chronic disease collaborative in health centers has subsequently led to refinements in how the Breakthrough Series is organized and run, future collaboratives are even more likely to be successful. However, several important research questions remain. Whether quality improvement can be sustained beyond 1 year needs to be determined. Is it possible

to sustain improvement without more funding for staff time? Can morale be maintained? Are continued collaborative activities necessary to ensure sustainability? If so, what types of activities and support are most critical? How much staff time needs to be freed for collaborative activities? Is it critical to free time for the team leader, the team members, or both parties?

In addition, it is unknown whether quality improvement efforts can survive major turnover in staff. How can the Breakthrough Series efforts be institutionalized so that health centers are not dependent on any one champion or few individuals? How does one create the culture and support for change and quality improvement?

As health centers broaden their quality improvement efforts, it will be important to determine how diabetes care can be integrated into an overall ongoing improvement process to avoid a segmented, "disease of the month" feel. Balancing attention and resources for diabetes with other worthy competing goals at the health centers will be challenging, and it will be important to determine if the collaborative intervention is cost-effective.

The BPHC's Diabetes Breakthrough Series and wider 6-year Health Disparities Collaborative are bold interventions to improve the quality of care in health centers. Our initial evaluation of this effort in Midwest health centers indicates that the model, in conjunction with the enthusiasm and hard work of clinicians and administrators, has led to significant improvements in diabetes care in 1 year as assessed through chart review.

Acknowledgments—This project was supported by the Bureau of Primary Health Care, the Agency for Healthcare Research and Quality (R01 HS10479-01), and the National Institute of Diabetes and Digestive and Kidney Diseases Diabetes Research and Training Center (P60 DK20595). M.H.C. is a Robert Wood Johnson Foundation Generalist Physician Faculty Scholar.

Presented in part at the American Diabetes Association Annual Meeting, June 23, 2001, Philadelphia, Pennsylvania, and at the American Public Health Association Annual Meeting, October 22, 2001, Atlanta, Georgia.

References

- Lefkowitz B, Todd J: An overview: health centers at the crossroads. *J Ambulatory Care Manage* 22:1–12, 1999
- National Association of Community Health Centers, 2003. Available at <http://www.nachc.com/about/mission.asp>. Accessed 21 August 2003
- Harris MI, Cowie CC, Stern MP, Boyko EJ, Reiber GE, Bennett PH, Eds: *Diabetes in America*. 2nd ed. Bethesda, MD, National Institutes of Health (NIH publication no. 95-1468), 1995
- Chin MH, Zhang JX, Merrell K: Diabetes in the African-American Medicare population: morbidity, quality of care, and resource utilization. *Diabetes Care* 21:1090–1095, 1998
- Walker EA, Engel SS, Zybert PA: Dissemination of diabetes care guidelines: lessons learned from community health centers. *Diab Educ* 27:101–110, 2001
- Walker EA, Wylie-Rosett J, Shamoon H, Engel S, Basch CE, Zybert P, Cypress M: Program development to prevent complications of diabetes: assessment of barriers in an urban clinic. *Diabetes Care* 18:1291–1293, 1995
- Deeb LC, Pettijohn FP, Shirah JK, Freeman G: Interventions among primary-care practitioners to improve care for preventable complications of diabetes. *Diabetes Care* 11:275–280, 1988
- Marrero DG: Current effectiveness of diabetes health care in the U.S.: how far from the ideal? *Diabetes Reviews* 2:292–309, 1994
- Miller KL, Hirsch IB: Physicians' practices in screening for the development of diabetic nephropathy and the use of glycosylated hemoglobin levels. *Diabetes Care* 17:1495–1497, 1994
- Starfield B, Powe NR, Weiner JR, Stuart M, Steinwachs D, Scholle SH, Gerstenberger A: Costs vs. quality in different types of primary care settings. *JAMA* 272:1903–1908, 1994
- Peters AL, Legorreta AP, Ossorio RC, Davidson MB: Quality of outpatient care provided to diabetic patients: a health maintenance organization experience. *Diabetes Care* 19:601–606, 1996
- Mayfield JA, Rith-Najarian SJ, Acton KJ, Schraer CD, Stahn RM, Johnson MH, Gohdes D: Assessment of diabetes care by medical record review: the Indian Health Service model. *Diabetes Care* 17:918–923, 1994
- Chin MH, Cook S, Jin L, Drum ML, Harrison JF, Koppert J, Thiel F, Harrand AG, Schaefer CT, Takashima HT, Chiu SC: Barriers to providing diabetes care in community health centers. *Diabetes Care* 24:268–274, 2001
- Chin MH, Auerbach SB, Cook S, Harrison JF, Koppert J, Jin L, Thiel F, Karrison TG, Harrand AG, Schaefer CT, Takashima HT, Egbert N, Chin SC, McNabb WL: Quality of diabetes care in community health centers. *Am J Public Health* 90:431–434, 2000
- Bell RA, Camacho F, Goonan K, Duren-Winfield V, Anderson RT, Konen JC, Goff DC Jr: Quality of diabetes care among low-income patients in North Carolina. *Am J Prev Med* 21:124–131, 2001
- Wylie-Rosett J, Basch C, Walker EA, Zybert P, Shamoon H, Engel S, Cypress M: Ophthalmic referral rates for patients with diabetes in primary-care clinics located in disadvantaged urban communities. *J Diabetes Complications* 9:49–54, 1995
- Porterfield DS, Kinsinger L: Quality of care for uninsured patients with diabetes in a rural area. *Diabetes Care* 25:319–323, 2002
- Wagner EH, Glasgow RE, Davis C, Bonomi AE, Provost L, McCulloch D, Carver P, Sixta C: Quality improvement in chronic illness care: a collaborative approach. *Jt Comm J Qual Improvement* 27:63–80, 2001
- Wagner EH, Austin BT, Von Korff M: Organizing care for patients with chronic illness. *Milbank Q* 74:511–544, 1996
- American Diabetes Association: Clinical practice recommendations 2003. *Diabetes Care* 26 (Suppl. 1), 2003
- Medicode: *The International Classification of Diseases, 9th Revision, Clinical Modification*. 5th ed. Salt Lake City, UT, Medicode Publications, 1995
- Landis JR, Koch GG: The measurement of observer agreement for categorical data. *Biometrics* 33:159–174, 1977
- Alexander JA, Lichtenstein R, Jinnett K, D'Aunno TA, Ullman E: The effects of treatment team diversity and size on assessments of team functioning. *Hosp Health Serv Admin* 41:37–53, 1996
- Bryk AS, Raudenbush SW: *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, CA, Sage Publications, 1992
- Harville DA: Maximum likelihood approaches to variance component estimation and to related problems. *J Am Stat Assoc* 72:320–338, 1977
- Lindstrom MJ, Bates DM: Nonlinear mixed effects models for repeated measures data. *Biometrics* 46:673–687, 1990
- Cronbach LJ: Coefficient alpha and the internal structure of tests. *Psychometrika* 16:297–334, 1951
- Solberg LI, Kottke TE, Brekke ML, Magnan S, Davidson G, Calomeni CA, Conn SA, Amundson GM, Nelson AF: Failure of a continuous quality improvement intervention to increase the delivery of preventive services: a randomized trial. *Effective Clinical Practice* 3:105–115, 2000
- Asch DA, Jedrzewski MK, Christakis NA: Response rates to mail surveys published in medical journals. *J Clin Epidemiol* 50:1129–1136, 1997