Deploying the Chronic Care Model to Implement and Sustain Diabetes Self-management Training Programs

Linda M. Siminerio, RN, PhD

Gretchen A. Piatt, MPH

Sharlene Emerson, CRNP, CDE

Kristine Ruppert, DrPH

Melissa Saul, MSc

Francis Solano, MD

Andrew Stewart, MD

Janice C. Zgibor, PhD

From the University of Pittsburgh Diabetes Institute, University of Pittsburgh Medical Center (Dr Siminerio, Ms Emerson, Dr Ruppert); the Department of Epidemiology, Graduate School of Public Health, University of Pittsburgh (Ms Piatt, Dr Zgibor); and the Department of Medicine, University of Pittsburgh (Ms Saul, Dr Solano, Dr Stewart).

Correspondence to Linda M. Siminerio, RN, PhD, CDE, 601 Kaufmann Building, 3471 Fifth Avenue, Pittsburgh, PA 15213 (simineriol@upmc.edu).

Acknowledgment: This research was partially sponsored by funding from the US Air Force administered by the US Army Medical Research Acquisition Activity, Fort Detrick, Maryland, award number W81XWH-04-2-0030.

DOI: 10.1177/0145721706287156

Purpose

The purpose of this project was to evaluate the utility of using the 6 elements of the chronic care model (CCM; health system, community, decision support, self-management support, clinical information systems, and delivery system design) to implement and financially sustain an effective diabetes self-management training (DSMT) program.

Methods

The University of Pittsburgh Medical Center (UPMC) uses all elements of the CCM. Partnerships were formed between UPMC and western Pennsylvanian community hospitals and practices; the American Diabetes Association DSMT recognition program provided decision support. A clinical data repository and reorganization of primary care practices aided in supporting DSMT. The following process and patient outcomes were measured: number of recognized programs, reimbursement, patient hemoglobin A1C levels, and the proportion of patients who received DSMT in primary care practices versus hospital-based programs.

Results

Using elements of the CCM, the researchers were able to gain administrative support; expand the number of recognized programs from 3 to 21; cover costs through increased reimbursement; reduce hemoglobin A1C lev-

els ($P < .0001$), and increase the proportion of patients receiving DSMT through delivery in primary care (26.4% suburban; 19.8% urban) versus hospital-based practices (8.3%; $P < .0001$).

Conclusions

The CCM serves as an effective model for implementing and sustaining DSMT programs.

Diabetes self-management training (DSMT) is widely considered to be an important part of diabetes management.[1,2] One of the goals of the US Health and Human Services' *Healthy People 2010* is to increase the number of people who receive diabetes education from 40% (1998) to 60% (2010).[3]

The national standards for DSMT[4] administered through the American Diabetes Association (ADA) recognition program[5] provide a framework for delivery and quality. Medicare and other third-party payers reimburse for programs when they meet ADA requirements. Reimbursement is linked to codes, and charges are typically based on Medicare rates.[6] Reimbursement is critical in generating revenue to support nurse and dietician educators who provide DSMT. Educators can be the target of cost-cutting initiatives when financial stability cannot be demonstrated.[7]

The numbers of patients who receive diabetes education are disappointingly small.[8,9] Access to education has been proposed as a barrier, particularly in communities in which the closest DSMT program may be miles away.[10] Another potential problem may be the traditional way in which education is prescribed and delivered. Currently, physicians are expected to refer diabetes patients to a hospital-based DSMT program. This process is consistent with the current system of health care delivery as it applies to acute care where services are provided at a hospital. Although more than 90% of patients with diabetes are cared for by primary care physicians (PCPs),[11] education is rarely available in the primary care office.[12,13]

Patients and physicians at University of Pittsburgh Medical Center (UPMC) identified education as a barrier to the promotion of quality diabetes care.[10] In an effort to provide education for physician practices and outlying hospitals, the UPMC Endocrine Division supported a certified diabetes educator (CDE). This provided an immediate solution, but a long-term strategy was needed for the UPMC system.

In contrast to traditional methods, the chronic care model (CCM) provides a framework for a systematic approach and has been shown to improve processes and outcomes.[14-16] The CCM is based on the premise that effective chronic disease programs are delivered in partnership with health systems and communities.[14-16] Although the CCM has been used in diabetes improvement projects, it has never been tested in facilitating DSMT programs.[10,17,19] The CCM identifies key elements that are critical to success: (1) health system, to serve as the foundation by providing structure and goals; (2) community, to link with community resources; (3) decision support, to ensure that providers have access to evidence-based guidelines; (4) self-management support, to help patients acquire skills and confidence to self-manage; (5) clinical information systems, to provide timely access to data about patients and patient populations using clinical information systems; and (6) delivery system design, to restructure medical practices to facilitate team care.

It was the objective of this study to evaluate the benefits of using all of the elements of the CCM to expand and support DSMT. The researchers hypothesized that introducing the components of the CCM would lead to increased administrative support along with improved reimbursement for services and A1C levels. By increasing the number of programs and providing DSMT in primary care, it was hoped that some of the barriers to DSMT could be curtailed, including access.

Methods

Setting

UPMC is an integrated health system that includes 19 hospitals and a physician division with 166 primary care and 1400 academic physicians providing services for approximately 90 000 people with diabetes in western Pennsylvania. Implementation of the CCM involved a stepped approach and changes at multiple levels from 2000 to 2004. This project was referred by the

Table 1

Implementation of the Chronic Care Model (CCM)

CCM Component	Activity
Community and health system	UPMC provided educators access to resources in Finance
	Information systems
	Physician practices
	Administration in community hospitals and practices
Self-management support	Nurses and dietitians educators agreed to
	Use consistent forms, educational materials, and a curriculum
	Meet the qualifications for recognition
	Facilitate DSMT to meet the ADA recognition requirements
	Monitor and report CQI processes
Decision support	UPMC supported
	The implementation of national standards for DSMT
	Fee for ADA recognition application
	A central coordinating center to support the educators
	Seminars for training and certification
	A central advisory committee with representation from physician practices, communities, and hospital sites
Clinical information systems	MARS was used to track
	Reimbursement
	Rates of DSMT services
	A1C levels by race
Delivery system design	DSMT delivered in primary care offices was facilitated by
	A CDE who worked with office staff to schedule DSMT
	A CDE who served as a clinical resource available by telephone to physicians, office staff. and patients
	Office staff who reorganized the practices to host “diabetes days”
	Physicians who made direct referrals to the CDE

UPMC = University of Pittsburgh Medical Center; DSMT = diabetes self-management training; ADA = American Diabetes Association; CQI = continuous quality improvement; MARS = Medical Archival Retrieval System; CDE = certified diabetes educator.

University of Pittsburgh Institutional Review Board to the UPMC Quality Council, where it was approved as a quality improvement project.

The CCM implemented at UMPC is outlined in Table 1. The CCM differs from traditional approaches in that it emphasizes self-management support and training.[14,15] The ADA recognition program provided the framework to implement the evidence-based DSMT standards[5] and served as the decision support. In compliance with ADA requirements, an Advisory Committee was established and became responsible for developing an annual plan, assessing the target population, and determining methods for continuous quality improvement (CQI). The Advisory Committee realized a dual purpose could be served if reports on reimbursement, access to DSMT, and A1C levels were available. These reports would serve as important CQI measures and would give UPMC

administration the feedback necessary to gain continued support.

Elements of the CCM

In 2000, the UPMC health system designated diabetes as its quality initiative and agreed to administratively support implementation of the CCM in its network of community hospitals and practices.[17]

The Medical Archival Retrieval System (MARS), a repository of information forwarded from the UPMC electronic clinical, administrative, and financial databases, was used to provide data to the educators and served as the clinical information system. MARS has been refined and validated so that diabetes patients are accurately identified by a combination of diabetes criteria, A1C levels, glucose >200 mg/dL (11 mmol/L), medications, and International Classification of Diseases, ninth revision, codes. At the time of the initiative, only 8 of 21 hospital programs had complete data that were accessible in MARS. This report includes information from those 8 hospitals and 2 primary care practices programs.

When reports of limited access were brought to the attention of the Advisory Committee, UPMC addressed delivery system design and began to implement DSMT in primary care offices in August 2003. A CDE provided DSMT at 1 suburban and 1 urban practice identified as having large populations of diabetes patients. A CDE was available on "diabetes days," when office staff scheduled DSMT appointments. Because of space constraints in the office, DSMT was delivered on an individual basis at the start of the initiative. Group visits were facilitated later on in the project when space was available.

Population

During the tracking period between January 2, 2003, and June 30, 2004, a total of 31 150 people were identified in MARS to have diabetes in the 8 hospitals with DSMT programs (Figure 1). During this time frame 4190 people were identified as having received DSMT at those hospital programs documented by a charge for service generated in MARS. To be eligible for the A1C component of this study, a person had to have their initial education session during this time frame and have at least 2 A1C levels (1 before and 1 after the initial session). Of the 4190 people receiving DSMT, 382 (9%) were eligible for tracking A1C levels. In the suburban and urban practices, 1306 patients were identified as having diabetes using the MARS criteria.

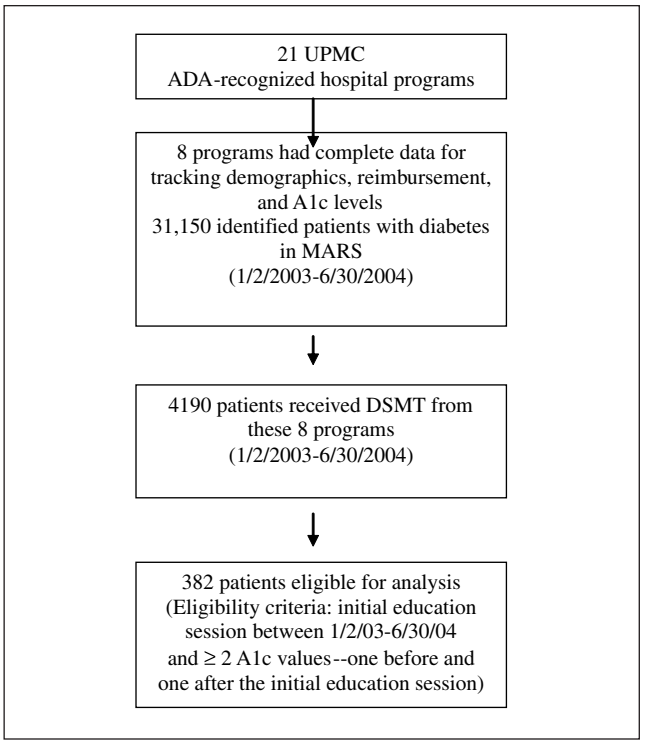

Figure 1. Monitored program populations. UPMC = University of Pittsburgh Medical Center; ADA = American Diabetes Association; MARS = Medical Archival Retrieval System; DSMT = diabetes self-management training.

Program Outcomes

Number of sites. At the start of the initiative, only 3 UPMC hospital programs had ADA recognition. Applications for additional sites were submitted throughout the initiative.

CQI Measures

Reimbursement and patient A1C levels. The tracking of reimbursement was initiated when a program received ADA recognition and bills for service could be generated. A subset of the reimbursement population was used to analyze the effect DSMT had on A1C level trends. At the time of the tracking period, the PCP offices had not

received ADA recognition and therefore could not bill for services.

Patient reach. The proportion of patients who received DSMT at 1 urban and 1 suburban primary care practice was compared to the proportion who received DSMT at the 8 hospital-based programs where DSMT services were available during the same time period (July 2003-December 2004).

Analyses. The statistical analyses incorporated both descriptive and inferential techniques. Measures of central tendency (e.g., proportions, means, standard deviations, medians, etc) were used for all descriptive analyses. In univariate analyses, Student *t* tests for continuous data and Pearson's χ^2 tests for categorical data were used to determine differences in means and proportions. In addition, for each outcome of interest, analysis of variance was used to test for differences in means between more than 2 groups, and χ^2 tests for trends were used to test for differences in proportions between more than 2 groups. To analyze the effect that education had on A1C values, a multilevel model for change was used. This type of analysis allows one to measure change over time while allowing the individuals to be their own controls. All models considered were adjusted for age.[18]

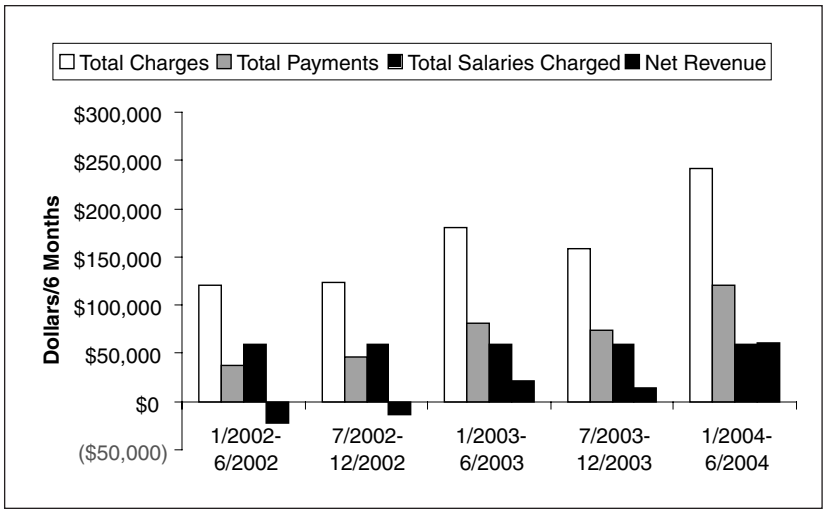

Figure 2. DSMT reimbursement and educator salary at 8 University of Pittsburgh Medical Center American Diabetes Association–recognized programs (January 2002-June 2004).

Results

Decision Support

Between 2000 and 2004, the number of ADA-recognized programs grew from 3 to 21 including pediatric, rural, academic, and 2 primary care practices.

Clinical Information Systems

MARS afforded the opportunity to track reimbursement and A1C levels. As shown in Figure 2, at the 8 DSMT hospital programs where revenue was captured, total charges in 6-month intervals increased from the beginning of the tracking period in January 2002 from $120 846.00 to $241 472.00 in June 2004. Total payment per 6 months increased from $37 192.00 to $120 572.00 over the same period. Interestingly, efficiency of collection increased from approximately 25% to 50%. Most important, diabetes educator effort was covered by the third 6-month period. Thus, at the initiation of this project, DSMT services were a loss leader. In contrast, by the conclusion, educators were more than self-supporting their efforts devoted to DSMT.

When examining patient data from the hospital programs, the mean age was 57.2 years. Patients who received DSMT at the point of service in a suburban office were significantly older than those at the urban PCP office (age: suburban = 66.2 years vs urban = 54.7 years, $P < .0001$). Patients entered the hospital DSMT programs with higher mean A1C values did those in the primary care practices (8.28% vs 7.83%). Figure 3 shows the analysis of the A1C values through 1 year after the initial education session. A mean age-adjusted decrease in A1C values in those in hospital programs (0.95%) versus primary care (0.48%) was achieved ($P = .0001$). A longer follow-up period would be necessary to determine the effects of DSMT over time.

Delivery System Design

In tracking numbers of patients who received DSMT from July 2003 through December 2004, it was found that a 2- to 3-fold greater proportion of patients were reached when DSMT was made available in PCP offices

(26.4% suburban; 19.8% urban) as compared to 8.3% of the population who were referred to hospital-based programs. Of 31 000 patients identified as having diabetes in MARS, only 13% (4190) received DSMT at hospital-based programs during the time period. Of 1306 identified diabetes patients in both the suburban and urban practices combined, 24.7% received DSMT in their PCP's office.

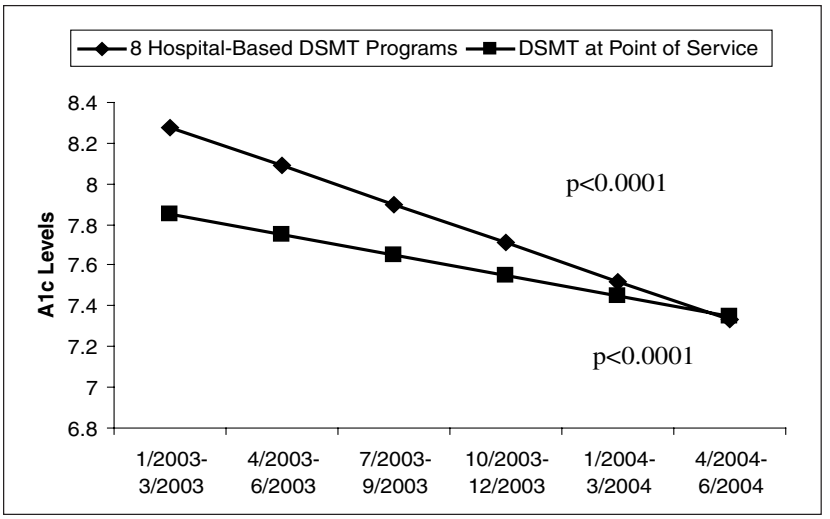

Figure 3. Age-adjusted trends in glycemic control after initial education session. DSMT = diabetes self-management training.

Discussion

In this report, it is demonstrated that the CCM is an effective framework to support DSMT, results in improved program and patient outcomes, and is fiscally self-supporting. With reliable clinical information systems, educators were able to demonstrate the benefits of DSMT delivered in different settings on A1C levels. In a fiscal environment in which hospital administrators are skeptical of services that do not generate revenue, tracking reimbursement in justifying positions was also important.

While the ADA recognition process is widely accepted, there is a paucity of literature on the delivery process, reimbursement practices, and, most important, hard outcomes. Educators in both the ADA and the American Association of Diabetes Educators (AADE) report program closings and express frustration with the implementation of Medicare benefits and receiving appropriate reimbursement.[7] The AADE and ADA collaborated to conduct a survey of DSMT programs. Their findings in 122 sites confirmed the findings of other studies that indicate that diabetes education is an underutilized service.[7-10] Nearly half of the sites reported an average visit volume of fewer than 50 visits per month, and 19% reported only 51 to 100 visits per month. More disappointing were the reimbursement practices. Of the sites that bill Medicare, only 57% were collecting the mandated collection fees, while 37% of the respondents did not even know how often they were collecting these fees.[7] Despite attempts to remedy this problem, only 57% reported having a fiscal reporting system. The ADA and AADE concluded that processes for monitoring billing and establishing a reporting system specific to DSMT were critically important.[7]

The authors took this message seriously and created a system to explore and satisfy these recommendations. Through the repository, educators had the opportunity to monitor reimbursement. UPMC education and billing staff members collaborated and reviewed monthly reports to determine payment practices. Although Pennsylvania mandates coverage for education, compensation for services was not always provided. As reported by others,[7] in addition to external reimbursement difficulties, numerous internal problems were identified throughout the system that precluded reimbursement. Education charges based on Health Care Common Procedure Coding System codes were inaccurately entered, recognition certificates were missing, and charge-entry staff neglected to enter charges. Once these problems were identified, internal efforts to correct the problems and capture reimbursement were implemented.

The authors were also eager to increase their DSMT services and realized that they needed to improve access. An important innovation was that they went beyond traditional models of DSMT delivery as a result of their system redesign; by integrating educators directly into offices, access to DSMT increased. It was demonstrated that DSMT delivered in the office has a positive effect on A1C levels along with PCPs and educators reporting other advantages that included increased communication

on management plans and CDE involvement in medication initiation and adjustments. Patients reported greater comfort with location and easy access to the educator for questions and problem solving. The intent is not to suggest that hospital-based programs be replaced or eliminated but that opportunities to support education and follow up in other settings are investigated.

To the best of the authors' knowledge, this project is the first to systematically develop a DSMT network using all of the elements of the model and report on ADA recognition and reimbursement practices. The CCM has been tested and shown to improve outcomes.[14,15] However, much of the research has focused on specific components of the CCM model, and evaluations of an overall plan are less frequent. More recently, Wagner et al[20] performed a survey and site visits of 72 chronic disease management programs that were considered to be innovative and effective. Only 1 program had instituted all 6 components of the model.

The limitations of the project are recognized. The UPMC diabetes initiative is in its infancy. As the project evolves, each of the components of the CCM continues to be developed and refined. For example, not all of the DSMT programs were linked to the data repository during the initiative.

Another weakness is that the researchers were unable to effectively track all hemoglobin A1C levels throughout the project. Patients may have had laboratory tests done elsewhere. It is recognized that factors other than DSMT may have influenced improvements in glycemic control and that A1C levels are not the only indicator for quality.[21] Other medical interventions and outcomes must be controlled for and captured in future studies.

It is recognized that reimbursement needs to increase to fully support an educator's salary. Now that billing practices have been remedied and new avenues for access have been identified, UPMC will move more educators into primary care practices, increase group visits, and begin an aggressive DSMT promotional campaign in its communities.

Although this study was performed in a large health system with access to many resources, it serves as a model for others to explore creative solutions. It provides a template for educators to explore collaboration with heretofore unlikely partners in administration, finance, and information systems and to create opportunities outside of traditional roles, such as the development of business models for sustainability. Smaller and independent facilities may seek opportunities to share data systems or form consortia to organize systemwide recognition applications. Hospital-based educators could partner with primary care practices to provide follow-up education in an office and seek creative methods for billing for services. Innovative technological methods, virtual teams, and community-based education afford other exciting opportunities that need to be tested. First and foremost, educators and physicians need to be open-minded to consider areas for change.

Developing systems that promote accessible, sustainable DSMT programs that affect metabolic outcomes have large- scale public health implications. Organizing efforts to support the facilitation of DSMT is critical in meeting the *Healthy People 2010* education objectives.

References

1. Norris SL, Engelgau MM, Narayan KMV. Effectiveness of self-management training in type 2 diabetes. Diabetes Care. 2001;24:561-587.
2. Piette JD, Glasgow R. Strategies for improving behavioral health outcomes among patients with diabetes: self-management education. In Gerstein HC, Haynes RB, eds. Evidence-Based Diabetes Care. Ontario, Canada: BC Decker; 2001:207-251.
3. US Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health. Washington, DC: Government Printing Office; 2000.
4. Mensing C, Boucher J, Cypress M, et al. National standards for diabetes self-management education. Diabetes Care. 2000;23:682-689.
5. American Diabetes Association. History of national standards and education recognition application. Available at: www .diabetes.org/for-health-professionals-and scientists/recognition/ edrecognition.ist. Accessed April 2, 2004.
6. US Department of Health and Human Services. Expanded coverage for diabetes outpatient self-management (final rule). Program memorandum B-01-40. 2001. Available at: http://www.cms.hhs.gov/Transmittals/Downloads/B0140.pdf.
7. Pearson J, Mensing C, Anderson R. Medicare reimbursement and diabetes self-management training: national survey results. Diabetes Educ. 2004;30:914-927.
8. Coonrod BA, Betschart J, Harris MI. Frequency and determinants of diabetes patient education among adults in the U.S. population. Diabetes Care. 1994;17:852-858.
9. Hiss RG, Anderson RM, Hess GE, Stepien CJ, Davis WK. Community diabetes care: a 10-year perspective. Diabetes Care. 1994;17:1124-1134.
10. Siminerio L, Piatt G, Zgibor J. Implementing the chronic care model in a rural practice. Diabetes Educ. 2005;31:225-234.
11. Janes GR. Ambulatory medical care for diabetes. In Group NDD, ed. Diabetes in America. Vol. 95-1468. Bethesda, Md: National Institutes of Health; 1995:541-552.

12. Glasgow R, Eakin E. Medical-office based interventions. In Snoek F, Skinner C, eds. Psychology in Diabetes Care. New York: John Wiley and Sons; 2005:141-168.
13. Glasgow RE, La Chance PA, Toobert DJ, Brown J, Hampson SE, Riddle MC. Long-term effects and costs of brief behavioural dietary intervention for patients with diabetes delivered from the medical office. Patient Education Counseling 1997;32:175-184.
14. Wagner EH, Austin BT, Von Korff M. Organizing care for patients with chronic illness. Millbank Q. 1996;74:511-544.
15. Wagner EH, Austin BT, Von Korff M. Improving outcomes in chronic illness. Manag Care Q. 1996;4:12-25.
16. Bodenheimer T, Wagner EH, Grumbach K. Improving primary care for patients with chronic illness: the chronic care model, part 2. JAMA. 2002;288:1909-1914.
17. Siminerio L, Zgibor J, Solano FX. Implementing the chronic care model for improvements in diabetes practice and outcomes in primary care: the University of Pittsburgh Medical Center experience. Clin Diabetes. 2004;22:54-58.
18. Singer J, Willett J. Applied Longitudinal Data Analysis. Oxford, UK: Oxford University Press; 2003.
19. Renders CM, Valk GD, Griffin S, et al. Interventions to improve the management of diabetes mellitus in primary care, outpatient and community settings. Cochrane Database Syst Rev. 2001;(1):CD001481.
20. Wagner EH, Davis C, Schaefer J, Von Korff M, Austin B. A survey of leading chronic disease management programs: are they consistent with the literature? Manag Care Q. 1999;7:56-66.
21. Glasgow RE, Osteen VL. Evaluating diabetes education: are we measuring the most important outcomes? Diabetes Care. 1992;15:1423-1432.