Outcomes of a Diabetes Education Program

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Synopsis

This study is the first part of an evaluation of a model program of education on diabetes mellitus for diabetic outpatients, currently in progress in Washington State. The program consists of 16 hours of education, covering all aspects of self-care, with an emphasis on the prevention of unnecessary morbidity from poor control of the disorder or from infections.

Eighty-eight percent of participants included in this study had not had formal diabetes education since receiving their diagnosis. The average duration of participants' diabetes was more than 7 years, and their average age was 55 years.

Participants were evaluated just before and 3 months after the education program. During this interval, they made significant improvements in their knowledge of diabetes and their attitudes toward and skills in managing the disorder, as well as in their degree of satisfaction with control. Moreover, their random blood glucose and glycosylated hemoglobin (Hb A1c) levels were significantly lower at the 3-month followup. The authors suggest that outpatient education offers a significant improvement in diabetic control.

EPIDEMIOLOGIC LITERATURE ASSERTS that a large fraction of the considerable mortality and morbidity from diabetes mellitus is preventable by correct management of the disorder. In a British population study, researchers found that 15 percent of persons less than 50 years of age, known to have diabetes at the time of their death, died of preventable complications of the disorder (*1*). A study of statewide mortality in Washington disclosed that at least 28 percent of deaths among diabetic persons less than 45 years of age had preventable causes (*2*). In Maine, staff of the CDC Diabetes Control Project found that 36.4 percent of hospital admissions of people with diabetes were for "preventable causes" (*3*). Researchers in Rhode Island reported that poor diabetic control or infections, or both, accounted for 46 to 62 percent of hospitalizations among a group of insulin-dependent patients less than 30 years of age (*4*). The National Diabetes Advisory Board has estimated that 50 to 75 percent of amputations among people who have diabetes are preventable (*5*).

These assertions are supported by reports of reductions in morbidity achieved by the institution of optimal diabetic management. Runyan and associates reported a 61 percent decline in days of hospitalization for ketosis or infections among patients who enrolled in a comprehensive care clinic that integrated patient education and patient care (*6*). Other hospital- or clinic-based programs have reported similar declines in hospitalizations and improvements in clinical measures of outcome such as blood glucose level, glycosylated hemoglobin (Hb A1c) fraction, and body weight (*7–10*).

Still other programs have tried to improve diabetic outcomes by providing education for patients that is independent of direct clinical care. This approach is less costly and has the potential to reach far more patients. The success rates for independent education programs have varied, depending on the evaluative measures used. For some education programs that use only knowledge, management skills, or attitudes as outcome measures, consistent improvements in these parameters have been reported (*11–16*). Unfortunately, what a patient with diabetes knows or can be taught about his or her disease, while important, correlates poorly with clinical outcomes (*12–15,17–19*). Accordingly, staff of some other education programs have gone one step further and have attempted to quantify clinical changes after education. In general, however, no improvements in control of the disorder attributable to diabetes education have been

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found (*12,13,15*). One exception was the Maine education program, whose students reportedly experienced 33 percent fewer hospitalizations in the year following their training (*3*). However, strong evidence is still lacking that diabetes education alone, without attendant improvements in clinical care, is effective. The lack of demonstrated efficacy has made third-party payers reluctant to reimburse such programs (*20*).

Model Diabetes Education Program

The Model Outpatient Diabetes Education Program (MODEP) reported on here was established in August 1981 in the Southwest Washington Health District, under the auspices of the Washington State Diabetes Demonstration Control Project. The program's goals are twofold: to improve the health of people with diabetes mellitus in the three counties of the district and to evaluate formally the effectiveness of such a program. Its specific objectives are to maximize each patient's skills in management of the disorder, to affect several specific clinical outcomes, and to reduce the number of preventable hospitalizations among program participants.

Clients learn of MODEP through the media or are referred to the program by their health care providers. Physicians learn of MODEP through the media or through their local professional organizations and hospitals. The program is 16 hours long and is divided into four sessions on consecutive days. The average class size is 10 people. Each participant pays $125 to help defray the actual cost of $250 per participant.

Classroom activities include lectures, films, slides, discussion sessions, skills laboratories, and a group lunch in a restaurant. A nurse, a dietitian, and a physician teach the various skills required for effective control of diabetes. Topics discussed include the pathophysiology of diabetes, the techniques of insulin injection, blood glucose monitoring, urine testing, the prevention of ketoacidosis and hypoglycemia, foot care, and meal planning. Individual consultation is available for clients with specific problems, and all are encourage to maintain telephone contact with the nurse educator after completion of the course. Followup visits are scheduled for 3 months and 1 year after course completion for the assessment and reinforcement of progress.

Program Evaluation

This preliminary evaluation of MODEP covers the period from inauguration of the program in August 1981 to the end of February 1983 and is restricted to clients who completed the 3-month followup interview during that period.

Methods. One week before entering the MODEP course, each participant in the study furnished a diabetes-related medical and social history and took pretests of his or her knowledge of diabetes, management skills such as insulin administration and meal planning, and attitudes toward the disorder. Each pretest score was simply the percentage of correct answers. Participants' height, weight, and blood pressure were recorded, and a random capillary blood glucose measurement was done. Blood was also drawn for glycosylated hemoglobin determinations, which were performed blindly by an outside laboratory. The same questions and measurements were repeated 3 months after completion of the course. The nurse who taught the class collected the data from all the participants.

Knowledge, skills, and attitude scores for the 17 persons who entered MODEP during August or September 1981 were excluded from the study because the testing process was not standardized during the first 2 months of program operation. The other outcome parameters for these 17 cases were retained. These 17 clients did not differ significantly from the remainder of the study group with respect to demographic or health status variables or with respect to clinical outcome measures.

Pre-education results expressed as continuous variables, such as weight or test scores, were contrasted with 3-month followup results, using Student's paired two-tailed t test.

The short-term results of this study will eventually be compared with the results of a second study that will evaluate MODEP clients 1 year after program completion and include information on changes in their use of health-care services.

Participants. During the 19 months of program operation covered in this study, 282 people with diabetes enrolled in MODEP. Nearly 60 percent of the clients were female, and the mean age of all clients was 55 years. Just 6 percent of clients were less than 25 years old. Roughly a third had a high school education, a third had less education, and a third had more. Fifty-five percent were retired or were not working outside the home.

Outcome measures for clients in a model diabetes education program

Measures	Number of clients tested	Mean score at pretest	Mean score at 3-month followup	Percent change[1]	P value
Nonclinical					
Knowledge	115	[2]48.9	[3]69.4	+41.9	<.0005
Skills	115	[2]56.5	[3]69.4	+22.8	<.0005
Attitudes	115	[2]82.9	[3]87.7	+ 5.8	.001
Satisfied with control	158	[2]35.4	[3]64.6	+29.2	<.005
Clinical					
Mean weight (pounds)	150	175.3	174.8	− 0.3	.4
Mean random blood glucose (mg per dl)	147	177.4	153.5	−13.5	<.0005
Mean glycosylated hemoglobin (percent hgb):					
Insulin-dependent diabetics	43	11.4	10.3	− 9.6	<.001
Non-insulin-dependent diabetics	106	10.6	9.9	− 6.6	<.001

[1] Percent change = (followup score − pretest score) ÷ pretest score.
[2] Mean percentage of correct responses to pretest questions.
[3] Mean percentage of correct responses to questions at followup.

Seventy-one percent of the clients had non-insulin-dependent diabetes, and 63 percent received the diagnosis of their disorder after the age of 44. A little more than half the clients received their diagnosis less than 5 years before entering the program. Interestingly, 88 percent had had no formal diabetes education since diagnosis. Seventy-three percent were referred to the program by their personal physicians. Fourteen percent had been hospitalized for their diabetes within the past year.

During the period of this study, 201 MODEP participants were eligible for a 3-month followup; 15 (7.5 percent) of these did not return for followup because of death, illness, or change in residence, and 28 (13.9 percent) were otherwise lost to followup. Those lost to followup did not differ significantly from those retained in the study group with respect to sex, age, type of diabetes, education level, referral source, or duration of diabetes, or with respect to their initial test scores or initial glycosylated hemoglobin levels.

Data from 158 clients who completed at least part of the 3-month followup assessment are included. Forty-three clients failed to complete their knowledge, skills, and attitude followup tests, but only nine failed to have their blood glucose drawn a second time, and this accounts for the discrepant sample sizes in the written test and clinical test analyses (table).

Results

Changes in selected outcome variables appear in the table. Nonclinical outcome measures—that is, knowledge, skills, and attitude test scores and clients' reported satisfaction with control—were all significantly improved at the 3-month followup. Mean knowledge scores were 48.9 percent at pretest and 64 percent at followup. The clients' attitudes toward their disorder proved relatively more resistant to change, the mean proportion of correct answers going from 82.9 percent at pretest to 87.7 percent as followup. A great many more clients (nearly 65 percent) were satisfied with their diabetic control 3 months after completing the course than had been satisfied with control before the course began (approximately 35 percent).

From a program-evaluation perspective, perhaps more important than improvement in test scores were the changes in the clinical parameters. Despite dietary instruction and encouragement, the MODEP clients were not able to reduce their weight significantly. They did, however, record a significantly lower mean random blood glucose at the followup examination ($P < .0005$) as well as lower mean glycosylated hemoglobin values ($P < .001$ for both insulin-dependent and non-insulin-dependent diabetics).

The glycosylated hemoglobin measures, the most critical of all the outcome variables, are presented for both insulin-dependent and non-insulin-dependent diabetics. Insulin-dependent clients reduced their mean glycosylated hemoglobin by nearly 10 percent, while non-insulin-dependent clients made smaller yet still significant improvements.

The simultaneous reduction in blood glucose and glycosylated hemoglobin levels suggests that the lower blood glucose levels had been maintained since completion of the course, whereas an isolated improvement in blood glucose might simply indicate a temporary improvement in diet in preparation for retesting.

Discussion

This study demonstrated that 3 months after clients with diabetes had completed an outpatient diabetes education program, they showed significant improvements in

knowledge, skills, attitudes, and satisfaction with control of their disorder. Despite the substantial gains documented by test scores, evaluations based only on such scores may be of limited validity for several reasons:

1. Clients may improve their scores on retest simply because of familiarity with the questions. Similarly, reporting error may invalidate outcome measures of attitude, health behavior, and satisfaction with control if the program graduates learn the "correct" responses to these questions.
2. Observer bias may enter into the scoring process whenever the tester is invested in the teaching process, as was the case here.
3. Self-selection bias may have been involved because 43 participants failed to complete the written followup examinations.

On the other hand, the clinical outcome measures chosen for this study should have been less affected by retesting, observer bias, and reporting error. Clients in this program experienced a significant decline in their mean glycosylated hemoglobin fraction when tested 3 months after the education program. One cannot conclude from this evaluation, however, that the observed improvements in knowledge, skills, or attitude scores directly caused improvements in blood glucose or glycosylated hemoglobin levels at followup. It might be argued that attendance at MODEP and better clinical control are both the result of superior motivation in a selected group of people with diabetes. A randomized clinical trial might remove the confounding effect of such motivation, and such a trial, although difficult to perform with this type of intervention, might eventually settle this issue.

An alternative explanation for the study results, although a less likely one, would be that the pretest laboratory results, which were reported back to the clients' physicians, motivated the physicians to tighten diabetic control measures. However, at followup only 12 percent of MODEP participants reported a change in their mode of management. Furthermore, even if a heightened awareness of diabetes, resulting from MODEP, caused physicians to attempt more rigorous control in their diabetic program, one might still suggest that MODEP changed its participants in some way conducive to better diabetic control, although the exact mechanism of that change is uncertain.

This evaluation of an independent education program may be put in some perspective when compared with the evaluation of insulin infusion pump therapy. A large study by Mecklenburg and associates (*21*) followed a highly motivated group of insulin-dependent patients without a control group and reported a mean decline of 20 percent in their glycosylated hemoglobin following an average of 5 months of infusion pump therapy combined with home monitoring and intensive education and support efforts. The insulin-dependent clients in the MODEP population experienced a 10 percent decline in glycosylated hemoglobin 3 months after education. Therefore, if one is willing to claim, despite the lack of appropriate controls, that both interventions were successful, it appears that half of the impact of an insulin pump program might be achieved in an outpatient population by education programs such as the one described here. Education plus home blood glucose monitoring might have even better results.

Judging from the 88 percent of clients in this study who reported no previous formal education about diabetes and the limited availability of such programs in general, outpatient diabetes education must be considered a seldom-utilized clinical strategy. However, its ability to improve patients' skills in self-management and thus enhance their sense of control over a chronic disorder is reason enough to recommend its wider use where available. This early followup study suggests that outpatient education's ability to generate real improvements in clinical control, at low cost, for at least a portion of the population with diabetes should justify making such education available to other communities through the sponsorship of third-party payers as an integral part of diabetes management.

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Fighting Smallpox on the Texas Border: an Episode from PHS's Proud Past

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Synopsis

The motto of the Public Health Service (PHS) is "Service with Distinction." An example of how that motto was earned can be seen in the work of the professionals of the Marine Hospital Service (as PHS was then known) in a smallpox epidemic on the Texas border in 1895.

Barely 2 years after Congress had given the U.S. Surgeon General the authority to intervene and prevent the spread of contagious diseases from one State to another, Surgeon General Walter Wyman, MD, stepped in. In response to a request from the Texas State Health Officer, Wyman sent a team of officers to assist the State and prevent the spread of smallpox. At that time the Surgeon General was head of the Marine Hospital Service, which became the Public Health Service in 1912.

In a period of slightly more than 2 months, the epidemic was contained in the population of 411 refugees. Sixty people had died at the camp, 51 from smallpox. Although that fatality rate would be incredibly high by current standards, it was low under the circumstances.

Milton Rosenau, MD, was a key to the containment of the disease and the humanitarian treatment of the survivors, a group of black Americans who had fled from Mexico after having been lured there with the promise of land that would be their own. Rosenau would later become the head of the Hygienic Laboratory, precursor of the National Institutes of Health.

THE U.S. PUBLIC HEALTH SERVICE was vastly different at the turn of the century from what it is today. In fact, it had a different name in the late 1800s—the U.S. Marine Hospital Service. In 1902 it became the U.S. Public Health and Marine Hospital Service, and in 1912 the agency received its present name (*1*). But, even in the late 1800s, the service had many responsibilities other than the treatment and care of sick and disabled seamen,