AS AMERICA AGES and as new advances in life-prolonging medical treatment occur, the medical profession is preparing itself for an increasing number of elderly and chronically ill patients. One element of that preparation has been the development of new programs of postgraduate and continuing medical education (PG and CME). National centers have been funded by the National Institutes of Health for the stated purpose of increasing the number of health care professionals skilled in the management of chronic diseases. While the necessity for a knowledge base and a repertoire of clinical skills cannot be denied, the unfortunate truth is that research on PG and CME indicates that knowledge and skills alone are not sufficient to produce better medical practice and patient outcomes.

Sanazzaro observed that additional essential factors in the translation of competence into practice are a conducive professional environment, detailed specification of expected practice changes with feedback, active intervention in the clinical setting, and adequate support personnel to facilitate practice changes.

The Diabetes Education Study was a controlled trial of the effects of physician and patient education. This article describes an educational program for internal medicine residents and its effects on ambulatory diabetes management practices. Forty-five of 86 residents practicing in the general medicine clinic of a university-affiliated city-county hospital were assigned randomly to receive a multifacted program intended to 1) provide specific care recommendations, 2) teach necessary skills, and 3) make the professional and institutional environment more supportive. During the subsequent 11 months, 323 diabetic patients were interviewed and their records audited for evidence of changes in care. Experimental residents utilized fasting blood glucose determinations more often than controls (i.e., during 40% of visits vs. 31%, \( p = 0.004 \)). Experimental residents also engaged more frequently in a variety of recommended dietary management recommendations. Isolated differences in monitoring/management of chronic complications also were found (e.g., lipid screening: 70% of experimental residents’ patients vs. 58%, \( p = 0.016 \)). Intensive, multifacted programs of this nature are concluded to result in improvements in diabetes care, over and above which is attainable through routine methods of clinical training for residents.

The Diabetes Education Study (DIABEDS) was a randomized, controlled trial of physician and patient education conducted by the Indiana University Diabetes Research and Training Center (DRTC). The goals of the project were to develop a state-of-the-art program of physician education concerning management of a prototypic chronic disease (i.e., diabetes mellitus) and to evaluate the effects of that intervention in conjunction with an independently manipulated program of systematic patient education. The purpose of this article is to describe DIABEDS education for physicians and its capacity to alter physician behavior. The specific hypotheses tested were:

- Physicians receiving an intensive educational program on the ambulatory management of diabetes mellitus would be more likely than their control group peers to:
  1) monitor the metabolic control of diabetes patients appropriately;
  2) follow program recommendations for dietary and pharmaceutical management of diabetes; and
  3) monitor and manage the chronic complications of diabetes.
Whereas the purpose of this article is to describe the DIABEDS program for physicians and its effects on clinical practice, only necessary attention will be directed to the independently manipulated patient education program and the effects of patient and/or physician education on physiologic markers of metabolic control. The reader is referred to earlier articles on these topics.

**METHODS**

**Clinical Setting**

The Diabetes Education Study was conducted in the General Medicine Clinic (GMC) of the Regenstrief Health Center at the Indiana University Medical Center. The GMC schedule consisted of nine weekly half-day sessions. During each session, three teams of health care providers operated concurrently. Each team consisted of three or four residents (at different postgraduate levels), a nurse practitioner, a registered nurse, and a senior staff physician from the Division of General Internal Medicine. New interns and residents are assigned individually at random to open positions in the GMC schedule every July. Each resident becomes responsible for the same half-day throughout his or her tenure. A new resident "inherits" the patient cohort of his or her predecessor and sees new patients, who are themselves assigned at random to physicians in the GMC system. The average patient load is about 75 patients—about 20% of whom have diabetes mellitus.

A noteworthy feature of the GMC is its computerized medical record system. All clinic data concerning diagnoses, appointments, laboratory values, prescriptions and much of patients' history and physical data are stored on a Digital Equipment Corporation VAX 11/780 computer and associated disk-drive memory. The Regenstrief Medical Record System (RMRS) prints out patient records in the format of a time-oriented spread sheet for use during clinic appointments. Encounter forms in the GMC also serve as data entry forms for the RMRS.

**Subjects**

Physician-subjects in DIABEDS were the 86 members of the Internal Medicine Residency Program at the Indiana University School of Medicine during the 1981–1982 academic year. Thirty-eight were interns (postgraduate level 1 residents). The remainder were in their second and third years of residency (26 and 22, respectively).

Patient-subjects in DIABEDS were recruited from the diabetic patient population cared for by these internal medicine residents. Criteria for inclusion in the study were that: 1) the clinic record contain either two fasting blood glucose (FBG) values in excess of 130 mg/dl (7.2 mmol/L), one FBG greater than 150 mg/dl (8.3 mmol/L), or a two-hour postprandial blood glucose value greater than 250 mg/dl (13.9 mmol/L); 2) the patient be able to perform at least two basic self-care tasks (i.e., insulin administration, urine glucose and ketone testing, food selection); 3) absence of concurrent psychiatric or terminal illness; and 4) informed patient consent after an explanation of the nature of the study.

From a total diabetic population of approximately 1,800, 994 patients were found to be assigned to residents and were contacted in the clinic over a 29-month recruitment period (August 1978–December 1980). Seven hundred twenty-eight patients (73%) agreed to participate (i.e., signed informed consent). Five hundred thirty-two patients entered the research protocol by virtue of submitting to an eight-hour baseline evaluation conducted by the DRTC. A complete physiologic description of this sample is presented elsewhere. Briefly, median age in the sample was 58.1 years. Seventy-nine percent were female and 72% were black. Median duration of diabetes was 6.3 years. By independent DRTC assessment, 95% of the sample were determined to have non-insulin-dependent diabetes mellitus (NIDDM) as evidenced by elevated postprandial C-peptide levels. Mean fasting blood glucose (FBG) (± SD) was 217 ± 92 mg/dl (12.0 mmol/L). Mean glycosylated hemoglobin (HbA1) was 10.7 ± 3.1%; average ideal body weight percentage was 142 ± 31%.

While 532 subjects entered the study over the 29-month recruitment period, 323 remained active in the GMC during the academic years just prior to (1980–81) and after (1981–82) the initiation of DIABEDS physician education. This subsample of patients is the source of the data that were used to evaluate the physician education program. The subsample of active GMC patients did not differ from the 209 clinic dropouts with regard to duration of diabetes, gender, race, FBG, HbA1, and body weight. Active GMC patients were slightly older than dropouts (58.2 vs. 56.0 years old, p < 0.10). Dropout rates in the experimental and control groups (38% and 41%, respectively) were not significantly different from one another.

The subsample of 323 active patients made 828 total (424, experimental; 404, control) visits to the GMC in the academic year following the education program. Face-to-face exit interviews with patients occurred during 673 clinic visits (82% of all visits). Depending on the behavior in question, this database represents 7.9 to 9.6 average observations per physician during visits made by 3.8 ± 1.9 patients.