AHRQ

RESEARCH IN ACTION

Improving Care for Diabetes Patients Through Intensive Therapy and a Team Approach

Introduction

Diabetes, the sixth leading cause of death in the United States, is a chronic disease characterized by persistent hyperglycemia (high blood glucose levels). Left untreated, diabetes can cause serious complications affecting the circulatory and nervous systems, kidneys, eyes, and feet.

Even though the proper treatment of diabetes can be complex, biomedical research has demonstrated in model settings what can be achieved clinically. Therefore, health services research funded by the Agency for Healthcare Research and Quality (AHRQ) has built on such results to learn more about what can be achieved when treating diabetic patients in a typical office practice. However, there are limits beyond which the data from biomedical trials cannot be extrapolated to the typical office practice because of differences between sample populations selected for such trials and the general patient population. This synthesis provides good evidence to show that intensive therapy using a team approach is an effective way to reach the major goals of diabetes therapy: lowering glucose (blood sugar) to appropriate levels and avoiding or postponing the onset of serious complications.

The following discussion is intended to provide health care professionals with information they can use in their practices to assist them in providing better care and helping their patients to become better self-managers.

Background

An increasing number of Americans have diabetes—approximately 16 million as of 1999—and diabetes costs society close to $100 billion per year in medical and nonmedical costs. In 2001, almost 800,000 people will be diagnosed with the disease and close to 200,000 will die from its complications. Furthermore, the burden of diabetes is considerably higher for the elderly and minorities than the general population.[1]

In a healthy person, blood sugar levels, which fluctuate based on food intake, exercise, and other factors, are kept within an acceptable range by insulin. Insulin, a hormone produced by the pancreas, helps the body absorb excess sugar from the bloodstream. In a person with diabetes, blood sugar levels are not adequately controlled by insulin. Physicians monitor glycemic levels by using the hemoglobin (Hb) A_{1c} test, which shows the average amount of sugar in the blood over the preceding 3 months. In

Summary

- A study of over 8,000 patients with type 2 diabetes found that, 2 years after the initiation of insulin, more than 60 percent of the patients still had blood sugar levels of over 8 percent (HbA_{1c}).

- A survey of providers found that there are many barriers to achieving treatment goals, including the frequently asymptomatic character of diabetes, the involvement of many body systems, and difficulties in altering lifestyle.

- Another study found that, after 12 months, 87 percent of patients (80 percent with type 2 diabetes) achieved good control of blood sugar (8 percent or less HbA_{1c}) by the use of complex treatment regimens and a team approach, with many patients receiving either two oral hypoglycemics or one oral hypoglycemic plus insulin injections.

- Patients can achieve good diabetic control if providers recommend intensive therapies, use a team approach, furnish appropriate preventive care, and put into practice proven strategies that help patients better manage their care.

healthy persons, glycemic values as measured by HbA_{1c} levels are in the 4-6 percent range, according to the American Diabetes Association (ADA).[a] The ADA guideline for diabetic patients is <7 percent.[2] There are two major types of diabetes.[b] Type 1 is an autoimmune disease in which the ability of the pancreas to make insulin has been destroyed. Type 1 diabetes usually develops in children or adults under age 30, but it can occur in older individuals. In type 2 diabetes, the pancreas produces some insulin, sometimes even large amounts; however, either the pancreas does not produce enough insulin or the body's cells are resistant to the action of insulin. Between 90 and 95 percent of diabetes patients have type 2 diabetes, which mostly affects adults over age 40. The incidence of this type of diabetes is rising rapidly; increasingly type 2 diabetes is appearing in patients in their 30s and younger.[3,4]

Providers say that diabetes is a difficult disease to treat because—

- It is closely related to patient behaviors that require complex interventions and persistent efforts to change (sedentary lifestyle, poor diet, and obesity).

- Patients may have the disease for years without knowing it, and even after diagnosis may remain asymptomatic, with the result that they are less motivated to make needed lifestyle changes.

- Patients need to actively manage the disease through diet, exercise, self-monitoring, and medicating, even in the absence of symptoms.

- Providers may need to coordinate interventions with different specialists.

Providers evaluate a patient's blood sugar levels both by glucose measurements and by the HbA_{1c} test. In contrast, the patient's self-monitoring of blood glucose shows the level of blood sugar only at the time of measurement.

Biomedical research shows positive outcomes under ideal conditions

Until the last decade, there was some controversy in the medical community regarding the relationship between

[a]The percentages for normal values may vary somewhat, depending on the authority being cited.

[b]There are also two other types of diabetes: "gestational diabetes," which affects pregnant women, and "other specific types," resulting from specific genetic syndromes, surgery, drugs, malnutrition, infections, and other illnesses.

careful control of blood sugar and delaying or preventing complications such as eye and kidney disease and vascular complications for people with diabetes. However, the United Kingdom Prospective Diabetes Study (UKPDS) for type 2 diabetes and, in the United States, the Diabetes Control and Complications Trial (DCCT) for type 1 diabetes have demonstrated that any reduction in blood sugar (as measured by HbA_{1c}) is likely to reduce the risk of complications.[5,6] These long-term trials, conducted under closely supervised clinical conditions and using newly diagnosed volunteer subjects, found that intensive therapy could achieve effective glycemic control and postponement of major complications over a period of many years.

In the UKPDS, 5,000 newly diagnosed type 2 diabetes patients first attended several sessions of dietary education given by physicians and dietitians and were treated with diet therapy for 3 months before receiving other treatment.[7,8] They were then randomly assigned to four groups. Each of the three "intensive therapy" groups received a single medication (chlorpropamide, glyburide, or insulin); the fourth group, a control group, received a special diet only. However, the single medication therapy in the intensive therapy groups failed to achieve tight glycemic control, making it necessary to institute combination drug therapy (using insulin or metformin along with one of the other two drugs).

Median HbA_{1c} levels over a 10-year period were 7.0 percent for the intensive therapy groups compared with 7.9 percent for those receiving conventional treatment. Additionally, complication rates were significantly lower for the intensive therapy groups compared to the conventional therapy group—33 percent lower for end stage renal disease and 17 percent lower for retinopathy.

In the DCCT, 1,441 type 1 diabetes patients were assigned to one of two groups.[6] The first group received intensive insulin therapy, either by external insulin pump or by receiving three or more daily insulin injections. The second (control) group received conventional therapy (one or two daily insulin injections). Patients in the first group monitored their blood sugar four times each day and, when necessary, made daily adjustments to their dosage levels. As part of their therapy, they made monthly visits to a health care team composed of a physician, nurse educator, dietitian, and behavioral therapist. Each patient was given a diet and exercise plan and was contacted weekly by a member of the team to review and adjust the treatment

regimen. Patients in the control group did daily self-monitoring of urine or blood but did not usually make daily adjustments to their dosage levels. These patients also received education about diet and exercise but were seen only every 3 months. Over a period of 6.5 years, the intensive therapy group had average HbA_{1c} levels (at 7.2 percent) and rates of diabetic complications significantly lower than the control group.[c]

A third study found that patients not only avoid complications, but also feel better, even over the short term, when their glucose levels are closer to normal. In this study by Harvard University researchers, patients received intensive drug therapy over a 12-week period. During the study period, patients were closely monitored at nine different times using clinical and laboratory evaluations. The patients received glipizide (an oral medication) in

[c] The mean value for all glucose profiles was 155 + 30 mg per deciliter in the intensive therapy group vs. 231 + 55 mg per deciliter in the control group. For the intensive therapy group, the rate of complications was 76 percent lower for the onset of retinopathy, 54 percent lower for albuminuria, and 60 percent lower for the appearance of neuropathy.

doses that were adjusted upward during the first part of the study in order to achieve appropriate glycemic control. The Harvard study found that the patients with mild to moderate type 2 diabetes receiving glipizide plus diet modification, when compared to a control group receiving a placebo plus diet modification, had better glycemic control (7.5 percent vs. 9.3 percent HbA_{1c}) and enjoyed substantial short-term symptomatic and quality of life (QOL) benefits.[9] Patients showed significant improvement on four of five QOL scales (symptom distress, general perceived health, cognitive functioning, overall visual acuity scale). On the fifth scale, mental and emotional health, there were no statistically significant changes.

Health services research studies show varied success in controlling blood sugar

Studies funded by AHRQ have used more broadly representative groups of patients with diabetes than either the DCCT or the UKPDS. The median patient age in the largest AHRQ study was 65, compared to a median age of

AHRQ-Funded Research on Diabetes Care

- *Variations in the Management and Outcomes of Diabetes*, 1990-97. New England Medical Center. Measured the effectiveness of existing clinical care in controlling blood sugar and avoiding or postponing complications. Showed that help from family members increases elderly diabetics' adherence to treatment and dietary regimens.

- *Center for Medical Treatment Effectiveness Programs*, 1997-98. Case Western Reserve University Henry Ford Health System. Developed, evaluated, and implemented culturally appropriate partnerships among patients, health care providers, and the community. Showed that social support increases African-American diabetic patients' adherence to treatment and dietary regimens.

- *Mexican-American Treatment Research Center*, 1992-98. University of Texas Health Sciences Center. Studied the effectiveness of existing treatments for chronic disabling conditions in Mexican Americans. Identified the existence of substantial barriers for both providers and patients in implementing accepted treatment guidelines.

- *Improving Primary Care of African-Americans with NIDDM*, 1998-2002. Emory University. Evaluates provider support strategies for the management of non-insulin-dependent diabetes mellitus (NIDDM). Identified barriers to provider adherence to management goals. Showed how an intensive approach to therapy (including patients taking more than one medication, a team of providers, and more frequent interactions between patients and clinicians) achieved therapeutic success.

- *Automated Assessments and the Quality of Diabetes Care*, 1999-2003. Palo Alto Institute for Research and Education. Evaluates whether innovations in information technology can increase patient/provider interactions and assist patients in self-management. Will examine variation in outcomes for patients with diabetes by using an automated telephone disease-management system to assess patients weekly for 1 year.

Important Facts About Diabetes

Persons Affected

- 15.7 million people (5.9 percent of the U.S. population)
- 6.3 million (18.4 percent) of the elderly (65 and over)
- 8.2 percent of people 20 and over
- 10.8 percent of non-Hispanic blacks, 10.6 percent of Mexican-Americans, and 9.0 percent of American Indians
- From 1990 to 1998, diabetes increased by 70 percent for people ages 30 to 39, by 40 percent for people ages 40 to 49, and by 31 percent for people ages 50 to 59.

Human Costs

- 798,000 new cases diagnosed per year
- 193,000 deaths (1996)
- 12,000 to 24,000 new cases of blindness each year due to diabetic retinopathy
- 27,000 cases of end stage renal disease (1995)
- 67,000 amputations per year (1993-95)

Financial Costs

- $98.2 billion per year:

    $44.1 billion in medical costs

    $54.1 billion in indirect costs (work loss, disability, and premature death)

Sources: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Disorders. Diabetes Statistics of the United States, Nov. 1, 1998; Centers for Disease Control and Prevention Web site: < cdc.gov/diabetes/pubs/facts98.htm>; American Diabetes Association. Direct and Indirect Costs of Diabetes: <diabetes.org/>; Mokdad AH, Ford ES, Bowman BA, et al. Diabetes trends in the U.S.: 1990-1998, Diabetes Care 2001; 23(9):1278-83.

53 in the UKPDS; older patients are more likely to have other comorbidities or complications from diabetes. These AHRQ-funded studies have shown that providers and patients may achieve only partial success in bringing blood sugar levels down to recommended levels and performing recommended examinations. For example, three AHRQ-funded studies evaluating diabetes care found that glycemic control was achieved for no more than 50 percent of the patients. They are summarized in Table 1.

The largest study examined what happened to the blood sugar levels of a large group of diabetic patients after primary care physicians started to treat them with insulin.[10] Most of these patients had previously been taking oral hypoglycemic medications. After 2 years, more than 60 percent of the patients in the study still had blood sugar levels of over 8 percent (HbA$_{1c}$).

A second AHRQ-funded study evaluated internal medicine residents' treatment of African-American diabetic patients in a hospital ambulatory care setting.[11] This study found that 51 percent of patients on oral medications and 47 percent of patients on insulin did not reach the recommended treatment goal for the study (an HbA$_{1c}$ level of less than 8 percent). It also found that on five tests recommended by the American Diabetes Association (dilated eye exam, lipid exam, home glucose monitoring, foot exam, and urine protein screen), practice levels fell short of national standards.

The third AHRQ-funded study looked at the outcomes of 170 mild to moderately ill diabetic patients treated by endocrinologists, family practitioners, and general internists.[12] In general, after 2 years of treatment, researchers found no meaningful differences in HbA$_{1c}$ levels or other health outcomes between patients of endocrinologists and patients of family practitioners and general internists. It is unclear whether similar results would occur if severely ill patients were studied.

Table 1. Physician specialty and glycemic control: Summary findings

Study	Subjects	Physician specialty	Glycemic levels
Hayward RA, Manning WG, Kaplan SH, et al. Starting insulin therapy in patients with type 2 diabetes. JAMA 1997; 278(20):1663-9	8,868 type 2 diabetics	Generalist physicians	2 years after initiation of insulin: • Over 60 percent of patients were >8 percent
Bernard AM, Anderson L, Cook CB, et al. What do internal medicine residents need to enhance their diabetes care? Diabetes Care 1999; 22(5): 661-6	140 diabetics (31 type 1, 109 type 2)	Internal medicine residents	After 12 months: • 50 percent of patients were >8 percent
Greenfield S, Rogers W, Mangotich M, et al. Outcomes of patients with hypertension and non-insulin-dependent diabetes mellitus treated by different systems and specialties. Results from the Medical Outcomes Study. JAMA 1995; 274(18):1436-44	170 type 2 diabetics	General internists ………… Family physicians ………… Endocrinologists ……………	After 2 years, all patients averaged: 9.7 percent 9.3 percent 9.3 percent

Note: According to the American Diabetes Association, an HbA_{1c} value of 4-6 percent is considered normal. This value is an approximation and may vary depending upon expert opinion.

Providers and patients experience barriers to meeting treatment goals

Both providers and patients encounter many barriers that prevent them from achieving established treatment goals. AHRQ has funded studies to understand the barriers that physicians cite for difficulties in achieving therapeutic goals. These barriers, summarized in Table 2, frequently were related to the complexity of the patients' condition and the difficulties in ensuring patient adherence, and they may have additional implications.[13,14] For example, when diabetic complications begin to affect different body systems and a variety of specialists become involved in treating the disease, primary care providers may find it difficult to ensure that treatment protocols are followed.

Underscoring provider perceptions of patient barriers to care, an AHRQ-funded study looking at how diabetic patients respond to physician recommendations found that patients were much less likely to follow recommendations about diet (69 percent) and exercise (19 percent) than they were to follow medication regimens (91 percent).[15] The

Table 2. Summary of barriers to treatment goals

Physican barriers:
- Diabetes affects many body systems
- Controversies about proper diagnosis and treatment
- Uncertainty of prognosis
- Lack of time
- Clinical inertia

Patient barriers:
- The frequently asymptomatic character of diabetes (removing an important incentive for self-care)
- Necessity of daily patient interventions
- Need to alter lifestyle (primarily diet and exercise patterns)
- Acute illness
- Hypoglycemia due to treatment
- Patient refusal to follow provider recommendations
- Lack of patient educational materials

Sources: Larme AC, Pugh JA. Attitudes of primary care providers toward diabetes. Barriers to guideline implementation. Diabetes Care 1998; 21(9):1391-6; El-Kebbi IM, Ziemer DC, Gallina, DI, et al. Diabetes in urban African-Americans. XV. Identification of barriers to provider adherence to management protocols. Diabetes Care 1999; 22(10):1617-20.

Table 3. Components of intensive therapy and a team approach in treatment of diabetes

- More frequent use of 2 oral medications (a hypoglycemic and an antihyperglycemic) or 1 oral medication plus insulin
- Greater likelihood of 3 or more daily injections for insulin recipients
- 4 or more visits per year for many patients
- Visits with both physicians and nurse practitioners alternating with visits with a nurse practitioner
- Direct telephone availability of nurse practitioners
- Dietitian visits with patients
- Screening for complications
- Self-monitoring

Source: Adapted from Miller CD, Phillips LS, Tate MK, et al. Meeting American Diabetes Association guidelines in endocrinologist practice. Diabetes Care 2000; 23(4):444-8.

researchers suggested that the reasons for poor adherence to lifestyle recommendations could include public awareness of controversy over the validity of recommendations, belief that physicians can sometimes be wrong, belief that physician instructions can be ignored, and the difficulty of incorporating new behavior into their daily lives.

## Combination of intensive therapy and team approach promotes good outcomes

Even though the treatment of diabetes is complex and major barriers to achieving good outcomes exist, AHRQ-funded research has shown that glycemic control can be achieved and complications of diabetes postponed through a combination of intensive drug therapy and a team approach. (See Table 3.) In a retrospective study, academic endocrinologists in Atlanta examined the clinical records of 151 diabetes patients (121 with type 2 diabetes and 30 with type 1) in their own practice.[16] Most of these patients had complications as a result of their diabetes, including peripheral neuropathy (78 percent), retinopathy (22 percent), hypertension (80 percent), hyperlipidemia (64 percent), coronary heart disease (27 percent), and peripheral vascular disease (14 percent)–not unusual for patients who had had diabetes, on average, for 12 years. Investigators found that half the patients made at least four visits during the study year. Patients alternated between visits that included both a physician and a nurse practitioner and visits with a nurse practitioner alone. Nurse practitioners, who were also directly available at other times

for phone contact, were able to facilitate more frequent adjustment of therapy when necessary. The average HbA_{1c} of patients with type 2 diabetes was 6.9 percent; 87 percent achieved good control of blood sugar (8 percent or less HbA_{1c}) by the use of complex treatment regimens, 78 percent were managed with more than diet alone or a single oral agent, and many patients received either two oral hypoglycemics or one oral hypoglycemic plus insulin injections. The average HbA_{1c} of patients with type 1 diabetes was 7.1 percent; 80 percent achieved good control of blood sugar with an average of 3.4 injections of insulin per day. (See Figure 1.) In addition, screenings were performed at recommended intervals for major complications, including eye and foot problems, high lipid levels, and hypertension.

The Atlanta researchers reviewed several earlier studies that focused mostly on patients in primary care settings and found that significant percentages of patients had HbA_{1c} levels above 8 percent.[17,18] When comparing their own study to one of these earlier studies,[19] the AHRQ-funded Atlanta team found that patients in their study were more likely than those in the earlier study[d] to be using oral hypoglycemic medications plus insulin (31 percent vs. 3 percent). Also, the Atlanta patients taking insulin were more likely to be injecting three or more times per day (42 percent vs. 4 percent).

[d]This study was based on persons with diabetes in the Third National Health and Nutrition Examination Survey (NHANES III). In this study, participants who received either oral hypoglycemics or insulin had average HbA_{1c} levels of 8.0 percent of above.

Figure 1. Glycemic values for patients in the Atlanta study by type of diabetes
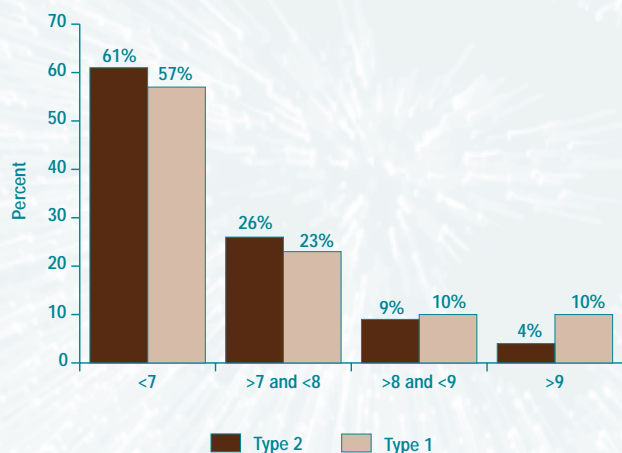
The Atlanta researchers stated that "the discrepancies between our data and those of primary care studies (showing less success in achieving glycemic control) may be because of factors other than the type of treating physician."[16] The following factors were mentioned by the researchers:

- The earlier primary care studies date from the early 1990s and may not reflect current practices.

- Patient motivation may have differed.

- A broader array of medications was available at the time of the Atlanta study.

- The ability to do rapid on-site HbA_{1c} measurements was available for the Atlanta physicians.

The researchers emphasized that "good glycemic outcomes are attributable to a commitment to achieving normal metabolic status that is reinforced through multiple contacts, including not only physician appointments but also nurse practitioner visits, dietitian visits, and telephone calls."[16]

In a study describing the results of diabetes therapy for type 2 patients in their own clinic, the Atlanta-based research team identified "clinical inertia" (not intensifying therapy when glycemic levels are high) as a barrier to care in a

small group of cases (40 visits, or 6 percent, out of 636 visits). This phenomenon occurred either because patients were not adhering to their meal plan or for no stated reason.[20] A related study, by the same researchers, found that clinical inertia could be reduced by the use of a step-sequence treatment intensification plan. The sequence of steps started with diet alone, advanced to the medications glyburide or glipizide, and then added insulin in varying strengths and frequencies of administration. The study, conducted from 1992 to 1996, found that when providers used this sequence of steps, the percentage of type 2 diabetes patients with good glycemic control (an HbA_{1c} of <7 percent) increased from under 40 percent to close to 60 percent over a 12-month period.[21] The researchers considered these results even more significant since they were achieved in an underserved minority population (urban African-Americans) that tends to have poor rates of glycemic control and high rates of diabetic complications. As part of the study, the researchers emphasized to providers that patients were to remain in a given treatment category only if their glycemic control was good.

Preventive care can help to postpone or avoid complications

Diabetes can lead to partial or total blindness as a result of proliferative retinopathy, a complication that occurs when new blood vessels that grow to replace older defective ones leak blood into the retina. Blindness can also result from macular edema, a complication that occurs when blood vessels in the eye balloon and malfunction, leading to a swelling of the retina.

In order for vision-related complications to be treated promptly, the American Diabetes Association recommends that diabetic patients have comprehensive periodic dilated eye and vision examinations by an ophthalmologist or optometrist.[2] An AHRQ-funded study reinforces these recommendations. Researchers, using a computer model, estimated that screening and prompt treatment for eye disease in all appropriate patients with type 2 diabetes, by virtually eliminating severe vision loss for patients with proliferative diabetic retinopathy and macular edema, would preserve the sight of thousands of diabetic patients.[22] Nearly all of the benefits would come from the early detection and prompt treatment of macular edema in patients whose type 2 diabetes began before age 45.

Provider questionnaires improve adherence to treatment protocols

Other strategies oriented toward assisting the provider can help patients receive needed care. An AHRQ-funded study showed that one way in which providers increased their ability to follow protocols was through completing questionnaires that served as a self-survey about the appropriateness of glycemic goals and whether their patients were well controlled.[14] Both physicians and nurses were asked to fill out one-page multiple-choice questionnaires after each office visit over a 3-month period. In this study, conducted at a diabetes clinic treating African-American patients, adherence to protocols calling for intensification of therapy when indicated (e.g., putting patients previously treated by diet alone on medication or adding sulfonylurea medication to insulin) increased from 55 percent to 63 percent when providers completed a questionnaire after every patient visit.

This study is part of a series of ongoing AHRQ projects that will be providing further evidence about other interventions to assist providers in rendering effective care. Two interventions being tested include: (1) the use of computerized reminders and flow sheets to track blood sugar levels, performance of tests, and test results for each of a provider's diabetic patients and (2) face-to-face discussions between primary care providers and endocrinologists to review patient management.

Barriers to patient adherence can be reduced

As discussed earlier (Table 2), both providers and patients have identified barriers that prevent patients from following the advice given to them about their treatment. Research funded by AHRQ and others can assist providers in helping their patients to overcome some of these barriers. For example, studies have shown that social support networks help elderly patients and African-American adults to comply with certain recommended practices.[23,24] Also, automated telephone disease management (ATDM) with nurse followup has been found to be a successful strategy for helping diabetic patients manage their care.[25] ATDM increased the number of patients who achieved glycemic control and avoided diabetic symptoms. In addition, a new program aimed at primary prevention in minority children at risk for developing diabetes has shown promise in one study.[26] Finally, a chronic disease self-management

program developed for chronic conditions other than diabetes and now being used in a number of diabetes clinics around the country may yield positive results for diabetic patients.[27]

Social support assists vulnerable populations in improving adherence

An AHRQ-funded study of family members of persons with diabetes age 70 and over found that more than one-third went with older diabetics on their doctor visits. In addition, 22-50 percent of family members reported helping with various aspects of diabetes care, with the top two categories being "keeping enough medication on hand" and "following a diet."[23] Such participation, as well as help with the daily management of diet and medications, was more likely if the patients were functionally disabled. Researchers found that those patients who received more family assistance were more likely both to take their medications as prescribed and to follow their diets.

Another AHRQ-funded study, a literature review of studies reporting on the effects of social support among African-American adults with diabetes, found that African-Americans relied more heavily than whites on informal social networks to meet their disease management needs.[24] The social support consisted of help with the day-to-day management of diabetes, including:

- Help with diet supervision.
- Medication assistance.
- General support.
- Blood sugar monitoring.
- Foot care.

In findings that parallel the study on social support and the elderly,[23] the review found that social support is significantly associated with improved diabetes management among this population.

Automated telephone disease management (ATDM) improves patient outcomes

An AHRQ-funded literature review of studies on the effects of interactive voice response systems in the diagnosis and management of chronic disease found that these systems can positively affect health and health behavior outcomes.[25] In a randomized controlled trial, 272 diabetic patients in the Department of Veterans Affairs (VA) health system received

biweekly calls from an automated telephone-messaging computer that enabled patients to provide a recorded assessment of their health status and health behaviors in 5-8 minutes. Patients used their phone's touch-tone keypad to report self-monitored blood glucose readings and various symptoms. Based on the automated assessment reports, a nurse made followup calls to address reported problems. The patients who received ATDM calls with nurse telephone followup had better glycemic control and self-care along with fewer diabetic symptoms than patients who did not receive these calls.[28] After a 12-month trial period, among patients with HbA_{1c} values above 9 percent, the average values were 9.1 percent for those receiving ATDM calls and 10.2 percent for those who did not. The entire group receiving ATDM calls had HbA_{1c} levels at followup that were 0.3 percent lower than those of the control group (8.1 percent vs. 8.4 percent). The researchers estimated that if the reduction in glycemic values achieved in this study could be replicated throughout the VA system, the government could save $100 million each year. The results of this study replicated those from a previous ATDM trial conducted among English- and Spanish-speaking patients in county clinics. In that study, the investigators found that ATDM improved patients' glycemic control, symptoms, and self-care, and decreased depressive symptoms.[29]

Primary prevention can lower risk factors for Mexican-American children

To learn more about how to prevent diabetes from occurring in the Mexican-American population, AHRQ funded a pilot study of an intervention program for children at risk for type 2 diabetes.[26] The $3^1/_2$-month program had a threefold emphasis on understanding of diabetes, diet, and exercise and was designed to be culturally and age-appropriate for Mexican-American children. Thirty-seven at-risk children 7-12 years of age (those with at least one diabetic parent or grandparent) and their parents were enrolled in an eight-session educational program intended to inform them about diabetes and its complications and to teach the essentials of a healthy lifestyle. Health screenings for the children were given before and after the program. Post-program analysis of individual risk factors showed a trend toward more normal values. For example, the percentage of children whose consumption of protein, total fat, saturated fat, and cholesterol fell within the recommended daily requirement increased. Also, 94

percent of parents and 67 percent of children began reading food labels, 83 percent of parents began to use fat-modified recipes, and 83 percent of children began exercising regularly. Parental involvement also resulted in parents making progress toward adopting healthier lifestyles.

Chronic Disease Self-Management Program may improve adherence

The Chronic Disease Self-Management Program (CDSMP) is now being used by health organizations in 31 States and 9 countries (including diabetes treatment facilities).[27] The CDSMP could eventually have a significant impact on the health status and health care use of persons with diabetes. The program originated in an AHRQ-funded study that tested a 7-week community-based patient education program for people with heart disease, lung disease, stroke, and arthritis. A premise of the program is that many chronic diseases, such as diabetes, heart disease, lung disease, arthritis, and high blood pressure, pose similar problems in patient self-management. The CDSMP focuses on improving people's self-efficacy in taking care of their own health. In the initial 6-month followup, the study found positive results for self-reported health, disability, fatigue, and hospital use indicators.

The CDSMP consists of seven weekly $2^1/_2$-hour sessions (later changed to six weekly sessions) focusing on nutritional change, adoption of exercise programs, use of medications and community resources, health-related problem solving, and decision-making.[e] Preliminary followup studies (covering a 2-year period) indicate that participants have improved health, more energy, and fewer hospitalizations and doctor visits.

Research is currently underway to improve diabetes care

AHRQ is continuing its efforts to find the most effective means of treating diabetes and improving outcomes of care. Currently, AHRQ-funded researchers are testing new technologies to improve patient care, enhancing existing treatment modalities, making care more culturally sensitive, testing interventions to improve provider performance, delineating the impact of managed care on patients with

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[e]For sites using the program for diabetes and other conditions, see www.Stanford.edu/group/perc.

diabetic retinopathy, and tracing the indirect economic impact of diabetes. For example, AHRQ funds are being used to—

- Examine variation in outcomes for diabetic patients using an automated telephone disease management system and extend the use of ATDM to Spanish-speaking patients.

- Test the impact of a culturally sensitive multimedia computer education program in a clinical setting on diabetes-related knowledge, attitudes, self-efficacy (the belief that what you do makes a difference), and self-care for African-American and Latino populations.

- Measure the effects of increased self-monitoring of blood glucose on the cost, quality, and outcomes of diabetes care in patients enrolled in a managed care program.

- Test a more intensive collaborative approach to disease management vs. a more traditional approach in 40 midwestern community health centers serving a medically underserved population in rural and urban areas. The "collaborative" approach involves intensive, extended training of providers in total quality management as well as improvement of skills in provider-patient communication, as compared to the "traditional" approach of basic, brief training in total quality management.

- Test the effect of interpreters on diabetes outcomes for Navajo patients.

- Examine methods for helping physicians follow recommended treatment modalities.

- Study the organizational and financing arrangements in managed care and their effects on eye care for working-age patients with diabetic retinopathy.

- Identify the extent of the indirect costs of diabetes, as represented by reduced on-the-job productivity. (This is the first study to consider this type of productivity loss for diabetes.)

- Pilot-test methods for improving the treatment of low-income diabetic patients in community health centers

- Pilot-test methods for developing a claims-based quality measure for ambulatory diabetic care.

- Study how features of managed care affect outcomes of patients with diabetes and, in a related study, outcomes for patients with diabetic retinopathy.

Conclusion

AHRQ-funded research shows that patients can achieve good diabetic control if providers recommend intensive therapies, use a team approach, furnish appropriate preventive care, and put into practice proven strategies that help patients better manage their care. Few patients have type 2 diabetes without other diagnoses.[33] Generalists, in treating multiple chronic illnesses in a single patient, may balance glycemic control with other interventions in order to achieve a treatment plan responsive to the most pressing needs of the patient. The barriers to implementing these methods and strategies are challenging, but improvements in patient outcomes are both important and achievable. In addition, new technologies for assisting the patient in self-management show considerable promise. An example is customized modules for personal digital assistants (electronic handheld appliances known as PDAs) for

managing diet and exercise. The results of these studies have set the stage for dramatic improvements needed to improve care and outcomes for all patients with diabetes.

For more information

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