State of Diabetes Care in the United States

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Abstract

As of 2005, it was estimated that 7% of the US population, approximately 21 million people, have diabetes. The major concern with diabetes is long-term complications, which are responsible for increased rates of morbidity and mortality.

Studies have shown that lower glycosylated hemoglobin reduces the microvascular and macrovascular complications associated with diabetes. To achieve this goal, the American Diabetes Association provides treatment goals to aggressively control diabetes to improve outcomes and decrease morbidity and mortality.

Although studies have proved the beneficial effects of currently used agents, there are still various concerns, including weight gain, high risk of hypoglycemia, poor postprandial control, and failure to maintain long-term glycemic control. With the advent of new incretin-related therapies, some of these concerns may be addressed. Diabetes is of growing concern, and better knowledge of treatment options and goals should be a priority for all healthcare professionals.

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In the United States, diabetes now affects an estimated 20.8 million people (7% of the population). The prevalence increases with age; 20.9% of individuals 60 years or older have diabetes, compared with 10.6% of individuals 40 to 59 years of age. Hispanics and non-Hispanic blacks are almost twice as likely to develop diabetes as non-Hispanic whites. Other ethnic subgroups, including Asians and certain American Indian tribes, are also at high risk for diabetes.[1] Obesity is an important risk factor in the development of type 2 diabetes. The incidence of diagnosed diabetes rose 41% between 1997 and 2003, and obesity is believed to be a major factor in this increase.[2]

Counteracting the diabetes epidemic will take a concerted, multifaceted approach. In this article, we discuss the current state of diabetes in the United States, guidelines and performance measures for diabetes care, new technologies and therapies to expand management options, and ways to improve diabetes care by modifying pharmacy benefit plans. Some combination of these approaches will hopefully allow better diabetes management, leading to improved outcomes and a reduced burden of disease.

Consequences and Costs of Diabetes

Elevated glucose levels and, often, associated increases in blood pressure and dyslipidemia lead to long-term complications, including cardiovascular disease, diabetic retinopathy, kidney disease, and nervous system damage.[1,3,4] These complications are largely responsible for the increased morbidity and mortality in patients with diabetes. As of 2002, diabetes was the sixth leading cause of death listed on US death certificates. This number is likely to underestimate the true effects of this disease, because diabetes-related deaths are frequently attributed to other causes. The risk for death in persons with diabetes is approximately twice as high as that in individuals who do not have diabetes.[1]

The economic costs of diabetes are also high. Institutional care and indirect costs, including lost work days, permanent disability, and early mortality, are the largest contributors to these expenses (**Figure 1**).[5] Overall, individuals with diabetes have medical expenditures that are approximately 2.4 times that of people without diabetes after adjusting for age, sex, and ethnicity.[4]

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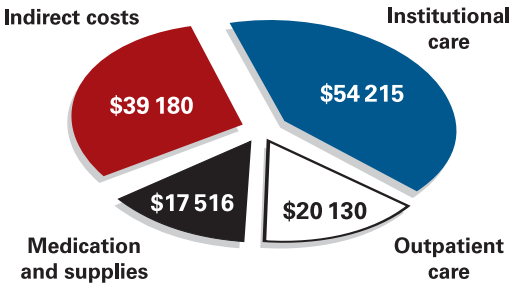
Benefits of Glycemic Control

Strict glycemic control has been shown to reduce both microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular (myocardial infarction [MI] and stroke) complications of diabetes. The Diabetes Control and Complications Trial (DCCT) provided initial proof of glycemic control benefit in patients with type 1 diabetes in 1993. In this study, intensive insulin therapy significantly reduced the risk of developing microvascular complications compared with conventional insulin therapy.[4] These observations were soon extended to patients with type 2 diabetes in a study reported by Ohkubo and colleagues in 1995.[6] In this analysis of the effects of intensive insulin therapy in Japanese patients with type 2 diabetes, the risk of worsening retinopathy or nephropathy was reduced by about 70%. Reduction in the number of complications was also observed in the United Kingdom Prospective Diabetes Study (UKPDS), which reported a 25% decrease in the risk of developing microvascular end points in patients in an intensive blood glucose control arm (insulin or sulfonylureas) compared with only diet control.[7]

Although not all studies have reported a statistically significant effect of strict glycemic control on macrovascular end points, mounting evidence suggests that this benefit also occurs. In UKPDS 34, patients with type 2 diabetes who were managed by intensive blood glucose control with metformin were shown to have an approximately 42% reduction in diabetes-related deaths and a 36% reduction in all-cause mortality compared with conventional treatment with diet control.[8] Moreover, the epidemiologic analysis of the UKPDS demonstrated that, irrespective of therapy, for every 1 percentage point reduction in glycosylated hemoglobin (A1C) there was a 14% reduction in the risk of MI and a 21% reduction in diabetes-related death; a 14% reduction in the risk of MI and all-cause mortality; a 12% reduction in the risk of stroke; a 16% reduction in the risk of congestive heart failure; and a 42% reduction in the risk of amputation or death from peripheral vascular disease.

Recently, a long-term follow-up of the DCCT cohort documented reductions in macrovascular end points in patients with type 1 diabetes.[9] Patients in the intensive-treatment arm had received intensive glucose-control therapy for a mean of 6.5 years. During much of the follow-up period after the trial, differences in glycemic control between the intensive and conventional groups was negligible. Nevertheless, after a mean follow-up of 17 years, patients originally enrolled in the intensive-treatment arm of the DCCT had a 42% reduction in cardiovascular events compared with patients who had originally received conventional treatment. There are 2 messages from this study: (1) glycemic control will reduce the risks for macrovascular disease; and (2) although it is never too late to optimize diabetes treatment, the earlier it is done the better, because there appears to be a metabolic memory of good and bad control that persists for many years afterwards.[9]

Figure 1. Direct and Indirect Medical Costs of Diabetes in the United States*



*Costs in the millions of dollars.
$132 billion for total excess US cost attributable to diabetes in 2002.
Source: Reference 5.

Glycemic Control: Where Do We Stand?

As a result of studies like these, several organizations have developed guidelines and goals for glycemic control. The American Association of Clinical Endocrinologists (AACE)/American College of Endocrinology (ACE) recommend an A1C of ≤6.5%. The American Diabetes Association (ADA) recommends an A1C of <7% in general, but for individual patients recommends an A1C as close to the nondiabetic range (<6%) as can be accomplished without significant hypoglycemia.[10,11] Other treatment goals to help reduce cardiovascular risk involve management of blood pressure, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol, and triglyceride levels as well as the use of

aspirin in appropriate adult patients without a contraindication.[10]

Clinical studies have shown that intensive efforts to meet treatment goals significantly reduce the risks of microvascular and macrovascular complications compared with usual care.[12] However, this task is not trivial. A survey of diabetes care based on data from the National Health and Nutrition Examination Survey and the Behavioral Risk Factor Surveillance System found that only 42% of individuals with diabetes had A1C levels <7%, a number that had changed little from surveys conducted 10 years earlier. Although significant improvements in dyslipidemia were reported, only about one third of patients achieved an LDL-C <100 mg/dL.[13] In a recent laboratory database analysis reported by AACE, among more than 157 000 patients with type 2 diabetes in 39 states, 67% had A1C levels exceeding the AACE goal of ≤6.5%.[14]

Achieving Treatment Goals

There are many reasons why patients do not achieve goals. Some of the most important include:

- Failure of some clinicians to adopt treat-to-target approaches and respond quickly to elevations in A1C levels
- Lack of optimal systems of healthcare delivery
- Suboptimal adherence of some patients to lifestyle modifications and pharmacologic treatments

Improving Response Time. Studies have documented that many clinicians are slow to respond to increased A1C levels. In a study of 9335 patients with type 2 diabetes who received oral antidiabetic monotherapy, the median time to a change in therapy in patients with an A1C result >7% was slightly more than a year (372 days).[15] A retrospective study of patients in a diabetes registry of Kaiser Permanente Northwest also found delays in pharmacotherapy changes in response to loss of glycemic control. In patients who had been treated with sulfonylurea or metformin monotherapy, 35 and 27 months, respectively, elapsed between the best A1C on therapy and the switch to or addition of another therapy. A1C levels were 8.8% to 9.1% by the time therapy was finally modified.[16] More rapid changes in response to elevated A1C levels would therefore be one way to improve glycemic control.

Drug Intensification. Drug intensification was a key factor contributing to diabetes care improvement in a large medical group in Minnesota. Between 1994 and 2003, median A1C improved from 8.3% to 6.9% ($P < .01$). This improvement was associated with an increased use of combinations of antihyperglycemic agents. Indeed, the authors refer to intensification of pharmacotherapy as the "final common pathway" for both A1C and LDL-C control. Other factors identified as contributing to these improvements were leadership commitment to diabetes improvement, greater continuity of primary care, participation in local and national diabetes care improvement initiatives, resources spent on diabetes and nutrition education, active outreach to high-risk patients facilitated by the use of registries, clinic-based training programs conducted by physician opinion leaders, and financial incentives to primary care clinics.[17]

Provider and Patient Resources. Several organizations have developed resources to aid healthcare professionals in providing diabetes care. The ADA (www.diabetes.org), AACE/ACE (www.aace.com), and other groups develop and disseminate practice guidelines and other valuable materials for clinicians. The National Diabetes Education Program (NDEP; www.ndep.nih.gov) provides many educational resources focusing on diabetes control and prevention messages. The NDEP's Better Diabetes Care Web site provides healthcare professionals with tools to organize the care they deliver to people with diabetes and offers continuing medical education credit for those using the Web site.[18] These and other organizations also provide extensive materials for people with and at risk for diabetes as well as their families and the public. A recent review by Blonde and Parkin contains a more comprehensive listing of patient and provider Internet resources.[19]

Unmet Needs of Conventional Therapies

Care using conventional therapies can be much better. Newly approved and in-development therapies offer additional potential to improve glycemic

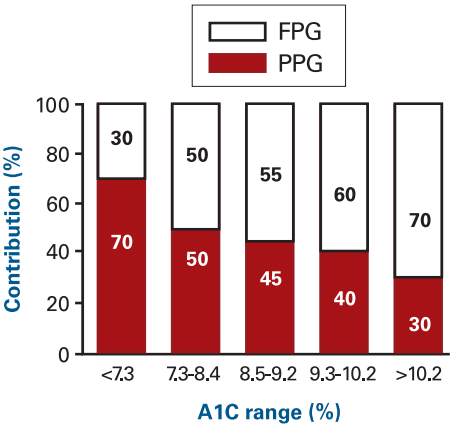
control by addressing some of the unmet needs of conventional diabetes medications. Many of the available therapies are associated with weight gain, which can increase cardiovascular risk. There is an increased risk for hypoglycemia with insulin and insulin secretagogue therapies. Most conventional treatments fail to adequately control postprandial hyperglycemia and excessive glycemic fluctuations, and most therapies fail to maintain long-term glycemic control. Nondiabetic individuals typically experience only a modest rise in glucose after a meal, which returns to preprandial levels in about 2 to 3 hours. In contrast, patients with diabetes exhibit an excessive and prolonged rise in glucose levels.[20] Postprandial glucose significantly contributes to A1C levels in individuals with type 2 diabetes and is the major contributor to A1C when A1C levels are <7.3% (Figure 2).[21] Therefore, to achieve optimal A1C levels, it will be necessary to control both fasting and postprandial hyperglycemia.

Diabetes Prevention

Given the significant complications associated with diabetes, the best management strategy is prevention. Delaying the onset of disease or slowing its progression would result in significant health benefits for patients.

The Diabetes Prevention Program (DPP) Research Group has provided convincing evidence that lifestyle modification or treatment with metformin can delay or prevent the progression to type 2 diabetes among high-risk adults with prediabetes. At an average follow-up of 2.8 years, lifestyle intervention (with the goals of at least 7% weight loss and at least 150 minutes of physical activity per week) reduced the incidence of type 2 diabetes by 58% compared with placebo. In this study, metformin monotherapy (with no attempt at lifestyle modification) reduced the incidence of type 2 diabetes by 31%.[22] In addition, acarbose compared with placebo reduced the development of diabetes among subjects with impaired glucose tolerance in the Study to Prevent Non–Insulin-Dependent Diabetes Mellitus (STOP–NIDDM),[23] and the recently reported Diabetes Reduction Approaches with Ramipril and Rosiglitazone Medications (DREAM) study demonstrated that treatment with rosiglitazone significantly reduced the incidence of type 2 diabetes compared with placebo in high-risk adults by 60%.[24]

Figure 2. Contribution of Postprandial Glucose to A1C Levels



A1C indicates glycosylated hemoglobin; FPG, fasting plasma glucose; PPG, postprandial glucose.
Source: Reference 21.

Based on the DPP results, the NDEP has launched the *Small Steps. Big Rewards. Prevent Type 2 Diabetes* campaign, a national diabetes prevention effort to encourage healthcare professionals and people at risk for diabetes to take action to prevent or delay the onset of the disease through modest changes in lifestyle (ie, small steps). Their Web site (www.ndep.nih.gov/campaigns/SmallSteps/SmallSteps_index.htm) provides motivational messages, information, and resources that can help in this effort.[25]

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