The Imperative to Prevent Diabetes

Diabetes is the seventh leading cause of death in the U.S. and increases the risk of death twofold over age-matched individuals. Even these are conservative numbers, as diabetes has been found to be underreported on death certificates (1). These findings are even more remarkable for the recent decline seen in diabetes mortality rates due to improved management of cardiovascular risk factors (2). Despite remarkable advances in our understanding of the disease and pharmacological interventions for its treatment, diabetes remains the leading cause of renal failure, nontraumatic lower-limb amputation, and blindness in working-age adults. Improved therapeutics and health care delivery have brought remarkable declines in the incidence of both diabetic microvascular and macrovascular complications, with a 50% reduction in amputations from their peak in 1997 and ~35% reduction in the incidence of end-stage renal disease (3). Similarly, 10-year coronary heart disease risk dropped from 21% in 2000 to 16% in 2008 (4).

The observed decline in the event rates of complications and death due to diabetes is swamped by the increase in the number of individuals affected by the disease. The multiplier effect of a growing population with diabetes converts a declining incidence of complications into an increase in the total number of events observed. Among adults aged 18–79 years, the number of individuals with diagnosed diabetes in the U.S. increased from approximately 12 million in 2000 to over 20 million in 2010 (3). The Centers for Disease Control and Prevention has projected that by 2050 as many as 33% of U.S. adults could have diabetes (5). These growth figures project intolerable numbers of cardiac events, amputations, and occurrences of renal failure despite our improved care and diminishing risk.

The last survey of health care costs attributable to diabetes was undertaken in 2007 by the American Diabetes Association (6). An individual with diabetes had average medical expenditures 2.3 times those for a matched population without diabetes. Total direct and indirect costs rose 33% from 2002 to a total of $174 billion. The American Diabetes Association is currently undertaking a repeat of this economic cost analysis with publication expected in early 2013. Given the increased prevalence of diabetes, there is no reason to believe that the direct medical costs will not continue to increase at this unacceptable rate.

The article in this issue of *Diabetes Care* by Imperatore et al. (7) significantly increases the concern over diabetes demographics, complications, and costs. Previous estimates of diabetes growth focused on adults. Now we see the impact of demographic changes in the U.S. and the rising rates of obesity-related type 2 diabetes in children and adolescents, as well as increasing rates of type 1 diabetes. Their estimates of a 23% increase in type 1 diabetes and a 49% increase in type 2 diabetes over the next 40 years assume no further increase in the incidence of the disease, whereas demographic shifts in the population of minorities in the U.S. could increase the prevalence by three- to fourfold.

If we are to avoid the catastrophic impact on our citizenry, our health care system, and our economy, we must aggressively address the issue of early detection and treatment and prevention. At the present time, the U.S. Preventive Services Task Force advocates screening for diabetes only among those individuals with hypertension (8). The American Diabetes Association advocates more aggressive screening of high-risk individuals including women with a history of gestational diabetes, first-degree relatives of those with diabetes, and members of high-risk ethnic groups, among others (9). The object of screening is twofold. First, identify those individuals with diabetes that is as yet undiagnosed—estimated to be approximately 7 million today. Second, identify the approximate 79 million Americans with prediabetes. The first group can benefit from early and aggressive interventions, which have demonstrated secondary prevention of microvascular and macrovascular complications (10–13). The second group will be more difficult to deal with, but clearly lies at the root of solving the problems described above. Only by decreasing the number of individuals affected by diabetes will we diminish the morbidity, mortality, and economic costs associated with the disease.

The Diabetes Prevention Program provides an excellent model for primary prevention of type 2 diabetes in adults. The demonstrated efficacy of both intensive lifestyle modification and metformin therapy provides a cost-effective approach to diminishing the onset of diabetes (14,15). Developing translational interventions meeting the Diabetes Prevention Program goals is currently a top national priority through the National Diabetes Prevention Program sponsored by the Centers for Disease Control and Prevention (16). At this time, we have no information on effective preventive measures for type 2 diabetes in youth. The recent Treatment Options for Type 2 Diabetes in Adolescents and Youth trial amplifies the difficulty of treating type 2 diabetes in children and adolescents and further emphasizes the need to identify preventative approaches for this unique high-risk population (17). Prevention of type 1 diabetes is even more problematic. Despite the lack of success of the Diabetes Prevention Trial–Type 1 and the European Nicotinamide Diabetes Intervention Trial, efforts to prevent type 1 diabetes move forward with Type 1 Diabetes TrialNet, which is supported by the National Institutes of Health (18–20).

Research and public policy changes are required to slow and ultimately reverse the deleterious impact diabetes has on our population, our health care system, and our economy. Effective strategies must be identified before we are able to move forward on the prevention of type 1 diabetes, but type 2 diabetes must be addressed now. In addition to the available data from the Diabetes Prevention Program, we must address the social determinants underlying the ongoing epidemic of obesity that is driving type 2 diabetes. The recent Institute of Medicine report provides a starting point for a societal solution to this enormous problem (Table 1) (21). With diabetes already responsible for over 25% of the Medicare budget, the increase in both type 1 and type 2 diabetes in youth described by Imperatore et al. sends an alarm that the future of the U.S. health delivery system will be overwhelmed unless prevention of diabetes becomes our next major health care goal. Let us learn from our public health colleagues and address the epidemic of obesity, prediabetes, and diabetes from a

Table 1—*Institute of Medicine goals for preventing obesity*

1. Make physical activity an integral and routine part of life.
2. Create food and beverage environments that ensure that healthy food and beverage options are the routine and easy choice.
3. Transform messages about physical activity and nutrition.
4. Expand the role of health care providers, insurers, and employers in obesity prevention.
5. Make schools a national focal point for obesity prevention.

Adapted from ref. 21.

public health perspective rather than a one-on-one clinical perspective.

ROBERT E. RATNER, MD

From the American Diabetes Association, Alexandria, Virginia.

Corresponding author: Robert E. Ratner, rratner@diabetes.org.

DOI: 10.2337/dc12-1997

References

1. Centers for Disease Control and Prevention. National Diabetes Fact Sheet, 2011 [Internet]. Atlanta, GA, Centers for Disease Control and Prevention. Available from http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2011.pdf. Accessed 28 September 2012
2. Charlton J, Latinovic R, Gulliford MC. Explaining the decline in early mortality in men and women with type 2 diabetes: a population-based cohort study. Diabetes Care 2008;31:1761–1766
3. National Center for Chronic Disease Prevention and Health Promotion, Division of Diabetes Translation. Diabetes Report Card 2012 [Internet]. Available from http://www.cdc.gov/diabetes/pubs/reportcard.htm. Accessed 28 September 2012
4. Ford ES. Trends in the risk for coronary heart disease among adults with diagnosed diabetes in the U.S.: findings from the National Health and Nutrition Examination Survey, 1999-2008. Diabetes Care 2011;34:1337–1343
5. Boyle JP, Thompson TJ, Gregg EW, Barker LE, Williamson DF. Projection of the year 2050 burden of diabetes in the US adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence. Popul Health Metr 2010;8:29–41
6. American Diabetes Association. Economic costs of diabetes in the U.S. in 2007. Diabetes Care 2008;31:1–20
7. Imperatore G, Boyle JP, Thompson TJ, et al. Projections of type 1 and type 2 diabetes burden in the U.S. population aged <20 years through 2050: dynamic modeling of incidence, mortality, and population growth. Diabetes Care 2012;35:2515–2520
8. Norris SL, Kansagara D, Bougatsos C, Fu R; U.S. Preventive Services Task Force. Screening adults for type 2 diabetes: a review of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med 2008;148:855–868
9. American Diabetes Association. Standards of medical care in diabetes—2012. Diabetes Care 2012;35(Suppl. 1):S11–S63
10. The Diabetes Control and Complications Trial Research Group. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. N Engl J Med 1993;329:977–986
11. Nathan DM, Cleary PA, Backlund JY, et al.; Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group. Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. N Engl J Med 2005;353:2643–2653
12. UK Prospective Diabetes Study (UKPDS) Group. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998;352:837–853
13. Holman RR, Paul SK, Bethel MA, Matthews DR, Neil HAW. 10-year follow-up of intensive glucose control in type 2 diabetes. N Engl J Med 2008;359:1577–1589
14. Knowler WC, Barrett-Connor E, Fowler SE, et al.; Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346:393–403
15. The Diabetes Prevention Program Research Group. The 10-year cost-effectiveness of lifestyle intervention or metformin for diabetes prevention: an intent-to-treat analysis of the DPP/DPPOS. Diabetes Care 2012;35:723–730
16. Centers for Disease Control and Prevention. National Diabetes Prevention Program [Internet]. Available from http://www.cdc.gov/diabetes/prevention/about.htm. Accessed 28 September 2012
17. Zeitler P, Hirst K, Pyle L, et al.; TODAY Study Group. A clinical trial to maintain glycemic control in youth with type 2 diabetes. N Engl J Med 2012;366:2247–2256
18. Diabetes Prevention Trial-Type 1 Diabetes Study Group. Effects of insulin in relatives of patients with type 1 diabetes. N Engl J Med 2002;346:1685–1691
19. Gale EA, Bingley PJ, Emmett CL, Collier T; European Nicotinamide Diabetes Intervention Trial (ENDIT) Group. European Nicotinamide Diabetes Intervention Trial (ENDIT): a randomised controlled trial of intervention before the onset of type 1 diabetes. Lancet 2004;363:925–931
20. Type 1 Diabetes TrialNet [Internet]. Available from http://www.diabetestrialnet.org/. Accessed 28 September 2012
21. Institute of Medicine. *Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation*. Washington, DC, National Academies Press, 2012