

## Diabetes Mellitus: A Major Risk Factor for Cardiovascular Disease

**A Joint Editorial Statement by the American Diabetes Association; the National Heart, Lung, and Blood Institute; the Juvenile Diabetes Foundation International; the National Institute of Diabetes and Digestive and Kidney Diseases; and the American Heart Association**

**A**bundant evidence shows that patients with type 1 diabetes or type 2 diabetes are at high risk for several cardiovascular disorders: coronary heart disease, stroke, peripheral arterial disease, cardiomyopathy, and congestive heart failure. Cardiovascular complications are now the leading causes of diabetes-related morbidity and mortality. The public health impact of cardiovascular disease (CVD) in patients with diabetes is already enormous and is increasing. Several explanations are behind this increase. First, the incidence of diabetes rises with advancing age, and the number of older people in the United States is growing rapidly. Second, insulin treatment for persons with type 1 diabetes has prolonged their lives significantly, and with each year of additional life comes an increased risk for CVD complications. Third, type 2 diabetes occurs at an earlier age in obese and overweight persons, and the prevalence of obesity is rising in the United States. The risk for diabetes in overweight persons is heightened by physical inactivity; unfortunately, the majority of Americans engage in little regular or sustained physical activity. Fourth, the populations that are particularly susceptible to diabetes—African Americans, Hispanics, Native Americans, Pacific Islanders, and Asians—are growing in this country. Fifth, improved medical care, particularly when extended to susceptible populations, will bring an increasing number of patients with type 2 diabetes into the medical care system. All of these factors will lead to an absolute increase in the number of patients who will require medical intervention to prevent the complications of diabetes.

Diabetes has long been recognized to be an independent risk factor for CVD. Prospective studies, such as the Framingham, Honolulu, and San Antonio Heart Studies, as well as numerous more recent population studies in the United

States and other countries, have documented the excess CVD risk in patients with diabetes from multiple racial and ethnic groups. The adverse influence of diabetes extends to all components of the cardiovascular system: the microvasculature, the larger arteries, and the heart, as well as the kidneys. Because of the increasing prevalence of diabetes in our society, it now rivals cigarette smoking, hypertension, and cholesterol disorders as major risk factors for CVD. It is a particularly strong risk factor among women and among the growing elderly population. In recent years, the National Institutes of Health, through programs of the National Heart, Lung, and Blood Institute and the National Institute of Diabetes and Digestive and Kidney Diseases, has substantially increased research on cardiovascular complications of diabetes. They have also noted the special risk of CVD among diabetic patients in guidelines and educational programs. The American Diabetes Association and the Juvenile Diabetes Foundation International have long emphasized the importance of identifying and applying interventions that help patients with diabetes reduce their risk for CVD. In addition, the growing importance of diabetes as a cause of CVD has led the American Heart Association (AHA) to formally designate diabetes as a major risk factor for CVD. This will place diabetes on a coequal status with cigarette smoking, hypertension, and cholesterol disorders as major CVD risk factors. In recognition of this, the AHA will adjust its agenda and allocate its resources so that its programs may be expanded and broadened to address the prevention and treatment of cardiovascular risk factors associated with diabetes and to gain a better understanding of the causes of the diabetes-specific excess CVD risk. In the accompanying article in *Circulation*, the AHA has published a formal statement for healthcare professionals on diabetes and CVD.<sup>1</sup>

The common recognition of diabetes as a major CVD risk factor that will continue to increase in importance comes at a time when surveys indicate that approaches proven to reduce CVD in diabetic patients are frequently not emphasized in clinical care. This makes it particularly important for organizations that fund diabetes-related research and provide public education and guidelines to coordinate their efforts to educate both health professionals and the public on what needs to be done. Among these organizations are the American Diabetes Association, the AHA, the Juvenile Diabetes Foundation International, the National Institute of Diabetes and Digestive and Kidney Diseases, and the National Heart, Lung, and Blood Institute. In this article, these organizations affirm their

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commitment to work together for the prevention and treatment of the cardiovascular complications of diabetes.

An important reason to become more aggressive about the cardiovascular complications of diabetes resides in the positive results achieved in recent clinical trials. Recent controlled trials of cholesterol-lowering therapy, particularly secondary prevention trials, showed that reducing low-density lipoprotein cholesterol levels results in a striking decrease in major coronary events in patients with type 2 diabetes. Blood pressure-lowering trials, such as the Systolic Hypertension in the Elderly Program (SHEP) and the United Kingdom Prospective Diabetes Study (UKPDS), likewise have shown a reduction in cardiovascular events in patients with diabetes comparable to benefits found in those without diabetes. The Diabetes Control and Complication Trial (DCCT) showed that improved glycemic control can prevent or reduce microvascular disease and may reduce macrovascular disease in patients with type 1 diabetes. The UKPDS demonstrated similar benefits in decreasing microvascular disease by controlling hyperglycemia in patients with type 2 diabetes and also reported that glycemic control probably reduces macrovascular disease. These positive results call for the cardiovascular community to aggressively treat the cardiovascular risk factors often seen in people with diabetes as well as to ensure that their patients with diabetes are supported in their efforts to maintain tight control of their blood glucose. Overall, results of these trials provide strong evidence that comprehensive risk factor control with drugs and other methods available today will substantially reduce the macrovascular complications of diabetes.

Closely linked to type 2 diabetes is the metabolic syndrome, the clustering of several metabolic risk factors. These risk factors are associated with insulin resistance, which is related to coronary heart disease and diabetes. Cardiovascular risk factors often seen in conjunction with the metabolic syndrome include hypertension, atherogenic dyslipidemia, a prothrombotic state, and in many patients, glucose intolerance. Two predisposing conditions, obesity and physical inactivity, both of which are recognized as CVD risk factors, often accompany the metabolic syndrome. Through efforts to reduce the prevalence of obesity and to promote regular physical activity in the general public, the collaborating organizations have the opportunity to lessen the burden of both the metabolic syndrome and type 2 diabetes and their attendant cardiovascular risks.

There is a growing recognition that diabetes belongs to a special category of risk factors because it markedly increases risk of CVD. This increase is partly the result of the

pernicious effects of persistent hyperglycemia on the vasculature and partly due to the coexistence of other metabolic risk factors. Recent studies suggest that the absolute risk for major coronary events in patients with type 2 diabetes approaches that of nondiabetic patients with established coronary heart disease. Worse, once patients with diabetes develop clinical coronary heart disease, they have a particularly bad prognosis, both acutely in the postinfarction period and over the long term. Consequently, many scientists and clinicians take the position that most patients with diabetes deserve the aggressive intervention on risk factors typically reserved for patients with clinically established coronary disease. It is important to recognize that the pathogenesis of diabetes-associated CVD is only partially understood and that expanded basic and clinical research is needed to determine the best and most efficacious ways to reduce cardiovascular complications in these high-risk patients. In addition, more needs to be learned about factors relatively unique to type 1 and type 2 diabetes, such as autoimmune inflammatory and immunological responses and the clustering of CVD risk factors in type 1 and type 2 patients, respectively, which may contribute to the increased risk for CVD. This should not delay implementation of what we already know, but new therapies will be needed to reduce the risk of CVD in diabetic patients to that of nondiabetic patients.

The ultimate goal of public health and clinical intervention is the prevention of diabetes and its complications. All of the signatory organizations reaffirm their commitment to efforts to better understand the causes and unique factors that contribute to excess risk for premature CVD and to develop and implement improved interventions. All will emphasize the prevention of type 2 diabetes through their efforts to reduce obesity and promote physical activity in the general population. In addition to prevention, however, is the need to increase the use of currently available tools in the management of diabetes, in part through control of risk factors to prevent or mitigate the complications of the disease and in part through better treatment of these complications. As a result, the organizations listed above will initiate new collaborative research and new educational programs that focus on CVD and diabetes.

## References

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