Poor Control of Risk Factors for Vascular Disease Among Adults With Previously Diagnosed Diabetes

Sharon H. Saydah, PhD
Judith Fradkin, MD
Catherine C. Cowie, PhD

Diabetes presents a significant public health burden on the basis of its increased morbidity, mortality, and economic costs. Individuals with diagnosed diabetes are at an increased risk for vascular disease, including microvascular complications (eg, retinopathy, neuropathy, and nephropathy) and macrovascular complications (eg, coronary heart disease and stroke), and lower extremity amputations. Improved glycemic control clearly reduces the risk of microvascular disease among individuals with diagnosed diabetes and is associated with lower risk of atherosclerosis and macrovascular disease. While treatment for individuals with diabetes has traditionally focused on control of glycemia to reduce these vascular complications, there is growing evidence highlighting the importance of controlling blood pressure and cholesterol levels. In addition, while intensive control of glycemia, blood pressure, and cholesterol levels all improve health outcomes for individuals with diabetes, control of blood pressure has been reported to be the most cost-effective intervention.

Context Control of blood glucose levels, blood pressure, and cholesterol levels is proven to reduce the risk of vascular disease among individuals with diabetes mellitus; however, the current state of control of these risk factors among individuals in the United States is uncertain.

Objectives To examine 1999-2000 national data on control of risk factors for vascular disease among adults with previously diagnosed diabetes and to assess trends during the past decade.

Design, Setting, and Participants Review of data from the Third National Health and Nutrition Examination Survey (NHANES III, conducted 1988-1994) and NHANES 1999-2000, cross-sectional surveys of a nationally representative sample of the noninstitutionalized civilian US population. Participants were adults aged 20 years and older with previously diagnosed diabetes who participated in both the interview and examination in either NHANES III (n=1265) or NHANES 1999-2000 (n=441).

Main Outcome Measures Levels of glycosylated hemoglobin (HbA1c), blood pressure, and total serum cholesterol in reference to target goals.

Results Compared with NHANES III, participants with previously diagnosed diabetes in NHANES 1999-2000 were similar by age and sex, were less likely to be non-Hispanic white, were diagnosed at an earlier age, had a higher body mass index, and were more likely to use insulin in combination with oral agents. In NHANES 1999-2000, only 37.0% of participants achieved the target goal of HbA1c level less than 7.0% and 37.2% of participants were above the recommended “take action” HbA1c level of greater than 8.0%; these percentages did not change significantly from NHANES III (P=.11 and P=.87, respectively). Only 35.8% of participants achieved the target of systolic blood pressure (SBP) less than 130 mm Hg and diastolic blood pressure (DBP) less than 80 mm Hg, and 40.4% had hypertensive blood pressure levels (SBP ≥140 or DBP ≥90 mm Hg). These percentages did not change significantly from NHANES III (P=.10 and P=.56, respectively). Over half (51.8%) of the participants in NHANES 1999-2000 had total cholesterol levels of 200 mg/dL or greater (vs 66.1% in NHANES III; P<.001). In total, only 7.3% (95% confidence interval, 2.8%-11.9%) of adults with diabetes in NHANES 1999-2000 attained recommended goals of HbA1c, level less than 7%, blood pressure less than 130/80 mm Hg, and total cholesterol level less than 200 mg/dL (5.18 mmol/L).

Conclusion Further public health efforts are needed to control risk factors for vascular disease among individuals with diagnosed diabetes.

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Author Affiliations: US Centers for Disease Control and Prevention, National Center for Health Statistics, Hyattsville, Md (Dr Saydah); National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, Md (Drs Fradkin and Cowie).

Corresponding Author and Reprints: Catherine C. Cowie, PhD, Diabetes Epidemiology Program, National Institute of Diabetes and Digestive and Kidney Diseases, 6707 Democracy Blvd, Room 691, MSC 5460, Bethesda, MD 20892-5460 (e-mail: cowiec@extra.niddk.nih.gov).
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trations through control of glycemia, blood pressure, and blood lipid levels, as well as through smoking cessation.18 The ADA goal for control of glycemia is glycosylated hemoglobin (HbA1c) level less than 7%; additional treatment is suggested for individuals with HbA1c levels greater than 8%. The goal for control of blood pressure is systolic blood pressure less than 130 mm Hg and diastolic blood pressure less than 80 mm Hg.18 The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) also now recommends this level of blood pressure control although the recommended diastolic target was 85 mm Hg until 2003.19 The ADA goal for lipid management is aimed at lowering levels of low-density lipoprotein cholesterol to less than 100 mg/dL (2.59 mmol/L), increasing levels of high-density lipoprotein cholesterol to greater than 45 mg/dL (1.16 mmol/L) for men and 55 mg/dL (1.42 mmol/L) for women, and lowering levels of triglycerides to less than 150 mg/dL (1.7 mmol/L).18 In addition, the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP-III) sets a goal for total cholesterol levels of less than 200 mg/dL (5.18 mmol/L).20

Previous analysis of nationally representative surveys found that individuals with diabetes had poor control of risk factors for vascular disease.21-23 However, these results were based on national surveys conducted in the early 1990s and may not accurately reflect the current state of control of risk factors for vascular disease among individuals with diabetes in the United States.

We examined the trends in control of risk factors for vascular disease among adults with diagnosed diabetes in the United States over nearly a decade using data from 2 national health surveys: the Third National Health and Nutrition Examination Survey (NHANES III) conducted from 1988-1994 and the NHANES 1999-2000. Specifically, we compared HbA1c levels, blood pressure, and total cholesterol levels among adults with previously diagnosed diabetes between these surveys to assess whether control of risk factors for vascular disease has changed.

METHODS

Surveys

The survey instruments, physical examination, and laboratory measurements of NHANES III and NHANES 1999-2000 have been described in detail.24-28 Both surveys comprised nationally representative samples of the noninstitutionalized civilian US population, obtained by a complex, stratified, multistage probability cluster sample design. Both surveys oversampled non-Hispanic blacks, Mexican Americans, and individuals aged 60 years and older; NHANES 1999-2000 also oversampled low-income individuals. Participants were interviewed in their homes to ascertain sociodemographic, medical, and family history data. A standardized set of physical examinations and laboratory measurements was performed in a mobile examination center. Blood pressure was measured using a mercury sphygmomanometer. In NHANES III, the average of the second and third values was used; in NHANES 1999-2000, 3 to 4 blood pressure measurements were averaged after excluding the first. In both surveys, HbA1c measurements were standardized to the Diabetes Control and Complications Trial (DCCT) method and levels of total serum cholesterol were measured enzymatically. The overall response rate for completion of the interview and physical examination was 78% in NHANES III and 75% in NHANES 1999-2000.

Participants

We included adults aged 20 years and older who completed the interview and examination and who answered “yes” when asked whether a physician (or a health care professional, in NHANES 1999-2000) ever told them they had diabetes (n = 1265 in NHANES III and n = 441 in NHANES 1999-2000). Women who reported a history of diabetes only during pregnancy were not included. To determine the percentage with diagnosed diabetes in each survey we included all adults aged 20 years and older who completed the interview (NHANES III, n = 18 822; NHANES 1999-2000, n = 4874).

Analysis

To define categories of desirable and undesirable HbA1c levels and blood pressure, we used the ADA standards of medical care for persons with diabetes.29 For desirable and undesirable levels of total cholesterol, we used guidelines from the ADA18 and the NCEP-ATP-III.20 We did not evaluate levels of low-density lipoprotein cholesterol or triglycerides, since few participants with diagnosed diabetes in NHANES 1999-2000 (n = 99 and n = 111, respectively) had valid measurements.

Microalbuminuria was defined as 30 µg or more of albumin per milligram of creatinine determined by spot urine collection for participants in each survey who reported fasting at least 6 hours prior to collection.18 A history of cardiovascular disease was defined as a history of angina, heart attack, or coronary heart disease. Participants were considered to be current smokers if they reported smoking at least 100 cigarettes in their lifetime and reported smoking on at least some days within the past 30 days.

Risk factors for vascular disease were reported for participants in both surveys overall and by sex. Due to the small number of individuals with diagnosed diabetes in NHANES 1999-2000, we were unable to stratify by age or race/ethnicity.

We report the unadjusted and age-standardized prevalence of diagnosed diabetes in NHANES III and NHANES 1999-2000. We age-standardized the prevalence of diagnosed diabetes to the 2000 US Census population using 3 age groups (20-39 years, 40-59 years, and ≥ 60 years) and corresponding weights (0.40589, 0.36621, 0.22790).

To compare characteristics and risk factors between the surveys, we age-standardized the NHANES III results by the direct method to the NHANES 1999-2000 diabetes population using...
The prevalence of diagnosed diabetes and the characteristics of adults with diabetes are shown in Table 1. The unadjusted prevalence of diagnosed diabetes in adults aged 20 years and older in NHANES 1999-2000 was 5.9% (SE, 0.52). The age-standardized prevalence of diagnosed diabetes was similar by age and sex in the 2 surveys. In NHANES 1999-2000, there were significantly fewer non-Hispanic whites, similar proportions of non-Hispanic blacks and Mexican Americans, and a significantly larger proportion of participants of other race/ethnicity groups compared with NHANES III. These changes in race/ethnicity between the 2 surveys reflect the changes in the US Census between 1990 and 2000. However, the

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decline in the proportion of non-Hispanic whites and the increase in the proportion of persons of other race/ethnicity are more substantial among individuals with diabetes than in the general population (data not shown).

Mean body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) among adults with diagnosed diabetes increased significantly from 29.9 in NHANES III to 32.3 in NHANES 1999-2000 (P = .002), and the percentage of those with diagnosed diabetes who were obese (BMI ≥30) increased from 41.6% to 54.6% (P = .008).

Individuals with previously diagnosed diabetes in NHANES 1999-2000 had been diagnosed at a significantly younger age (46.7 vs 50.7 years; P = .003) and had a significantly longer duration of diabetes (12.5 vs 10.2 years; P = .03) than those in NHANES III. There was no significant change in the prevalence of microalbuminuria or history of cardiovascular disease.

Medication Use
Use of insulin alone decreased significantly (27.6% vs 17.0%, P = .002), and insulin use in combination with oral agents increased significantly (3.5% vs 10.4%, P = .01) over the 2 surveys. The percentage of adults who reported no pharmacological treatment for diabetes decreased (24.8% vs 18.7%; P = .06) and use of blood pressure medications increased (77.0% vs 85.2%; P = .05). Use of blood pressure medications could be underreported if use of renin-angiotensin system agents were attributed to nephropathy rather than to hypertension. Among adults with diagnosed high cholesterol, medication use for high cholesterol was more than 2-fold higher in NHANES 1999-2000 (56.1%) compared with NHANES III (27.7%) (P < .001). There was no difference in regular use of aspirin.

HbA1c Levels
The mean HbA1c levels did not change from NHANES III to NHANES 1999-2000 (Table 2). Overall, only 37.0% of

Table 2. Levels of HbA1c, Blood Pressure, and Total Serum Cholesterol Among Adults Aged 20 Years and Older With Previously Diagnosed Diabetes in NHANES III (1988-1994) and NHANES 1999-2000*

<table>
<thead>
<tr>
<th>NHANES III†</th>
<th>NHANES 1999-2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall‡</strong></td>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>No. of adults</td>
<td>1218</td>
</tr>
<tr>
<td>Mean (SE) [SD], %</td>
<td>7.6 (0.09) [2.02]</td>
</tr>
<tr>
<td>HbA1c, category, % &lt;7.0</td>
<td>44.3 (2.37)</td>
</tr>
<tr>
<td>7.0-8.0</td>
<td>19.2 (1.48)</td>
</tr>
<tr>
<td>&gt;8.0</td>
<td>36.5 (2.26)</td>
</tr>
<tr>
<td>≥9.0</td>
<td>21.2 (1.67)</td>
</tr>
<tr>
<td>≥10.0</td>
<td>12.8 (1.57)</td>
</tr>
</tbody>
</table>

**Blood Pressure Level**

<table>
<thead>
<tr>
<th>NHANES III†</th>
<th>NHANES 1999-2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall‡</strong></td>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>No. of adults</td>
<td>1263</td>
</tr>
<tr>
<td>Mean (SE) [SD], mm Hg</td>
<td>137.9 (0.76) [19.48]</td>
</tr>
<tr>
<td>Systolic</td>
<td>73.5 (0.37) [10.06]</td>
</tr>
<tr>
<td>Diastolic</td>
<td>33.9 (0.89) [17.49]</td>
</tr>
<tr>
<td>Normal (SBP&lt;130 mm Hg and DBP&lt;80 mm Hg)</td>
<td>29.0 (1.73)</td>
</tr>
<tr>
<td>High normal (SBP of 130-139 mm Hg or DBP of 80-89 mm Hg)</td>
<td>28.2 (1.78)</td>
</tr>
<tr>
<td>Hypertension (SBP≥140 mm Hg or DBP≥90 mm Hg)</td>
<td>42.9 (1.87)</td>
</tr>
</tbody>
</table>

**Total Serum Cholesterol Level**

<table>
<thead>
<tr>
<th>NHANES III†</th>
<th>NHANES 1999-2000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall‡</strong></td>
<td><strong>Men</strong></td>
</tr>
<tr>
<td>No. of adults</td>
<td>1210</td>
</tr>
<tr>
<td>Total, mean (SE) [SD], mg/dL</td>
<td>222.6 (2.14) [51.39]</td>
</tr>
<tr>
<td>Total ≥200 mg/dL</td>
<td>66.1 (1.98)</td>
</tr>
</tbody>
</table>

Abbreviations: DBP, diastolic blood pressure; HbA1c, glycated hemoglobin; NHANES, National Health and Nutrition Examination Survey; SBP, systolic blood pressure. SI conversion factor: To convert total serum cholesterol levels to mmol/L, multiply mg/dL values by 0.0259.

*All values are % unless otherwise noted.
†Age-standardized to the NHANES 1999-2000 population using age groups 20-39 years, 40-59 years, and ≥60 years.
‡In NHANES III the overall unadjusted mean (SE) HbA1c level was 7.7% (0.10) and the overall percentages (SEs) in HbA1c categories were 43.5 (2.52) at ≤7.0%, 17.7 (1.46) at 7.0%-8.0%, 38.6 (2.48) at >8.0%, 23.3 (1.94) at >9.0%, and 14.1 (1.69) at >10.0%. The overall unadjusted mean (SE) systolic blood pressure was 135.5 (0.85) mm Hg, mean (SE) diastolic pressure was 74.4 (0.46), and the overall percentages (SEs) in blood pressure categories were 33.2 (2.14), 28.2 (2.01), and 38.0 (2.21) in the normal, high normal, and hypertension categories, respectively. The overall unadjusted mean (SE) total serum cholesterol level was 221.6 (2.59) mg/dL and the overall percentage (SE) with levels ≥200 mg/dL was 60.0 (2.36).
§Relative standard error (SE/estimate × 100%) >30% and therefore the estimate should be interpreted with caution.

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adults in NHANES 1999-2000 had HbA₁c levels at the ADA goal of less than 7.0%. The percentage of participants with HbA₁c levels less than 7.0% did not change significantly from NHANES III (P = .11) and did not differ by sex. Overall, the percentage of participants with HbA₁c levels greater than 8%, the level suggested by the ADA for focused treatment action, was 37.2% in NHANES 1999-2000 and was unchanged from NHANES III (P = .87).

**Blood Pressure Levels**

The mean systolic blood pressure among adults with diagnosed diabetes was significantly lower in NHANES 1999-2000, particularly in men, but the diastolic blood pressure did not change appreciably between the surveys (Table 2). There was a slight increase in the percentage of participants with blood pressure at the level currently recommended by the ADA (systolic <130 mm Hg and diastolic <80 mm Hg) from NHANES III (29.0%) to NHANES 1999-2000 (35.8%) (P = .10), with a corresponding small decrease in the percentage with high normal (28.2% vs 23.8%; P = .19) and hypertensive (42.9% vs 40.4%; P = .56) blood pressures. The proportions based on the recommended levels by the ADA in 1995 (systolic <130 mm Hg and diastolic <85 mm Hg) also did not change significantly from the NHANES III (1988-1994) (32.1%) to NHANES 1999-2000 (36.6%) (P = .29).

**Total Serum Cholesterol Levels**

Overall, total serum cholesterol levels decreased significantly from NHANES III to NHANES 1999-2000 (P < .001) (Table 2). However, in NHANES 1999-2000, 50.0% of men and 53.8% of women still had total serum cholesterol levels of 200 mg/dL (5.18 mmol/L) or greater, below which is the NCEP-ATP-III goal.

**Combined Control of Risk Factors**

Overall, the percentage of adults with diagnosed diabetes in NHANES 1999-2000 who achieved currently recommended goals of HbA₁c level, blood pressure, and total serum cholesterol level was only 7.3% (95% confidence interval, 2.8%-11.9%) (Figure). This is similar to the percentage who had these recommended levels in NHANES III (5.2%; 95% confidence interval, 3.8%-6.6%).

**COMMENT**

Compelling evidence from well-designed, randomized clinical trials demonstrates that control of glucose levels, blood pressure, and cholesterol levels can dramatically delay or prevent the microvascular and macrovascular complications of diabetes. Based on these data, the ADA, the JNC, and the NCEP have developed guidelines for control of blood glucose levels, blood pressure, and cholesterol levels in individuals with diabetes. Despite these evidence-based guidelines, only a small fraction (2.8% to 11.9%) of adults with diagnosed diabetes in the United States are achieving the currently recommended levels of control. Other studies examining diabetes care in various clinical settings also have found that current medical practice is not achieving goals for management of glucose levels, blood pressure, and lipid levels in individuals with diabetes. This study presents contemporary data from a nationally representative sample of noninstitutionalized adults in the United States with previously diagnosed diabetes. Comparison of the current data and representative data from approximately a decade earlier, obtained through similar standardized procedures, demonstrates significant improvement in the control of total cholesterol levels, but little to no change in control of blood glucose levels and blood pressure.

The period between NHANES III (1988-1994) and NHANES 1999-2000 has seen a substantial accumulation of evidence regarding the benefits of glycemic control. In 1993, the landmark DCCT study showed that intensive glycemic therapy of type 1 diabetes reduced the risk of microvascular disease by up to 70%. Similar dramatic reductions in risk of microvascular complications in type 2 diabetes were subsequently found in the United Kingdom Prospective Diabetes Study (UKPDS). Despite this compelling evidence of benefit, an ADA recommendation of an HbA₁c target level of less than 7.0% in January 1995, the creation of the National Diabetes Educa-
tion Program (NDEP) in 1997\textsuperscript{37} to pro-
mulgate the importance of glycemic control, and the advent of several new classes of medications for glycemic control.\textsuperscript{38} NHANES 1999-2000 found no change in mean HbA\textsubscript{1c} values or in the fraction of adults with diabetes with HbA\textsubscript{1c} levels below the target levels. Long-term follow-up of the DCCT study population provides impressive new evidence of the importance of glycemic control. The period of improved glycemic control in the intensively treated arm of the DCCT continues to yield potent reduction in risk of microvascular disease well beyond the period of intensive implement-
tion\textsuperscript{11} and the beneficial effect of gly-
cemic control now extends to macrovascular disease, indicated by reduced carotid artery wall thickening.\textsuperscript{12} These latest observations should strengthen public health efforts to translate intensive glycemic control into clinical practice.

Impressive evidence that intensive control of blood pressure in adults with type 2 diabetes prevents both microvascular and macrovascular diseases also emerged during and after NHANES III,\textsuperscript{13,14,39} leading to recommendations by the JNC-5 in 1993 and the ADA in 1995 that blood pressure levels for pa-
tients with diabetes should be lower (<130/85 mm Hg) than in other hyp-
ertensive groups. The recommended blood pressure level was further re-
duced to less than 130/80 mm Hg by the ADA in 2001\textsuperscript{15} and the JNC-7 in 2003.\textsuperscript{19} From NHANES III to NHANES 1999-2000, the prevalence of hyper-
tension increased significantly in the general US population, and its preva-
lence was associated with risk factors for diabetes including older age, non-
Hispanic black race, and higher BMI.\textsuperscript{19} When individuals with diabetes were excluded from analysis, the preva-
lence of hypertension was no longer signif-
ificantly increased. That analysis of in-
dividuals with diagnosed hypertension found that the percentage of those with diabetes and hypertension controlled to less than 140/90 mm Hg declined non-
significantly (to 46.9\%) in those with diabetes. We found a small but statistically significant decrease in mean systolic blood pressure in individuals with diagnosed diabetes and a small and non-
significant increase in the fraction of participants with diabetes with nor-
mal blood pressure. The new guide-
lines for control of blood pressure is-
sued near the conclusion of NHANES III may have contributed to the small but statistically significant decrease in mean systolic blood pressure in indi-
viduals with diagnosed diabetes in NHANES 1999-2000, but there has been minimal, if any, effect in reduc-
ing the proportion of those with blood pressure of 140/90 mm Hg or greater.

Data from NHANES 1999-2000 was collected just after clinical trials demon-
strated that, by lowering lipid lev-
els, individuals with diabetes can sub-
stantially reduce the risk of developing cardiovascular disease.\textsuperscript{15} Moreover, in 1998, diabetes was identified as a risk factor for cardiovascular disease equiva-
 lent to having preexisting coronary ar-
tery disease.\textsuperscript{11} The ADA guidelines on man-
agement of lipid disorders issued in 1993 were revisited in 1998 based on these new data\textsuperscript{42} and the American Heart Association\textsuperscript{8} and the NCEP\textsuperscript{20} also subsequently issued guidelines for lipid manage-
ment in diabetes. Thus the im-
provement in total cholesterol levels ob-
served in NHANES 1999-2000 oc-
urred on the cusp of new data showing the benefits of lowering lipid levels, and further reductions in total cholesterol levels may be anticipated in the future as a result of dissemination of the new guidelines.

Progress in improving risk factors for vascular disease among individuals with diagnosed diabetes in the United States over nearly a decade has been modest. While there has been increased aware-
ness among physicians and individuals with diabetes of the use of HbA\textsubscript{1c} levels to monitor glycemic control,\textsuperscript{23} only 37.0\% of adults with diagnosed dia-
betes in the United States are achieving the ADA goal of HbA\textsubscript{1c} levels less than 7.0\%. In addition, 37.2\% of adults with diag-
nosed diabetes have HbA\textsubscript{1c} levels greater than 8.0\%, the level of additional treat-
ment action suggested by the ADA. Al-
though the percentage of adults with di-
agnosed diabetes and diagnosed hyperten-
sion who use blood pressure medication has increased in the past de-
cade, only 35.8\% of individuals with di-
agnosed diabetes have achieved the cur-
rent ADA blood pressure goal of less than 130/80 mm Hg and only 36.6\% achieved the ADA goal set in 1995 (<130/85 mm Hg); 40.4\% have hyperten-
sive blood pressure levels. Finally, al-
though the percentage of adults with di-
agnosed high cholesterol has increased and twice as many of these adults report taking medication for their high cholesterol in NHANES 1999-
2000 compared with NHANES III (1988-1994), more than half the indi-
viduals with diagnosed diabetes have total cholesterol levels greater than 200 mg/dL (5.18 mmol/L). The increased use of medication to control high choles-
terol levels and high blood pressure has not been accompanied by attention to lifestyle change; fewer adults with dia-
betes report eating less fat to control cho-
esterol than approximately a decade ago, and there has been no change in the use of weight control or exercise to control lipid levels or blood pressure. Due to the small sample size, we were unable to stratify the analysis by previously diag-
nosed high blood pressure or high cho-
esterol levels.

Biological and behavioral character-
istics of individuals with diagnosed dia-
betes are likely to affect control of risk factors for vascular disease. The ear-
lier age at diagnosis of diabetes in NHANES 1999-2000 may reflect an ear-
lier onset of disease or may be due to increased screening for undiagnosed diabetes leading to individuals being di-
agnosed at an earlier point in the dis-
ease pathway. This earlier age at dia-
gnosis corresponded to a significantly longer duration of diabetes in 1999-
2000. The longer duration might also reflect increased longevity due to bet-
ter treatment. The increase in BMI of adults with diagnosed diabetes in the United States over nearly a decade mir-
rors the increase in prevalence of over-
weight and obesity in the US popula-
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The overall prevalence of previously diagnosed diabetes among adults aged 20 years and older, although the change was not significantly different. The lack of a statistically significant increase in the prevalence of previously diagnosed diabetes in NHANES 1999-2000 could be due to the small sample size of the survey. The 95% confidence interval for the change in the prevalence of diagnosed diabetes between the 2 surveys ranges from a decrease of 0.34 percentage points to an increase of 1.98 percentage points.

The cost of providing care for diabetes and its complications in the United States is rapidly increasing and was estimated at $132 billion annually in 2002. The failure to achieve recommended levels of control of vascular risk factors, coupled with the rise in type 2 diabetes and its occurrence in individuals at earlier ages—which increases the risk of duration-dependent vascular complications—have ominous implications for the future burden of morbidity, mortality, and health care costs associated with diabetes.

The increased awareness of the importance of controlling risk factors for vascular disease among adults with diabetes has led to national programs such as the “Control the ABCs” (for which A, B, and C indicate HbA1c, blood pressure, and cholesterol, respectively) campaign by the NDEP and the Diabetes Quality Improvement Project. While these programs represent important steps toward improving the quality of diabetes care, further measures are needed to reduce the large proportion of adults with diagnosed diabetes in the United States who continue to have high levels of blood glucose, blood pressure, and total cholesterol. Ongoing monitoring and measurement of the quality of care, empowering clinicians with medical decision-support tools and patients with information to improve the quality of care they receive, and building incentives for providing comprehensive care into the health care delivery system are essential to translating into practice the therapies that have been proven effective in reducing the risk of vascular disease in individuals with diabetes.

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