

Ethnic Disparities and Trends in Glycemic Control Among Adults With Type 2 Diabetes in the U.S. From 1988 to 2002

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Tight blood glucose control has been shown to effectively reduce the incidence of retinopathy, neuropathy, and nephropathy in type 2 diabetic patients (1). The American Diabetes Association recommends that patients with diabetes maintain an HbA_{1c} (A1C) level of <7% (2). Our findings, using the National Health and Nutrition Examination Survey (NHANES) data, indicate that from 1999 to 2000, only 36% of adults with type 2 diabetes in the U.S. met this glycemic control goal (3). The current report updates our previous findings of trends in glycemic control from NHANES III (1988–1994) to NHANES 1999–2002. We also appraise the current status of ethnic disparities in diabetes control by examining whether ethnic differences in glycemic control exist among adults aged ≥ 20 years with type 2 diabetes in the U.S.

RESEARCH DESIGN AND METHODS

— We used questionnaire and laboratory data from NHANES III, NHANES 1999–2000, and the newly released NHANES 2001–2002.

Data on demographic information, including race, sex, age, BMI, diagnosis and duration of diabetes, and medication use, were collected by structured questionnaires. To identify diabetes status, participants were asked, “Other than during pregnancy, has a doctor ever told you that you had diabetes or sugar diabetes?” Subjects reporting the first diagnosis of diabetes at <30 years of age and starting

insulin therapy within 1 year of diagnosis were considered to have type 1 diabetes and were therefore excluded.

Subjects were categorized as non-Hispanic whites, non-Hispanic blacks, and Mexican Americans based on self-reports (4–6). Due to small sample size, participants who classified themselves as “other race” were excluded.

To evaluate ethnic disparities in glycemic control from 1988 to 2002, we calculated the percentages of patients achieving glycemic control for each racial group in the two surveys. We then established multivariable logistic regression models to compare the relative odds of glycemic control among non-Hispanic blacks and Mexican Americans compared with non-Hispanic whites in the NHANES III and NHANES 1999–2002 surveys separately, adjusting for age, sex, BMI, diabetes duration, and antidiabetes medication use. To explore the trend in glycemic control, we fitted logistic regression models to compare the odds of glycemic control among subjects in NHANES 1999–2002 with that of diabetic subjects in NHANES III, stratified by ethnic group and controlling for age, sex, BMI, diabetes duration, and antidiabetic medications.

All analyses were performed using SAS 9.1 (SAS Institute, Cary, NC) and SAS callable SUDAAN 9.0 (Research Triangle Institute, Research Triangle Park, NC) to account for the complex sampling designs in NHANES.

RESULTS — After excluding patients diagnosed with diabetes during pregnancy, patients with type 1 diabetes, the “other race” group, and subjects with missing data, our final study sample was 1,142 subjects from NHANES III and 683 subjects from NHANES 1999–2002.

In NHANES III, the proportions of adults with diabetes who achieved the American Diabetes Association target of glycemic control (A1C <7%) were 43.8% for non-Hispanic whites, 41.2% for non-Hispanic blacks, and 34.5% for Mexican Americans ($P = 0.03$ for differences across groups, Table 1). In NHANES 1999–2002, the corresponding percentages changed to 48.4% for non-Hispanic whites, 36.5% for non-Hispanic blacks, and 34.2% for Mexican Americans ($P = 0.03$, Table 1).

After adjustment for age, sex, BMI, diabetes duration, and antidiabetes medication use, Mexican Americans were less likely to achieve control compared with non-Hispanic whites in both NHANES III (odds ratio [OR] 0.67 [95% CI 0.46–0.98]) and NHANES 1999–2002 (0.46 [0.30–0.71]) (Table 1). While not statistically significant, non-Hispanic blacks tended to have worse glycemic control than non-Hispanic whites in NHANES 1999–2002 (0.64 [0.38–1.08]) (Table 1).

Comparing NHANES 1999–2002 with NHANES III findings, glycemic control between the two surveys did not change for non-Hispanic blacks (OR 0.96 [95% CI 0.64–1.45]) and Mexican Americans (1.22 [0.80–1.87]), after risk factor adjustment. However, an improvement in glycemic control was suggested for non-Hispanic whites (1.42 [0.88–2.28]), particularly among non-Hispanic white female subjects (1.40 [1.01–1.94]) in NHANES 1999–2002.

CONCLUSIONS — We found considerable ethnic differences in glycemic control rates among adults with type 2 diabetes in both surveys. Mexican Americans were statistically significantly less likely to achieve glycemic control compared with non-Hispanic whites in both survey periods. This is consistent with

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Abbreviations: NHANES, National Health and Nutrition Examination Survey.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1—Proportion and adjusted ORs of adults with controlled (A1C <7%) and uncontrolled (A1C ≥7%) type 2 diabetes in NHANES III and NHANES 1999–2002 by ethnicity

	Non-Hispanic whites	Non-Hispanic blacks	Mexican Americans	All subjects	P values*
NHANES III					
n				1,142	
A1C (%)	7.60 ± 0.14	8.21 ± 0.16	7.96 ± 0.13	7.7 ± 0.1	
Controlled diabetic subjects	43.8	41.2	34.5	42.9	0.03
Uncontrolled diabetic subjects	56.2	58.8	65.5	7.96	
Adjusted glycemic control†	Ref.	1.12 (0.76–1.65)	0.67 (0.46–0.98)		
NHANES 1999–2002					
n				683	
A1C (%)	7.30 ± 0.14	8.02 ± 0.16	8.09 ± 0.14	7.5 ± 0.1	
Controlled diabetic subjects	48.4	36.5	34.2	45.0	0.03
Uncontrolled diabetic subjects	51.6	63.5	65.8	55.0	
Adjusted glycemic control†	Ref.	0.64 (0.38–1.08)	0.46 (0.30–0.71)		

Data are percent, means ± SE, or OR (95% CI). * χ^2 test comparing percentage of subjects with controlled and uncontrolled diabetes across various ethnic groups within NHANES surveys. †Adjusted for age, sex, BMI, duration of diabetes, and antidiabetes medication use.

worse glycemic control among Mexican-American diabetic patients reported in San Antonio (7). Our findings do not indicate worse glycemic control among non-Hispanic blacks compared with non-Hispanic whites in NHANES III. However, while not statistically significant, non-Hispanic blacks tended toward less control than non-Hispanic whites in NHANES 1999–2002.

We hypothesize that the tendency for less glycemic control in blacks compared with whites in NHANES 1999–2002, which was not apparent in NHANES III, is due to improved control in whites (especially white female participants) and not to worsening control in blacks over the past decade.

There are several limitations to this analysis. The sample size from the NHANES 1999–2002 survey is small relative to the NHANES III. Because NHANES surveys are cross-sectional, the control rates may be overestimated due to survival bias, i.e., subjects with the poorest glycemic control may have died over time and could not participate in the sur-

veys. Also, in 1997, the American Diabetes Association changed the diagnostic criteria for diabetes, which may have influenced prevalence estimates of diagnosed diabetes between the two NHANES surveys (8). We conclude that ethnic disparities in glycemic control among adults with type 2 diabetes persist in the U.S. The current glycemic control rates for all ethnic groups remains unacceptably low.

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