Race-Ethnic Disparities in Cardiometabolic Risk Profiles among Stroke Survivors with Undiagnosed Diabetes and Prediabetes in the United States

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Background and Purpose: Up to 25% of the U.S. population has undiagnosed diabetes. Diabetes and stroke both disproportionately afflict race/ethnic minorities. We assessed race/ethnic differences in the prevalence of undiagnosed diabetes, prediabetes, and cardiometabolic risk profiles among stroke survivors in the United States. *Methods:* The prevalence of diabetes and prediabetes among adults (≥20 years) with a self-reported history of stroke was assessed using the National Health and Nutrition Examination Surveys (NHANES) from 1999 to 2010. Cardiometabolic risk factors across race/ethnic groups were compared using linear and logistic regression before and after adjusting for covariates. *Results:* From 1999 to 2010, 1070 individuals who participated in NHANES had a self-reported history of stroke. Among stroke survivors without a formal diagnosis of diabetes and prediabetes, 233 (32%) had undiagnosed prediabetes and 27 (3.7%) had undiagnosed diabetes. The prevalence of undiagnosed diabetes and prediabetes was the highest among non-Hispanic (NH) blacks (8% and 38%) compared with Mexican Americans (4% and 26%) and NH whites (3% and 32%). Compared with NH whites, NH blacks were significantly younger, more likely to take antihypertensive medications, more likely to smoke, and have poorly controlled diabetes. NH blacks were twice as likely as NH whites to have poorly controlled blood pressure, after adjustment for sociodemographic and vascular risk factors. *Conclusion:* In the United States, NH black stroke survivors have the highest rates of undiagnosed diabetes and prediabetes, and have poorer cardiometabolic risk factor control than their NH white counterparts. **Key Words:** Diabetes—prediabetes—hypertension—dyslipidemia—stroke—cardiometabolic—risk factor.

Introduction

Diabetes is an established independent risk factor for stroke.[1] Prediabetes, a condition predictive of the development of diabetes,[2] has also emerged as an independent predictor of stroke risk.[3] According to the Centers for Disease Control and Prevention, currently high rates of diabetes (26 million people) and prediabetes (79 million people) are expected to increase substantially over the next 2 decades, yet approximately 25% of people with frank diabetes remain unaware of their diagnosis.[4] Individuals with diabetes who survive a stroke tend to have poorer outcomes than those without diabetes,[5,6] a situation likely to worsen given the rising rates of diabetes among hospitalized stroke patients nationwide.[7]

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In the United States, minority racial/ethnic groups have higher stroke incidence, poorer functional outcomes, and higher mortality than whites.[8] Although the reasons for these differences remain uncertain, notable race/ethnic disparities in the prevalence of diabetes and other cardiometabolic risk factors may play a role.[9] For instance, compared with non-Hispanic (NH) whites, the prevalence of diabetes is twice as high in Mexican Americans (MAs) and NH blacks.[10] There are also race/ethnic disparities in the burden of various other cardiometabolic risk factors, such as hypertension, dyslipidemia, and cigarette smoking.[8]

The prevalence of undiagnosed diabetes and prediabetes among race–ethnic minority stroke survivors is unknown, and the cardiometabolic risk profiles for these individuals are unclear. More information on these high-risk stroke groups may inform the development of strategies to mitigate risk. In this study, we aimed to determine the prevalence of both diagnosed and undiagnosed diabetes and prediabetes in a nationally representative sample of U.S. stroke survivors. We also evaluated the prevalence of cardiometabolic risk factors among these individuals.

Methods

Study Population

The National Health and Nutrition Examination Surveys (NHANES) are conducted by the National Center for Health Statistics, a branch of the Centers for Disease Control and Prevention. Individuals participating in NHANES are interviewed in their homes and examined at mobile examination centers. Signed informed consent is obtained from each person during the home interview.

NHANES uses a complex, multistage probability sampling design to select a sample representative of the civilian noninstitutionalized household population of the United States.[11] At different time points, subgroups of particular public health interest are oversampled to increase the reliability and precision of estimates of health status indicators for those population subgroups. Weighting schemes allow estimates from those subgroups to be combined to obtain national estimates reflective of the relative proportions of those groups in the overall population.

The weighting of sample data permits analysts to produce estimates of statistics they would have obtained if the entire sampling frame had been surveyed. Weighting accounts for the differential probabilities of selection for the individual domains, nonresponse to survey instruments, and differences between the final sample and the total population. Weights are adjusted for nonresponse to the in-home interview when creating the interview weights and are further adjusted for nonresponse to the mobile examination center examination when creating the examination weights.[11]

Data Set and Variables

NHANES data sets were downloaded from the website of the National Center for Health Statistics (http://www.cdc.gov/nchs) for the survey years 1999-2010. The study sample excluded individuals younger than 20 years and those who were pregnant. History of stroke was identified by self-report. Undiagnosed prediabetes was defined as glycosylated hemoglobin (HbA1c) 5.7%–6.4%, and diabetes was defined as HbA1c 6.5% or higher in the absence of health care professional–diagnosed diabetes or borderline diabetes by self-report.

We assessed the following continuous and categorical cardiometabolic variables: blood pressure (BP) control defined as systolic BP (SBP) lower than 130 mm Hg and diastolic BP (DBP) lower than 80 mm Hg, mean SBP, mean DBP, mean total cholesterol level, elevated cholesterol defined as total cholesterol level higher than 200 mg/dL, mean low-density lipoprotein (LDL) cholesterol level, elevated LDL cholesterol defined as LDL higher than 100 mg/dL, mean high-density lipoprotein (HDL) cholesterol level, low HDL cholesterol defined as HDL lower than 40 mg/dL, mean triglyceride level, and elevated triglyceride level defined as triglyceride level higher than 150 mg/dL. The thresholds for cardiometabolic risk factors were based on secondary stroke prevention guidelines in place during the study period.[12,13] The optimal BP threshold after a stroke or transient ischemic attack remains unknown. We used a threshold of 130/80 mm Hg, recommended for individuals with diabetes by the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, and American Diabetes Association, which were in effect at the time of the NHANES study period.[14,15]

Statistical Methods

In the first multivariate model, comparisons were carried out before and after adjusting for the following potential confounders: age, sex, antilipid medication use, antihypertensive medication use, NHANES cycle categorized as 2-year intervals, and HbA1c level (≥6.5% versus <6.5%). The second multivariate model also adjusted for insurance coverage (insured versus uninsured), poverty income ratio (<2 versus ≥2), history of hypertension, history of hypercholesterolemia, and physical activity (< versus ≥ 12 times per month).

Continuous outcomes were compared across race/ethnic groups using linear regression before and after adjusting for the above-mentioned covariates while taking into account the complex NHANES survey design. The variables for total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels exhibited a skewed distribution on the original scale and were therefore log10-transformed prior to the regression analysis because we determined that the data on the log scale followed an approximately normal distribution. Categorical vari-