Overall stroke incidence has decreased in the United States in the past decade, but ischemic stroke (IS) incidence has remained stable or increased among midlife adults (ages 45–59 years), and racial-ethnic stroke risk disparities remain greatest in this age range. Stroke risk disparities among midlife Mexican Americans (MAs), as compared with midlife non-Hispanic Whites (NHWs), have been especially high and persistent. Several hypotheses might explain the ethnic disparity in this age group, including a higher prevalence of risk factors, greater influence of stroke risk factors, and challenges accessing primary stroke prevention among midlife MAs. We examined the contribution of traditional stroke risk factors to ethnic differences in stroke rates among midlife MAs and NHWs. In addition, we examined if stroke risk factors had differential associations with IS rates in midlife MAs as compared with midlife NHWs.

Background and Purpose—We examined the contribution of stroke risk factors to midlife (age 45–59 years) Mexican American and non-Hispanic White ischemic stroke (IS) rate disparities from 2000 to 2010.

Methods—Incident IS cases (n=707) and risk factors were identified from the Brain Attack Surveillance in Corpus Christi Project, Nueces County, TX (2000–2010). US Census data (2000–2010) were used to estimate the population at-risk for IS, and the Behavioral Risk Factor Surveillance System (2000–2010) was used to estimate risk factor prevalence in the stroke-free population. Poisson regression models combined IS counts (numerator) and population at-risk counts (denominator) classified by ethnicity and risk factor status to estimate unadjusted and risk factor–adjusted associations between ethnicity and IS rates. Separate models were run for each risk factor and extended to include an interaction term between ethnicity and risk factor.

Results—The crude rate ratio (RR) for ethnicity (Mexican American versus non-Hispanic White) was 2.01 (95% confidence interval [CI], 1.71–2.36) and was attenuated in models that adjusted for diabetes mellitus (RR: 1.50; 95% CI, 1.26–1.78) and hypertension (RR: 1.84; 95% CI, 1.50–2.26). In addition, diabetes mellitus had a stronger association with IS rates among Mexican Americans (RR: 6.42; 95% CI, 5.31–7.76) compared with non-Hispanic Whites (RR: 4.07; 95% CI, 3.68–4.51).

Conclusions—The higher prevalence of diabetes mellitus and hypertension and stronger association of diabetes mellitus with IS among midlife Mexican Americans likely contribute to persistent midlife ethnic stroke disparities. (Stroke. 2017;48:00-00. DOI: 10.1161/STROKEAHA.117.018861.)

Key Words: diabetes mellitus ■ hypertension ■ Mexican Americans ■ risk factors ■ stroke
Data Supplement). Study was approved by the University of Michigan Institutional Review Board and the institutional review board of local hospital systems.

**Behavioral Risk Factor Surveillance System**

Behavioral Risk Factor Surveillance System is a cross-sectional telephone survey that collects self-reported data on health-related risk behaviors. Behavioral Risk Factor Surveillance System data from Public Health Region 11 were used to estimate stroke risk factor prevalence for the stroke-free population in Nueces County. Data from the region was pooled from 2000 to 2010 and limited to self-identified Hispanics and NHWs aged 45 to 59 years. Stroke risk factors included the same risk factors collected in the Brain Attack Surveillance in Corpus Christi study. Multiple imputation was used to account for missing data (please see the online-only Data Supplement).

**Statistical Analysis**

Poisson regression models were run combining yearly stroke counts (numerator) and yearly populations at-risk counts (denominator) to estimate unadjusted and risk factor–adjusted (separate models for each risk factor) associations between ethnicity (MA versus NHW) and rate of IS. For each imputed data set, separate regressions were run to obtain the rate ratio (RR) and 95% confidence intervals (CI) for ethnicity adjusted for each risk factor and time modeled as years since 2000. Each risk factor model was extended to include an interaction term between ethnicity and the risk factor. Risk factor–adjusted ethnic RR’s and ethnic-specific interaction effect estimates from each imputed data set were then combined to obtain pooled RR’s and 95% CI estimates.

**Results**

A total of 707 incident ISs among those 45 to 59 years were identified, 493 among MAs and 214 among NHWs. Stroke risk factor prevalence among stroke cases and the stroke-free population is reported in Table 1 in the online-only Data Supplement.

The crude RR comparing IS rates in MAs and NHWs was 2.01 (95% CI, 1.71–2.36). Models that included diabetes mellitus (RR: 1.50; 95% CI, 1.26–1.78) and hypertension (RR: 1.84; 95% CI, 1.50–2.26) attenuated the RR for ethnicity compared with the crude model (Table 1). Models including current smoking status and no health insurance increased the RR for ethnicity compared with the crude model.

Stroke risk factors with significant interaction (P<0.20) with ethnicity included diabetes mellitus, no insurance, and less than high school education (Table 2). The stroke RR comparing MAs (RR: 6.42; 95% CI, 5.31–7.76) with and without diabetes mellitus was greater than the RR among NHWs (RR: 4.07; 95% CI, 3.68–4.51), while the stroke RR comparing MAs (RR: 0.59; 95% CI, 0.48–0.71) with and without health insurance was in the opposite direction than the RR among NHWs (RR: 2.60; 95% CI, 1.89–3.58). Stroke RRs comparing NHWs with and without education less than high school were greater than those in MAs (Table 2).

**Discussion**

We found that midlife MAs have double the IS risk compared with NHWs. The higher prevalence of diabetes mellitus and, to a lesser extent, hypertension in MAs contributed to their greater midlife stroke rates. In addition, the influence of diabetes mellitus on IS rates was significantly greater in midlife MAs compared with midlife NHWs.

**Table 1. Unadjusted and Adjusted Incidence Rate Ratios Among Midlife (45–59 Years) Mexican Americans and Non-Hispanic Whites, Nueces County, TX, 2000 to 2010**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Crude*</th>
<th>Rate Estimate</th>
<th>LCL</th>
<th>UCL</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus*</td>
<td>2.01</td>
<td>1.71</td>
<td>2.36</td>
<td>…</td>
<td>−25.45</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1.84</td>
<td>1.50</td>
<td>2.26</td>
<td>−8.31</td>
<td></td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>2.04</td>
<td>1.70</td>
<td>2.44</td>
<td>1.63</td>
<td></td>
</tr>
<tr>
<td>High cholesterol</td>
<td>2.07</td>
<td>1.73</td>
<td>2.47</td>
<td>3.14</td>
<td></td>
</tr>
<tr>
<td>Body mass index &gt;30</td>
<td>2.10</td>
<td>1.63</td>
<td>2.71</td>
<td>4.71</td>
<td></td>
</tr>
<tr>
<td>No insurance</td>
<td>2.19</td>
<td>1.83</td>
<td>2.61</td>
<td>8.91</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>2.13</td>
<td>1.79</td>
<td>2.52</td>
<td>5.91</td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>1.93</td>
<td>1.62</td>
<td>2.30</td>
<td>−3.80</td>
<td></td>
</tr>
</tbody>
</table>

LCL indicates lower confidence limit; and UCL, upper confidence limit. *Unadjusted model: stroke risk=intercept+yrs since 2000+ethnicity. †Adjusted model: stroke risk=intercept+yrs since 2000+ethnicity+β×risk factor.

Although causes of race–ethnic disparities in diabetes mellitus and hypertension have been elucidated and interventions aimed at preventing and treating these risk factors have been developed, disparities remain largely unabated. Social epidemiologists argue that race–ethnic inequalities in cardiovascular risk factors and the downstream clinical outcomes, such as stroke, will persist unless upstream causes of disparities, including poor social conditions and low socioeconomic status that are prevalent among minority populations, are addressed. Although health insurance did not explain midlife IS rate disparities in our analysis, there were large ethnic differences in health insurance status with nearly half of stroke-free MAs being uninsured. Therefore, policies that improve healthcare access may be particularly important for primary stroke prevention in midlife MAs. In particular, policies that curtail disparities in risk factors in early life (eg, disparities in...
childhood obesity) may be more successful in the long term by reducing disparities in major risk factors in midlife.8

Reasons for the stronger association of diabetes mellitus with IS among MAs compared with NHWs are not known but may be because of race–ethnic variation in the pathogenesis of diabetes mellitus or more likely to greater rates of uncontrolled diabetes mellitus among midlife MAs.9 In addition, it is unclear why lack of health insurance was protective for MAs, but this may be because of low income healthy MAs opting out of health insurance programs, while MAs with overt disease may choose to purchase health insurance because of high costs of medications.

This study is subject to several limitations. First, because of the ecological nature of the study, definitive statements about the causal role of stroke risk factors in midlife IS disparities cannot be made. Second, data from Behavioral Risk Factor Surveillance System are self-reported which is subject to recall bias, and this bias may differ between cases and controls. Last, the analysis was focused on only on the presence or absence of risk factors and did not take into consideration if a patient was currently receiving treatment and if the risk factor was being controlled. Future studies should consider use of continuous risk factor data, such as blood pressure, hemoglobin A1c, or low-density lipoprotein levels, to examine the influence of treatment and control of risk factors on ethnic stroke disparities in midlife.

Summary

Our findings suggest that diabetes mellitus and to a lesser extent hypertension contribute to the persistent IS disparities among midlife MAs. Social policies may be particularly relevant to reducing the consequences of stroke in midlife MAs, including greater years of living with disability, greater lifetime lost earnings, and greater healthcare expenditures from stroke.

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Disclosures

None.

References