Racial Disparities in the Development of Dysphagia After Stroke: Further Evidence From the Medicare Database

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Objective: To describe the relationship between minority race/ethnicity and dysphagia after stroke in a national sample. Unlike the multiple studies that have examined racial disparities in stroke incidence, risk factors, outcomes, and quality of care, the influence of race or ethnicity on dysphagia after stroke has been understudied. We hypothesized that the odds of dysphagia would be higher for Asians compared with Caucasians in the United States given the results of a previous study in the U.S.

Design: Observational study.

Setting: Conducted using the U.S. National Medicare Medical Provider Analysis and Review Data.

Participants: Medicare beneficiaries admitted in 2007 with a stroke diagnosis.

Intervention: We selected 382,959 cases with cerebrovascular disease codes with self-identified race/ethnicity of Caucasian, African American, Asian, Hispanic, Native American, or other/unknown. Cases had a diagnosis of cerebrovascular disease, defined as International Classification of Disease, Ninth Revision codes 430 to 438.9. Self-reported race/ethnicity was recorded in the following categories: Caucasian, African American, Asian, Hispanic, Native American, and other/unknown.

Main Outcome Measure: Dysphagia after stroke as coded in the data.

Results: The adjusted odds ratio (OR) for poststroke dysphagia was higher for Asians and other minority groups compared with Caucasians (Asian: OR, 1.73; 95% confidence interval [CI], 1.60–1.88; Hispanic: OR, 1.50; 95% CI, 1.39–1.63; African American: OR, 1.42; 95% CI, 1.37–1.47; unknown/other: OR, 1.27; 95% CI, 1.16–1.38; Native American: OR, 1.44; 95% CI, 1.22–1.69).

Conclusions: Our findings confirm previous research suggesting an association between Asian race and dysphagia after stroke while adding evidence for increased odds in other racial/ethnic minority groups.

Key Words: Deglutition; Disparities; Dysphagia; Epidemiology; Race; Rehabilitation; Stroke.

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SWALLOWING DISORDERS (dysphagia) are common in acute poststroke patients and are associated with poor short-term outcomes, such as institutionalization and mortality.1 Dysphagia is implicated in most cases of aspiration in elderly patients who have had a stroke, thereby increasing their risk for bacterial pneumonia.2 If risk factors or high-risk groups for dysphagia could be identified better, recognition would allow health care providers to classify patients into risk strata for surveillance and treatment of dysphagia, potentially decreasing morbidity and mortality. However, a better epidemiologic description of patient risk is hindered by a paucity of research for patient-based predictors of swallowing disorders after stroke.

Previous studies have focused mostly on identifying signs and symptoms associated with dysphagia.3-6 Researchers have estimated that 22% to 76% of patients with acute stroke develop dysphagia, depending on the diagnostic method used.7,6 However, unlike multiple studies that examined racial disparities in stroke incidence, risk factors, outcomes, and quality of care, the influence of race or ethnicity on dysphagia after stroke has been understudied.7,8 A previous study9 explored the relationship between race and dysphagia after stroke. In that study, it was reported that Asian race was associated with increased odds of dysphagia after stroke compared with Caucasians, whereas results for African Americans were inconclusive. The association between Asian race and poststroke dysphagia was present even after adjustment for stroke type and severity. However, it was unclear what factors accounted for the observed difference and it was not known whether differences in stroke (such as type, severity, or location) or disparities in stroke prevention and care were related to increased incidence of dysphagia (as shown consistently in the case of stroke).7,10-12 Work by Kuhlemeier and Stiens10 suggested that African Americans had more severe strokes than Caucasians. Klatsky et al13 reported that Asians were at increased risk for hemorrhagic stroke.

In the present study, our attention focused on confirming previous work in this area by expanding the analysis to a U.S. national sample. We therefore aimed to offer a generalized epidemiologic description of race as it pertains to the odds of...
dysphagia after stroke and to confirm previous analyses. Based on the previous evidence, we hypothesized that the odds of dysphagia would be higher for Asians compared with Caucasians in the United States.

METHODS

Study Design and Sample

We conducted an observational study of 382,959 unique inpatient admissions with a diagnosis of cerebrovascular disease (ICD-9 codes 430 – 438.9) from the U.S. 2007 MedPAR administrative database. Cases were stratified based on stroke codes as occlusive (ICD-9 codes 433– 434.9), hemorrhagic (ICD-9 codes 430 – 432.9), and ill-defined (ICD-9 codes 436 – 437.9). Data were provided without the presence of unique identifiers; thus, institutional review board exemption was granted.

The MedPAR file contains data from claims for services provided to Medicare beneficiaries admitted to Medicare-certified inpatient hospitals and skilled nursing facilities. The MedPAR record includes beneficiaries’ demographic characteristics, diagnosis and surgery information, and use of hospital resources. MedPAR data allow researchers to track inpatient diagnoses, procedures, and outcomes. All diagnostic and procedural data are recorded using ICD-9 codes based on the diagnoses recorded in the medical chart. The database does not provide information about how particular diagnoses were evaluated or diagnosed. The accumulation of claims from a beneficiary’s inpatient admission date to discharge or death represents 1 stay. Managed care bills are excluded in the MedPAR file. This database allows for up to 10 diagnoses for each case to be recorded. MedPAR data have been used extensively in research across multiple disciplines. For example, a National Center for Biotechnology Information PubMed title search (query date, April 18, 2010) listed 20 articles with the term MedPAR.

Medicare is the primary health care services payor for people older than 65 years in the United States. Medicare eligibility depends on U.S. citizenship (foreign nationals who have lived in the United States for at least 5 years also are eligible). People generally use Medicare starting at the age of 65 years, but people with disabilities or end-stage renal disease are eligible for benefits at a younger age.

Case Selection

From the original MedPAR short-stay 2007 file, we were provided with 1,042,483 records selected based on stroke (fig 1). We excluded 43 duplicate records and 639,318 duplicate cases that had the same case identifier and admission date. After verifying for the presence of stroke codes, 20,163 cases had no cerebrovascular disease codes and were excluded, leaving 382,959 stroke cases for analysis. Mean ± SD age of the sample was 79.5 ± 7.9 years, and 43% were men. Transient and late effects of cerebrovascular disease and cases with more than 1 stroke diagnostic code were described as part of the sample, but were excluded from subsequent analysis, leaving 266,663 beneficiaries with a single diagnosis of ischemic, hemorrhagic, or ill-defined stroke for adjusted analyses.

Variables

Primary outcome variable and primary predictor. Dysphagia, our primary outcome, was defined as the presence of ICD-9 codes 787.2 to 787.29. Code 438.82, other late effects of cerebrovascular disease-dysphagia, was not used because this code likely is associated with a stroke occurring before the admission of interest, the number of beneficiaries with this code was small, and its accuracy has not been validated. Code 787.2 for dysphagia has been studied previously for its use in this manner. Gonzalez-Fernandez et al16 reported that dysphagia was largely undercoded in administrative data, but when the code was present, dysphagia was confirmed by using videofluoroscopy in 94% of cases.

Self-reported race, our primary predictor, was recorded in the following MedPAR categories: Caucasian, African American, Asian, Hispanic, Native American, other, and unknown. The race variable in MedPAR is populated from the Social Security Administration’s master file. The race variable in MedPAR is accurate because it comes directly from the Social Security Administration’s master file. The race variable is accurate because it comes directly from the Social Security Administration’s master file. The race variable is accurate because it comes directly from the Social Security Administration’s master file.
Table 1: Characteristics of Stroke Cases by Race or Ethnic Group, MedPAR 2007

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Caucasian (n=379,181)</th>
<th>African-American (n=37,085)</th>
<th>Asian (n=4375)</th>
<th>Hispanic (n=5852)</th>
<th>Native American (n=1384)</th>
<th>Other/Unknown (n=5082)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>80 (12)</td>
<td>77 (13)</td>
<td>80 (11)</td>
<td>80 (11)</td>
<td>77 (12.5)</td>
<td>75 (11)</td>
</tr>
<tr>
<td>Men</td>
<td>143,582 (43.6)</td>
<td>14,040 (37.9)</td>
<td>1918 (45.3)</td>
<td>2490 (42.6)</td>
<td>536 (38.7)</td>
<td>2317 (45.6)</td>
</tr>
<tr>
<td>Dysphagia</td>
<td>17,806 (5.4)</td>
<td>2374 (6.4)</td>
<td>376 (8.6)</td>
<td>404 (6.9)</td>
<td>83 (6.0)</td>
<td>303 (6.0)</td>
</tr>
<tr>
<td>Aspiration pneumonia</td>
<td>8785 (2.6)</td>
<td>1047 (2.8)</td>
<td>209 (4.8)</td>
<td>200 (3.4)</td>
<td>32 (2.4)</td>
<td>169 (3.3)</td>
</tr>
<tr>
<td>Stroke type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occlusive</td>
<td>190,338 (57.8)</td>
<td>19,402 (52.3)</td>
<td>2217 (50.7)</td>
<td>2918 (49.9)</td>
<td>765 (55.3)</td>
<td>2740 (53.9)</td>
</tr>
<tr>
<td>Hemorrhagic</td>
<td>32,576 (9.9)</td>
<td>3710 (10.0)</td>
<td>784 (17.9)</td>
<td>794 (13.6)</td>
<td>146 (10.6)</td>
<td>693 (13.6)</td>
</tr>
<tr>
<td>Ill-defined</td>
<td>8056 (2.5)</td>
<td>1107 (3.0)</td>
<td>84 (1.9)</td>
<td>148 (2.5)</td>
<td>45 (3.2)</td>
<td>140 (2.8)</td>
</tr>
<tr>
<td>Transient</td>
<td>59,581 (18.1)</td>
<td>6770 (18.3)</td>
<td>619 (14.1)</td>
<td>1181 (20.2)</td>
<td>229 (16.6)</td>
<td>808 (15.9)</td>
</tr>
<tr>
<td>Late-effects</td>
<td>4964 (1.5)</td>
<td>1226 (3.3)</td>
<td>116 (2.7)</td>
<td>137 (2.3)</td>
<td>31 (2.2)</td>
<td>119 (2.3)</td>
</tr>
<tr>
<td>&gt;1 code/type</td>
<td>33,666 (10.2)</td>
<td>4870 (13.1)</td>
<td>555 (12.7)</td>
<td>674 (11.5)</td>
<td>168 (12.1)</td>
<td>582 (11.5)</td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>1986 (0.6)</td>
<td>135 (0.4)</td>
<td>45 (1.0)</td>
<td>31 (0.5)</td>
<td>10 (0.7)</td>
<td>28 (0.6)</td>
</tr>
<tr>
<td>Aphasia</td>
<td>25,455 (7.7)</td>
<td>2495 (6.7)</td>
<td>300 (6.9)</td>
<td>375 (6.4)</td>
<td>83 (6.0)</td>
<td>337 (6.6)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>204,971 (62.2)</td>
<td>22,596 (6.4)</td>
<td>2828 (64.6)</td>
<td>3363 (62.5)</td>
<td>900 (65.0)</td>
<td>3311 (65.1)</td>
</tr>
<tr>
<td>Charlson index score</td>
<td>1.12 ± 1.44</td>
<td>1.47 ± 1.61</td>
<td>1.12 ± 1.41</td>
<td>1.33 ± 1.52</td>
<td>1.32 ± 1.49</td>
<td>1.20 ± 1.52</td>
</tr>
</tbody>
</table>

NOTE. N=382,959. Values expressed as n (%) or mean ± SD unless otherwise indicated. Charlson index does not include cerebrovascular disease.

*Median (interquartile range), †P<.0001; ‡P<.001.

Security Administration’s master beneficiary record at birth or when a person files for a name change, new social security card, or benefits. For this study, we collapsed the other and unknown categories into 1.

Other variables. We also sought to investigate the role of stroke severity in the development of dysphagia after stroke. In the absence of a direct measure of stroke severity (such as the NIHSS or CSS), hemiplegia (ICD-9 code 342–342.1 and 342.9) and aphasia (ICD-9 code 784.3) were assessed as proxies for stroke severity. These items are part of the most widely used stroke severity scales (NIHSS and CSS) and have been included in shortened versions of the NIHSS. The Charlson index (as modified by Deyo et al) was used to assess the effect of comorbidity on dysphagia. Cerebrovascular disease was excluded from the index because this was the group of interest. CCS was used to create the following single-level diagnosis groups: aspiration pneumonia (CSS 98) and essential hypertension (CSS 129).

Statistical Analysis

Sample and demographic characteristics were calculated and analyzed by using 2 sample tests of proportions, Fisher exact test, and Pearson chi-square test, as applicable. Caucasians were used as the main comparison group for all analyses because they were the largest group. ORs for dysphagia after stroke by racial groups were calculated with 95% CIs. The significance level was set at P<.001. We used overdispersed binary logistic models to adjust for sex, age, stroke type, hemiplegia and aphasia, and comorbidity (Charlson index). No colinearity or statistically significant interactions were observed among variables in our models. The net effect of correcting for overdispersion was to decrease our CIs as follows: Asian by 0.1%, African American by 4%, Hispanic by 10%, other/unknown by 10%, and Native American by 22%. Sensitivity analyses were performed by fitting multivariate logistic regression models and using Hosmer-Lemeshow goodness-of-fit test, but because of the age variable’s nonlinearity, we were unable to generate a good-fitting model unless we modeled cases younger than 85 years (the linear portion of the distribution). Thus, we favored binary logistic regression models for a fuller description of the sample. Stratification also was used for subgroup analyses of patients with dysphagia by the presence of hemiplegia and/or aphasia and by stroke type. Data were analyzed using Intercooled Stata 11.

RESULTS

Demographic and stroke characteristics are listed in table 1. Caucasians, Asians, and Hispanics had the same median age, whereas African Americans, Native Americans, and the other/unknown groups were younger. Women were the larger proportion of the stroke population across race/ethnic strata. Dysphagia was higher for Asians (8.6%), African Americans (6.4%), and Hispanics (6.9%) compared with Caucasians (5.4%). Aspiration pneumonia was significantly higher in Asians (4.8%) and Hispanics (3.4%) versus the reference group.

Stroke type varied across racial groups. Occlusive strokes were the most common in every group, but represented a larger proportion of strokes in Caucasians compared with the other groups. The proportion of hemorrhagic strokes was highest in Asians (17.9%), Hispanics (13.6%), and other/unknown (13.6%) compared with Caucasians. No clinically meaningful differences were seen in the proportion of cases with hemiplegia (all <1%) by racial groups. The proportion of cases with aphasia was significantly higher for Caucasians compared with African Americans and Hispanics. Comorbidity (measured by using the Charlson score) was higher for all groups (except Asians) compared with Caucasians. The proportion of cases with hypertension was lower for African Americans and higher for all other groups, although it was not statistically significant for Hispanics and Native Americans.

Within dysphagic cases, we explored the relationships between stroke severity indicators (hemiplegia or aphasia), stroke type, and race (table 2). Although we did not find statistically significant differences among race/ethnicity groups with regard to stroke severity indicators (either hemiplegia or aphasia), Asians and Hispanics had the greatest proportion of hemor-
rhagic strokes (19.6% and 16.3%, respectively) and fewer ischemic strokes than whites. African Americans and Native Americans had more ischemic strokes than the reference group, although this increase was not statistically significant for Native Americans.

Results from our binary multiple logistic regression models for stroke cases are listed in Table 3. The OR for dysphagia after stroke was 73% higher for Asians compared with Caucasians in our saturated model (95% CI, 1.60–1.88). Adjustment did not significantly change the magnitude of the dysphagia-race association compared with our most parsimonious model including only age and sex. An increase in odds of dysphagia after stroke also was found for all other racial/ethnic groups (African Americans: OR, 1.42; 95% CI, 1.37–1.47; Hispanics: OR, 1.50; 95% CI, 1.39–1.63; Native Americans: OR, 1.44; 95% CI, 1.16–1.63). Hemiplegia and aphasia were strong predictors of dysphagia (OR, 4.17; 95% CI, 3.88–4.49; OR, 2.99; 95% CI, 2.42–3.07, respectively).

DISCUSSION

In this analysis of 266,663 Medicare beneficiaries admitted with a single stroke diagnosis, we showed that Asians had higher odds of dysphagia after stroke compared with Caucasians while also finding differences for African Americans, Hispanics, and Native Americans. Our findings are compared with the previous study in figure 2.

Some important themes emerged from this analysis. First, the point estimate for Asians was very close to estimates in the previous study (including New York and California). Moreover, this robust finding did not seem dependent on sample size or how data were collected, what Song et al.21 have called database bias. The Medical Information Reporting for California database (MIRCal) and the New York Statewide Planning and Research Cooperative System (SPARCS) databases are structured for billing and financial planning. Conversely, using the larger MedPAR data set was important to uncover differences in risk in other racial groups. In the previous study, conflicting evidence was presented for increased odds in African Americans. Because the CI for an OR can depend highly on the variance of the sample (overdispersion), high variance in previous studies might have explained the difference between estimates in California and New York for African Americans. Correcting for overdispersion in the present analysis resulted in estimates for African Americans that were statistically significant and of larger magnitude than previously described (MedPAR OR, 1.42; New York OR, 1.15; California OR, 1.08).

We have no evidence from our analysis of comorbidity to suggest that the overall health status of cases affected our estimates. Asians and Caucasians were similar in terms of comorbid conditions measured by using the Charlson index. The OR for the Charlson index in our multivariable models is 0.92 (0.91–0.93). Although this increase was not statistically significant for Native Americans, this robust finding did not seem dependent on sample size or how data were collected, what Song et al.21 have called database bias. The Medical Information Reporting for California database (MIRCal) and the New York Statewide Planning and Research Cooperative System (SPARCS) databases are structured for billing and financial planning. Conversely, using the larger MedPAR data set was important to uncover differences in risk in other racial groups. In the previous study, conflicting evidence was presented for increased odds in African Americans. Because the CI for an OR can depend highly on the variance of the sample (overdispersion), high variance in previous studies might have explained the difference between estimates in California and New York for African Americans. Correcting for overdispersion in the present analysis resulted in estimates for African Americans that were statistically significant and of larger magnitude than previously described (MedPAR OR, 1.42; New York OR, 1.15; California OR, 1.08).

We have no evidence from our analysis of comorbidity to suggest that the overall health status of cases affected our estimates. Asians and Caucasians were similar in terms of comorbid conditions measured by using the Charlson index. The OR for the Charlson index in our multivariable models should be taken with caution because it likely is a result of the data collection process. Cases with a high number of important comorbid conditions may have those priority coded, making it less likely for dysphagia to be coded (the database is limited to 10 diagnoses), thus generating an OR less than 1.

Table 2: Dysphagic Cases Stratified by Severity Indicators (hemiplegia and/or aphasia), Stroke Type, and Race/Ethnicity, MedPAR 2007

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Caucasian (n=16,190)</th>
<th>African American (n=2081)</th>
<th>Asian (n=336)</th>
<th>Hispanic (n=362)</th>
<th>Native American (n=77)</th>
<th>Other/Unknown (n=266)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predictors</td>
<td>Model 1</td>
<td>Model 2</td>
<td>Model 3</td>
<td>Model 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1.05 (1.04–1.05)</td>
<td>1.04 (1.04–1.04)</td>
<td>1.04 (1.04–1.04)</td>
<td>1.04 (1.04–1.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemiplegia</td>
<td>3.60 (3.35–3.87)</td>
<td>3.54 (3.30–3.80)</td>
<td>4.17 (3.88–4.49)</td>
<td>2.99 (2.92–3.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aphasia</td>
<td>3.11 (3.03–3.19)</td>
<td>3.01 (2.93–3.09)</td>
<td>2.99 (2.92–3.07)</td>
<td>2.99 (2.92–3.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hemorrhagic (vs occlusive)</td>
<td>0.85 (0.82–0.88)</td>
<td>0.84 (0.81–0.87)</td>
<td>0.84 (0.81–0.87)</td>
<td>0.84 (0.81–0.87)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ill-defined (vs occlusive)</td>
<td>0.24 (0.22–0.27)</td>
<td>0.24 (0.21–0.27)</td>
<td>0.24 (0.21–0.27)</td>
<td>0.24 (0.21–0.27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race (vs Caucasian)</td>
<td>1.67 (1.54–1.81)</td>
<td>1.71 (1.58–1.86)</td>
<td>1.73 (1.60–1.90)</td>
<td>1.73 (1.60–1.88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1.34 (1.30–1.39)</td>
<td>1.38 (1.33–1.43)</td>
<td>1.38 (1.34–1.44)</td>
<td>1.42 (1.37–1.47)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.42 (1.32–1.54)</td>
<td>1.47 (1.36–1.59)</td>
<td>1.48 (1.37–1.60)</td>
<td>1.50 (1.39–1.63)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other/unknown</td>
<td>1.23 (1.12–1.34)</td>
<td>1.25 (1.14–1.37)</td>
<td>1.26 (1.15–1.40)</td>
<td>1.27 (1.16–1.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td>1.36 (1.14–1.60)</td>
<td>1.40 (1.18–1.65)</td>
<td>1.41 (1.20–1.67)</td>
<td>1.44 (1.22–1.69)</td>
<td></td>
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</tr>
</tbody>
</table>

NOTE. N=266,663. All estimates are OR (95% CI) for all variables included in each model as described. Empty cells represent characteristics/variables not included in the model.
We explored the possibility that stroke type, particularly hemorrhagic stroke, was associated with increased odds of dysphagia. In favor of this view are studies suggesting that Asians have more hemorrhagic strokes and the larger proportion of Asians with hemorrhagic strokes in our sample. Adjusting for stroke type did not alter our estimates of the OR of dysphagia for any group.

These data do not allow us to determine potential causes for the observed increase in odds of poststroke dysphagia for Asians. The role of stroke location and severity needs further evaluation. There is no evidence in the literature for or against differing stroke locations by racial or ethnic groups. A study of stroke location would be useful to elucidate potential differences. There is no evidence in the literature for or against differing stroke locations by racial or ethnic groups. A study of stroke location would be useful to elucidate potential differences. Hemiplegia and aphasia were used as a proxy for stroke severity because no data were available for stroke severity. It is possible that this measure did not completely account for the spectrum of stroke severity and a more thorough evaluation of stroke severity will yield different results. Because the magnitude of the effect is large and consistent among different studies, it seems unlikely that stroke severity by itself will completely explain the differences observed.

We examined the possibility that differing stroke types by race affected the occurrence of dysphagia after stroke. Adjusting for stroke type did not affect the estimate for the odds of dysphagia in our adjusted models, and stratified analysis failed to show differential rates of dysphagia for Asians with hemorrhagic strokes.

Differences in treatment availability and stroke care as they relate to the development of dysphagia after stroke also should be investigated. It is possible that there are differences in system-of-care variables (such as adherence to stroke treatment protocols) that result in increased stroke severity and worse outcomes for minority groups because most minority groups had increased dysphagia after stroke. Nevertheless, the heightened OR of poststroke dysphagia in Asians was disproportionately large compared with other minorities and could not be explained by health care or system-of-care factors by themselves, pointing toward a different process accounting for the observed differences in Asians.

**Study Limitations**

Limits to the generalizability of our work include the exclusion of people younger than 65 or older than 65 years not enrolled in Medicare and exclusion of claims paid by a source other than fee-for-service Medicare (eg, managed care organizations). With these data, we cannot make conclusions about possible associations between race and dysphagia when patients are younger than 65 years. Moreover, data were collected for the purpose of health care payments and billing, not research.

No meaningful conclusions can be made about the prevalence of dysphagia in this sample. It is known from previous work that dysphagia likely is undercoded. Thus, the proportion of dysphagic cases in these data likely underestimates the true prevalence in this population.

The effect of recurrent strokes was not assessed. If Asians were more likely to have recurrent strokes than other groups, this potentially could explain the differential rates of dysphagia in this cohort. Further studies are needed to address recurrent strokes as a potential cause because they account for a significant proportion of all strokes.

In addition, misclassification of dysphagic cases based on race also is possible. However, in light of past misclassification, in 2003, the Department of Health and Human Services applied a new algorithm to improve classification of Hispanic and Asian/Pacific Islander beneficiaries, increasing sensitivity. We believe that self-reported race is a robust measure of minority status, and it is the best possible classification scheme available at this time.

Finally, our ability to evaluate stroke severity was limited. We were reliant on using hemiplegia and aphasia to gauge stroke severity. A full description was not possible because
most items on standardized stroke scales cannot be described using ICD-9 codes and thus are not included in the MedPAR file. Therefore, it is possible that we were not completely successful in adjusting for stroke severity. Other relevant descriptors of stroke and stroke severity, such as stroke location, side, or presence of neglect, are not available in this database and should be evaluated in the future.

CONCLUSIONS

In this diverse national sample of stroke cases, we confirmed the previous finding that dysphagia was associated with Asian race while describing new differences in other minority groups. Differences in stroke type and severity indicators (hemiplegia or aphasia) did not explain the increased odds in Asians or other groups in multivariable models. Multiple physiologic and system-of-care differences could explain differences in the odds of dysphagia after stroke for minority groups compared with Caucasians and should be the focus of future research. Of particular importance are differences in quality of care that might differentially affect dysphagia risk in minority groups. Regardless of the underlying cause, better epidemiologic characterization of factors related to dysphagia after stroke (physiologic or social) will allow for better risk assessments and heightened surveillance and vigilance on the part of health care providers, potentially improving outcomes for stroke patients with dysphagia. The increased odds of dysphagia in Asians are unlikely to be explained by differences in quality of care alone because of the magnitude of the effect. Differences in stroke severity, location, and type should be the focus of future studies in Asian populations.

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Suppliers

b. Stata 11, Stata Corp, 4905 Lakeway Dr, Campus Park, TX 77845.