Background and Purpose—Despite evidence that primary stroke center (PSC) certification is associated with improvements in care and outcome, only a minority of hospitals have achieved this certification. We sought to determine hospital-based factors associated with achievement of PSC certification.

Methods—We used the 2011 American Hospital Association survey and the 2010 national census for population and household data to identify potential hospital and demographic factors influencing certification as a PSC by the Joint Commission, Healthcare Facilities Accreditation Program, and DNV Healthcare.

Results—Of the 3696 hospitals to complete the survey, 3069 fulfilling study criteria included 908 PSC (31%) and 2161 non-PSC. Independent hospital characteristics associated with PSC certification were Joint Commission accreditation (odds ratio [OR], 3.5; 95% confidence interval [CI], 2.4–5.0), increasing size (per quartile in number of beds; OR, 2.5; 95% CI, 2.1–3.1) and inpatient neurological services (OR, 3.2; 95% CI, 2.4–4.6), number of households per zip code (per 1000 households; OR, 1.1; 95% CI, 1.0–1.2), increasing Hispanic population (by 10% increase; OR, 1.1; 95% CI, 1.0–1.2), and income per household (per $10000; OR, 1.2; 95% CI, 1.1–1.3). Designation as a sole community provider (OR, 0.22; 0.10–0.47) or governmental hospital control (0.61; 0.44–0.84) was associated with noncertification.

Conclusions—Less than 1 in 3 hospitals has achieved certification as an PSC. Potential areas of improvement include increasing certification of governmental-controlled hospitals.

Key Words: certification ■ hospitals ■ quality improvement

See related article, p 3499.

In 2000, the Brain Attack Coalition published recommendations for the establishment of primary stroke centers (PSCs) to improve and advance acute stroke care. Based on these requirements, hospitals began applying for PSC certification starting in 2003. PSC certification has been associated with higher compliance with national guideline proven care, higher starting rates of acute stroke therapy, and, most importantly, improved clinical stroke outcomes.

In an attempt to identify possible factors affecting PSC certification, we sought to determine hospital-based characteristics associated with successful achievement of certification. Understanding these factors could assist in a targeted approach to increasing stroke center certification, improving the delivery of emergent stroke care in the United States.

Methods

Using the 2011 American Hospital Association annual survey, we identified hospital-related factors potentially affecting PSC certification (listed in Table 1). PSC certification status for each hospital through January 2013 was determined via the Joint Commission (JC), Healthcare Facilities Accreditation Program, and DNV Healthcare websites. Comprehensive and PSC certifications were combined for this analysis. We determined regional emergency medical services routing policy by survey. We obtained demographic information by linking the hospitals participating in the American Hospital Association survey to the 2010 national census for population and household using the hospital address.

Only hospitals with ≥25 beds (smallest hospital to achieve PSC) and 24-hour emergency departments were evaluated. Data were analyzed using SAS. We performed univariate analysis for each individual factor’s association with advanced stroke certification using test for continuous and tests for categorical variables. Factors found to be associated with achievement of certification (P<0.010) were evaluated by logistic regression to determine a final model of independent association.

Results

Of 5723 hospitals meeting American Hospital Association criteria in the United States, 3696 completed the 2011 survey. Of these, 3069 fulfilled study criteria of potentially becoming a PSC including 908 PSC (31%) and 2161 non-PSC (Table 1).

PSCs were typically larger (mean 354 beds versus 136 beds), had busier EDs (mean 724 vs 24 visits/y), were more often affiliated with Accreditation Council for...
Graduate Medical Education (ACGME) residency programs (43% versus 14%), AMA medical schools (51% versus 21%), JC-accredited (95% versus 65%), had inpatient neurological services (94% versus 46%) and trauma centers (55% versus 38%). PSCs were less likely to be governmental (federal/state/county 10% versus 26%) and designated as the sole community provider (1% versus 9%).

Independent hospital characteristics associated with PSC certification were JC accreditation (odds ratio [OR], 3.5; 95% confidence interval [CI], 2.4–5.0), sole community provider (OR, 0.22; 95% CI, 0.10–0.47), hospital type (governmental versus nongovernmental, 0.61; 95% CI, 0.44–0.84), increasing size (per quartile in number of beds; OR, 2.5; 95% CI, 2.1–3.1), and inpatient neurological services (OR, 3.2; 95% CI, 2.4–4.6; Table 2).

Although controlling for hospital-based factors, the demographic and regional factors independently associated with hospital PSC designation were number of households per zip code (per 1000 households; OR, 1.1; 95% CI, 1.0–1.2), and increasing income per household (per $10000; OR, 1.2; 95% CI, 1.1–1.3; Table 2).

Governmental hospitals were the less likely to achieve PSC certification, and rates varied depending on controlling body (Table 3). Hospitals administered by states and hospital districts were more often PSC, whereas county-administered hospitals had extremely low rates of certification. The low rates of certification in the 294 county facilities drove the association of governmental control with low rates of advanced stroke certification.

### Discussion

We found that larger hospitals with JC certification who offered neurological services were most likely to be accredited, whereas sole community provider hospitals and governmental hospitals, particularly county facilities, were much less likely to be certified. Demographic characteristics of hospitals achieving PSC certification included increased number of households, increasing Hispanic population, and wealthier neighborhoods. Hospital size is a recognized barrier, but smaller hospitals can successfully achieve stroke center certification, often using telemedicine to link to larger hospitals or regional stroke networks for the resources needed for acute stroke care.

Many factors drive hospitals to become stroke centers, including the desire to improve care. Factors working against certification include lack of coordination, financial constraints, inadequate available medical expertise, and increasing administrative complexity because of hospital regulations. We recently described the positive effect of regional emergency

### Table 2. Results of Multivariate Analysis: Independent Associations With Primary Stroke Certification

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Commission certification</td>
<td>3.5</td>
<td>2.4–5.0</td>
</tr>
<tr>
<td>Sole community provider</td>
<td>0.22</td>
<td>0.10–0.47</td>
</tr>
<tr>
<td>Governmental hospital control</td>
<td>0.61</td>
<td>0.44–0.84</td>
</tr>
<tr>
<td>Increasing bed size (per quartile)</td>
<td>2.5</td>
<td>2.1–3.1</td>
</tr>
<tr>
<td>Hospital-based neurological services</td>
<td>3.2</td>
<td>2.4–4.6</td>
</tr>
<tr>
<td>1000 households</td>
<td>1.1</td>
<td>1.0–1.2</td>
</tr>
<tr>
<td>10% increase in Hispanic population</td>
<td>1.1</td>
<td>1.0–1.2</td>
</tr>
<tr>
<td>Household income increase of $10000</td>
<td>1.2</td>
<td>1.1–1.3</td>
</tr>
</tbody>
</table>

### Table 3. Governmental Control Type and Primary Stroke Center Certification

<table>
<thead>
<tr>
<th>Control Type</th>
<th>n</th>
<th>Percent Certified, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal government</td>
<td>68</td>
<td>1.5</td>
</tr>
<tr>
<td>City</td>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td>County</td>
<td>294</td>
<td>5</td>
</tr>
<tr>
<td>Hospital district</td>
<td>422</td>
<td>12</td>
</tr>
<tr>
<td>Both city and county</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>State</td>
<td>873</td>
<td>32</td>
</tr>
</tbody>
</table>
medical services diversion to certified stroke centers in driving hospital certification.7

The most striking result in our analysis is that hospitals controlled by governmental entities were significantly less likely to be certified as stroke centers. This was most evident in the group of county facilities, in which 1 in 20 achieved certification. County hospitals have an important role as safety net for uninsured and underinsured, often providing care to the indigent and underserved. This population is at particularly high risk for stroke and in great need of stroke education and acute stroke care.

There are limitations to this study, including incomplete participation (65%) of hospitals nationwide in the survey. The hospitals that did not participate are more likely to be smaller and resource-poor, and it is possible that we may have overestimated the rate of stroke centers nationwide. Survey results may not reflect actual practices in the hospitals. We were unable to take into account state-based acute stroke certification systems, which several states use. For example, in 2004, the Massachusetts Department of Public Health began designating primary stroke service hospitals, independently of the JC certification program, using criteria based on the Brain Attack Coalition recommendations.5 The American Hospital Association survey data used in this study reflected only PSCs that had been certified by the JC, DNV, and the Healthcare Facilities Accreditation Program. Another limitation is the data’s inability to reflect which hospitals tried and failed to achieve PSC certification. These survey data give us a snapshot of certification at only 1 point in time. A longitudinal analysis could provide a different perspective because hospital certification is not a static process; the number of hospitals seeking certification change all the time.

Sources of Funding

This work was supported by the 2013 American Heart Association Student Scholarship in Cerebrovascular Diseases and Stroke (C.M. McDonald), Roxanna Todd Hodges Foundation (W.J. Mack, N. Sanossian), and Joachim Splichal (N. Sanossian).

Disclosures

Dr Saver is a member of the Get with the Guidelines steering committee and is an employee of the University of California. The University of California, Regents receive funding for Dr Saver’s services as a scientific consultant on trial design and conduct to Covidien, CoAxia, Stryker, BrainsGate, and St. Jude Medical. Dr Saver has served as an unpaid site investigator in multicenter trials run by Lundbeck for which the UC Regents received payments on the basis of clinical trial contracts for the number of subjects enrolled. Dr Saver serves as an unpaid consultant to Genentech advising on the design and conduct of the Potential of rtPA for Ischemic Strokes With Mild Symptoms (PRISMS) trial; neither the University of California nor Dr Saver received any payments for this voluntary service. The University of California has patent rights in retrieval devices for stroke. The other authors report no conflicts.

References

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Catherine M. McDonald, Steven Cen, Lucas Ramirez, Sarah Song, Jeffrey L. Saver, William J. Mack and Nerses Sanossian

Stroke. 2014;45:3717-3719; originally published online November 11, 2014;
doi: 10.1161/STROKEAHA.114.006819
Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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