Vascular Neurologists as Directors of Stroke Centers in the United States
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**Background and Purpose**—Hospital certification as primary and comprehensive stroke center is associated with improvement in care. We aimed to characterize the leadership at stroke centers nationwide to determine the proportion led by vascular neurologists, a board-recognized subspecialty focusing on stroke care.

**Methods**—We identified hospitals in the United States holding primary and comprehensive stroke center designation as of September 2013. We contacted each hospital to identify the medical director and used data from relevant medical boards to determine specialization. Sex and date of medical school graduation were obtained from an online physician database.

**Results**—Of the 1167 primary and 50 comprehensive stroke center hospitals certified by the Joint Commission (n=1114), Det Norske Veritas (n=68), and Healthcare Facilities Accreditation Program (n=35), we identified the director in 940 (77%). Leadership was most often by a neurologist (n=745; 79%) followed by physicians in emergency medicine (n=58; 6%) and internal medicine (n=17; 2%). Vascular neurologists (n=319) led about one-third of stroke centers. Directors were mostly men (n=764; 81%), with a median number of years after medical school graduation of 25 (interquartile range, 18–34). Comprehensive stroke centers were more likely than primary stroke centers to have leadership by vascular neurologist (77%, n=37 versus 32%, n=282; \( P < 0.001 \)).

**Conclusions**—Vascular neurologists led about one-third of stroke centers. There is opportunity for vascular neurologists to increase their role in stroke center directorship. (Stroke. 2015;46:2654-2656. DOI: 10.1161/STROKEAHA.115.009888.)

**Key Words:** accreditation ■ certification ■ neurology ■ stroke

Stroke is a leading cause of adult hospitalization, disability, and mortality in the United States. Systems of stroke care have evolved to include stroke units, stroke-specific protocols, and establishment of primary stroke centers (PSCs) and comprehensive stroke centers (CSCs). Hospital certification as a PSC is associated with higher compliance with proven therapies and improved outcomes.

The Brain Attack Coalition recommendations for establishing PSCs and CSCs emphasize strong leadership as an important element in the creation and operation of stroke centers with a director demonstrating expertise in cerebrovascular disease/stroke. Completion of a vascular neurology fellowship or board certification in vascular neurology is cited as only 1 example of qualification for directorship (Table 1). Vascular neurology is a relatively new subspecialty, recognized by the American Board of Psychiatry and Neurology (ABPN) in 2003, focusing expertise in the treatment of vascular events, including stroke. The ABPN first provided board certification in 2005.

We aimed to characterize the leadership of US stroke centers by determining the specialization of the director at certified stroke centers nationwide and describing the proportion of programs lead by board-certified vascular neurologists.

**Methods**

In September 2013, we identified hospitals holding certification as a PSC or CSC using the Joint Commission, Det Norske Veritas Healthcare, and Healthcare Facilities Accreditation Program (HFAP) websites. The identity of the stroke center director was obtained by website search or by contacting each individual hospital using the following progressive steps to find those which did not make this information easily accessible: Website neurology/neuroscience tab, Website search link stroke, directly calling hospital neurology department or administration and lastly e-mailing individuals based on staff recommendations. The method by which each director was identified was not recorded. Director specialization was confirmed using the director’s name and the zip code of the hospital. Board certification in neurology and vascular neurology was verified via the ABPN certification and status verification system. Board certification for other specialties was verified via certificationmatters.org, a certification verification system of the American Board of Medical Specialties. The sex and date of graduation from medical school were obtained from Healthgrades Operating Company Inc’s online physician database.
Table 1. Requirements for Stroke Center Directors per the Brain Attack Coalitiona

<table>
<thead>
<tr>
<th>Achievement of &gt;2 of the following:</th>
<th>Category Number (%)</th>
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<tbody>
<tr>
<td>Completion of a vascular neurology fellowship or board certification</td>
<td>ABPN—Neurology 745 (79.3)</td>
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<tr>
<td>or vascular neurology</td>
<td>ABPN—Vascular Neurology 319 (33.9)</td>
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<tr>
<td>Participation (as an attendee or faculty) in at least 2 regional,</td>
<td>ABPN—Neurophysiology 79 (8.4)</td>
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<tr>
<td>national, or international stroke courses or conferences in the past 2 y</td>
<td>ABPN—Sleep Medicine 32 (3.4)</td>
</tr>
<tr>
<td>Greater than or equal to 5 peer-reviewed publications in the area of</td>
<td>ABPN—Neuromuscular Medicine 13 (1.4)</td>
</tr>
<tr>
<td>clinical cerebrovascular disease</td>
<td>Joint ABPN—Neurology and Psychiatry 8 (0.9)</td>
</tr>
<tr>
<td>Greater than or equal to 8 continuing medical education credits (or</td>
<td>ABPN—Child Neurology 4 (0.4)</td>
</tr>
<tr>
<td>equivalent educational exposure) each year in the area of cerebrovascular disease</td>
<td>Emergency medicine 58 (6.2)</td>
</tr>
<tr>
<td>Other criteria agreed on by local physicians and hospital administrators</td>
<td>Internal medicine 17 (1.8)</td>
</tr>
<tr>
<td></td>
<td>Radiology 15 (1.6)</td>
</tr>
<tr>
<td></td>
<td>Neurosurgery 13 (1.4)</td>
</tr>
<tr>
<td></td>
<td>Psychiatry 11 (1.2)</td>
</tr>
<tr>
<td></td>
<td>Physical medicine and rehabilitation 10 (1.1)</td>
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<tr>
<td></td>
<td>Family practice 5 (0.5)</td>
</tr>
<tr>
<td></td>
<td>Surgery 2 (0.2)</td>
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<tr>
<td></td>
<td>Unable to confirm certification 64 (6.8)</td>
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</tbody>
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Cross tabulation using $\chi^2$ was used for comparison of hospital accreditation category, accreditation body, sex, CSC, and PSC. t test was used in comparison of graduation year.

Results

We identified a total of 1217 stroke centers: 1167 PSCs and 50 CSCs. The certifying organization was most often Joint Commission (n=1114) followed by Det Norske Veritas (n=68) and HFAP (n=35). We identified the stroke center director at 940 (77%) of the 1217 centers (892 at PSCs and 48 at CSCs). These 940 made up the denominator for the following analyses (Table 2).

The majority of stroke centers were led by a board-certified neurologist (745/940, 79%), followed by physicians in internal medicine (n=58, 6%), vascular medicine (n=58, 6%), internal medicine (n=17, 2%), radiology (n=15, 2%), neurosurgery (n=13, 1%), and psychiatry (n=11, 1%). There were 12 centers that identified >1 director, most often a combination of neurologist and emergency medicine physician (n=10) or 2 emergency medicine physicians (n=2). For purposes of this analysis, hospitals with joint neurologist and emergency medicine leaders were counted as neurology. At 64 centers, the medical director was identified but did not hold a current board certification, including 26 who self-identified as neurologists. For the purposes of this analysis, we included all physicians who were not board-certified in a separate category.

Among the centers with neurology leadership, there were 319 led by vascular neurologists. Vascular neurology–led centers accounted for 34% of total and 43% of centers within the neurology leadership category (Figure). CSCs were more likely than PSCs to have leadership by a board-certified vascular neurologist (77%, n=37 versus 32%, n=282; $P=0.001$). Among certifying organizations, HFAP-certified stroke centers were least likely to be led by neurologist (65% HFAP, 82% Joint Commission, 86% Det Norske Veritas; $P=0.045$) or vascular neurologist (14% HFAP, 23% Det Norske Veritas, 37% Joint Commission; $P=0.043$).

Stroke directors were most often men (n=764, 81%), and the median number of years after medical school graduation was 25 (interquartile range, 18–34). Many neurologists serving as stroke center directors had added certification in nonvascular subspecialties (n=136) of neurophysiology (n=79, 11%), sleep medicine (n=32, 4%), neuromuscular medicine (n=13, 2%), psychiatry (n=8, 1%), and child neurology (n=4, 0.5%). Vascular neurologist stroke center directors were also mostly men (84%) and were more recent graduates with and thus presumably younger compared with nonvascular neurologist directors (median number of years after medical school graduation was 24 [interquartile range, 16–32] versus 27 [interquartile range, 18–35], $P=0.023$).

Discussion

This is the first study that we are aware of describing the characteristics of stroke center directors in the United States. The majority of certified stroke centers were led by a neurologist (79%), about a third by a vascular neurologist (34%). One striking characteristic was the under-representation of women (19%) in stroke center leadership positions. This may be because of underlying sex distribution within neurology. Although women make up 34% of full-time US physicians and 38% of full-time physicians in academic settings, in 2010, per the AMA Physician Masterfile, only 25% of neurologists were women.

Although the majority of US stroke center directors are neurologists, there are many different specialists who serve in this role. According to the Brain Attack Coalition recommendations, the director does not need to be a neurologist, although should demonstrate expertise in cerebrovascular disease (Table 1).3 These recommendations are similar to the requirements placed by the different certifying bodies. Although we think that vascular neurologists may have the ideal training and set of skills to serve in directorship, it is unknown whether the expertise of stroke center director has any impact on quality of care.

This study has several limitations. Not all PSC and CSC medical directors could be identified. This was because of lack of information on hospital websites, unreachable hospital personnel, and staff being unaware of the information we requested. Our dependence on 2 verification systems that are...
not all inclusive is a limitation as well. Hospitals with vascular neurologist directors may be more likely to advertise and provide information potentially biasing the results.

In summary, we think that there is a need for vascular neurologists to take on leadership positions within stroke centers nationwide. Future studies need to address the question of whether subspecialty training in vascular neurology among stroke center leaders leads to better patient outcomes.

Disclosures
None.

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