Neurocritical care education during neurology residency

AAN survey of US program directors

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ABSTRACT

Objective: Limited information is available regarding the current state of neurocritical care education for neurology residents. The goal of our survey was to assess the need and current state of neurocritical care training for neurology residents.

Methods: A survey instrument was developed and, with the support of the American Academy of Neurology, distributed to residency program directors of 132 accredited neurology programs in the United States in 2011.

Results: A response rate of 74% (98 of 132) was achieved. A dedicated neuroscience intensive care unit (neuro-ICU) existed in 64%. Fifty-six percent of residency programs offer a dedicated rotation in the neuro-ICU, lasting 4 weeks on average. Where available, the neuro-ICU rotation was required in the vast majority (91%) of programs. Neurology residents' exposure to the fundamental principles of neurocritical care was obtained through a variety of mechanisms. Of program directors, 37% indicated that residents would be interested in performing away rotations in a neuro-ICU. From 2005 to 2010, the number of programs sending at least one resident into a neuro-ICU fellowship increased from 14% to 35%.

Conclusions: Despite the expansion of neurocritical care, large proportions of US neurology residents have limited exposure to a neuro-ICU and neurointensivists. Formal training in the principles of neurocritical care may be highly variable. The results of this survey suggest a charge to address the variability of resident education and to develop standardized curricula in neurocritical care for neurology residents. *Neurology*® 2012;78:1793-1796

GLOSSARY

AAN = American Academy of Neurology; **GES** = Graduate Education Subcommittee; **ICU** = intensive care unit; **neuro-ICU** = neuroscience intensive care unit; **UCNS** = United Council for Neurologic Subspecialties.

Neurocritical care is a rapidly growing field, and the majority of practitioners are neurologists trained in critical care. In 2005, neurocritical care joined the United Council for Neurologic Subspecialties (UCNS), and the first diplomates were awarded certificates 2 years later.¹ The field has undergone significant maturation, evidenced by the formation of a formal society, independent medical journal, and accredited fellowship. There are currently 102 neuroscience intensive care units (neuro-ICUs) and 31 UCNS certified fellowship programs registered with the Neurocritical Care Society.² Although practitioners are multidisciplinary and the subspecialty is devoted to multisystem care, neurologists have played a prominent role in its development.

Currently, clear curricular guidelines exist for neurocritical care fellowship training programs. However, despite the increase in number of training programs and neurology residents entering these fellowships, the current American Academy of Neurology (AAN) Residency curriculum does not include specific directives for neurocritical care education for trainees. Few previous data regarding exposure to the principles and management of critically ill patients during neurology residency are available. The objective of this survey, administered through

Supplemental data at www.neurology.org

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the AAN Graduate Education Subcommittee (GES), was to provide survey data regarding the need and current state of neurocritical care training for US neurology residents.

METHODS The survey instrument was created by the AAN GES in fall 2010 and reviewed by leadership from the Critical Care and Emergency Neurology Section of the AAN. The Member Research Subcommittee reviewed the instrument in January 2011. The stated objectives of the *Neuro-Critical Care Education Survey* were to evaluate the composition, need, and state of neurocritical care training for neurology residents in the United States. The findings were meant to provide information regarding the current state of formal and informal exposure to neurocritical care during neurology residency training and to inform strategic planning for the AAN and the Neurocritical Care Society regarding resident education in neurocritical care. This data were also to be used in the development of formal neurocritical care electives for visiting residents. The full survey instrument is available as appendix e-1 on the *Neurology*[®] Web site at www.neurology.org.

The survey was first sent to all US neurology program directors on February 23, 2011. Directors received an E-mail with a link to the online version of the survey and a paper survey that was sent via postal mail or fax. A letter signed by the GES Chair accompanied each paper survey. Nonrespondents received reminders to participate at 2 additional time points. GES representatives called nonresponding directors on March 30, 2011, for a final attempt at collection. Data collection was closed on April 4, 2011.

The results were analyzed using descriptive statistical measures. For determination of significance, t , χ^2 , or Fisher exact tests were used as appropriate; p values < 0.05 were considered significant.

RESULTS A response rate of 74.2% (98 of 132) was achieved for the *Neuro-Critical Care Education Survey*. There were no clear differences in geography or composition or large vs small programs between responder and nonresponder centers.

Characteristics of programs surveyed are presented in table 1. The overwhelming majority of programs were primary stroke centers and were designated level I trauma centers. More than half of program directors (64%) indicated that their hospital

has a dedicated neuro-ICU. The median number of beds in such units was 16 (minimum–maximum 5–42). In hospitals with a dedicated neuro-ICU, 75% were staffed with at least one UCNS board-eligible or board-certified neurology-trained neurointensivist. Only 30% of programs without a neuro-ICU had a neurology-trained neurointensivist on staff. In programs with a neuro-ICU, the primary specialties involved in teaching and clinical care were neurology (68%), anesthesiology (40%), internal medicine (22%), neurosurgery (15%), emergency medicine (10%), and surgery (7%). Among programs that did not have a dedicated neuro-ICU, 96% of programs reported caring for critically ill neurology patients in the medical intensive care unit (ICU) and 57% in a surgical ICU.

With regard to resident education and training, 56% of residents had a dedicated rotation in a neuro-ICU. For programs in which the rotation is offered, it is required by 91% and typically offered in the first or second year. On average, residents rotate through the neuro-ICU for 4 weeks (SD 2). Factors that increased the likelihood of participating in a neurocritical care rotation included a dedicated neuro-ICU (87% vs 13%, $p < 0.001$), neurology-trained intensivists (87% vs 13%, $p = 0.001$), the presence of a neuro-ICU fellowship (56% vs 44%, $p < 0.001$), and a higher number of neurology residents (mean 19 vs 13, $p < 0.001$) in the program.

Of program directors, 37% indicated that 2 residents per year might be interested in an away elective in a neuro-ICU at another institution. Program directors were more interested in an away elective if they did not have a neuro-ICU (58% vs 42%, $p < 0.001$) or a dedicated rotation for their residents (61% vs 39%, $p = 0.009$). Resident staffing of programs with a dedicated neuro-ICU was variable. Approximately half (46%) have a dedicated ICU neurology resident who participated in the coverage of the unit. Programs also use dedicated ICU residents from neurosurgery (36%) or anesthesiology (21%) or physician extenders (28%).

Program directors were also asked to estimate the primary methods by which residents acquired the principles of critical care neurology training (table 2). A large proportion of this knowledge base was obtained through didactic series and self-directed learning. Residency directors were also asked to provide the number of residents who had entered a neuro-ICU fellowship for each of the prior 6 years, beginning in 2005, when neurocritical care joined the UCNS. The number of programs with at least one resident entering a neuro-ICU fellowship over this time period increased from 14% to 35%. This trend was consistent throughout this period (figure). Pro-

Table 1 Residency program and hospital characteristics

Characteristic of responding neurology programs (n = 98)	%
Dedicated neuro-ICU, %	64
Offers neuro-critical care fellowship	34
Neuro-ICU resident rotation	56
Primary stroke center designation	97
Level I trauma center designation	81
Patients with intracerebral hemorrhage always or often admitted to neurology	70
Patients with subarachnoid hemorrhage always or often admitted to neurology	22

Abbreviation: neuro-ICU = neuroscience intensive care unit.

Table 2 Methods for knowledge acquisition in critical care neurology

Resident education in neurocritical care	%
Lecture series	90
Routine patient care	83
Self-directed education and reading	74
Journal clubs	57
Dedicated rotation	54
Elective rotation	47
Other	9

grams were more likely to send at least one resident into a neurocritical care fellowship during the last 5 years if the program had a dedicated neuro-ICU rotation (68% vs 32%, $p = 0.002$), fellowship program (47% vs 53%, $p = 0.001$), and greater number of total residents (mean of 19 vs 13, $p < 0.001$).

DISCUSSION This survey of neurology resident exposure to neurocritical care provides data regarding programmatic exposure to neurocritical care during residency training. The survey reveals significant variability in programmatic offerings to neurology trainees across the country, but also an increasing interest in exposure to neurocritical care among neurology residents and program directors. Among institutions with an active neuro-ICU program defined as a program with a dedicated unit, fellowship training in neurocritical care, and neurology-trained intensivists on the faculty, increasing numbers of residents enter careers in critical care neurology.

In the early 1980s, only a handful of formal, dedicated neuro-ICUs were in existence. Over the last 20 years, there has been a surge in the number of neuro-ICUs at both large and small centers, academic and

nonacademic. In parallel, as inpatient neurology services have increased, along with trends in the geographic clustering of care (e.g., stroke units), many academic centers are developing or are continuing to expand existing service lines in neurocritical care, and this need was recognized in the 2008 Leapfrog Group update.³

At virtually every institution, departments of neurology and residency program directors are faced with unique challenges in determining trainees' role and obligations in this field. From 2005 to 2010, there has been a 150% growth in the number of programs that send at least one resident into a neurocritical care fellowship. However, almost half of graduating residents have little or no access to a dedicated neuro-ICU, either because a dedicated unit does not exist or a rotation designed to follow critically ill patients is not required. As one would expect, those programs that have developed units and neurocritical care faculty are more likely to provide residents with clinical experiences that supplement didactic and self-directed learning. One recent survey of intensivists suggested that neurology programs develop a special track for those residents interested in neurocritical care.⁴

The variability in exposure and participation in neurocritical care, as evident in the results of this survey, in conjunction with sustained interest in this subspecialty by rising neurologists, suggests a need for formal recommendations in neurocritical care training. Academic departments and residency programs may benefit from such guidance, ideally put forth by a working group of neurology educators and program directors, along with practicing neurointensivists. This working group may be charged with guidance for several aspects of neurocritical care training during residency including minimal requirements for skills and concepts to be acquired and procedural competencies. In addition, the survey results here indicate that current leading forms of instruction are didactic and self-directed. A fundamental issue is the ongoing conflict between increasing restrictions on clinical service and exposure time of residents for education. Neurocritical care learning and education are driven mostly by direct patient care, which is a key issue in developing guidelines for future training of neurology residents in the neuro-ICU.

Neurocritical care is a subspecialty of neurology that has deep interdisciplinary roots in the related fields of neurosurgery, anesthesiology, and critical care medicine, both in its founding and its membership. Such collaboration in critical care neurology is essential and probably an attractive characteristic to those who are drawn to its practice. In the present day, however, because existing guidelines from the

Figure Percentage of programs with residents entering neuroscience intensive care unit (neuro-ICU) fellowships

Neurology Residency Review Committee suggest that additional residents cannot serve to solely fulfill clinical service obligations, the community of neurology educators is faced with the following question: what are the fundamental skills and basic requirements, if any, of neurology residents with regard to the practice of neurocritical care? It is clear that neurologists will continue to bear a significant proportion of the care of patients with acute neurologic disease.

As a natural consequence, neurology educators may desire to provide some guidance with regard to clinical exposure and the necessity of dedicated rotations in a neuro-ICU, whether at home or away, components of the curriculum that are specific to the critically ill patient and instruction on how best to seek this knowledge from those with the appropriate skill set, whether they be neurologists, anesthesiologists, general critical care intensivists, emergency physicians, or neurosurgeons. The growing number of dedicated neuro-ICUs and recognition by organizations such as Leapfrog imply that the need for intensivists with neurologic expertise will remain strong. Because expertise in neuroscience is the distinguishing feature of this subspecialty, neurology residency training is a natural setting to share and develop this unique skill set.

AUTHOR CONTRIBUTIONS

Dr. Sheth is the corresponding author and is responsible for study concept/design, acquisition of data, drafting/revising the manuscript, and analysis/interpretation of data. O. Drogan is responsible for study

concept/design, acquisition of data, drafting/revising the manuscript, analysis/interpretation of data, and statistical analysis. Dr. Manno is responsible for study concept/design and drafting/revising the manuscript. Dr. Geocadin is responsible for study concept/design and drafting/revising the manuscript. Dr. Ziai is responsible for study concept/design, acquisition of data, drafting/revising the manuscript, and analysis/interpretation of data.

DISCLOSURE

Dr. Sheth has received research funding from the American Academy of Neurology, American Heart Association, US Army, Remedy Pharmaceuticals, and Brainscope, Inc.; serves on the editorial board for *Neurology Today*; is a section editor for *Frontiers in Hospitalist Neurology*, *Current Treatment Options in Neurology*, and *Neurotherapeutics*; and has received royalties from *Blueprints: Clinical Cases in Neurology*. O. Drogan is a salaried employee of the American Academy of Neurology. Dr. Manno, Dr. Geocadin, and Dr. Ziai report no disclosures. **Go to Neurology.org for full disclosures.**

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