Neurosurgical training in USA

The US Residency Selection Process

The United States Medical Licensing Examination (USMLE) Step 1, arguably the most significant assessment in the USMLE examination series, changed from a 3-digit score to a pass/fail outcome in January 2022.

In the United States, a neurosurgeon must generally complete four years of college, four years of medical school, and seven years of residency (PGY-1-7).

Most, but not all, residency programs have some component of basic science or clinical research. Neurosurgeons may pursue an additional training in a fellowship, after residency or in some cases, as a senior resident. These fellowships include pediatric neurosurgery, trauma/neurocritical care, functional and stereotactic surgery, surgical neuro-oncology, radiosurgery, neurovascular surgery, Interventional neuroradiology, peripheral nerve, spine surgery and skull base surgery.

In the U.S., neurosurgery is considered an extremely competitive specialty composed of only 0.6% of all practicing physicians and attracts only the top students of medical schools per year (with a <60% match rate and highest average USMLE scores).

http://www.neurosurgeryschools.com/Colleges_list/index.html

Neurosurgery is a very competitive specialty. Good grades in the first two years of medical school are essential and even more important is performance in clinical clerkships. High pass and honors should be in nearly all clinical rotations, including Surgery, Medicine, Pediatrics, OB-GYN and even Psychiatry. Honors in your neurosurgical sub-internships and rotations is, of course, critical. Being in the top quartile of your medical school class is very helpful, as is being a member of the Alpha Omega Alpha (AOA) Honor Medical Society, as this gives the residency admission committee the best evidence that you are among the top of your class. You can still match without being AOA, but it will be more difficult to match at top programs. Some top medical schools do not have AOA chapters. If this is the case at your home institution, the Electronic Residency Application Service (ERAS) allows you to select the "No AOA Chapter at My School" option on the application.

Today, neurosurgeons practice in a variety of locations, from academic centers to community hospitals and outpatient surgery centers, to major research facilities such as the National Institute of Health (NIH).

The community of neurosurgeons is relatively small. In the U.S., there are about 3,500 practicing Board-certified neurosurgeons and just over 100 residency training programs. In 2014-2015, 105 neurosurgery residency training programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) offered 210 positions. Neurosurgery residents are trained to perform all types of neurosurgery, including neurocritical care.

Subspecialization with enfolded or post-residency fellowships can be pursued in pediatric

neurosurgery, spine, neurointerventional, cerebrovascular/skull base, neuro-oncology, pain, trauma and functional neurosurgery.

Like many specialties, neurosurgery strives to attract the best and brightest candidates graduating from accredited medical schools. Men and women considering a career in neurosurgery should have the intellectual curiosity and ability to embrace and understand the detail and complexity of the nervous system. They must have the personal and physical stamina to meet the challenges of a demanding residency and surgical procedures that often extend for many hours and the desire to pursue excellence, as this is a specialty of high acuity with tremendous consequence.

Because the number of residency positions is limited, most students granted acceptance to a neurosurgical training program are exemplary and generally rank at or near the top of their class. Neurosurgery appeals to those individuals who are drawn to the intellectual challenge of constant learning coupled with a strong desire to cure neurosurgical disease; those willing to make difficult decisions and take responsibility for critically ill patients. No two operations are exactly the same, and much time is spent considering the various options before choosing an approach to a problem. Stress and the challenges of dealing with severely disabled and dying patients are every day occurrences for neurosurgeons.

History

It was William Stewart Halsted in the early twentieth century who introduced the format of a residency program to USA as a tool to improve clinical practice. As a surgeon teaching at Johns Hopkins Medical School in Baltimore, his aim was to guarantee a well-organized training period for young medical doctors to finally become qualified surgeons—and this model is still considered the standard for education in any medical specialization ¹⁾.

In United States, the Institute of Medicine examined resident duty hours and their impact on patient safety. Experts have suggested that reducing resident work hours to 56 hours per week would further decrease medical errors. Although some reports have indicated that cutbacks in resident duty hours reduce errors and make resident life safer, few authors have specifically analyzed the effect of the Accreditation Council for Graduate Medical Education (ACGME) duty-hour limits on neurosurgical resident education and the perceived quality of training. Jagannathan et al. have evaluated multiple objective surrogate markers of resident performance and quality of training to determine the impact of the 80-hour workweek.

Test scores and levels of participation in national conferences, however, indicate that the 80-hour workweek may adversely affect resident training. Subjectively, neurosurgical program directors and chief residents believe that the 80-hour workweek makes neurosurgical training and the care of patients more difficult. Based on experience with the 80-hour workweek, educators think that a 56-hour workweek would further compromise neurosurgical training and patient care in the US²

Long working hours and sleep deprivation have been a facet of physician training in the US since the advent of the modern residency system. However, the scientific evidence linking fatigue with deficits in human performance, accidents and errors in industries from aeronautics to medicine, nuclear power, and transportation has mounted over the last 40 years. This evidence has also spawned

regulations to help ensure public safety across safety-sensitive industries, with the notable exception of medicine. In late 2007, at the behest of the US Congress, the Institute of Medicine embarked on a year-long examination of the scientific evidence linking resident physician sleep deprivation with clinical performance deficits and medical errors. The Institute of Medicine's report, entitled "Resident duty hours: Enhancing sleep, supervision and safety", published in January 2009, recommended new limits on resident physician work hours and workload, increased supervision, a heightened focus on resident physician safety, training in structured handovers and quality improvement, more rigorous external oversight of work hours and other aspects of residency training, and the identification of expanded funding sources necessary to implement the recommended reforms successfully and protect the public and resident physicians themselves from preventable harm. Given that resident physicians comprise almost a quarter of all physicians who work in hospitals, and that taxpayers, through Medicare and Medicaid, fund graduate medical education, the public has a deep investment in physician training. Patients expect to receive safe, high-quality care in the nation's teaching hospitals. Because it is their safety that is at issue, their voices should be central in policy decisions affecting patient safety. It is likewise important to integrate the perspectives of resident physicians, policy makers, and other constituencies in designing new policies. However, since its release, discussion of the Institute of Medicine report has been largely confined to the medical education community, led by the Accreditation Council for Graduate Medical Education (ACGME). To begin gathering these perspectives and developing a plan to implement safer work hours for resident physicians, a conference entitled "Enhancing sleep, supervision and safety: What will it take to implement the Institute of Medicine recommendations?" was held at Harvard Medical School on June 17-18, 2010. This White Paper is a product of a diverse group of 26 representative stakeholders bringing relevant new information and innovative practices to bear on a critical patient safety problem. Given that our conference included experts from across disciplines with diverse perspectives and interests, not every recommendation was endorsed by each invited conference participant. However, every recommendation made here was endorsed by the majority of the group, and many were endorsed unanimously. Conference members participated in the process, reviewed the final product, and provided input before publication. Participants provided their individual perspectives, which do not necessarily represent the formal views of any organization. In September 2010 the ACGME issued new rules to go into effect on July 1, 2011. Unfortunately, they stop considerably short of the Institute of Medicine's recommendations and those endorsed by this conference. In particular, the ACGME only applied the limitation of 16 hours to first-year resident physicans. Thus, it is clear that policymakers, hospital administrators, and residency program directors who wish to implement safer health care systems must go far beyond what the ACGME will require. We hope this White Paper will serve as a guide and provide encouragement for that effort. RESIDENT PHYSICIAN WORKLOAD AND SUPERVISION: By the end of training, a resident physician should be able to practice independently. Yet much of resident physicians' time is dominated by tasks with little educational value. The caseload can be so great that inadequate reflective time is left for learning based on clinical experiences. In addition, supervision is often vaguely defined and discontinuous. Medical malpractice data indicate that resident physicians are frequently named in lawsuits, most often for lack of supervision. The recommendations are: The ACGME should adjust resident physicians workload requirements to optimize educational value. Resident physicians as well as faculty should be involved in work redesign that eliminates nonessential and noneducational activity from resident physician dutiesMechanisms should be developed for identifying in real-time when a resident physician's workload is excessive, and processes developed to activate additional providersTeamwork should be actively encouraged in delivery of patient care. Historically, much of medical training has focused on individual knowledge, skills, and responsibility. As health care delivery has become more complex, it will be essential to train resident and attending physicians in effective teamwork that emphasizes collective responsibility for patient care and recognizes the signs, both individual and systemic, of a schedule and working conditions that are too demanding to be safeHospitals should embrace the opportunities that resident physician training redesign offers. Hospitals should recognize and act on

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the potential benefits of work redesign, eg, increased efficiency, reduced costs, improved quality of care, and resident physician and attending job satisfactionAttending physicians should supervise all hospital admissions. Resident physicians should directly discuss all admissions with attending physicians. Attending physicians should be both cognizant of and have input into the care patients are to receive upon admission to the hospitalInhouse supervision should be required for all critical care services, including emergency rooms, intensive care units, and trauma services. Resident physicians should not be left unsupervised to care for critically ill patients. In settings in which the acuity is high, physicians who have completed residency should provide direct supervision for resident physicians. Supervising physicians should always be physically in the hospital for supervision of resident physicians who care for critically ill patientsThe ACGME should explicitly define "good" supervision by specialty and by year of training. Explicit requirements for intensity and level of training for supervision of specific clinical scenarios should be providedCenters for Medicare and Medicaid Services (CMS) should use graduate medical education funding to provide incentives to programs with proven, effective levels of supervision. Although this action would require federal legislation, reimbursement rules would help to ensure that hospitals pay attention to the importance of good supervision and require it from their training programs. RESIDENT PHYSICIAN WORK HOURS: Although the IOM "Sleep, supervision and safety" report provides a comprehensive review and discussion of all aspects of graduate medical education training, the report's focal point is its recommendations regarding the hours that resident physicians are currently required to work. A considerable body of scientific evidence, much of it cited by the Institute of Medicine report, describes deteriorating performance in fatigued humans, as well as specific studies on resident physician fatigue and preventable medical errors. The question before this conference was what work redesign and cultural changes are needed to reform work hours as recommended by the Institute of Medicine's evidencebased report? Extensive scientific data demonstrate that shifts exceeding 12-16 hours without sleep are unsafe. Several principles should be followed in efforts to reduce consecutive hours below this level and achieve safer work schedules. The recommendations are: Limit resident physician work hours to 12-16 hour maximum shiftsA minimum of 10 hours off duty should be scheduled between shiftsResident physician input into work redesign should be actively solicitedSchedules should be designed that adhere to principles of sleep and circadian science; this includes careful consideration of the effects of multiple consecutive night shifts, and provision of adequate time off after night work, as specified in the IOM reportResident physicians should not be scheduled up to the maximum permissible limits; emergencies frequently occur that require resident physicians to stay longer than their scheduled shifts, and this should be anticipated in scheduling resident physicians' work shiftsHospitals should anticipate the need for iterative improvement as new schedules are initiated; be prepared to learn from the initial phase-in, and change the plan as neededAs resident physician work hours are redesigned, attending physicians should also be considered; a potential consequence of resident physician work hour reduction and increased supervisory requirements may be an increase in work for attending physicians; this should be carefully monitored, and adjustments to attending physician work schedules made as needed to prevent unsafe work hours or working conditions for this group"Home call" should be brought under the overall limits of working hours; work load and hours should be monitored in each residency program to ensure that resident physicians and fellows on home call are getting sufficient sleepMedicare funding for graduate medical education in each hospital should be linked with adherence to the Institute of Medicine limits on resident physician work hours ³⁾.

Attrition rates

Overall, neurosurgery training attrition rates are low. Women have had greater attrition than men during and after neurosurgery residency training. International and private medical school alumni had higher attrition than public medical school alumni ⁴.

Away rotations

Subspecialization of physicians and regional centers concentrate the volume of certain rare cases into fewer hospitals. Consequently, the primary institution of a neurological surgery training program may not have sufficient case volume to meet the current Residency Review Committee case minimum requirements in some areas. To ensure the competency of graduating residents through a comprehensive neurosurgical education, programs may need for residents to travel to outside institutions for exposure to cases that are either less common or more regionally focused.

Gephart et al. sought to evaluate off-site rotations to better understand the changing demographics and needs of resident education. This would also allow prospective monitoring of modifications to the neurosurgery training landscape. They completed a survey of neurosurgery program directors and query of data from the Accreditation Council of Graduate Medical Education to characterize the current use of away rotations in neurosurgical education of residents. We found that 20% of programs have mandatory away rotations, most commonly for exposure to pediatric, functional, peripheral nerve, or trauma cases. Most of these rotations are done during postgraduate year 3 to 6, lasting 1 to 15 months. Twenty-six programs have 2 to 3 participating sites and 41 have 4 to 6 sites distinct from the host program. Programs frequently offset potential financial harm to residents rotating at a distant site by support of housing and transportation costs. As medical systems experience fluctuating treatment paradigms and demographics, over time, more residency programs may adapt to meet the Accreditation Council of Graduate Medical Education case minimum requirements through the implementation of away rotations ⁵⁰.

Postoperative complications

Resident involvement in the operating room was not a significant factor for postoperative complications in neurosurgery service. This analysis also showed that much of the observed difference in postoperative complication rates was attributable to other confounding factors. This is a quality indicator for resident trainees and current medical education. Maintaining high standards in postgraduate training is imperative in enhancing patient care and reducing postoperative complications ⁶.

More North Americans than those from the rest of the world are of the opinion that graduating residents are presently competent to perform basic cerebrovascular procedures like evacuation of a hematoma and clipping a simple 7-mm middle cerebral artery aneurysm. Extremely few graduating neurosurgical residents anywhere are presently capable of performing endovascular techniques for even the most basic of aneurysms. Most of those surveyed also believe that endovascular and open surgical management of aneurysms should be a part of residency training for all residents (70.4 and 88.7 %, respectively)⁷.

Neuroendovascular treatment

Endovascular interventions have become an essential part of a neurosurgeon's practice.

A study suggest potential gaps in the training of neurosurgery residents with regard to endovascular neurosurgery. In an era of minimally invasive therapies, changes in residency curricula may be

needed to keep pace with the ever-changing field of neurosurgery ⁸⁾

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