

TEACHING THE NEXT GENERATION

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I. Challenges to Educating the Next Generation of Neurologists

Several challenges confront educators of the next generation of neurologists. Undergraduate and graduate medical education, including neurology residency and fellowships, has undergone tremendous change in recent years. This change reflects differences in the enterprise of academic medicine generally, changes within neurology itself, and characteristics of the new generation, raised in the information age, that could have implications for their learning (Table 1). All of these, easy enough to enumerate and classify, pose both challenges and opportunities for educators and administrators.

Table 1. Challenges to Educating the Next Generation of Neurologists

Changes in the Enterprise of Academic Medicine	Education competes with research and practice for attention
	Decline in faculty time/reward for teaching
	Decreased funding
	Relationships between commercial sponsors and education
	Inflexible regulatory requirements
Changes in Neurology	Rapid pace of growth in scientific knowledge
	Increased subspecialization
	Role of inpatient versus outpatient care
Changes in Trainees	Generational differences
	Demographic differences
	General comfort with "virtual reality" and the "information superhighway"
	Changing interpretation of professionalism

Changes in the Enterprise of Academic Medicine

Commentators have noted the increased pressures faced by academic medical centers today, and the concomitant corrosive effect on the education of young physicians.¹ Research, commercial development of research findings, and practice have all challenged education as a major focus of the academic mission. Individual physicians at these institutions, moreover, find it increasingly difficult to balance teaching with research careers and practice. Many teachers do not receive special compensation or recognition for their teaching efforts. Development of optimal methods for teaching the next generation, therefore, will likely need to take place in an environment of reduced financial support and, in many cases, reduced morale.

Commercial development of research ideas has also become increasingly important on academic campuses.² While this offers the possibility of alternative funding sources, it carries with it several risks, as well. In particular, physicians may be exposed to biased information or feel pressured to behave in ways that are not in the best interests of their patients or society.^{3,4} Most physicians underestimate the effect of exposure to industry representatives on their own decisions, though they believe that others are influenced by them. This problem may be especially acute for students and trainees, who may be less able to distinguish between unbiased and biased data, and who may be more vulnerable to influence or coercion, explicit or subtle, from faculty.⁵ These concerns have led to stricter rules regarding interactions between trainees and pharmaceutical representatives, but such interactions are unlikely to be fully eliminated. Efforts to simply block trainees from encountering drug reps, however, may be shortsighted,

and appear not unlike teenage sex education campaigns that teach abstinence rather than contraception. After all, the same trainees will eventually become independent physicians.

In addition, educational programs have been increasingly subjected to regulatory oversight. For example, the Accreditation Council on Graduate Medical Education (ACGME) introduced the core competencies, requiring educators to redefine the medical educational mission according to strict guidelines covering 6 specific areas of core knowledge and ability. These core competencies as they apply to Neurology have been thoroughly reviewed,⁶ and suggestions for how to incorporate them into training programs have been published.⁷ In addition, the ACGME, as well as New York State, have introduced resident duty hour restrictions.⁸ Of note, these changes have occurred in the setting of shrinking reimbursements and increased administrative burdens, compounding the difficulties for program directors and other educators. Changes in educational approaches will thus need to account for these regulatory requirements and unfunded mandates.

Changes in Neurology

Changes specific to neurology are occurring, as well. While the rapid growth in basic and clinical neuroscience is welcomed, it poses challenges to educators. First, one can reasonably argue that there is more and more neurology to learn, due to the successes of neuroscientists and clinical researchers. Hardly a day goes by without a report of a new gene for a neurological disorder or an entirely new syndrome. Neurologists in training must now incorporate into practice new medications, clinical trials, and guidelines on an ever expanding basis. How to teach more and more neurology in the same time period is an issue.

As a result of the boom in knowledge and therapeutic possibilities, sub-specialization is also increasing. The ACGME and the United Council for Neurologic Subspecialties (UCNS) have expanded the number of subspecialties with formal certification processes (including Vascular Neurology, Endovascular Surgical Neuroradiology, Neurocritical Care, Neuro-oncology, Headache Medicine, and others). The growth of subspecialties necessarily entails a certain chauvinism around their practice, and general neurologists may become an endangered species, or at least one rarely encountered in the wilds of the dog-eat-dog world of academic medicine. Yet generalists may be the best teachers for young neurologists learning to master the neurological exam in its entirety or trying to choose a career path.

At the same time, some have noted a tension within neurology residency education between the increasing demands of critically ill inpatients versus the growing importance of outpatient training, where most practicing neurologists will ultimately spend the majority of their time.^{9,10} Hospitalist medicine now exists,¹¹ and similar fellowships in neurology have been considered. Thus the sheer burden of neurology that must be learned by the next generation is growing, and the spectrum of choices they will face in their careers has increased.

Changes in Trainees

A perhaps equally profound challenge for neurology educators, however, is that posed by the differences between the generations themselves. Sociologists and educators, at some risk of overgeneralization, have made much of the differences between the 4 generations currently practicing (or beginning to practice) today (Table 2).^{12,13} With Traditionalists, Baby Boomers, Gen Xers, and Gen Yers (or Millennialists) all working together in the hospital environment, there is need for all to work well together, and yet there is a potential for conflict between different styles of learning and working.

In most situations in medicine, the older three generations will be teaching Gen Y, although it is already becoming clear that Gen Y has much to teach the older generations, as well (as discussed below). Personality characteristics of Gen Y reflect the fact that they grew up in a world saturated with personal computers, the internet, easy access to information, and graphics. They are therefore comfortable with parallel processing and multi-tasking. They often respond more readily to information presented in graphic rather than textual format. Gen Yers are said to function best when working in a network rather than individually. They have seen several of their peers catapulted to positions of great wealth and power

in our culture, and so are less impressed by traditional hierarchies. As a result of this, and perhaps most importantly to the situation of medical education, they expect adults to consult and include them readily.

In addition to these general personality characteristics of the next generation, their rapid adoption of specific new technologies, with wacky, often fanciful names, including Google, podcasting, and wikis is likely to play an important role in their education. Because the pace of technological innovation has been so rapid, organized institutional bodies responsible for education, such as the ACGME and Residency Review Committee, cannot easily master these technologies and fit them into their long-term educational strategies. Educators, however, will need to recognize both the potential benefits and limitations of these new developments if they are to best incorporate them into the educational mission. The challenges of these technological innovations are of course being felt across the educational and cultural spectrum, but their effects are likely to be as great in medical education as anywhere else.

Generational Group	Birth Years	Characteristics	Key Traits
Traditionalists	1901-1945	Loyalist	Puts aside individual needs Faith in institutions Top-down management style Respect for hierarchy
Baby boomers	1946-1964	Optimists	Grew up in world of opportunities Idealistic: Focused on righting wrongs Expect interpersonal communication and sharing
Gen X	1965-1980	Skeptics	Less faith in institutions More faith in themselves as individuals Participated in technological revolution and are comfortable with multiple media Resourceful and independent
Gen Y (Millennials)	1981-1999	Realists	Very comfortable with technology and the information "superhighway" Comfortable with physical and virtual space Appreciate and expect diversity Like to collaborate

II. Restructuring the Approach and Commitment to Teaching

Neurologists, perhaps more than many others in academic medical centers, have always prided themselves on being among the best teachers (only in part, one hopes, because of their traditionally limited ability to do much for their patients!). In the setting of limited salary support for teaching, and the growing pressures to be more productive in research and practice, however, their teaching role is at risk of being shortchanged. Two of the major recommendations of the recently released American Medical Association Initiative to Transform Medical Education (ITME), in fact, focus on the need for institutional commitments to faculty development and ensuring that funding and time commitments are made conducive to faculty teaching.¹⁴ Educational planning, delivery and research should explicitly be considered in promotion and tenure decisions. Some institutions have responded to this challenge creatively by creating academies within medical centers that focus on education, such as those at Harvard, UCSF, and Columbia.^{15,16,17} These academies may provide a way for teachers and clinician-educators to share ideas across departments, join forces in promoting the crucial role of the educational mission in their institutions, and to argue for greater respect and funding of education to society. In the competitive world of the healthcare marketplace, educators will need to look out for their own interests to survive.

One potential advantage of the increased consolidation of education within medical centers is the possibility for educational research. The AAN has recognized the importance of education research by initiating a grant mechanism for education research proposals,¹⁸ and the journal *Neurology* is committed

to the publication of education research papers in the parent journal and in its Resident and Fellow Section.¹⁹ It is anticipated that with the growth in the quality of education research there will be improved career possibilities along clinician-educator promotion tracks.

An interest in education research goes beyond the improved career prospects for educators, however. In our endeavor to practice current, scientifically-based medicine, it is intuitively appealing that our approach to education should be equally scientific. Evidence-based medicine should be taught through evidence-based education. A major aspect of the ACGME move towards use of the core competencies is its embrace of the Outcomes Project, which seeks to determine what works best and what doesn't in achieving our goal of training physicians and, ultimately, improving patient outcomes. A wealth of information on possible ways to measure and achieve improved outcomes in graduate medical education is available on the ACGME website.²⁰ Research is needed to prove the efficacy of these techniques, however.

A further desirable structural change in hospital organization of work would be a more honest recognition of the difference between trainee education and service. This, however, will not come cheaply, as hospitals will need to replace resident labor with that of fully trained nurse practitioners, physician assistants, hospitalists and other non-trainees. In addition to freeing residents for educational activities, however, such shifts in the labor force could have other beneficial consequences, including improving continuity of care, providing additional opportunities for teaching by and to residents, and improving overall hospital morale.

III. Changes in the Scope of Educational Content

The new “Neuros”

The breadth of neurology education will clearly continue to grow, and this will pose challenges as discussed above. But at a deeper level, the scope of neurology education may reasonably need to be broadened beyond traditional scientific areas. Clinical neurology education has traditionally and appropriately been focused on neuroanatomy, neuropathology, neurophysiology, and more recently neurogenetics and neuroimaging, as well as other key scientific disciplines. These are enough to master in 3 years of training. It is clear that in the future, however, the scope of practicing neurology will continue to change. As new technologies bring new dilemmas, social neuroscience and social neurology will continue to evolve. Several neurologists, for example, played an important role in the national debate over whether to let Terri Schiavo die, for example.²¹ More recently, evidence of the potential neuropsychological effects of repeated concussive injuries in football players has engendered neuroepidemiological debate.²² We have already witnessed the birth of neuroethics as a subspecialty of bioethics (nicely reviewed at neuroethics.upenn.edu), neurophilosophy,²³ and neuroreligion,^{24,25} and neurologists continue to tackle such difficult concepts as the nature of the self.²⁶ In the future, new “neuros” are likely to emerge.

The hidden curriculum

On a broader scale, in a fragmented healthcare system, neurologists, like other physicians, will increasingly require an appreciation of the context within which healthcare is delivered. Neurologists will need to be taught to navigate the system, play an important role in helping patients to navigate it, and, ideally, work to help fix it, as well. David Leach, until recently the director of the ACGME and an important proponent of the core competency approach to graduate medical education, has written about efforts to transform Family Medicine training to incorporate knowledge of the context in which healthcare is provided, and to involve trainees in the efforts to improve the healthcare system.²⁷ In fact, he argues, residents are in many ways better positioned to fix or improve the healthcare system because of their unique role in the trenches. Their specific, local knowledge of how medicine is practiced is part of the “hidden curriculum.”

These issues are equally important for neurologists as they are for family practitioners. For example, issues related to practice and hospital systems frequently arise within the residency program, such as medical record completion, hospital initiatives to improve documentation, hospital certification, and

optimal ways to structure rotations to maximize efficiency and work hour compliance. These issues provide opportunities for practical resident education. For example, by involving residents in committees focused on these issues, we have an opportunity to teach and evaluate competence in these areas. For example, at our institution residents have been intimately involved in redesigning the curriculum, rotation structure, and lecture content. **Error! Bookmark not defined.** Active participation in this process provides an opportunity for residents to demonstrate competence in Practice-Based Learning and Improvement, Professionalism, and Systems-Based Practice. Neurology residents at the University of Pennsylvania, together with medical students, have helped to organize a program to teach neuroscience to community high school students, and they are beginning to assess the effects of this program on the career choices of these students.²⁸ Others have studied methods of improving the teaching skills of residents, though it remains unclear how best to do this, and few reports have included neurology residents.²⁹

An excellent example of a more formal approach to this process of involving residents in the improvement of healthcare systems is a combined residency program in preventive medicine at Dartmouth-Hitchcock in Hanover, New Hampshire, in which residents in any of several subspecialties do additional training in preventive medicine.³⁰ As part of this training, they must identify, study, and make recommendations for fixing a systems-based clinical problem at the hospital. A goal for the future should be to recognize that resident involvement in addressing these issues is not something apart from their education but rather an essential part of it.

Balancing the art and science of neurology

With greater therapeutic possibility comes greater responsibility. Integral to the provision of excellent neurological care is learning to balance the art and science of neurology. The definition of the art of medicine may be changing, as well, however, as the role of individual discretion changes in the face of the growth of evidence-based neurology. Residents will thus need to learn how to practice in a healthcare system that expects and rewards an understanding of evidence-based and, sometimes, protocol-driven, neurology. In some cases, they may be better prepared for this than even their teachers and mentors.

In many cases, the use of evidence-based medicine requires an appreciation of the importance of the availability of guidelines, like those produced by the AAN, and strict adherence to protocols. Nowhere within neurology is this more obvious than in stroke and critical care neurology. The American Heart Association Get with the Guidelines program, for example, emphasizes the need to treat patients in a standardized fashion, although many neurologists may object to the regimentation of treatment.³¹ JCAHO has mandated several standards for hospitals that wish to consider themselves Primary Stroke Centers, and there are plans to create a similar set of criteria for Comprehensive Stroke Centers.³² There is thus less room for individual discretion in many instances.

At the same time, residents must learn how to balance evidence with the calls for treatment from patient advocacy groups. The recent controversy over practice parameters stating an absence of benefit for the treatment of chronic Lyme disease with long-term antibiotics provide a case-in-point.³³ Residents are explicitly invited to participate in writing guidelines for the AAN,³⁴ and their involvement arguably goes a long way toward satisfying core competency requirements for Practice-Based Learning and Improvement and Professionalism.

Learning to balance patient care with industry influence will also be paramount in the future. It is increasingly clear that neurologists of the future will have more opportunities to become involved in clinical trials. The NINDS has pushed for the development of a network of centers and clinicians involved in clinical research, along the lines of similar efforts in oncology clinical research. At the same time, relationships between industry and academia are likely to continue. Learning to interact appropriately with industry, without detriment to patient care, should receive more emphasis in the future. Neurologists will need to navigate the benefits of industry's impact on health care and the risks of undue influence. There is evidence that educational efforts can mitigate some of the biases created by industry influence on trainees, although this is an area in need of further study.³⁵

The end of rotations?

While reports of the death of clinical rotations are probably exaggerated, the limitations of traditional rotations are becoming increasingly evident. For one thing, an emphasis on competence, rather than completion of time-locked rotation experiences, would suggest that some trainees may be able to achieve competence in a shorter period of time than others. Similarly, the same length of time training in a program at one institution may afford a different breadth of clinical experiences than training in a different program. Fixed duration experiences for everyone, therefore, do not appear to account for the fact that competence may be achieved in different ways and on different schedules by trainees.

Inpatient hospital-based rotations, moreover, may not provide optimal training for the type of neurology that most residents will ultimately practice.¹⁰ Since the 1970s neurologists have reported a disconnection between the types of illnesses encountered in training and those encountered in practice, and there have been calls to increase the proportion of time spent in outpatient training substantially.¹⁰ In 1995, for instance, one resident found that the most common disorder admitted by residents was acute ischemic stroke, the most common consultation metabolic encephalopathy, and the most common outpatient encounter radiculopathy.³⁶ Residents are now required to have a longitudinal continuity clinic at least one day per week throughout residency, and to have at least 6 months of outpatient training. Even with these increases in outpatient training, however, neurology still falls short of the outpatient training requirements for training programs in other similar medical specialties. The Internal Medicine RRC requirements, for example, require that a full third of the three year residency be spent in the ambulatory setting.³⁷ Pediatrics requires outpatient continuity clinics one half to one full day per week and a separate and formal non-clinical community experience to “prepare residents for the role of advocate for the health of children within the community.”³⁸ Longitudinal clinical training experiences, emphasizing outpatient training, may be optimally suited for teaching a specialty like neurology. Doing so effectively, however, would require restructuring responsibility for the costs of graduate medical education to include payors other than Medicare, as well as the use of other non-trainee health care providers, including physician assistants, nurse practitioners, or hospitalists.¹⁰

Some educational experiences other than clinical care, moreover, are best suited to longitudinal training. Appreciation of systems-based issues of clinical care—such as problems in healthcare delivery or development of clinical guidelines—may similarly benefit from longitudinal educational approaches. Involvement in research, as well, requires a similar long-term commitment. One month “research electives” often do not offer more than a break from the wards. There is some evidence that the recognition of the needs of different types of trainees is leading to changes in the structure of training. The Neurology RRC, for example, has approved a proposal from the American Neurological Association to allow a “flexible curriculum” for developing physician-scientists.³⁹

IV. New Technological Advances and Their Potential Role in Neurology Education*

Some experienced neurologists have written about the divide between those who were trained before the advent of advanced neuroimaging, when the neurological exam was still paramount, and those who trained after. Brooke, for instance, discusses *cis*-imaging and *trans*-imaging neurologists (i.e., those trained before or after the neuroimaging revolution).⁴⁰ He further alludes to the next big divide, between those trained before or after the advent of the genetics revolution. It is possible, however, that these distinctions represent minor quantitative changes compared with the qualitative changes that may occur before and after the current information revolution, and thus between the Millennial generation (and whatever follows) and the preceding generations.

Googling the diagnosis

I recently came face-to-face with the potential role of one of these new technologies in neurological diagnosis. I had cared for a patient for 6 years with an unusual vasculopathy that we had been treating as a primary CNS vasculitis. JF had presented at 33 years of age with a distal right carotid and ophthalmic artery stenosis, and several infarcts in the right hemisphere. Initial extensive evaluation revealed only a mild lymphocytic pleocytosis. His course involved a progressive basal occlusive disease process with features of CNS vasculitis, though several characteristics made us uncomfortable with the diagnosis,

including an abnormal serum protein electrophoresis, clubbing, and skin angiomas. An alternative definitive diagnosis eluded us, however, despite consultation with experienced rheumatologists, hematologists, and dermatologists. He was treated with steroids and cyclophosphamide for presumed CNS vasculitis. Two outside physicians whom the patient consulted for second opinions diagnosed cerebral vasculitis, and recommended continuing this treatment. Finally, after 6 years, a second bone marrow biopsy confirmed a plasma cell dyscrasia, and a diagnosis of POEMS syndrome was made. After the case was discussed at a CPC, at which general bewilderment about the unusual presentation prevailed among those attending, I tried "Googling the diagnosis." I entered "stroke" and "gammopathy" into Google, and POEMS syndrome came up as the second entry. I added "angiomas" to the list of terms, and POEMS came in first. Had I only thought to try this 6 years ago, I thought!

In fact, others have described the power of Google in providing possible medical diagnoses. One medical resident impressed her attending on rounds by diagnosing the extremely rare disorder IPEX (immunodeficiency, polyendocrinopathy, enteropathy, X linked) on rounds using Google.⁴¹ A group of medical residents found that Google was able to provide challenging medical diagnoses over 50% of the time when faced with challenging cases from the New England Journal of Medicine clinicopathological case conferences.⁴²

These examples demonstrate that the ready availability of a virtually limitless database of information is potentially transformative of not only of trainees' knowledge, but also of their relationship with their supervising attendings. Where previously students and residents in rounds would need to defer to their attendings' often superior knowledge base, particularly for rarely-encountered illnesses, now they may be able to find a diagnosis or a recommended treatment more quickly without help. Attendings can no longer assume that their trainees will assume what they say is correct, moreover, because the means to verify their statements are so readily available.

Web 2.0, Wikis, podcasts, simulation and other new technologies

There is no doubt that modern computer technology and the Internet create an incredible ability to find the proverbial needle in a haystack in medicine as in other endeavors. The broader possibilities represented by this capability are encapsulated by the concept of **Web 2.0**, a vast, distributed network of individuals who openly share information and technology.⁴³ Whereas the initial phase of the internet included many static pages created by individuals or private interests, Web 2.0 represents an interactive, collaborative, constantly evolving network of information reflecting communication among many different people. The benefits derive from open access and sharing of information. The specific ways in which Web 2.0 manifests itself are numerous and growing: **blogs** (such as <http://casesblog.blogspot.com/>), medically-oriented **wikipedias**, podcasts and others.

Wikipedias are websites or similar online resources that allows users to add and edit medical information collectively. The pages are constantly evolving as different users edit and change the content. The content is as up-to-date as the users make it, which is generally much more up-to-date than any books or even journals can be. The problem is that there is generally very little oversight by experts in traditional wikipedias, though this may be changing.

Podcasts offer an easily-accessible and convenient way to learn about topics in neurology.⁴⁴ To be truly educational and successful, however, they must offer unbiased content, ideally approved and sponsored by well-recognized professional organizations, including journals. The American Association of Neuromuscular and Electrodiagnostic Medicine has a podcast program related to neuromuscular medicine (see <http://www.aanem.org/education/podcast/index.cfm>). *Neurology*[®] has recently begun offering podcasts, and will soon offer CME credits associated with them, as well.⁴⁵

Listservs also seem to be an effective part of Web 2.0. In neurology, there are several examples of on-line communities communicating through email about clinical and other topics. For example, a listserv of members of the Stroke section of the Academy has fostered lively discussion and debate about several topics within stroke. The major advantage of these listservs is that one can immediately access the expertise of a broad group of specialists who are willing to offer their own experience and opinions about

a case. The disadvantage of course, is that conversation is largely unregulated, there is no standard for determining what is correct or true, and the legal implications of what is said remain uncertain.

The next generation of web technology may already be here, according to some experts. **Web 3.0**, also referred to as the “semantic web,” will be a more efficient way of retrieving information.⁴⁶ While current web technologies allow the searching of nearly limitless pages of information, most of it poorly organized and much of it junk, Web 3.0 technologies aim to better organize this information for physicians and make deeper use of the knowledge base. How this will play out in practice remains unclear.

An outstanding question is how electronic media leads to changes in communication among physicians, and between physicians and patients. Electronic mail, for example, provides wonderful opportunities for rapid, easy, inexpensive, virtually unlimited communication among users. The writing contained in e-mail is less formal than traditional writing, however, and in many ways is closer to oral forms of communication rather than written communication. Physicians may need to take this into consideration when using e-mail to communicate among themselves or with patients. Consider the “curbside consult,” in which the one physician asks advice informally of another physician, but no note appears in the chart. The consulting physician providing the “curbside consult” has generally not examined the patient or reviewed the records fully, if at all. Typically, the opinion is provided verbally to the requesting physician, with the often tacit understanding that the opinion is based on a superficial knowledge of the case. If the opinion is provided through e-mail, however, it may take on a greater degree of formality and potential liability in the case of error. For better or worse, then, we will need to educate residents--and ourselves--in the context of the availability of these technologies.

Simulation

Simulation is likely to play an increasingly visible role in medical education at several levels. Simulated situations offer a way to train residents without risk of injury to actual patients, and they also offer the possibility of exposing residents to disorders that they might otherwise encounter only rarely or not at all (POEMS, anyone?), either because the condition is unusual or because their hospital’s training program does not see the disorder much. Simulators may include both live actors portraying patients as well as computer simulators.⁴⁷ Computer simulators may be most effective in teaching skills relevant to acute, life-and-death situations, or those that involve adherence to a well-delineated paradigm.⁴⁸ They have been shown to be effective particularly in teaching procedural skills, and in certain procedurally-oriented specialties, such as anesthesia, but are also being recommended in new models of teaching family medicine.²⁷ Neurologists have also begun to experiment with using standardized patients to teach communication, including end-of-life issues, breaking bad news, disclosing medical errors, handling difficult patients, and obtaining informed consent.⁴⁹ While simulation may have an increasing role in neurology training in the future, it has been recommended that simulated procedures should account for not more than 20% of training in neurovascular procedures.⁵⁰ It may be argued that that incorporation of actors into simulation techniques will be needed to effectively teach the interpersonal and other communication skills to transfer knowledge from the simulation setting to real patient encounters.⁴⁷

V. Gen Y and the New Professionalism

Generational differences

The current generation of trainees may differ from previous generations in ways that are relevant to their education and future practice. First, as noted above, they have been brought up in a world of rapid technological innovation and change, and they are accustomed to having access to a virtually effortless and limitless network of information. This information can be archived, as well, and accessed whenever and wherever they wish, including through webcasts, podcasts, and other digital media. They are thus skeptical of traditional top-down educational methods, such as lectures, and they are interested in and capable of organizing their own educational experiences. They are also comfortable interacting, communicating, and forming relationships with others whom they know only “virtually,” that is, with people whom they have never met (think Facebook). Thus, using distributed networks of people, they may be able to organize themselves across geographic space to solve difficult problems.

Second, the demographics of younger generations of neurologists differ from those of previous generations. One of the most notable changes has been the increase in the proportion of women in medicine in younger generations. Over the past 20 years the proportion of medical students who are women has increased from less than 10% to about 50%.⁵¹ The proportion of neurologists who are women is increasing comparably.⁵²

Third, while studies are limited and methodologically limited, there is evidence that the Baby Boomer generation perceives younger generations as being more concerned with lifestyle and work-life balance, being less committed to medicine, and working fewer hours.⁵³ There is also some thought that the presence of more women in medicine has led to a greater emphasis on family. The presence of women doesn't tell the whole story, though, since both men and women in Gen X express similar feelings about the balance of work and personal life.^{53,54} As of yet, there is little data about Gen Y physician attitudes toward work. Interestingly, however, these perceived differences do not necessarily translate into actual differences in hours worked or experienced problems balancing work with personal life.⁵³

Fourth, other demographic and societal trends seem to have an influence on the career choices being made by medical school graduates today. As alternative career opportunities have expanded, younger physicians may be less likely to pursue traditional full-time clinical practice careers. From 1997 to 2004, the proportion of medical school graduates planning on full-time practice has decreased.⁵⁵ More physicians may also choose sequential career changes, rather than committing to a single career pathway for life.

The democratization of knowledge

Additionally, traditional hierarchies may have less significance to today's trainees. One consequence of new information technologies is the democratization of knowledge. With the availability of information to all at the click of a button on a handheld device, medical students, residents, and even patients have as much information available on rounds as highly experienced clinicians. This changes the typical hierarchical structure of information transmission in medicine. Rather than information flowing downhill from attending to resident to medical student to patient, information may flow up the chain of command, as well. **Error! Bookmark not defined.** Everybody will need to adjust to the new possibilities this entails, but it is likely that the greatest challenge, as in most revolutions, will be for those who are accustomed to being at the top of the hierarchy. There is already evidence that competence declines with time after training; several studies have shown that there is an inverse relationship between time in practice and quality of care delivered.⁵⁶ This decline with time could accelerate as the pace of scientific and information technological change increases, further augmenting the differences between the generations. In the future, it is possible that each generation will offer complementary skills in educating each other and providing optimal care.

At the same time, however, information in abundance is still only information. Mastery of information requires the ability to see the forest for the trees. In fact, the availability of nearly unlimited information about a topic, by slowing purposeful action, can sometimes have negative consequences (see Malcolm Gladwell's *Blink*). Rendering compassionate, empathic care may have very little to do with data at all. Sometimes what is needed is not more data, but more understanding. We will therefore best serve our students, colleagues, and—most importantly—our patients, by leading trainees to this understanding.

The evolution of professionalism

Several medical professional organizations have sought to redefine professionalism in the setting of a changing healthcare environment and marketplace,⁵⁷ and in doing so they have affirmed three major principles as guiding the profession: the primacy of patient welfare, including altruism; patient autonomy; and social justice. It remains unclear, however, how new generational, demographic and technological trends will influence educational philosophy and the evolving views of medical professionalism, if at all.

Given what are thought to be the defining characteristics of Gen Y, this next generation may not be happy being told by others what professionalism is. Principles and abstract commitments may not be accepted without question, and Gen Y may prefer to define professionalism for itself. In particular, the importance of balancing professional and personal lives may become an increasingly important aspect of their definition of professionalism. While altruism and social justice are likely to remain important principles among most physicians, self-actualization, attention to the family, and flexibility in work schedules may emerge as alternative values, in degree if not in kind. Consistent with these evolving notions of professionalism, younger physicians may view their career paths as including different activities at various stages. They may not see themselves as committing to a lifelong practice of a particular specialty. How these potentially competing values will be balanced in the professional lives of the next generation, and how these issues will be addressed by professional organizations and certifying bodies, remains unknown. Awareness of these potential differences, however, may smooth relationships among physicians of different generations and improve the education of all.

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Footnote:

* As a committed Luddite, I am perhaps not best suited to expound on technological changes and advances. I confess to not using a PDA and never having listened to a podcast, not to mention having no Facebook page. On the other hand, perhaps skepticism about technology may serve as an appropriate caution about its transformative potential. After all, we are still, and I think always will be, first and foremost in the business of educating caring physicians, and not m