The Workforce Task Force Report

Clinical implications for neurology

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ABSTRACT

The American Academy of Neurology Workforce Task Force (WFTF) report predicts a future shortfall of neurologists in the United States. The WFTF data also suggest that for most states, the current demand for neurologist services already exceeds the supply, and by 2025 the demand for neurologists will be even higher. This future demand is fueled by the aging of the US population, the higher health care utilization rates of neurologic services, and by a greater number of patients gaining access to the health care system due to the Patient Protection and Affordable Care Act. Uncertainties in health care delivery and patient access exist due to looming concerns about further Medicare reimbursement cuts. This uncertainty is set against a backdrop of Congressional volatility on a variety of issues, including the repeal of the sustainable growth rate for physician reimbursement. The impact of these US health care changes on the neurology workforce, future increasing demands, reimbursement, and alternative health care delivery models including accountable care organizations, nonphysician providers such as nurse practitioners and physician assistants, and teleneurology for both stroke and general neurology are discussed. The data lead to the conclusion that neurologists will need to play an even larger role in caring for the aging US population by 2025. We propose solutions to increase the availability of neurologic services in the future and provide other ways of meeting the anticipated increased demand for neurologic care. *Neurology*® 2013;81:479–486

GLOSSARY

AAN = American Academy of Neurology; **ACO** = accountable care organizations; **ED** = emergency department; **GDP** = gross domestic product; **GME** = graduate medical education; **IMG** = international medical graduates; **NRMP** = National Residency Match Program; **PCP** = primary care physician; **PPACA** = Patient Protection and Affordable Care Act; **STEMI** = ST-elevation myocardial infarction; **tPA** = tissue plasminogen activator; **USMG** = US medical graduates; **WFTF** = Workforce Task Force.

PREAMBLE AND SCOPE OF THE US HEALTH CARE PROBLEM The US health care system is currently seen as financially unsustainable, in large part due to Medicare and various provisions of the Patient Protection and Affordable Care Act (PPACA), including Medicaid. Health care expenditures now comprise about 16% of the US gross domestic product¹ (GDP), currently about \$2.2 trillion,² compared to less than 8% in 1970. Rising health care expenditures are one target for major spending cuts to reduce the national debt, which is at a historic high of \$16 trillion in 2012 (figure 1)² (and compared to the 2012 GDP of \$15.83 trillion). Moreover, expenditures are increasing due to an aging population with an average life expectancy of 78 years, a decade longer than when Medicare was introduced in the 1960s (figure 2).^{3,4} The financial health of the Medicare system is threatened. Measures proposed to keep Medicare viable include an increase in the Medicare eligibility age, further reductions in Medicare physician reimbursements, and cost-saving measures such as accountable care organizations (ACO).⁵ Adding to the decline in Medicare reimbursement over 3 decades is a steady rise in the numbers of Medicare patients physicians must care for and a reciprocal rise in the US health care system's administrative costs, which are disproportionate to those of other countries, such as Canada (16.7% vs 31% in the United States).⁶

The confluence of decreasing Medicare physician reimbursements, increased administrative costs, and increasing overhead of medical and surgical equipment due to advances in technology challenges the financial viability of clinical practice and the ability of physicians to provide safe, high-quality care. It remains to be seen whether the implemented provisions and pilot programs of PPACA^{7,8} actually reduce long-term US health care costs and improve quality.⁶ Reduced reimbursement potentially has consequences and already has forced

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Figure 1 US national debt and health care expenditures (1970–2012)²

practices to increase throughput and reduce time spent with individual patients to maintain equivalent financial margins.⁹ Cognitive specialties tend to require more time to elicit a history, perform a detailed physical examination, and develop a clinical formulation with an appropriate differential diagnosis. Cuts in reimbursement for time spent with patients can paradoxically increase spending by making physicians more reliant on expensive diagnostic testing.

WORKFORCE REPORT SUMMARY AND HIGHLIGHTS

The American Academy of Neurology (AAN), as part of its mission to promote the highest

quality patient-centered neurologic care, established the Workforce Task Force (WTF) in 1999¹⁰ and again in 2011 to determine the existing supply of neurologists practicing in the United States and to predict, to the extent possible, future supply and demand. A comprehensive report¹¹ was generated by IHS Healthcare & Pharma, an independent firm not associated with the AAN, and a summary report has been published in *Neurology*.¹² IHS methods utilized a state-of-the-art microsimulation model that pooled data from multiple sources, existing databases, and national indicators of health care delivery.

The summary WTF report estimates there are 16,366 neurologists in 2012 and projects an increase to 18,060 by 2025.¹² One important trend that has changed since the 1999 report is the increased percentage of women neurologists. Figure 3¹¹ illustrates the age and demographic differences in the neurology workforce in 2012. While the summary report could not elaborate on this trend due to space constraints, the implications of these gender-specific workforce data are discussed below.

The current neurologist shortfall averaged for the entire United States is 11% in 2012 and is projected to increase nationally to 19% by 2025.¹² The increased demand is due in large part to the epidemiology of the aging US population and the higher utilization of neurology health care services in those aged 65 and older. An increased demand is also anticipated from implementation of PPACA and the anticipated increased referrals of those who become insured under the new health care system. The demand is highest in patients aged 65 and older and by 2025 will represent a 70% increase above current rates.¹¹

With regard to education, the microsimulation model projects future supply and demand under 3 scenarios: one postulating a hypothetical 10% cut in graduate medical education (GME) funding slots for neurology residency; a baseline scenario, which assumes that current rates of new neurologists entering the workforce are maintained; and a hypothetical 10% increase in neurology GME slots. The model predicts that under all 3 scenarios supply will fall short of predicted future demand for neurologists, even with a 10% increase in GME funding.¹² Even this relatively small increase is unlikely based on proposed Medicare cuts in GME.¹³

IMPLICATIONS AND FORECAST FOR NEUROLOGY IN 2025

Changing neurology workforce demographics: Women in neurology. As of 2012, there had been an increase in the percentage of women in the current neurology workforce¹¹ compared to historical data¹⁰ (figure 3). In younger age groups, however, men and women are almost equally represented. Thirty years ago, neurology, like all medical and surgical specialties, was a predominantly male profession. As medical

Figure 2 Increasing US population median life expectancy (1945–2000)

Re-created from data² and Centers for Disease Control and Prevention and Senate reports.³

Figure 3 2012 active neurologists in the workforce by age group and by sex¹¹

school admissions have resulted in equal numbers of male and female medical students, the neurology workforce has become more balanced. The summary WFTF report¹² shows that women neurologists tend to work fewer hours in direct patient care than their male counterparts for reasons that are not entirely clear, but may include a greater degree of part-time status, childbearing/rearing responsibilities, and relatively earlier attrition from patient care. This is an important trend to follow in future studies.

Neurology GME. Another important finding came from the 2012 National Residency Match Program (NRMP) data, which showed that about 729 neurologists are trained annually, of whom 114 are child neurologists.

The NRMP data also show that international medical graduates (IMG) comprise about 40%–45% of filled US neurology residency positions compared to US medical graduates (USMG). While the absolute number of USMG entering neurology is similar to or slightly more than in 1989 (~1,000–1,200), the proportion of IMG to USMG in neurology residencies has shifted (figure 4). This shift arguably reflects an inability of neurology to compete, in terms of lifestyle and remuneration, with fields such as ophthalmology and dermatology for the best and brightest USMG and therefore represents a long-term concern for future recruitment into neurology.

Additionally, the length of time it takes to train a neurologist has increased over time because of the increased complexity of neurology due to advances in medical knowledge generally and in neuroscience in particular. For example, the average neurology graduate now spends 13–14 years in undergraduate and postgraduate education, including 1–2 years of fellowship, resulting in a neurologic physician who has the expertise necessary to diagnose and manage a wide array of neurologic conditions. Management by neurologists of disorders such as Parkinson disease, for example, has been shown to reduce hospitalizations and health care expenditures.¹⁴ Similar beneficial effects on outcome and cost have been noted for neurologic inpatients as well.¹⁵

The impending and proposed cuts in Medicare GME funding (as discussed earlier) will likely result in fewer neurologists being trained, with perhaps a concomitant reduction in the length and quality of training, thus producing negative consequences in terms of outcomes and costs of neurologic disorders.

Figure 4 Adult neurology residents by year: US medical graduates (USMG) and international medical graduates (IMG)

Data created from individual source data from JAMA annual education issues: 2010;304:1255–1270; 2009;302:1357–1372; 2008;300:1228–1243; 2007;298:1081–1096; 2006;296:1154–1169; 2005;294:1129–1143; 2004;292:1099–1113; 2003;290:1234–1248; 2002;288:1151–1164; 2001;286:1095–1107; 2000;284:1159–1172; 1999;282:893–906; 1998;280:836–845; 1997;278:775–784; 1996;276:739–748; 1995;274:755–762; 1994;272:725–732; 1993;270:1116–1122; 1992;268:1170–1176; 1991;266:933–943; 1990;264:822–832; 1989;262:1029–1037; 1988;260:1093–1101; 1987;258:1031–1040.

Following neurologists from training to practice to retirement. An important finding from the summary WFTF report was that there is no central database to track US neurologists—although the majority (~11,000–12,000) of the US data came from the AAN database, supplemented by the American Medical Association Masterfile.¹² Therefore, going forward, we recommend that the AAN consider maintaining a centralized database of all US neurologists in order to track and monitor key issues of the neurologic workforce, such as the number of neurologists in training (residency or fellowship), in active practice (including subspecialty, if any, and whether the location can be categorized as academic medical center, large group or solo practice, or hospital-based), and retired as well as other pertinent income and practice information. A central database is also needed to receive regular feedback from US neurologists on workforce and other practice-related issues. This would also provide information with regard to the impact of health care policy changes on neurology practice. Additionally, tracking international members of the AAN, or those who train in the United States but return to their country of origin, would also provide useful information on factors that affect the neurology workforce.

Emergency department trends in the future: Increasing or decreasing? Another concerning trend, provided in the comprehensive WFTF report,¹¹ is that hospitals and emergency departments (EDs) face a future increase in neurologic patients compared to current utilization rates (figure e-1 on the *Neurology*[®] Web site at www.neurology.org). This prediction is supported by epidemiologic trends in the US population but is inconsistent with the PPACA objectives to reduce patient utilization of EDs and hospitals, all of which add costs to the system. A goal of ACO is to reduce hospital admissions and, especially, readmissions, by utilizing more nurse-driven posthospital discharge processes and protocols. While this works for some conditions, it is not likely to work for patients whose acute neurologic disorders demand immediate evaluation for time-limited treatments. Stroke epitomizes this issue. Stroke occurrence is unpredictable and requires a team of providers to be involved rapidly so that tissue plasminogen activator (tPA) can be administered immediately after a CT scan has excluded intracranial hemorrhage. Acute stroke patients could hardly be expected to receive equivalent care, requiring specially trained personnel and hospital-based equipment, in an outpatient setting. Further, stroke incidence increases with age, which is perhaps why increased utilization of EDs and hospitalization is predicted in the report (data from trends in the Nationwide Inpatient Sample database¹⁶).

An undersupply of neurologists and a lack of sufficient neurologic training on the part of internal

medicine or family medicine hospitalists in treating acute neurologic disorders could result in worse outcomes in EDs, longer or repeat hospitalizations, or increased costs to the health care system (see further discussion in the Practice and business considerations section). This underscores the need for cross-training of primary care specialists by neurologists in acute care neurology and for training more neurologists with acute care expertise. For example, establishing protocols and cross-training primary care specialists and emergency department physicians in acute stroke management, a time-based therapy similar to acute ST-elevation myocardial infarction (STEMI) for cardiologists, could enable neurology and other specialties to improve patient care by working together without necessarily increasing the number of neurologists.

Practice and business considerations. The comprehensive WFTF report indicates that 92.8% of neurologists accept new Medicare patients and predicts that more elderly patients will require neurologic evaluations in the future.¹¹ It is thus no surprise that anticipated cuts in Medicare reimbursement will have a major impact on the economics of practicing neurology. Physicians in cognitive fields rely on having sufficient time with patients to take a meaningful history, perform an appropriately complete physical examination, and counsel and educate patients and their families. Even before recent cuts in Medicare reimbursements, some neurology practices had been struggling to keep overhead and other administrative costs at or below Medicare reimbursement levels.^{5,6,17} Finally, a number of adjustments to Medicare reimbursement have been selectively adverse for neurology. One example is the 10% increase in reimbursement to primary care physicians for evaluation and management that excluded neurologists. In fact, neurologists typically provide similar services and utilize the same evaluation and management codes for many of their patients as primary care physicians. Recently, reimbursement cuts of up to 66% were made for EMG, nerve conduction studies, and polysomnography,⁹ procedures that are intrinsic to accurate neurologic diagnosis and also help sustain practices financially, especially in consideration of the cuts in cognitive reimbursements.

Another issue to consider is the likely increase in neurologic referrals by primary care physicians (PCPs) as a consequence of the PPACA, another factor that will further exacerbate the demand for neurology services. While PCPs can serve as valuable gatekeepers of health care cost containment, they are unlikely, because of the nature of their training, to be able to triage adequately all urgent and emergency neurologic symptoms in a busy outpatient setting. The result of this practice model will almost certainly be increased

numbers of patients referred to the ED. In addition, many PCPs would seem to be insufficiently trained to diagnose neurologic disease. The American Board of Internal Medicine does not mandate a minimum number of months in neurology over a 3-year period of training, but rather leaves this to the discretion of the individual internal medicine program (American Board of Internal Medicine, oral communication, February 2013). As such, given the time requirements for rotations in other important medical specialties such as rheumatology, cardiology, and nephrology, the time internal medicine residents spend in neurology over a 3-year period of training is highly variable and in many cases is 1 month or less. According to the American Board of Family Practice, 2% of their certification/recertification content is neurology, compared with cardiovascular (9%), endocrine (6%), and gastrointestinal (5%).¹⁸ A likely consequence of this lack of neurologic training and experience among PCPs will be a failure to recognize neurologic disorders, leading to unnecessary or inappropriate referrals to neurologists and to unnecessary laboratory and radiologic (CT, MRI) tests.

OVERVIEW OF WORKFORCE ISSUES AND PROPOSED SOLUTIONS

Strategies to help ensure that provision of neurologic services is adequate to meet anticipated future demand might include the following:

1. Increase the number of neurologists in the clinical workforce. To achieve this requires that neurology once again be made an attractive choice of specialty for medical students. According to the American Association of Medical Colleges, in 2009–2010, 28 out of 131 medical schools had no required rotation in neurology (oral communication, 2011), and in 22 of 131 medical schools the required clerkship was 3 weeks or less.¹⁹ Exposure to neurology in the early clinical years of medical school is a necessity if it is to be made, once again, a realistic specialty option. To attract students to neurology, it is also necessary to increase the expected future remuneration to be more in line with other medical specialties, especially considering the high student debt levels.²⁰ Efforts are under way to persuade policymakers and legislators that the survival of neurology as a specialty is in peril without better monetary incentives. Given the state of the economy and with the health care delivery system in flux, this will be an uphill climb, but one that is vital to the preservation of the neurology specialty.
2. Utilize supervised nonphysician providers trained in the essentials of neurologic diagnosis and management. Nonphysician providers, i.e., nurse practitioners and physician assistants supervised by neurologists, are reimbursed by Medicare at 85%–100% of the physician rate and are therefore less costly than physicians.¹⁷ While this practice would be a fundamental departure from the traditional doctor–patient relationship, it may be imposed by financial exigencies that make it impossible to sustain the traditional model. Powers and Craft⁵ provide an informative recent review about future payment systems.
3. Train non-neurologist physicians, especially those in primary care, far more extensively in neurology than is now being done. They are the ones initially responsible for recognizing neurologic symptoms and disorders and for making appropriate referrals to neurologists. We strongly recommend collaboration between primary care and neurology physician organizations to establish protocols that will assist PCPs and primary care hospitalists when confronted with neurologic diagnosis and treatment issues. In addition, we recommend that minimal requirements be established both for neurology education and exposure for medical students and for neurology training of residents in the primary care specialties, including internal medicine, family medicine, and emergency medicine. These requirements should be extended to maintenance of certification for primary care and ED physicians. Acute care neurology, including IV tPA management of acute ischemic stroke, should be taught to PCPs and ED physicians across the United States via existing guidelines to increase national IV tPA administration rates and improve health care efficiency and outcomes. It will be necessary to incorporate technological advances such as telestroke, thereby better integrating the roles of the ED and primary care physicians with neurologists or neurohospitalists, similar to that of cardiology involvement with ED physicians and PCPs in acute STEMI management within the acute period. Further, adequate clarification of level of involvement, once a neurologist has been consulted, would help PCP coordination^{21,22} or at-care transitions.
4. Make neurology care more efficient through the use of new technology. Neurologists must be at the forefront of making changes to existing health care delivery models, utilizing advances in technology to make practices efficient and cost-effective. Neurology has a deep historical legacy of innovation and scientific advancement.²³ Perhaps the best examples of such alternative health care delivery models are telestroke and teleneurology, both of which help bridge the gap between the neurologist supply and demand—especially for rural and underserved areas—without altering the current supply of neurologists.^{24–30} Telestroke, for example, allows access to subspecialist neurologists in underserved or rural areas,²⁶ who can then provide an evidence-based therapy IV tPA, which has been proven to improve outcomes and reduce

morbidity.^{29,30} Without adequate reimbursement for such patient care services, however, it will be difficult to advance health care delivery models, and to date, standard reimbursement codes for these new modalities have not been formalized. Future technology also has the potential to become “disruptive” in the sense

that the technology itself can change the supply and demand equation, resulting in higher demand for neurologist services.^{31,32} Recent examples include “apps” run on the iPhone iOS operating system that monitor blood pressure, ECG, diabetic control, and other conditions. These could be modified for various

Table Future challenges and proposed solutions for innovative health care delivery

	Potential solutions
1. Reimbursement	<p>1.1—Leverage high demand by better reimbursement with high value care (value = quality/cost) within PPACA systems of care</p> <p>1.2—Create new, more efficient health care delivery models (reduce time if reimbursement stays equal)—e.g., prepopulated EHR, quality metrics tied to reimbursement</p> <p>1.3—Consider expansion of ARNP/PA models for Medicare/Medicaid level E&M-coded reimbursement</p> <p>1.4—Two-tiered payer system formation—one governmental Medicare/Medicaid (or similar payer “exchange rate” insurance) and one private pay (which exists in Canada and Europe), e.g., government provides basic levels of health care, and cutting-edge leading therapies are paid by the patient</p>
2. Demand exceeds supply	<p>2.1—Improve access for acute neurologic disorders, and for outpatient care consider health care delivery redesign (number 5, below)</p> <p>Telestroke and teleneurology²⁵—ARNP/PA model for inpatients and outpatients (improve throughput)</p> <p>2.2—If future increased demand cannot be accommodated, this will likely result in increased wait times for Medicare/Medicaid beneficiaries compared to commercial payers</p>
3. Documentation “escalation”	<p>3.1—Seamless, efficient EHR interface; documentation: history information prepopulated by patient or other input devices such as vital signs verified/modified by physician via voice transcription or in-room dialogue and tied to quality metrics; neurologic diagnoses entered will generate evidence-based guideline suggestions and patient education materials</p> <p>3.2—Virtual teleneurology patient follow-ups: reduction in face-to-face physical visits using (HIPAA-compliant) audiovisual interfaces</p> <p>3.2—Patient outcomes become a shared responsibility of the patient (e.g., diabetic, blood pressure control “apps” on the patient’s smartphone, migraine or multiple sclerosis diaries [similar to PatientsLikeMe]),³⁶ but reimbursed for physician monitoring</p> <p>3.3—Reimbursement for alternative health care delivery models as above commensurate with the degree of cognitive and time components, or tax deductions/credits for EHR software to physicians or patients</p>
4. Future workforce concerns	<p>Reductions in GME funding and progressive cuts in physician work hours for both residents and attendings exacerbate the supply and demand equilibrium, which will cause longer wait times for patients and paradoxical shunting to emergency departments</p> <p>4.1—More effective, efficient health care delivery redesign with a premium for efficiency (i.e., better integration of primary care specialties with neurology caring for neurologic patients—“when to refer to neurology,” basic level neurologic management, as well as acute care neurology guidelines and when to involve neurologists [acute stroke and IV tPA via telestroke robotic presence], telephone coverage or physical neurohospitalist coverage); AAN mandates for minimal neurologic education in medical school, primary care specialties, ED residency, and maintenance of certification for primary specialties long-term to improve competencies and health care outcomes</p> <p>4.2—PPACA notes some contingencies for education loan funding⁷</p> <p>4.3—Student loans for medical training, continued or expansion of government student loan repayment (public health) programs to help offset medical training debt</p>
5. Health care delivery requires redesign	<p>5.1—Consider alternative models for health care delivery, especially if demand is extremely high and supply is “saturated”</p> <p>Teleneurology/telestroke have provided some data (especially telestroke) in terms of safety and feasibility to provide care to rural and underserved areas^{24–27}</p> <p>ARNP/PA model for new Medicare patients to help some of the imbalance in future supply and demand</p> <p>5.2—Improve transitions of care from the inpatient setting to outpatient setting to prevent readmissions,²¹ and coordinate care from PCPs to neurologists and vice versa²²</p> <p>5.3—Offloading some outpatient return visits with patient-centered computer interfaces that secure (HIPAA-compliant) logs (apps) to monitor disease progression, track quality efforts, and offer incentives (health care discounts) to patients with regard to their own health care^{31,32} (diabetes, blood pressure, exercise, smoking cessation, medication compliance, Parkinson disease, or amyotrophic lateral sclerosis scales^{36,37})</p> <p>5.4—Site-specific specialists improve quality and outcomes (e.g., neurointensivists^{38,39} and neurohospitalists^{17,25,40} in inpatient settings, and Parkinson outpatient disease management¹⁴)</p> <p>5.5—Future cognitive artificial intelligence software automates workflow, e.g., the Watson IBM supercomputer to deliver some aspects of neurologic care, or follow-up once trained⁴¹</p> <p>5.6—Patient “apps” run on portable digital assistants, iPhones, and Android phones monitor disease progression, monitored by physician remotely³⁶</p>

Abbreviations: AAN = American Academy of Neurology; ARNP = advanced registered nurse practitioner; E&M = evaluation and management; ED = emergency department; EHR = electronic health record; GME = graduate medical education; HIPAA = Health Insurance Portability and Accountability Act; PA = physician assistant; PCP = primary care physician; PPACA = Patient Protection and Affordable Care Act; tPA = tissue plasminogen activator.

chronic neurologic disease states like Alzheimer disease, Parkinson disease, and secondary stroke prevention monitoring of vascular risk factors.

5. Recognize the value of cognitive work and time spent with the patient and family. William Osler famously said, "Listen to your patient, he is telling you the diagnosis."³³ Neurologists should be able to practice neurology using their clinical skills rather than having to resort to expensive and often wasteful ancillary testing as a substitute for "face time" spent with the patient. Neurology was not considered to be a primary care specialty and therefore was not eligible for the Medicare Primary Care Bonus Program despite the fact that neurologists spend more time managing patients with chronic neurodegenerative diseases and counseling families than do many internists and family practitioners. Further, now that the fees for procedures such as EMG and polysomnography have also been reduced substantially, the viability of many neurology practices is in danger.⁹ Neurology should be paid at least as well as the other primary care specialties for this type of primary care disease management if it is to survive. Policy-makers and legislators must be educated in detail as to the unique and indispensable place of neurology in the delivery of health care, especially as the population ages.

Other challenges exist and are outlined in the table, along with some additional suggested solutions.

DISCUSSION Neurology is an integral component of the US health care system. Based on increasing future demand predicted by 2025, along with the supply issues shown in the WFTF report, there will be a shortfall in the provision of neurology services. This shortfall will have adverse consequences in terms of the quality and cost of care delivered. We have attempted to provide a menu of possible solutions to this problem.

Neurologists in practice face stiff economic challenges similar to those of other medical and surgical specialties. Further, medical school exposure and education in neurology may be insufficient to interest students enough to choose neurology as a specialty; there is insufficient GME funding for neurology residency programs; and primary care and emergency medicine programs often include little or no training in neurology. Congress must focus on making GME funding at least neutral over time to counter the looming crisis of patient access to neurologic care.^{11–13} The US economy should also prioritize and continue funding for neuroscience research and neurologic clinical trials, since this research ultimately has a return on investment to the economy and an integral place in changes in health care delivery.

Overall, continuing discoveries in basic neuroscience, advancements in diagnostic and functional neuroimaging, a diversified "portfolio" of neurologic subspecialties, and an expanding therapeutic armamentarium add up to greater opportunities for neurologic patients than ever before. This is especially important when one considers the predominance of human nervous system genes relative to the entire size of the genome (about one-third),³⁴ as well as plans for mapping a brain "transcriptome" and "connectome" (functional brain wiring interconnectivity).³⁵ This, combined with the progressively more powerful portable and hand-held computers of the digital age, make future health care delivery an exciting endeavor for young medical students interested in the neurologic profession.

AUTHOR CONTRIBUTIONS

Dr. Freeman: drafting/revising the manuscript for content. Dr. Vatz: drafting/revising the manuscript for content. Dr. Griggs: drafting/revising the manuscript for content. Dr. Pedley: initial discussions and objectives, drafting/revising the manuscript for content.

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