Association of University Professors of Neurology

The 2013 Leaders' Forum

October 12, 2013

Hilton New Orleans Riverside
New Orleans, LA

In Partnership with:

AMERICAN ACADEMY OF NEUROLOGY

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"Concrete Action to Counter Threats to Academic Neurology"

2013 Leaders' Forum
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The Association of University Professors of Neurology

Presents

The 2013 Leaders' Forum:
"Concrete Action to Counter Threats to Academic Neurology"

Saturday, October 12, 2013/6:00-8:00pm

Versaille Room- Hilton New Orleans Riverside- New Orleans, LA

As leaders of neurology departments, we are all well aware of falling reimbursement for clinical activity, reductions in federal funding for research, the flight of Pharma from neurotherapeutic development, the inadequate supply of neurologists, and the poor support for training medical students, residents, and fellows. To have any chance of influencing the environment in which we now live, academic leaders must advocate together for what neurology needs to survive. The issues are such that they cannot be dealt with effectively by institutions or organizations acting separately and without coordination and synergy. The challenges will not go away if we wait long enough.

The AUPN session at the ANA marks the start of an ongoing collaboration among the AUPN, ANA, and the AAN to coordinate broad support from academic and other leaders for an action plan to save our profession.

The AUPN invites every Chair and other departmental leaders to participate in saving academic neurology. Please send Dr. Kaminski your best practices so that this session may focus on proved solutions.

6:00–6:30 p.m.	Reception
6:30–6:40 p.m.	**Overview of Challenges** *Henry J. Kaminski, MD, President, AUPN* *Timothy A. Pedley, MD, President, AAN* The Presidents of the AUPN and the AAN present a brief review of major threats to academic neurology including specific regulatory and financial changes that have already occurred and those which are on the near-term horizon. They will also recognize commonalities between full-time practitioners and academic neurologists and the need to work together as we face an erosion of payment for patient care and research funding and other important issues.

6:40–7:25 p.m. **The Meat of the Matter: Re-engineering Practice**
Bruce Sigsbee, MD, Immediate Past President, AAN
Neil Busis, MD, AAN Board of Directors

Drs. Sigsbee and Busis will proceed to focused recommendations on several areas including:

- Optimize billing and collections with an emphasis on outpatient visits
- Productivity issues including incentives and disincentives
- Coordinated clinic operations and laboratory issues
- Government programs that provide bonus/penalties
- Innovations in education
- Philanthropy – motivating donors

7:25 – 7:40 p.m. **Success Stories**- Moderator: *Henry Kaminski, MD, President, AUPN*

The good news is that there have been successes in overcoming these obstacles. Dr. Kaminski will moderate a session with 2 Chairs who describe success in re-engineering clinical practice to the benefit of the academic mission of the department.

Improvement Initiative: Billing in Resident Clinic: *Jeffrey Waugh, MD, PhD, Harvard University*
Improving Discharge Procedures: *Jennifer Simpson, MD, University of Colorado, Denver*

The Development of a Neurohospitalist Advanced Clinical Practice Instructorship: *John C. Probasco, MD, Johns Hopkins University*

7:40 – 8:00 p.m. **Open Discussion**

SPEAKER BIOGRAPHIES

(in order of appearance)

Henry J. Kaminski, MD

"Overview of Challenges" and Moderator of "Success Stories"

Henry J. Kaminski, MD, is the chair of the Department of Neurology at The GW Medical Faculty Associates. He is also the Meta Amalia Neumann professor of Neurology at the George Washington University School of Medicine & Health Sciences. He most recently served as professor and chair of the Department of Neurology and Psychiatry and director of the Clinical Research Unit at St. Louis University. He is an internationally recognized expert in the care of patients with myasthenia gravis, a chronic autoimmune neuromuscular disease characterized by varying degrees of weakness of the skeletal (voluntary) muscles of the body. His research, which has been funded by the National Institutes of Health since 1993, focuses on understanding the biology of the extraocular muscles and the pathogenesis of myasthenia gravis.

Dr. Kaminski is the author of more than 100 peer-reviewed articles and book chapters and serves as the editor of Myasthenia Gravis and Related Disorders, which is now in its second edition, and of Neuromuscular Disorders in Clinical Practice, one of the only comprehensive texts in the field of neuromuscular disease. He serves as councilor for the American Neurological Association, president of the Association of University Professors of Neurology, and chair of the Myasthenia Gravis Foundation of America scientific board. He is also a fellow of the American Academy of Neurology.

Dr. Kaminski received both his BA and MD from Case Western Reserve University, and performed his internship in Internal Medicine and his residency in Neurology at the University Hospitals of Cleveland. He spent most of his career at Case Western Reserve University, where medical students elected him to the Alpha Omega Alpha honor society for his dedication and excellence to teaching. During his time in Cleveland, he also was chief of the Neurology Service at the Cleveland Veterans Affairs Medical Center and was awarded several performance awards for his work in the care of veterans.

Timothy A. Pedley, MD

"Overview of Challenges"

Timothy A. Pedley, MD, FAAN, is the 33rd President of the American Academy of Neurology. He is also a Henry and Lucy Moses Professor of Neurology at Columbia University's College of Physicians and Surgeons and an attending neurologist at the Neurological Institute of New York, New York Presbyterian Hospital at the Columbia University Medical Center. He previously served as Chair of Columbia's Department of Neurology and as Neurologist-in-Chief at the Neurological Institute of New York from 1998-2011.

Pedley received his bachelor's degree from Pomona College and his doctor of medicine degree *cum laude* from Yale University. He trained in neurology at Stanford University and obtained additional experience in child neurology at the University of Colorado, after which he was a postdoctoral fellow in cellular neurophysiology with Professor David A. Prince and in clinical EEG and epilepsy with Dr. Barry R. Tharp, both at Stanford. After completing his training, he was a member of the faculty of the School of Medicine at Stanford University from 1975-1979. During 1978-79, Pedley was a Research Fellow in Experimental Neurology with Professor Brian S. Meldrum at the Institute of Psychiatry in London and in 1979 he joined the Faculty of Medicine at Columbia University.

Throughout his professional career, Pedley's major clinical and research interest has been epilepsy, and he has made both basic laboratory and clinical contributions to the field. Most recently, he collaborated with Drs. Ruth Ottman and W. Allen Hauser in family studies of epilepsy and identification of genes associated with human epilepsy syndromes. In 1989, Pedley established the Neurological Institute's Comprehensive Epilepsy Center, one of the first such centers in New York State to be accredited by the Department of Health. He has edited several standard textbooks on epilepsy, EEG and neurology. He was Editor-in-Chief of *Epilepsia*, the international professional journal of epilepsy, from 1994 to 2001. In 1995, Pedley was named Ambassador for Epilepsy by the International League Against Epilepsy and the International Bureau for Epilepsy for his international contributions to epilepsy. In 2006, he received the William G. Lennox Award of the American Epilepsy Society for lifetime achievements.

Pedley is a major leader in American neurology. He formerly served as President of the American Neurological Association (2007-2009), the American Clinical Neurophysiology Society (1989-1990), the American Epilepsy Society (1991-1992), and the Epilepsy Foundation of America (1991-1993), where he was later Chairman of the Board (1993-1995). He also served as Chairman of the American Board of Clinical Neurophysiology (1989-1990). He was a member of the National Advisory Neurological Disorders and Stroke Council of the NINDS/NIH from 2007-2011. He is a Fellow of the American Association for the Advancement of Science, and he was elected to the Institute of Medicine of the National Academy of Sciences in 2007.

Bruce Sigsbee, MD

"The Meat of the Matter: Re-Engineering Practice"

Bruce Sigsbee, MD, who is the Immediate Past President of the American Academy of Neurology (AAN), is a graduate of Dartmouth College and Dartmouth Medical School. He completed his neurology residency at New York Hospital-Cornell Medical Center. Sigsbee completed a Master's degree in business at Husson College in Bangor, Maine. Sigsbee has served in private practice since 1980. He is currently in private practice with Penobscot Bay Neurology in Rockport, Maine. Sigsbee has served in leadership capacities in a variety of practice settings, including as medical director for a 36-physician multispecialty practice, as executive director of an independent physician association with a Medicare risk contract, and as president and managing partner of practices.

Sigsbee has held numerous leadership roles within the American Academy of Neurology, with a focus on health care economics and policy. He served as the American Academy of Neurology representative to the Advisory Committee for the Relative Value System Update Committee (RUC) of the American Medical Association (AMA) from September 1992 to August 1996, when Neurology was granted a seat on the RUC. He served as a member of the RUC through January 2002 and also served as chair of the RUC's Research Subcommittee. Sigsbee has served on the AAN Medical Economics and Management Committee and chaired the committee from 1993 to 1997. He has also served as the AAN's treasurer from December 2006 to April 2009, on the Board of Directors, and on the Legislative Affairs Committee. He currently chairs the AAN's Health Care Reform Task Force.

On the state level, Sigsbee has served on the Board of Directors of the Maine Medical Association and as the association's representative to the local Medicare Carrier Advisory Committee. He currently serves on the Maine Medical Association's Peer Review and Quality Committee.

Sigsbee is the local site Principal Investigator for the IRIS study and a reviewer for the journal *Neurology*.

He and his wife, Jane, have two grown daughters.

Neil A. Busis, MD, FAAN

“The Meat of the Matter: Re-engineering Practice”

Neil A. Busis, MD, FAAN, is Director of Community Neurology of the University of Pittsburgh Physicians Department of Neurology and Visiting Clinical Professor of Neurology at the University of Pittsburgh School of Medicine. He is Chief of Neurology and Director of the Neurodiagnostic Laboratory at UPMC Shadyside, Pittsburgh, PA. Prior to joining University of Pittsburgh Physicians in 2012, Dr. Busis was in the private practice of neurology for 27 years.

Dr. Busis received his BA from Yale University and his MD from the University of Pennsylvania School of Medicine. He trained in internal medicine at the Johns Hopkins Hospital and in neurology at the Massachusetts General Hospital, where he also completed a fellowship in electromyography (EMG) and nerve conduction studies. Dr. Busis was a research associate in neurobiology at the Laboratory of Biochemical Genetics, National Heart, Lung, and Blood Institute under Marshall Nirenberg, PhD. He received additional training in medical informatics from the U.S. National Library of Medicine and in health care delivery improvement from Intermountain Health Care, Salt Lake City, Utah.

In addition to clinical neurology, Dr. Busis has expertise in practice issues - especially coding, billing, reimbursement and regulatory agency advocacy; and health information technology - including electronic health records and the use of Web-based resources and mobile devices to enhance neurologic practice.

Dr. Busis serves on the Board of Directors of the American Academy of Neurology (AAN). He is a former chair and current member of the AAN’s Medical Economics and Management Committee and is a member of its Meeting Management Committee. He is a former president of the American Association of Neuromuscular & Electrodiagnostic Medicine (AANEM) and former chair of its Professional Practice Committee. Dr. Busis served on the American Medical Association's CPT®, Relative Value Update, and Practice Expense Advisory Committees representing the AAN and the AANEM. He recently represented the AAN at a Centers for Medicare & Medicaid Services Refinement Panel advocating for fair reimbursement for EMG and nerve conduction studies. Dr. Busis participated in many web-based projects for organizations including the AAN, AANEM, Medscape, and the National Institute of Neurological Disorders and Stroke.

Jeff L. Waugh, MD, PhD

Success Stories:

"Improvement Initiative: Billing in Resident Clinic"

Jeff L. Waugh, MD, PhD, is a fellow in Pediatric Movement Disorders with dual appointments in the departments of child neurology at the Massachusetts General Hospital and Boston Children's Hospital. He was the recipient of the Clinical Research Training Fellowship through the AAN, and the Silverman Family Fellowship through the Bachmann-Strauss Dystonia Parkinson Foundation. The clinical and research focus of Dr. Waugh's fellowship is childhood-onset dystonia.

Dr. Waugh earned a BA at Washington University in St. Louis, followed by a combined MD and PhD (Neuroscience) from the University of Texas, Southwestern, at Dallas. He continued in Dallas at Children's Medical Center for internship and pediatrics residency (2009). He completed a second residency in child neurology at Boston Children's Hospital (2012). He was named the child neurology Resident Teacher of the Year in 2012. He developed and is now leading a curriculum in academic productivity at Boston Children's.

He and his wife Jessica have three daughters, ranging in age from 7 years to 7 months.

Jennifer R. Simpson, MD

Success Stories:

"Improving Discharge Procedures"

Jennifer R. Simpson, MD, attended Pittsburg State University in Pittsburg, Kansas, for an undergraduate degree. She graduated medical school at the University of Kansas. She completed neurology residency at the University of Michigan and a vascular neurology fellowship at Henry Ford Hospital. She is now faculty at the University of Colorado. Dr. Simpson received the resident teaching award her first year on faculty and the medical student teaching award after her second year on faculty. Her primary research interest is in quality improvement and has been chosen for the University of Colorado's inaugural class of the Institute for Healthcare Quality, Safety, and Efficiency Certificate Training Program. Her current quality improvement projects include improving time to intra-arterial therapy for acute ischemic stroke, a multidisciplinary group clinic, a TIA clinic, and reducing length of stay of inpatient stroke admissions. She is the local site Principal Investigator for the POINT trial. She is an Images Section editor for the journal *Neurohospitalist* and is the newsletter editor for the Neurohospitalist Society.

John C. Probasco, MD

Success Stories:

"The Development of a Neurohospitalist Advanced Clinical Practice Instructorship"

John C. Probasco, MD, is an assistant professor in the Johns Hopkins Department of Neurology. He cares for patients on the inpatient neurology service as well as in the post-hospitalization and urgent care clinics. He holds his undergraduate degree from the University of New Mexico, a second Bachelor's degree from the University of Oxford, and his medical degree from the University of California - San Francisco School of Medicine. He completed his internship at Johns Hopkins Bayview Medical Center, his neurology residency at Johns Hopkins, the neurohospitalist advance clinical practice instructorship at Johns Hopkins, and the Armstrong Institute Resident Scholars Program in patient safety and quality at Johns Hopkins.

COUNTERING FINANCIAL THREATS TO ACADEMIC DEPARTMENTS OF NEUROLOGY

TIMOTHY A. PEDLEY, MD
The Neurological Institute of New York
Columbia University Medical Center
and
President
American Academy of Neurology

Association of University Professors of Neurology
October 12, 2013
New Orleans, LA

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FINANCIAL THREATS TO ACADEMIC DEPARTMENTS OF NEUROLOGY – CONSIDERATION OF POSSIBLE SOLUTIONS

I. Maximizing patient-related revenues
  - Patient issues
  - Physician issues
  - Billing issues
  - Institutional support
  - Ancillary services

II. Graduate Medical education

III. Research Funding

IV. Case studies

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THE ALPHABET SOUP OF HEALTHCARE PAYMENT AND REGULATION - 1

AAPCC	Adjusted Average Per Capita Cost
ADU	Accessory Dwelling Unit
ALJ	Administrative Law Judge
AWV	Annual Wellness Visit
ACO	Accountable Care Organization
AHRQ	Agency for Healthcare Research and Quality
APC	Ambulatory Payment Classification
APRN	Advanced Practice Registered Nurse
ASC	Ambulatory Surgical Center
CCCM	Complex Chronic Care Management Services
CG-CAHPS	Clinician and Group Consumer Assessment of Healthcare Providers and Systems
CMS	Center for Medicare and Medicaid Services
CPC	Comprehensive Primary Care
CY	Calendar Year
DSH	Disproportionate Share Hospital
EP	Eligible Professional
GPRO	Group Practice Reporting Option

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THE ALPHABET SOUP OF HEALTHCARE PAYMENT AND REGULATION - 2

HCAHPS	Hospital Consumer Assessment of Healthcare Providers and Systems
IVR	Interactive Voice Recognition system
MEI	Medicare Economic Index
MPFS	Medicare Physician Fee Schedule
MSSP	Medicare Shared Savings Program
NQF	National Quality Forum
OIG	Office of the Inspector General
OPPS	Outpatient Prospective Payment System
PA	Physician Assistant
PCMH	Patient-Centered Medical Home
PCOR	Patient-Centered Outcomes Research
PE	Practice Expense
PPAPA	Patient Protection and Affordable Care Act
PQRS	Physician Quality Reporting System
QRURs	Quality Resource and Use Reports
RUC	Relative Value Update Committee

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THE ALPHABET SOUP OF HEALTHCARE PAYMENT AND REGULATION - 3

RVU	Relative Value Units
TAP	Technical Advisory Panel
VBPM	Value-based Payment Modifier

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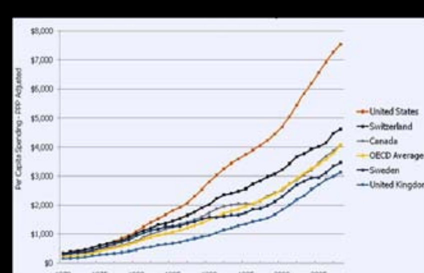
PER CAPITA HEALTHCARE COSTS FOR WESTERN INDUSTRIALIZED NATIONS



Source: OECD Health Data - 2010

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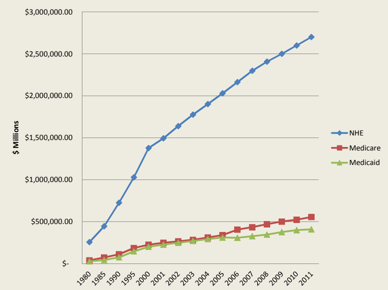
GROWTH IN MEDICARE AND MEDICAID SPENDING IN RELATION TO TOTAL NATIONAL HEALTH CARE EXPENDITURES

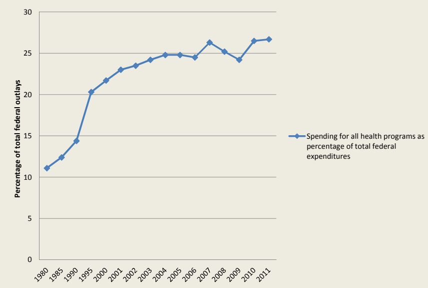
1980 - 2011



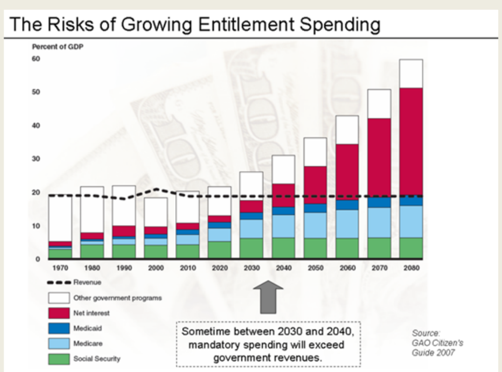
Source: OECD Health Data - June 2010

FEDERAL SPENDING FOR ALL HEALTH PROGRAMS AS PERCENTAGE OF TOTAL FEDERAL EXPENDITURES

1980 - 2011

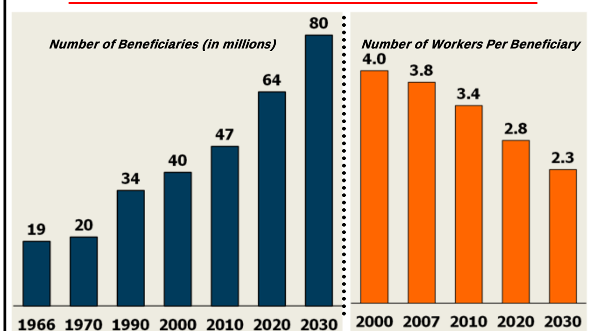


Source: White House Office of Management and Budget - 2014



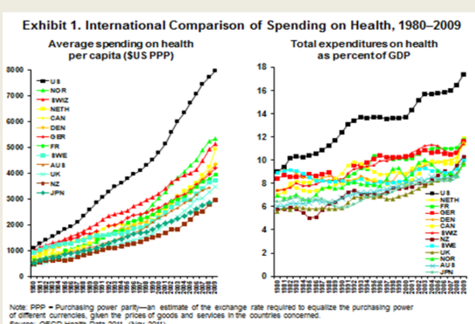
Source: GAO Citizen's Guide 2007

CURRENT COSTS ARE UNSUSTAINABLE



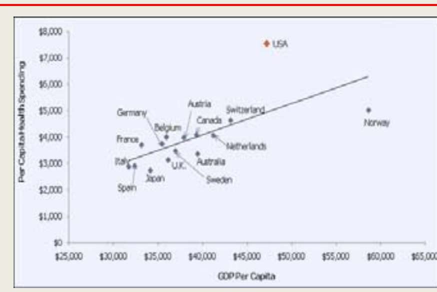
SOURCE: 2010 Annual Report of the Boards of Trustees of the Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds.

WE CAN'T COMPETE GLOBALLY



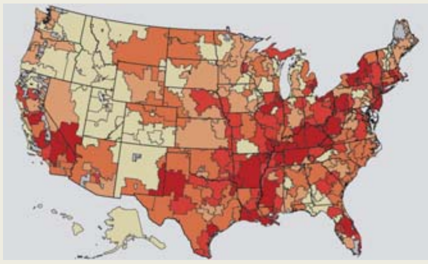
Source: OECD Health Data 2011

HEALTHCARE SPENDING PER CAPITA VS. GDP PER CAPITA



Source: Henry J. Kaiser Foundation - 2008

PER CAPITA COSTS AND 30-DAY HOSPITAL READMISSIONS



Source: Dartmouth Atlas – "Report on US Hospital Readmissions" - 2013

OUTCOMES ARE POOR

	AUS	CAN	GER	NETH	NZ	UK	US
OVERALL RANKING (2010)	3	6	4	1	5	2	7
Quality Care	4	7	5	2	1	3	6
Effective Care	2	7	6	3	5	1	4
Safe Care	6	5	3	1	4	2	7
Coordinated Care	4	5	7	2	1	3	6
Patient-Centered Care	2	5	3	6	1	7	4
Access	6.5	5	3	1	4	2	6.5
Cost-Related Problem	6	3.5	3.5	2	5	1	7
Timeliness of Care	6	7	2	1	3	4	5
Efficiency	2	6	5	3	4	1	7
Equity	4	5	3	1	6	2	7
Long, Healthy, Productive Lives	1	2	3	4	5	6	7
Health Expenditures/Capita, 2007	$3,357	$3,895	$3,588	3,874	$2,454	$2,992	7,290

QUALITY INDICATORS IN SELECTED INDUSTRIALIZED COUNTRIES

Exhibit 11. Quality Indicators in Select OECD Countries, 2009

	Asthma mortality among ages 5 to 39 per 100,000 population	Diabetes lower extremity amputations per 100,000 population	In-hospital fatality rate within 30 days of admission per 100 patients[c]		
			Acute myocardial infarction	Ischemic stroke	Hemorrhagic stroke
Australia	0.13	11.0	3.2	5.7	17.2
Canada	0.17[b]	9.5	3.9	6.3	20.6
Denmark	0.08	18.1	2.3	2.6	16.4
France	—	12.6[b]	—	—	—
Germany	0.17[b]	33.7	6.8	4.0	13.8
Japan	—	—	9.7[a]	1.8[a]	9.7[a]
Netherlands	0.09[a]	12.0[b]	5.3[b]	5.7[b]	22.5[b]
New Zealand	0.43[b]	7.0	3.2	5.4	21.1
Norway	0.27	9.9	2.6	2.8	11.6
Sweden	0.01[a]	5.7	2.9[b]	3.9[b]	12.8
Switzerland	—	7.4[a]	4.5[a]	—	14.8[a]
United Kingdom	0.27	4.8	5.2	6.8	19.3
United States	0.40[b]	32.9[a]	4.3[a]	3.0[a]	21.0[a]
OECD Median	***0.09***	***9.9***	***4.6***	***4.9***	***19.3***

Note: Rates are age–sex standardized.
[a] 2008.
[b] 2007.
[c] Figures do not account for death that occurs outside of the hospital, possibly influencing the ranking for countries, such as the U.S., that have shorter lengths of stay.
Source: OECD Health Data 2011 (Nov. 2011).

Commonwealth Fund-2012

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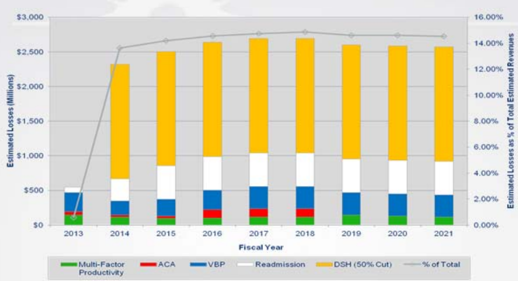
The Meat of the Matter: Re-engineering Practice

Bruce Sigsbee, MD
Neil Busis, MD

Revenue threats

- Payment modifiers
  - PQRS
  - Meaningful use
  - VBPM
  - Documentation
- Facility fee
  - 2008
  - Average 65%
  - MedPAC and others – "pay the same"
- Reduced NIH support
  - 5.1% sequestration
  - No prospect for modification of sequestration for foreseeable future
- Impact of ACA
  - No relief that other non-procedural specialties have received
  - Exchanges – reduced payments for specialists
  - Other – see slide
- GME funding
- PCP v. all specialists – procedural v. non-procedural

Estimated Losses for All Major Teaching Hospitals – Baseline Reductions in Medicare Revenue From ACA Implementation



Source: AAMC Analysis of Medicare Cost Report Data, FY2009 (March 31, 2011 Release)

Deficit Reduction Plans—GME

Plan	Cuts
Simpson/Bowles (bipartisan) (2010) "Fix the Debt"/Simpson/Bowles II (bipartisan) (2012) Sen. Conrad (D-ND, Budget Committee Chairman) (2012)	Cut GME by **60%**
Domenici-Rivlin Debt Reduction Task Force (2010) Rep. Ryan (R-WI, Budget Committee Chairman) (2012)	Potentially **eliminate** GME (Premium Support)
BCA (Sequestration) (2011)	Cut GME by **2%**
Biden Negotiations Team (bipartisan) (2011)	Cut GME by **15%**
Super Committee (bipartisan) (2011) Senate Gang of Six (bipartisan) (2011)	Cut GME by **15%-60%**
President Obama FY 2013 Budget Proposal (2012) President Obama Deficit Reduction Plan (2011, 2012)	Cut GME by **10%** (CHGME by 60%)
Sen. Corker (R-TN) (2012)	Cut GME by **$50 Billion** over 10 Years
CAP (2012)	Cut GME by **$28 Billion** over 10 years
CBO Choices for Deficit Reduction (2012)	Cut **$10 Billion** annually by 2020 (consolidate and reduce federal payments to teaching hospitals)
President Obama Offer During Fiscal Cliff Negotiations (11/29/12)	Cut **$400 Billion** in Medicare/entitlement payments (to be determined)
Republican Offer During Fiscal Cliff Negotiations (12/3/12)	Cut **$600 Billion** in health spending (to be determined)
Domenici-Rivlin Debt Reduction Task Force Plan 2.0 (2012)	Cut **$65 Billion** over 10 years

$40
Million

Productivity and Wait Time

- Address no show: confirm, book to no show rate
- Set expectation for patients seen – for example 8 per ½ day
- Off load as much on forms, others such as PFSH, ROS, PMH
- Consider not seeing certain patients: example headache on opioids or butalbital
- Consider MA for each physician – in one program increased productivity and more than paid for MA
- Patient education: how much do patients really retain, consider educational material to take home and read
- Example: BU Medical Center

Financial Success

- Financial success in academic practice and private practice depends on the same factors!
- Increase revenues
- Lower costs
- Increase quality
- Don't leave money on the table
- "Front office" and "back office" functions overlap more than you might think

Coding, Billing, Reimbursement: Fee For Service Model

- See patient (if they are authorized)
- Provide service or procedure
- Document encounter
- Prepare claim
  - Diagnosis code(s)
  - CPT code(s)
- Get patient co-pay
- Submit claim to insurance company
- Receive reimbursement
- Review explanation of benefits
- Appeal denied claims if needed
- Send unpaid patient claims to collection agency

Coding, Billing, Reimbursement: New Payment Models

- Decreasing reimbursement for neurologic services and procedures
  - Bottom line still depends on fee-for-service payments
- Quality programs, value-based reimbursement
  - Incentives and penalties are calculated from fee-for-service payments
- Shared savings programs
  - Shared savings are calculated from fee-for-service payments
- Bundled payments
  - Risk is calculated from fee-for-service payments

- Optimizing fee-for-service processes are key to success in all new payment models

Providing Services and Procedures

- Physicians and other qualified health care professionals must know the essentials of coding and documentation requirements before they see the patient
- Inadequate data collection at the time of the patient encounter:
  - Prevents billing at the proper level *or*
  - Does not support the level of billing if that claim is audited, exposing risk of costly repayments, penalties, repeat audits
- Many providers intentionally undercode to prevent scrutiny of their claims
  - This approach undervalues our services and leads to unnecessary loss of revenue

Evaluation and Management Codes

- E/M codes – office and hospital visits
- Outpatient
  - New
  - Established
- Inpatient
  - New
  - Established
- Consults (some carriers, not Medicare)

- We provide these services but often do not code for them:
  - Prolonged services
  - Critical care
  - Discharge day management
  - Transitional care management
  - Complex chronic care coordination

Levels of E/M Services

- Up to five levels for each type of E/M service
- Determined by
  - History
  - Physical
  - Medical decision making

  or
  - Time
  - Medical necessity underlies all

- Proper E/M documentation and coding is hard
- Templates and clinical calculators are needed unless you always bill by time (and correctly document it)

Neurologic Procedure Codes

- Codes for many neurologic procedures have changed markedly in recent years
- EMG
- Nerve conduction studies
- Intra-operative monitoring
- Autonomic testing
- Chemodenervation
- EEG
- Infusions
- Neurointerventional procedures
- Some don't have Category I CPT codes yet:
  - Telemedicine

Billing Procedures Correctly

- Many questions with all the new codes
- What constitutes a "nerve" for the new NCS codes?
- How do I bill for an EMG if NCS are done on the same day?
- What is the proper code for prolonged outpatient or inpatient EEG monitoring?
- How do I bill correctly for the time of EEG monitoring?
- How do I bill for a service or procedure that doesn't have a CPT code?

CPT Solutions

- Education about coding and documentation requirements
  - Online resources
  - Lectures
  - Encourage attendance at AAN practice courses
  - Ask the experts
- Build coding and documentation resources into provider workflow
  - Paper templates
  - Electronic templates, reminders, alerts
- More education, since the rules change often
- Yearly CPT/RUC/CMS/Congress cycle for Medicare
- Other insurers often follow Medicare's lead

Preparing the Claim

- "Physician code thyself"
- Begins in the exam room with the data obtained and the service provided
- Determine diagnosis code or codes
- Determine the service(s) and the level(s) of service(s)
- If you bill by paper, prepare a paper bill
- If you bill electronically, make sure bill is completed promptly
- Different processes for different EHRs
  - All-in-one EHRs (Epic: close the encounter)
  - Modular EHRs (Cerner: go to billing module)
- Need to monitor clinical staff to make sure bills are submitted for each patient encounter

Diagnosis Coding

- Originally for public health, now used for billing
- Currently we use ICD-9-CM
- We will move to ICD-10 on October 1, 2014
- Both systems will need to be available through 2015, at least, to take care of claims submitted on or before September 30, 2014
- Paper method:
  - Lots of cross referencing in the ICD-9-CM book
- Electronic method
  - Search ICD database for keywords, pick one or more codes
  - Different vendors use different crosswalks
  - Different systems at the same academic medical center may use different ICD vendors!

The Importance of ICD

- Payment is denied if diagnosis code and service/procedure codes don't agree
- Some chronic care models may depend on the second or third ICD code, not just the diagnosis code for that day's encounter
- Risk-adjusted quality measures may depend on patient populations gathered from claims data
  - Insurance companies "tier and steer"
- Value-based payment models may depend on selecting patient populations from claims data

ICD Solutions

- Need to understand neurologic crosswalks used for ICD coding at your institution
- For best results, all coding processes should use a common database
- Chronic condition codes should automatically carry forward on patient documentation and bills
- Need to educate staff on correct diagnosis coding
- Get ready for ICD-10 now!

Front and Back Office Overlap

- Need to make sure patient insurance information is correct before encounter
- Need to make sure patient is authorized for service/procedure before the encounter
- Need to collect co-pay from patient at time of encounter
  - Eliminates a costly paper billing cycle
- After encounter is finished, need to make sure bill is created
- Review bill to make sure it is a clean claim before it is submitted
  - Billing personnel should review bills created by providers and modify them if necessary
    - ✓"New" versus "Established" patients in a big organization
  - Eliminates denials and future audits

Review Reimbursement and Denials

- Business expertise required
  - In-depth knowledge of billing and coding
  - Analysis of payer fee schedules
  - Strategic planning
  - Contract negotiation
- Denials may not mean the claim was bad:
  - Budget cuts affect training claims processors
  - Many denials go uncontested making this a good business strategy
  - Leaves more profit for insurance company

Billing Challenges

- Reimbursement rules vary from one payer to the next
- Insurance carriers have created a variety of ways to delay or deny reimbursements
- The rules change constantly, sometimes without notice
- Without close vigilance, consequences include:
  - Denied compensation
  - Unnecessary write offs
  - Rising aging accounts receivables
  - Unnecessary overhead costs

Reasons for Denied Claims

- Pre-submission failures
- Errors in office claims preparation
- Errors in insurer claims processing
- Errors in payment posting procedures
- Lack of procedures to combat denials

Scope of the Denial Problem

- 24%-43% of claims reviewed contain clinical coding errors
- Cost of resubmission of claim is estimated at $25/claim
- Paper chart pull alone is estimated at $5/chart

Preventable Errors

- Incorrect or missing DOB
- Invalid referring provider NPI number
- Date of service or format of date is invalid
- Insured last name not present or wrong format
- Insured address incorrect
- Patient not found
- Cancelled policy
- No coverage for type of charge

What Does Your Department Need?

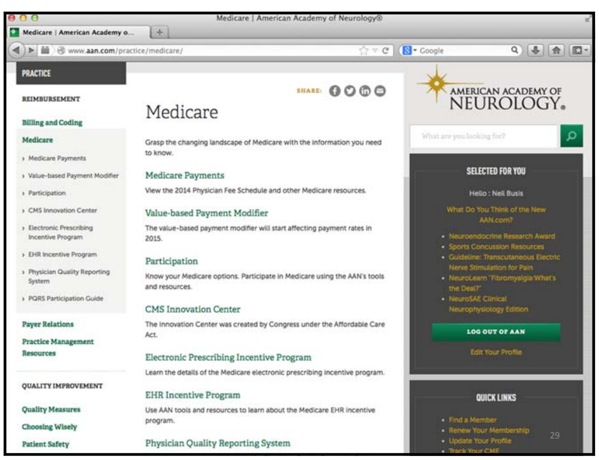
- Keep patient data up to date
- Make sure you have preauthorizations, if needed
- Keep files on payers
- Referral rules
- Prior authorization of testing
- Attachment of documentation
- Limits on procedural testing
- Requirements for medical necessity
- Appeals process
- Good information technology infrastructure

Appeals Work

- Of the 1.1 billion 2010 claims to Medicare, 117 million were denied; of those, only 2 percent were appealed
- Of more than 40,000 appeals in 2010, administrative law judges reversed claims denials in favor of appellants 56% of the time
- For health professionals, the rate of favorable decisions was 61%, compared with a favorable rate of only 28% for beneficiaries
- RAC audits:
  - 94% of claims identified as overpayments were not appealed by providers
  - Of the 6% of claims that were appealed, roughly half of the claims were overturned in favor of providers

Don't Leave Money on the Table

- Follow the principles in the last few slides:
  - Submit claims for all encounters with correct codes and data
  - Review reimbursements, appeal denials
- Use other qualified health care professionals to fill in the gaps (under physician supervision, of course):
  - PFSH and ROS incorporated by reference can raise level of E/M service while increasing physician efficiency
  - PAs and CRNPs can bill for outpatient and inpatient follow-up visits
- Participate in all available "quality" programs to increase chances of incentive payments and decrease chances of penalties



Medicare Quality Programs

- Incentives and penalties based on meeting certain quality goals
- Dollar value calculated from Medicare fee-for-service reimbursements

- Physician Quality Reporting System
- Maintenance of Certification
- Electronic Prescribing Incentive Program
- EHR Incentive Program
- Value-Based Payment Modifier

Physician Quality Reporting System

- Incentive payment for eligible professionals who satisfactorily report data on quality measures for covered professional services furnished to Medicare beneficiaries
- Academy developed quality measures
- Expect public reporting of physician names
- Bonuses through 2014
  - 2012-2014 +0.5%
- Penalties begin in 2015
  - 2015 -1.5%
  - 2016 & on -2.0%
- 2013-2014 additional +0.5% for certain MOC/PIP programs

Maintenance of Certification

- For 2011-2014, EPs who satisfactorily report PQRS measures can earn an additional 0.5% incentive payment by participating in MOC/PIP more frequently than is required to qualify for or maintain board certification status
- Definition of "more frequently"
- CMS must preapprove MOC programs before participation in them qualifies for PQRS incentive payments
- The rules are very complex

E-Prescribing Incentive Program

Reporting the eRx Measure

Year	Incentive Amount	Applicable Reporting Dates	Reporting Instances	Reporting Method
2011	1.0%	01/01/2011-12/31/2011	25	Claims, Registry, EHR
2012	1.0%	01/01/2012-12/31/2012	25	Claims, Registry, EHR
2013	0.5%	01/01/2013-12/31/2013	25	Claims, Registry, EHR
2014	N/A	N/A	N/A	N/A

eRx Payment Adjustment

Year	Penalty Amount	Applicable Reporting Dates	Reporting Instances	Reporting Method
2011	N/A	N/A	N/A	N/A
2012	-1.0%	01/01/2011-06/30/2011	10	Claims
2013	-1.5%	01/01/2011-12/31/2011	25	Claims, Registry, EHR
2013*	-1.5%	01/01/2012-06/30/2012	10	Claims
2014	-2.0%	01/01/2012-12/31/2012	25	Claims, Registry, EHR
2014*	-2.0%	01/01/2013-06/30/2013	10	Claims

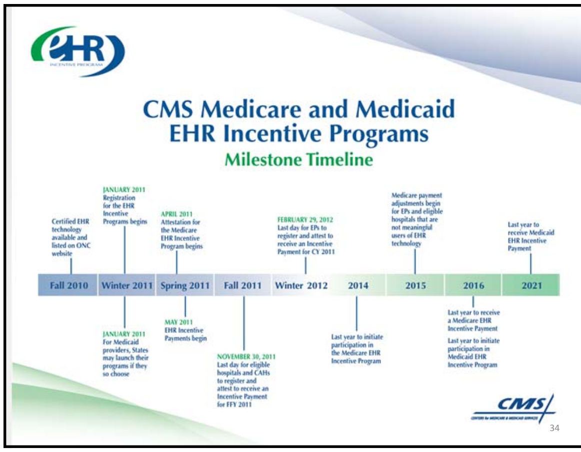


Table 1: Maximum EHR Incentive Payments by Program Based on the First Calendar Year (CY) for Which the EP Receives Payment

CY	CY 2011		CY 2012		CY 2013		CY 2014		CY 2015		CY 2016	
	Medicare	Medicaid	Medicare	Medicaid	Medicare	Medicaid	Medicare	Medicaid	Medicare	Medicaid	Medicare	Medicaid
2011	$18,000											
2012	$12,000		$18,000									
2013	$8,000		$12,000		$15,000							
2014	$4,000		$8,000		$12,000		$12,000					
2015	$2,000		$4,000		$8,000		$8,000					
2016			$2,000		$4,000		$4,000					
2017												
2018												
2019												
2020												
2021												
Total (if EP does not switch programs)	$44,000	$63,750	$44,000	$63,750	$39,000	$63,750	$24,000	$63,750	$0	$63,750	$0	$63,750

NOTE: Medicare EPs may not receive EHR incentive payments under both Medicare and Medicaid.
NOTE: The amount of the annual EHR incentive payment limit for each payment year will be increased by 10 percent for EPs who predominantly furnish services in an area that is designated as an HPSA.

10/3/2012 was the last day to start participating in the Medicare EHR Incentive Program and earn the maximum incentive amount of up to $44,000

Payment Adjustments Beginning in 2015

If an EP does not successfully demonstrate meaningful use of certified EHR technology, the EP's Medicare physician fee schedule amount for covered professional services will be adjusted by the applicable payment adjustment specified in the Recovery Act beginning in 2015. The payment adjustments will be as follows:

- 2015—99 percent of Medicare physician fee schedule covered amount
- 2016—98 percent of Medicare physician fee schedule covered amount
- 2017 and each subsequent year—97 percent of Medicare physician fee schedule covered amount

If it is determined that for 2018 and subsequent years that less than 75 percent of EPs are meaningful users then the payment adjustment will change by one percentage point each year until the payment adjustment reaches 95 percent.

The Recovery Act allows for a hardship exception, which, if applicable, could exempt certain EPs from the payment adjustment. The exemption is subject to annual renewal, but in no case will a hardship exemption be given for more than five years. ***Note: More information on payment adjustments and the requirements to qualify for a hardship exemption will be provided in future rulemaking prior to the 2015 effective date.***

Value-Based Payment Modifier

- The Affordable Care Act mandated that by 2015 CMS begin applying a value modifier under the Medicare Physician Fee Schedule
- Both cost and quality data are to be included in calculating payments for physicians
- Physicians in groups of 100 or more eligible professionals who submit claims to Medicare under a single tax identification number will be subject to the value modifier in 2015, based on their performance in calendar year 2013
- All physicians who participate in Fee-For-Service Medicare, are subject to the value modifier in 2017 based on calendar year 2015 data

How the Value Modifier Works

- The value modifier and PQRS are aligned
- All physicians who participate in the value modifier will be evaluated on quality measures submitted through PQRS
- The value modifier functions in both directions by rewarding high-performing physicians with increased payments and by punishing low-performing physicians with decreased payments
- Physicians who do not participate in PQRS and do not report at least one measure will receive a downward payment adjust of -1.0%
- The 2015 and 2016 value modifier does not apply to groups that are Accountable Care Organizations (ACO) or ACO participants

The Story So Far…

- Optimize fee-for-service processes
  - Collect needed data from patients, payers, and regulators
  - Educate your providers and staff
  - Monitor them to make sure they submit their bills and quality data
  - Internal audits are a good idea
  - Get ready for ICD-10
- Don't leave money on the table
  - Fill in the gaps with other qualified health care professionals
- Keep up to date on Medicare quality incentive and penalty programs
- Make sure your institution has the proper information technology infrastructure to move from volume to value

Institutional Level

Institutional Level Efforts

- Downstream revenue
- Grants for pilot programs – in particular bundled payments in stroke, Alzheimer's
- Add other services – neuroimaging, ultrasound, etc.
- Risk contracting
  - Only 5% of AMC in top performers on key quality measures
  - AMC leaders hesitant to address governance issues
  - Majority not willing to pay premium to go to AMC
  - Must have central organizational structure before implementation begins
- Competition will escalate

Risk Contracting – Steps for Success (PWC)

- Build brand by holding faculty accountable for cost and quality
  - Tackle variability in quality and cost
  - Analyze cost structures
- Become part of larger community network
- Push envelope in extenders
  - Virtual home visits, extend clinical and educational reach
  - Work with different disciplines
  - Shared services
- Become information hub
  - Focus IT analytics for research and clinical care, not automation
  - Prepare to share data outside organization
- Align research pipeline with clinical and business strategies
  - Increase communication between basic and clinical scientists
  - Develop collaborations with industry
  - Focus on centers of excellence
- Nabel, Ferris and Slavin. NEJM 369;11 2013

Prepare for Risk Contracting

- Cost and quality – major issue for policy makers
- Demonstrate value – change in culture
  - Quality metrics – increased transparency
  - Cost (efficiency) must be part of consideration
- Network must include community sites
- Work as teams
  - Across departments
  - Across providers
- Information systems must support cost and quality
- Integrate: education, research and clinical efforts
- Identify centers of excellence
- Effective institutional governance and leadership are critical

Questions?

BILLING EDUCATION FOR TRAINEES: EVERYONE WINS

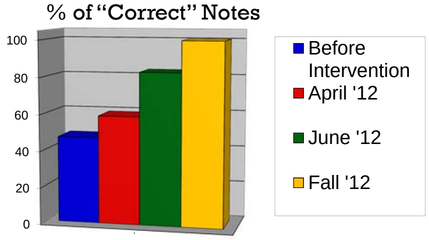
Jeff Waugh, MD, PhD
Fellow in Pediatric Movement Disorders
Massachusetts General / Boston Children's / Harvard University

THE PROBLEM

- Over two audit cycles in 2011, our largest insurer markedly increased the stringency of audits
- For Residents and Fellows:
  - 97% of all inpatient notes were downcoded
  - 53% of all outpatient clinic notes were downcoded
- Mean outpatient value lost : $232 per note
- Inpatient notes lost 71% of billed value

2

ELIMINATING OUTPATIENT DOWNCODE



Over one year, we reduced downcodes from 54% to zero.

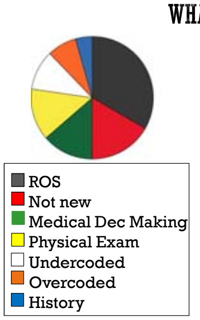
3

HOW DID WE DO IT?

- Three key changes:
  - Identified group weaknesses
  - Identified individual weaknesses
  - Found incentives that benefitted both trainees and department

4

WHERE DO THESE ERRORS COME FROM? WHAT DO THEY COST?

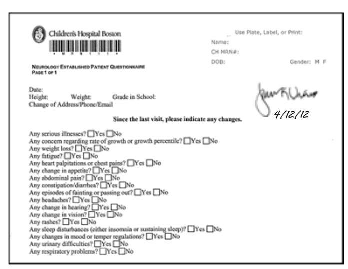


Conservative savings estimate:
$23,892/individual/year

x 26 fellows + residents:
$621,200 per year

5

A BULLETPROOF ROS

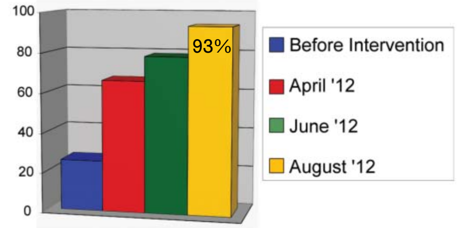


1. Family fills it out while waiting
2. Clinician reviews, signs, and dates it
3. Admins scan into medical record

6

SYSTEM CHANGE + EDUCATION
ELIMINATED GREATEST SOURCE OF LOSS

% of ROS meeting "Complete" criteria



7

HOW DID WE DO IT?

- Three key changes:
  - Identified group weaknesses
  - **Identified individual weaknesses**
  - Found incentives that benefitted both trainees and department

8

DO TRAINEES CARE ABOUT THE BUSINESS OF MEDICINE?

Survey results: Residents and Fellows stated that they

- Had not been adequately trained in the business of medicine: (100%) 1)
- Would like feedback on their own billing performance: (76%)
- Could adjust their billing to fit the visit level: (46%)

Several residents added that they recognized their knowledge gap, but had no one to teach them.

9

IDENTIFIED INDIVIDUAL ~~WEAKNESSES~~ strengths

- One-on-one sessions with every trainee, 3+ notes each
- Utilized a very powerful force: righteous indignation
- Rather than hours of tedium, trainees learned the few points that needed polishing
- Emphasized that clinical care and clinical billing are separate but dependent skillsets – one is useless without the other

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HOW DID WE DO IT?

- Three key changes:
  - Identified group weaknesses
  - Identified individual weaknesses
  - **Found incentives that benefitted both trainees and department**
- Primary motivator of trainees: saved time
  - Notes go faster when you know the rules
  - Low code? Titrate dictation accordingly
  - Shifted learning from day one of 1st job to progressive throughout residency

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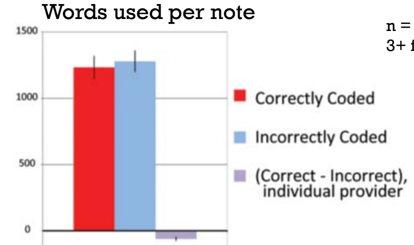
CORRECT NOTES USE FEWER WORDS

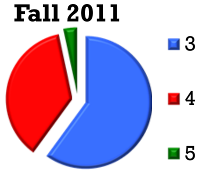


n = 76 notes,
3+ for each trainee

12

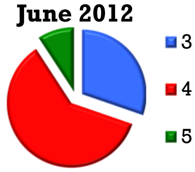
MEASURING SUCCESS: INCREASED NOTE LEVEL

Fall 2011



Average Level: 3.4

June 2012



Average Level: 3.8

We improved average level by 11%,
Improved average note value by 16%

13

MEASURED IMPACT OF INCREASED LEVEL

44 clinics per year
x average of 4 hours (patients) per clinic
x $96/note in improved mean level
x 26 residents and fellows

$438,000/y in improved billing, just from resident clinic. Spillover benefits?

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THANKS TO:

- Scott Pomeroy, MD, PhD
- Frank Davis, MHA
- Angeliki Medrano, CPC, CPMA

Please Contact me with Questions:
Jeff.Waugh@Childrens.Harvard.edu

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Success Story:
Improving Time of Hospital Discharge with Quality Improvement Methods
October 12, 2013

Jennifer Simpson MD

University of Colorado Hospital
UNIVERSITY OF COLORADO HEALTH

No financial disclosures

Primary Endpoint

- **Improve Discharge Efficiency**
  - Goal was 50% by 10AM
  - Rationale:
  1. Be a trailblazer for the hospital
  2. Improve patient satisfaction
  3. Improve resident efficiency
  4. See more patients, therefore improve resident education
  5. TEAM approach = better morale

Balancing Measures

1. Monthly Census
2. Bounce backs in 30 days
3. Mean/median length of stay
4. Resident input on rounding and education
5. Patient satisfaction

Baseline Data: July - September

Discharge by 10AM:
July: 6/54=**11%**
August: 10/60=**17%**
September: 5/40=**13%**

Total: 21/154=**14%**

Mean length of stay:
July: **5**
August: **4.7**
September: **4.5**
TOTAL: 4.8 days

Median length of stay:
July: **3**
August: **3**
September: **2**
TOTAL 3 days

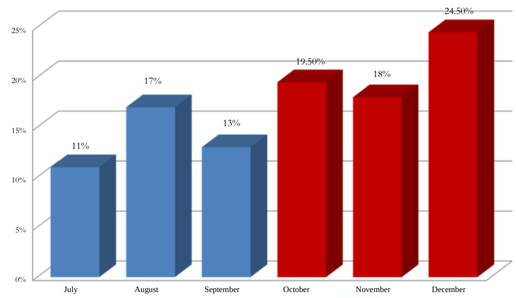
Bounce Backs in 30 days:
2/154 = **1%**

PDSA Cycle #1 Interventions

- RESIDENT and ATTENDING Education
- Ancillary Staff Education
- Social Work Rounds at 3:00 PM
- Use EMR to our advantage
  - Pend discharge orders
  - Make a list to track our patients easier

October - December

Discharge Rate by 10 AM



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Preliminary Lessons

- "SYSTEMS" problems
  - ★SNF discharges = 6%
  - ★Awaiting ECHOs
- ⦿ Social work rounds are good in theory, but not working.
- The Best Practice Effect
  - – Identifies patients ready for d/c
  - – Pends d/c orders
  - – 1 resident can make a difference

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PDSA Cycle #2 Interventions

- Change SW rounds to 11 AM
  - – Involved PT/OT
  - – Made less frequent
- More awareness and education
  - – Meetings (QI project team)
  - – Emails
  - – Emphasized EMR

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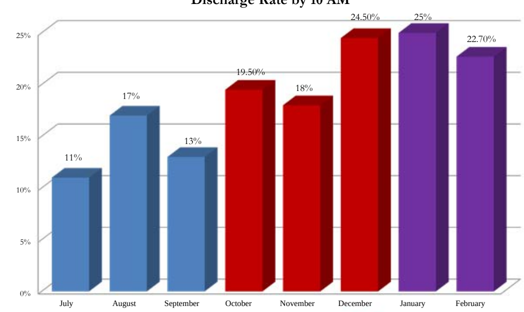
January – February

Discharge Rate by 10 AM



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PDSA Cycle #3 Interventions

- Concept of competition
  - – Weekly tracking of 10 am discharges
  - – Charted in conference room and made visible
- Daily awareness
  - – Neurohospitalists became integral
- Positive reinforcement
  - – Dinner at my house

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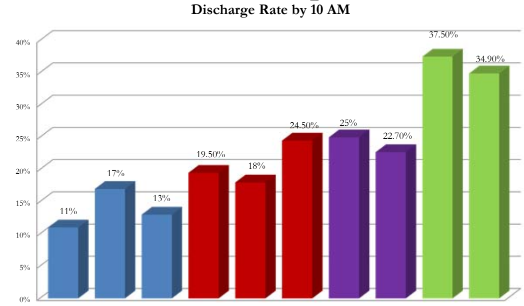
March-April

Discharge Rate by 10 AM



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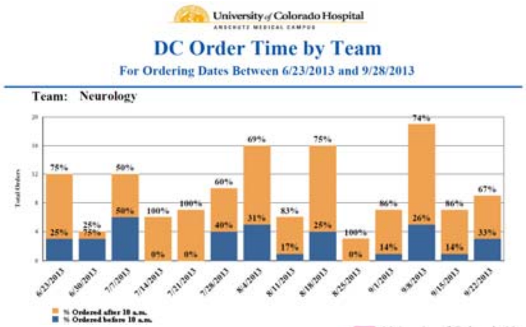
How are we doing now?



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Why is this project so hard?

- Not self sustaining!
- Effort related
- "The new norm"

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Thank You!

- Charles Braun, Cliff Hampton, Taylor Finseth and Taka Higashimori
- *William Jones, *Jennifer Simpson, Matthew West, Sharon Poisson
- Ethan Cumbler for his advice
- Steve Ringel for his leadership and advice

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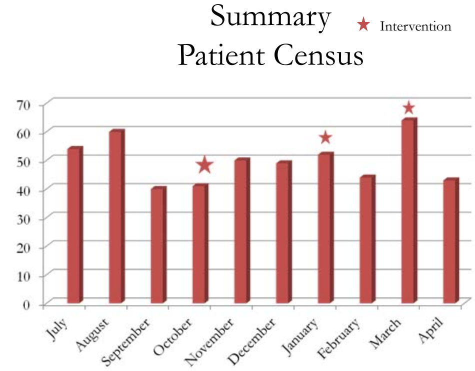
Summary
Patient Census



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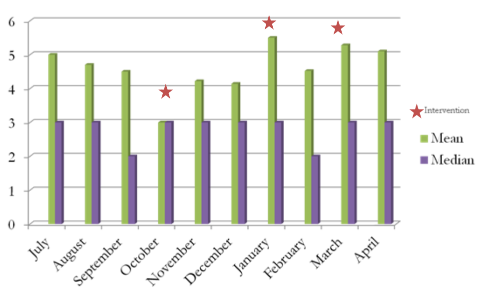
Summary
Mean and Median Length of Stay



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Concrete Actions:

Johns Hopkins Neurology Neurohospitalist Advanced Clinical Practice Instructorship

John C. Probasco, MD
Assistant Professor of Neurology, Johns Hopkins School of Medicine

AUPN Leader's Forum
New Orleans, LA
October 12, 2013

Neurohospitalists:

- Physicians whose primary focus is the care of inpatients with or at risk for neurological disease.[1]
- Practice in academic and non-academic settings.[2]
- Care for patients of high acuity and a wide spectrum of neurological disease.[2,3]
- Care quality, patient safety, neurological disease pathophysiology, treatment and education are natural interests of neurohospitalists.[2]
- The necessity of neurohospitalist-specific training, and core features of such training yet to be defined.[2,3]

1. AAN (2012).
2. Likosky, *et al.* (2010) *Frontiers in Neurology.*
3. Josephson, *et al.* (2008) *Annals of Neurology.*

Johns Hopkins Neurohospitalist Experience

In 2011, Johns Hopkins Neurology began process of developing a neurohospitalist training program.

Recognition of need for specialized training in inpatient neurological management

Raised questions regarding:

- Demand for specialized training
- What such training should entail
- Form of such training: fellowship vs. instructorship

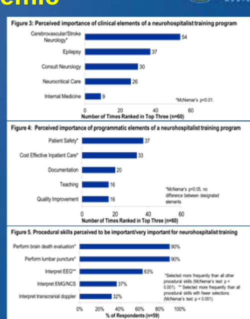
Neurohospitalists: Perceived Need in Academic Neurology

- In 2012, performed survey of ACGME accredited US neurology departments.
- 38% of responding academic neurology departments reported employing neurohospitalists.
- 65% felt that neurohospitalist neurology should be an ACGME accredited fellowship.
- 4 departments had created a neurohospitalist training program.
- 10 departments reported plans to create a training program within the next two years.

Probasco, *et al* (2013). *The Neurohospitalist.*

Neurohospitalists: Training Requirements in Academic Neurology

- Clinical Elements
  - Cerebrovascular/Stroke
  - Epilepsy
  - Consult Neurology
- Programmatic Elements
  - Patient Safety
  - Cost Effective Inpatient Care
- Procedural Skills
  - Brain Death Evaluation
  - Lumbar Puncture
  - Interpretation of EEG



Probasco, *et al* (2013). *The Neurohospitalist.*

Johns Hopkins Neurohospitalist Advanced Clinical Practice Instructorship

In July 2012, Johns Hopkins Neurology introduced an advanced clinical practice instructorship in general inpatient neurology.

Goal: to provide neurologists the experience and skill set necessary to excel and lead in this developing area of clinical neurology and academia.

- Clinical Care
- Education
- Research

Clinical Care

1. Clinical experience gained by attending on various inpatient academic services:
   - Work alongside PAs, students, residents and fellows
   - Johns Hopkins Hospital Inpatient General Neurology Service
     - Broad neurology exposure
     - Opportunity to refine and instruct in procedural skills
   - Johns Hopkins Hospital Neurology Consultation Service
   - Johns Hopkins Bayview Medical Center Inpatient Neurology Service
     - Broad exposure including cerebrovascular/stroke
     - Experience managing intermediate care patients

Clinical Care

2. Urgent care and post-hospitalization clinic
   - Develop experience in outpatient practice
   - Broad clinical exposure
   - Understand issues of patient care transitions between the outpatient and inpatient settings
     - Urgent new patient evaluation
     - Coordination of expedited outpatient evaluation
     - Coordination for admission and evaluation
     - Coordinate post-hospitalization care and facilitate care transition

Education

- Develop expertise in the education of residents and fellows while attending
- Provided further clinical training through:
  - Departmental conferences
  - One-on-one instruction from senior faculty in various aspects of academic neurology, including clinical care and advances in research
- Emphasis on quality improvement
  - Participation in departmental and care unit initiatives

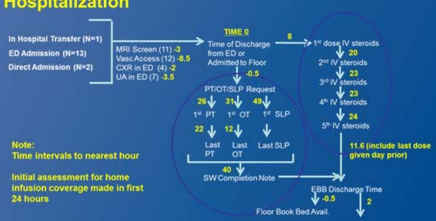
Research

- Provide the opportunity to pursue complementary training in a variety of areas, such as:
  - Patient safety and quality improvement
  - Clinical research
  - Global neurology
- Provide protected time for development of research interests
- Senior faculty provide research guidance and mentorship

Example: Focus on Inpatient Care Coordination

- Sought to understand patient flow and barriers to discharge
- Focused on patients with multiple sclerosis admitted for IV steroids

Hospitalization



Example: Focus on Inpatient Care Coordination

- Developed 3 interventions:
  - Interdisciplinary provider checklist
  - Provider order set
  - Patient checklist and education materials
- Preliminary analysis:
  - Improved care coordination
    - Reduced time from request to first therapy assessment from 26 to 13 hours (50% reduction)
  - Improved discharge process efficiency:
    - Reduced time from treatment completion to discharge from 8.5 to 4.5 hours (>50% reduction)

Funding Source

Position is currently funded through hospital resources based primarily on billing activity.

- Inpatient clinical activity
- Outpatient clinical activity
- Training in billing through departmental administrative offices

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Importance and Hurdles to Drug Discovery for Neurological Disease

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This is a critical time in neurotherapeutics. The prevalence of neurological disease, such as dementia, stroke, and peripheral neuropathy, is large and growing consequent to the aging population. The personal and societal impact of these disorders is enormous, and the number of novel therapies in the pipeline for these disorders has been contracting. Support for the development of neurotherapies must continue from the bench to their ultimate place at the bedside. Academic medicine must continue to play a critical role, in league with industry and government, in the development of novel neurotherapies desperately needed by an ever-expanding population. Critical steps include the identification and adoption of reliable, valid, and reproducible biomarkers to serve as primary endpoints in clinical trials of neurological disease.

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The burden of neurological disease is remarkable in both its impact on the quality of life and its cost. This has been particularly true in developed countries where an increasing life expectancy has resulted in substantial increases in the prevalence of diseases that chiefly afflict the elderly, such as stroke and dementing disease. Were a critical prospective analysis to be done on the elderly population, it is likely that few would escape some form of neurological ailment, with many individuals suffering from more than one.

The nature of neurological disorders varies with age. Autistic spectrum disorders (ASDs), cerebral palsy, and Tourette syndrome are among many disorders that present in childhood. A conservative estimate of the frequency of ASDs is 27.5 per 10,000, with newer surveys suggesting that it is as high as 60 per 10,000 individuals.[1] A surveillance study of ASDs during 2008 from 14 sites in the United States found a prevalence of 11.3 per 1,000 (1 in 88) children aged 8 years old.[2] With respect to cerebral palsy, studies from Europe and the United States reveal a median prevalence of 2.4 per 1,000.[3] An increase in preterm births, which has been occurring in the United States in the recent past,[4] is associated with an even higher prevalence of cerebral palsy. The reported prevalence of Tourette syndrome is age-dependent and has varied widely from study to study, but a median estimated prevalence of 3.5 per 1,000 has been proposed.[3] One in 5 children experience transient tics, and 1 in 100 develop Tourette syndrome.[5]

Among the more common neurological disorders across the age spectrum are migraine headache and epilepsy. The 1-year prevalence per 1,000 for migraine derived from an analysis of multiple epidemiological studies was 121.[3] The 1-year prevalence in a study conducted in Philadelphia revealed that 17.2% of women and 6.0% of men were migraineurs, with the highest prevalence between the ages of 30 and 49 years.[6] The economic impact of migraine is substantial, with indirect costs outweighing the cost of treatment.[7] Approximately 1% of the US population will have epilepsy by age 20

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years, with >2/3 having onset in childhood.[8,9] The incidence of seizures is high in the first year of life, but highest in individuals age 75 years or greater,[9] which represents an increasing percentage of the population of the developed world. The 1-year prevalence per 1,000 for epilepsy in the United States is estimated at 7.1,[3] and the cumulative incidence of all unprovoked seizures through age 74 years is 4.1%.[10]

Traumatic brain injury (TBI), spinal cord injury (SCI), and multiple sclerosis (MS) lead to the highest rate of neurologic disability among young adults. TBI has a median annual incidence in the United States of 101 per 100,000[3] and is notably frequent among veterans returning from the Iraq and Afghanistan wars. In a Veterans Administration study of 327,388 veterans of these 2 recent wars, 6.7% had been diagnosed with TBI, and 89% of those patients carried a psychiatric diagnosis.[11] Similarly, chronic traumatic encephalopathy has been recognized with increased frequency in individuals engaged in contact sports.[12,13] SCI from trauma resulting in complete or incomplete functional interruption of spinal pathways has a median annual incidence of 4.5 per 100,000 and a prevalence of 72 per 100,000 in the United States.[3] The median estimate of the annual incidence of MS in the United States is 4.2 per 100,000 (range 5 0.8–12.0), with prevalence estimated between 47.2 and 109.5 per 100,000.[14] Both the incidence and prevalence are twice as high in women as in men, and the peak age of onset is approximately 30 years.[3]

In the 20th century, the age-adjusted death rate of Americans declined by about 74% and the life expectancy increased 56%.[15] The aging population has been accompanied by an increase in neurological disorders, particularly stroke and neurodegenerative conditions, such as Alzheimer and Parkinson disease. In 2009, the life expectancy at birth in the United States was 78.5, and for a person age 65 years old, 19.2 years.[16] In 2010, the Department of Health and Human Services estimated that there were >40 million individuals in the United States >65 years old, constituting 13.0% of the total population.[17] By 2030, that number will nearly double to >71 million and represent 19.7% of the population.[17] Data collected from 17 series with >15,000 persons aged 60 years or more revealed a mean incidence of moderate to severe dementia of 4.8%.[18] The incidence rate for dementia in Rochester, Minnesota was 187 per 100,000 and for Alzheimer disease was 123 per 100,000.[19] The frequency of Alzheimer disease increases with advanced age; for those 60 to 69 years old, the prevalence approximates 300 per 100,000, for those 70 to 79 years old, the prevalence is 3,200, and for those >80 years old, the prevalence is 10,800.[20] In 2010, 4.7 million people aged 65 years or older in the United States had Alzheimer disease,[21] accounting for 42% of the chronic conditions among persons living in residential facilities.[22] By 2050, it is estimated that there will be 13.8 million people with Alzheimer disease in the United States.[21]

Estimates from several studies of the incidence and prevalence of Parkinson disease indicate that the median incidence is 160 (range 5 62–332) per 100,000 for persons aged 65 or older, with a prevalence rate of 9.5 per 1,000 (range 5 7.0–43.8).[3] It is estimated that Parkinson disease affects about 1 million people in the United States.[20]

Regarding cerebrovascular disease, the median annual incidence of first-ever stroke is 183 per 100,000, with the rate roughly doubling every decade during adulthood. The prevalence of stroke, as determined in a study from Rochester, Minnesota, was 1% of the population,[23] and nationwide studies suggest that it approaches 2% for persons aged 25 to 74 years.[24] Annually, 700,000 people in the United States suffer a stroke, about 1 person every 45 seconds, and >1/2 die within 8 years of their stroke.[25] In 2010, there were 4.7 million people living with stroke in the United States.[25] Stroke accounted for 11% of the persons living in residential facilities.[22]

The neurological disorders described above are but a short list of some of the more common neurological afflictions. Disorders of the peripheral nervous system, such as Guillain–Barré disease, chronic inflammatory demyelinating peripheral neuropathy, diabetic neuropathy, postherpetic neuralgia and other pain syndromes, and myasthenia gravis, as well as other central nervous system (CNS) disorders, such as amyotrophic lateral sclerosis, are not encompassed in this review. It also does not address the 20% of orphan diseases that are neurological; neurological disease has the third-highest number of orphan product designations.[26] When all these conditions are considered in aggregate, it reveals a substantial burden of neurological disease, with a significant impact on health and well-being coupled with enormous direct and indirect financial costs. Neurological disorders accounted for a substantial amount of the $2.1 trillion dollars of direct cost of personal health care expenditures in the United States in 2009.[16]

Difficulties of Bringing Drugs to Market

About 85% of all drug therapies fail in clinical trial, and on average only 25 to 30 new molecular entities are approved in the United States annually.[27,28] Data collected by the US Food and Drug Administration indicate that over the past 20 years there was a spike in new drug approvals in the mid-1990s (53 in 1996), with a

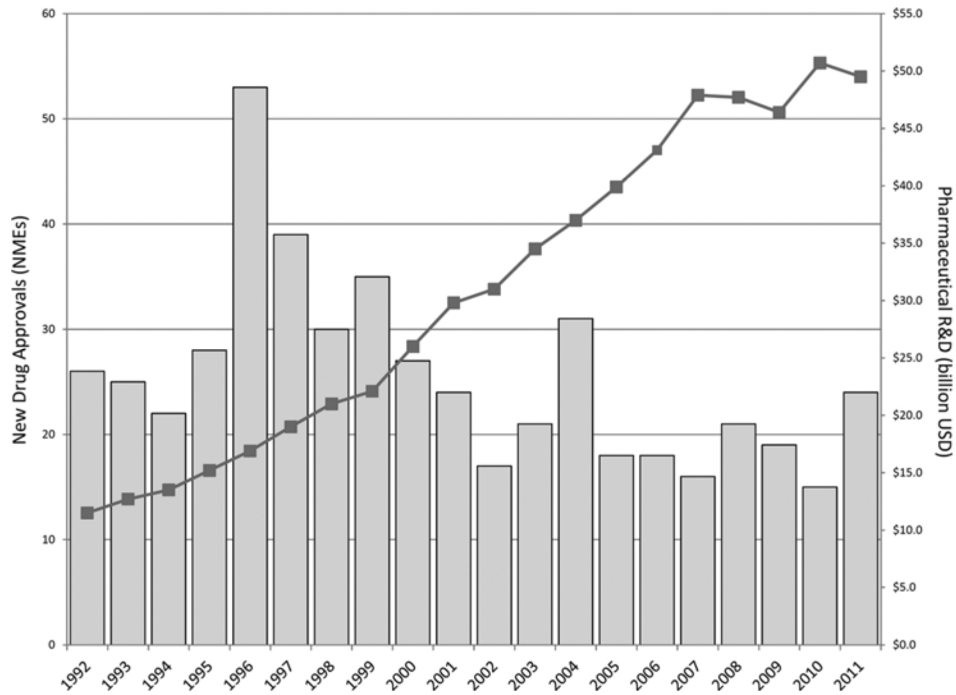

FIGURE 1: Annual research and development (R&D) spending versus new drug approvals over the past 20 years. The number of new drug approvals, reported in number of new molecular entities (NMEs; gray bars), is plotted against the amount of money spent on pharmaceutical R&D, reported in billions of United States dollars (USD; blue line). [Color figure can be viewed in the online issue, which is available at www.annalsofneurology.org.]

flattening out in the past decade.[29] In the past 3 years, the number of annual new drug approvals has averaged approximately 1/3 of the approval rate of the preceding 2 decades.[29] Nonetheless, the cost of research and development has continued to increase during this time, with an inverse relation to the number of approved new drugs. The expense of research and development in 1996 was $16.9 billion, compared to $49.5 billion in 2011, roughly a 3-fold increase (Fig 1).[30] The capitalized clinical development costs for CNS drugs is higher than drugs in any other category[31]; estimates for the cost of research and development for bringing a new medical entity to market averages as much as $1.8 billion.[32] In 2005 in the United States, industry contributed $7.8 billion US dollars for the development of neurotherapeutic agents, exceeding the contributions for any other therapeutic area.[33,34]

The process of drug development is complex and costly. The initial phase is exploratory research for drug discovery. In this phase, efforts are made to identify biological pathways important to disease pathogenesis that can be modified by a specific drug. Once such a pathway and targeting agent is identified, it must be demonstrated that the drug reaches the appropriate target tissue, that it affects the pathway of interest, and that there is a therapeutic window for the drug. Clinical research must also determine the pharmacokinetics and pharmacodynamics for the drug to identify its optimal dosing. Following testing in animals, a sequential series of clinical trials with increasing numbers of human volunteers is undertaken.

New neurological therapies have a higher attrition than therapies in any other area, other than oncology.[35] Only 8% of CNS drugs ever make it to clinical trials, roughly 1/2 the rate of drugs in other fields.[31] Furthermore, CNS drugs tend to fail late in development,[31] substantially increasing their cost and the financial risk to companies working in the CNS drug space. The probability of success for a new neurotherapeutic agent has been calculated at 2.85%.[35]

The approval success rate for therapies varies widely by discipline. For instance, systemic anti-infectious disease therapies have nearly 3× the likelihood of making it to the market as therapies for neurological disorders.[36] Additionally, the time to market for CNS drugs from clinical trials (Fig 2) through the approval process averages 10.0 years (8.1 in clinical trials and 1.9 years in the approval phase), substantially exceeding that for any other therapeutic area.[36] Therefore, there are economic disincentives for industry to pursue neurological therapies, and as such, neurological therapies are considered a high-risk investment with long, costly development phases and low probabilities of approval. Because of these considerations, in the past 3 years, many large pharmaceutical companies, including AstraZeneca, GlaxoSmithKline, Pfizer, Merck, Sanofi, and Novartis, have significantly downsized their neuroscience commitment.[37,38]

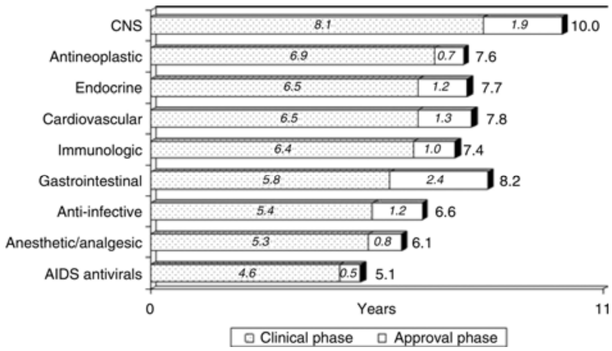

FIGURE 2: Mean clinical and approval phase times for approved new molecular entities and significant biologicals, 2005–2009, grouped by therapeutic class. Note that the anti-infective group does not include acquired immunodeficiency syndrome (AIDS) antivirals. CNS 5 central nervous system. Reprinted by permission from Macmillan: Clin Pharmacol Ther 2011;89:183–188, copyright 2011.[36]

Decreasing the time and financial investment in bringing neurological therapies to the marketplace will likely require the development and support of biomarkers. For instance, biomarkers could potentially assist in identifying particular populations that are at high risk of disease activity or rapid disease advancement. Biomarkers may also enrich study populations by increasing their homogeneity. Biomarkers could potentially provide not only more objective measures of disease activity than clinical batteries, but also more sensitive measures for early presymptomatic disease (eg, magnetic resonance imaging in MS).[39] Biomarkers may also play a role in drug safety (for example, JC virus antibody testing to identify risk of progressive multifocal leukoencephalopathy with natalizumab treatment for MS) and may predict the rapidity of disease progression. The outcome measures for clinical trials need to be validated, sensitive to change, reliable having low inter- and intrarater variability, and practical. Identification of meaningful biomarkers will be important for achieving those goals.

Solutions for Increasing the Drugs Available for Neurological Disorders

Increasing drug discovery for neurological disorders requires a multifaceted approach. Academic neurological societies must play a leading role in this neurotherapeutic endeavor and support the domain of neurologists who have contributed to the discovery of these agents, their clinical testing, and their use at the bedside. Scientists must first identify the hurdles in shepherding a novel neurotherapy from the bench to the patient's bedside, and then implement measures to overcome these challenges.

Direct measures to promote neurotherapeutics by the academic neurological community (Table 1) include targeting meeting programs for drug discovery, developing and training fellows for translational neuroscience, and promoting publications that advance the field. Additionally, academic neurological societies can advocate prioritizing translational neuroscience within academia. Academic leaders may also serve at the forefront of developing public–private partnerships to develop disease models, outcome assessment tools, biomarkers, and therapies. To facilitate the development of neurological therapies, these individuals must engage with many entities, including funding agencies, such as the National Institutes of Health and private foundations, with regulatory agencies, such as the US Food and Drug Administration, and with industry. In addition, the neurological academic leadership needs to play a pivotal role in informing governmental policy makers that support of investigations in neurotherapeutics has high value regarding quality of life, survival, and societal costs.

As appropriately addressed by Leppert and Glanzman,[40] among the greatest challenges for neurological therapies is determining reliable and measurable

TABLE 1. Recommendations to Improve Neurotherapeutic Development

Engagement of neurological societies
Promote educational programs for therapeutic discovery during national meetings
Develop training programs in translational neuroscience for early career neurologists
Advocate for translational research
Academic leaders
Support development of public–private partnerships
Fundraising
Enhance communication among National Institutes of Health, US Food and Drug Administration, and industry
Political advocacy to educate policy makers
Research focus
Enhance clinical trial endpoints
More rigorous clinical endpoints
Biomarker discovery
Other approaches
Promotion of federal and industry partnerships specific for therapy development
Tax incentives for neurotherapeutics
Increased patent length for neurotherapeutics

endpoints for clinical trials. The endpoints for neurological and psychiatric disease often lack the precision and validity observed with those employed for other forms of therapy. These endpoints are often dependent on soft psychophysical measures, rater dependency, and clinical phenomenology, and may be affected by culture and language.[40] Substituting biomarkers as primary endpoints, such as the use of magnetic resonance imaging for MS, may decrease the expense and improve the facility and speed with which studies can be performed. Academic neurology should consider strongly encouraging regulatory agencies to permit neurotherapeutic trials to utilize such biomarkers when they have been proven scientifically valid, reliable, reproducible, and predictive of disease activity.

Other approaches that might be considered for fostering neurological therapies include encouraging partnerships between federal funding agencies and industry for the performance of clinical trials, providing tax incentives to pharmaceutical companies engaged in neurotherapeutic development, and increasing the patent length on therapies to assist in the financial viability for the initial investment.

Conclusions

This is a critical time in neurotherapeutics. The imperative for agents that treat neurological disorders is large and expanding. Continued research is needed to identify the most sensitive and specific clinical outcome measures and biomarkers of safety and efficacy. A concerted commitment by academic medicine, industry, and government will fulfill the promise of new, effective, and safe therapies for many neurological diseases.

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Potential Conflicts of Interest

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Supply and demand analysis of the current and future US neurology workforce

Timothy M. Dall, Michael V. Storm, Ritashree Chakrabarti, et al.

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CONTEMPORARY ISSUES

Supply and demand analysis of the current and future US neurology workforce

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ABSTRACT

Objective: This study estimates current and projects future neurologist supply and demand under alternative scenarios nationally and by state from 2012 through 2025.

Methods: A microsimulation supply model simulates likely career choices of individual neurologists, taking into account the number of new neurologists trained each year and changing demographics of the neurology workforce. A microsimulation demand model simulates utilization of neurology services for each individual in a representative sample of the population in each state and for the United States as a whole. Demand projections reflect increased prevalence of neurologic conditions associated with population growth and aging, and expanded coverage under health care reform.

Results: The estimated active supply of 16,366 neurologists in 2012 is projected to increase to 18,060 by 2025. Long wait times for patients to see a neurologist, difficulty hiring new neurologists, and large numbers of neurologists who do not accept new Medicaid patients are consistent with a current national shortfall of neurologists. Demand for neurologists is projected to increase from ~18,180 in 2012 (11% shortfall) to 21,440 by 2025 (19% shortfall). This includes an increased demand of 520 full-time equivalent neurologists starting in 2014 from expanded medical insurance coverage associated with the Patient Protection and Affordable Care Act.

Conclusions: In the absence of efforts to increase the number of neurology professionals and retain the existing workforce, current national and geographic shortfalls of neurologists are likely to worsen, exacerbating long wait times and reducing access to care for Medicaid beneficiaries. Current geographic differences in adequacy of supply likely will persist into the future. *Neurology*® 2013;81:470–478

GLOSSARY

AAN = American Academy of Neurology; **ACS** = American Community Survey; **AMA** = American Medical Association; **BRFSS** = Behavioral Risk Factor Surveillance System; **CDC** = Centers for Disease Control and Prevention; **FTE** = full-time equivalent; ***ICD-9*** = *International Classification of Diseases, Ninth Revision*; **MEPS** = Medical Expenditure Panel Survey; **MGMA** = Medical Group Management Association; **NNHS** = National Nursing Home Survey; **NRMP** = National Residency Match Program; **PPACA** = Patient Protection and Affordable Care Act.

Neurologists provide care to many of the nation's most vulnerable populations, but indicators point to inadequate patient access to care. The average wait in 2012 for new patients to see a neurologist (34.8 business days) and for follow-up visits (30.0 days) was higher than in 2010 (28.1 days for new and 25.6 for follow-up visits).[1,2] Other studies report average wait for new patient visits of 24.1 days for neurosurgery, 20.3 for family practice, 16.8 for orthopedic surgery, and 15.5 for cardiology.[3,4] In 2012, 39% of children's hospitals reported vacancies of 12 months or longer for child neurologists, and child neurology ranked as one of the most short-handed specialties, with average wait times of 45 business days.[5]

While excessive wait times and difficulty recruiting suggest insufficient capacity to provide neurology services, there is substantial uncertainty regarding the future. Rising prevalence of neurologic conditions associated with an aging population, expanded medical coverage under the Patient Protection and Affordable Care Act (PPACA), and the nation's growing reliance on nonphysician

Supplemental data at www.neurology.org

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Go to Neurology.org for full disclosures. Funding information and disclosures deemed relevant by the authors, if any, are provided at the end of the article.

clinicians to provide primary care (many of whom have limited training in neurology) will likely increase demand for neurologists.

This study forecasts neurologist supply and demand through 2025 nationally and by state. Key supply and demand trends are taken into account, with scenarios modeled that consider the implications of neurologist work patterns and number of new neurologists trained.

METHODS The microsimulation approach used to model neurologist supply and demand differs from approaches used historically, including the approach used in a 1998 neurologist workforce study.[6] We provide a brief overview of the data and methods; appendix e-1 on the *Neurology*® Web site at www.neurology.org provides greater detail.

Modeling supply. The approach simulates career choices of neurologists from training through retirement or mortality. Future year projections start with current supply and simulate retirement probability, new graduates, and patient care hours worked. The cycle repeats to simulate subsequent year's supply.

To develop a representative sample of neurologists in each state, we combined information from the 2012 American Academy of Neurology (AAN) database of neurologists, 2008 AAN Member Census File, and 2012 American Medical Association (AMA) Masterfile. The process produces an estimate of 16,366 child and adult neurologists (including residents and fellows, and physicians active in non–patient care activities such as teaching and research) practicing in 2012. This is a relative overestimation of the number of neurologists in practice as residents and fellows require supervision during patient encounters, and academic neurologists and some fellowship-trained neurologists pursue teaching and research and see patients part time.

The 2012 National Residency Match Program (NRMP) data suggest approximately 729 neurologists enter training annually, including 114 child neurology positions.[7] NRMP data report that international students represent roughly 40% of filled resident positions. Our analysis of AMA data for 2010–2011 suggests approximately 14% of neurology residents have a visa status that might require leaving the United States after training. The average training length of residency is assumed to be 4 years, with 2.8% attrition probability assumed for residents during training.[8] The age distribution of new residents comes from the AAN's database of neurologists. The computer simulation creates a synthetic population of new graduates each year with each new resident assigned an age, sex (56% male), and child/adult specialty that reflects distributions seen in recent years. The 2011 AAN Resident Survey indicates that 86% of neurology residents plan to enter fellowships following completion of their residency and reports that the majority of fellowships last a year or two.[9]

Retirement patterns for neurologists were estimated using age at retirement for 168 neurologists (ranging from age 54 to 88 years) whose status recently changed to Senior in the AAN's membership files. These patterns were consistent with retirement rates for general internists who participated in a 2006 survey conducted by the Association of American Medical Colleges.[10] Retirement rates are combined with mortality rates from the Centers for Disease Control and Prevention (CDC) to estimate overall attrition, taking into account that mortality rates through age 65 for professional occupations are approximately 25% lower than national rates for men and 15% lower for women.[11,12] Overall attrition rates suggest that for every 1,000 neurologists entering the workforce, 787 will remain active past age 60, 285 past age 65, and 16 past age 75.

In 2010, neurologists averaged 57.1 professional hours per week, with 42.3 hours in patient care activities. These numbers changed little over the previous decade.[13] To account for changing demographics of the neurologist workforce, we calculated average patient care hours by age and sex using data from the AAN 2010 Practice Profile Survey merged with the 2008 AAN Census. Women tend to work about 14% fewer hours in direct patient care compared to men of similar age.

Future supply is projected under alternative scenarios:

- The baseline scenario assumes current patterns of retirement and hours worked remain unchanged, 729 new neurologists enter the workforce annually, and the demographics of newly trained neurologists remain unchanged from the current distribution.
- High and low graduate scenarios model the implications of a 10% increase (high scenario) and a 10% decrease (low scenario) in new neurologists trained annually.
- Delayed or earlier retirement scenarios reflect retiring 2 years later or earlier (relative to current patterns).

Modeling demand. Demand projections consider demographic, socioeconomic, and health risk factors for a representative sample of the population in each state for 2010 and projected through 2025. Each person's characteristics are used to forecast his or her use of neurology services by care delivery setting (office, outpatient, emergency, and inpatient). The model then applies neurologist productivity estimates to calculate clinical full-time equivalents (FTEs) required to meet demand for services.

The population database. Population characteristics come from the United States Census Bureau's 2010 American Community Survey (ACS) and population projections, the CDC's 2009 and 2010 Behavioral Risk Factor Surveillance System (BRFSS), and the CDC's 2004 National Nursing Home Survey (NNHS).[14–18] The population database starts with the approximately 3 million individuals in the ACS, for which we have socioeconomic and demographic data. Health data from the approximately 1,029,000 people in the combined 2009 and 2010 BRFSS files (which covers the noninstitutionalized population) are randomly matched to the noninstitutionalized population in the ACS in the same state, age group, sex, race/ethnicity, income level, and insurance status. Health data from the NNHS are matched to the elderly, institutionalized population in the ACS by age group, sex, and race/ethnicity. The resulting database has over 3 million records and contains demographics (age, sex, race, and Hispanic ethnicity); metro/nonmetropolitan resident; household income; medical insurance type (private, public, self-pay); weight status (unknown, normal, overweight, obese); smoker/nonsmoker status; and diagnosed history of 9 general medical conditions (arthritis, asthma, cardiovascular disease, diabetes, hypertension, depression, heart attack, cancer, and stroke).

With data for approximately 169,000 participants in the combined 2005–2009 files of the Medical Expenditure Panel Survey (MEPS), we used logistic regression to estimate the relationship between patient characteristics and presence of select neurologic conditions: Alzheimer disease, attention-deficit/hyperactivity disorder, cerebral degeneration, epilepsy, extrapyramidal disease not elsewhere classified, mental retardation, migraine, mononeuritis of limb, multiple sclerosis, Parkinson disease, and sleep disorders.[19] These predictive equations were applied to the population database to estimate the probability that each person has the above conditions. Many patient conditions treated by neurologists (e.g., cerebral palsy) are unavailable in the population database. Health care utilization patterns associated with these omitted conditions are captured in the underlying rates of using neurologist services and vary by patient demographics and the other variables that may be correlated with the presence of these conditions (e.g., Medicaid status).

The predictive equations for health care. Health care seeking behavior is generated from equations using data from the combined 2005–2009 files of the MEPS. Poisson regression quantifies the relationship between patient characteristics and annual number of office visits and annual outpatient visits to a neurologist. Logistic regression is used to calculate the annual probability of an emergency visit and annual probability of hospitalization for neurology-related conditions. Unlike office and outpatient visits, where MEPS specifically identifies the medical professional seen, emergency visits and hospitalizations have no information on medical professionals who provided services. For these settings, we identify neurology visits based on primary *ICD–9* diagnosis codes of 320.xx–359.xx (Diseases of the Nervous System). Separate regressions were estimated for adults and children for each care delivery setting. Explanatory variables include patient demographic and health characteristics described previously.

Neurologist workload and care delivery. Estimates of provider time per encounter convert estimates of demand for services into demand for clinical FTEs. Productivity data come from multiple sources:

- The 2010 AAN Practice Profile Survey (n = 910) reports 72.9% of professional time goes to patient care, 9.7% to administrative responsibilities, 9.1% to research, 5.2% to teaching, and 3% to other activities.[20] Average patient encounters per week by neurologists are 17.4 new patient and 34.2 follow-up ambulatory visits; 8.9 new patient and 14.2 follow-up inpatient consults; and 3.8 new patient and 8.5 follow-up inpatient attending encounters.
- The AAN's 2011 Survey of Neurohospitalists (n = 189) reports that each week the average neurohospitalist has 12.6 new patient and 27.7 follow-up attending evaluations, and 18.0 new patient and 30.2 follow-up consulting evaluations.[21]
- The Medical Group Management Association's (MGMA) 2010 Physician Compensation and Production Survey reports that adult neurologists in group practices average 2,205 ambulatory encounters annually (n = 383 neurologists in 118 practices).[22] MGMA also reports an annual average 515 hospital encounters. Child neurologists average 1,851 ambulatory encounters per year (n = 38 neurologists in 19 practices) and 380 hospital encounters per year (n = 29 neurologists in 16 practices).

Combined with information on the average work relative value unit for new patient and follow-up visits in office/outpatient (2.43 for new patient visit level 4 and 0.93 for established patient visit level 3) and hospital settings (2.61 for initial hospital care level 2 and 1.39 for subsequent care) and after model calibration (to account for fewer patient visits among academic neurologists), we calculate that each 2,860 ambulatory visits equates to approximately one clinical FTE, and each 1,580 hospital consults equates to approximately one clinical FTE, representing about 42.3

Figure 1 **Estimated supply and demand for neurologists: 2012**

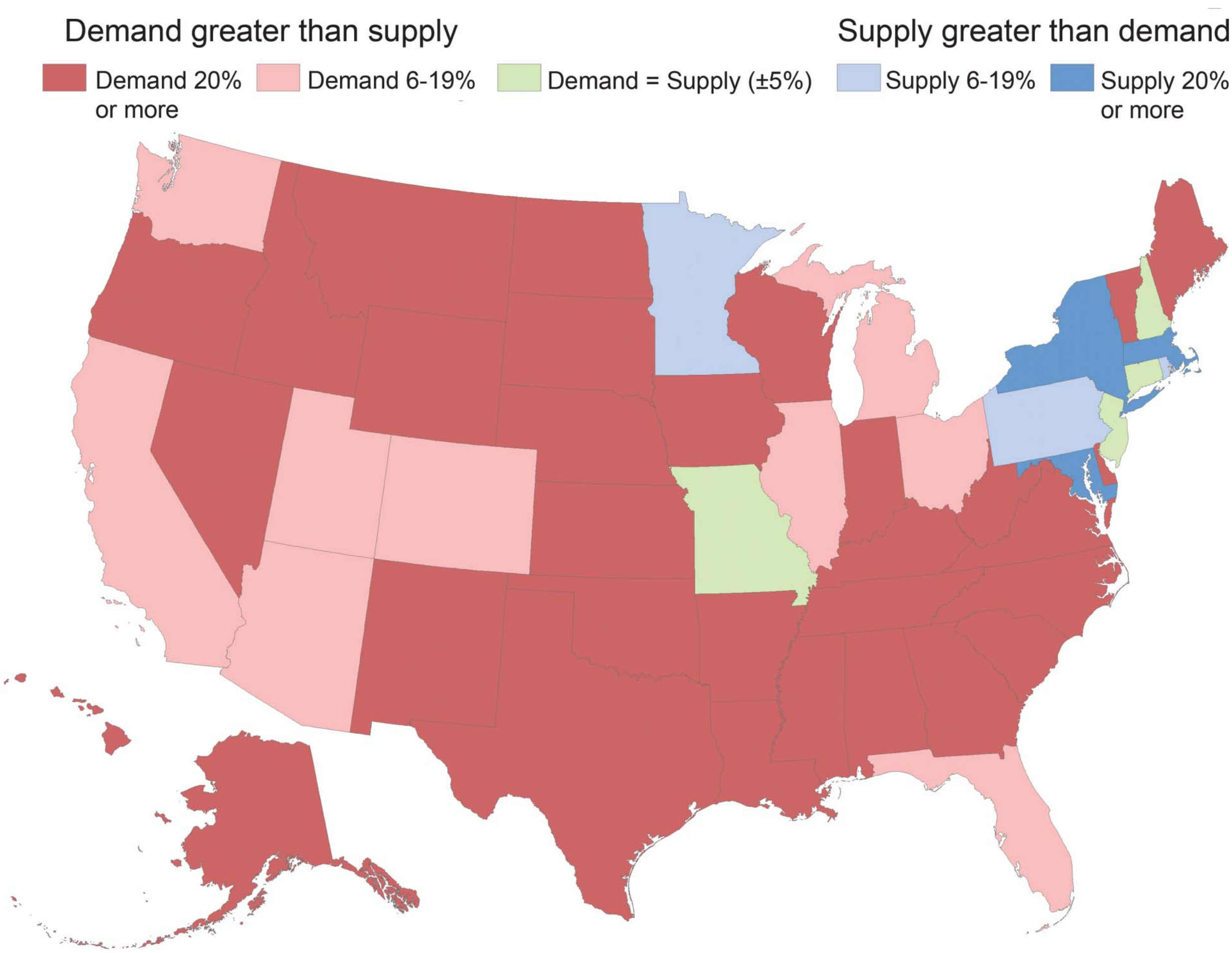

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Table Estimated supply and demand for neurologists by state: 2012-2025[a]

State	2012 Supply	2012 Demand	2012 Gap	2014 PPACA demand impact	2025 Supply	2025 Demand	2025 Gap
AK	24.4	38.1	13.7	1.5	30	46	16
AL	185.3	295.6	110.3	8.6	207	334	127
AR	98.3	178.7	80.4	7.8	109	210	101
AZ	336.4	381.7	45.3	8.8	444	547	103
CA	1,650.6	1,935.5	284.9	56.1	1,811	2,309	498
CO	237.8	281.7	43.9	8.4	259	330	71
CT	218.4	223.2	4.8	3.6	231	239	8
DC	128.7	34.4	(94.3)	0.5	114	31	(83)
DE	38.8	56.1	17.3	0.9	43	66	23
FL	956.7	1,110.8	154.1	44.2	1,235	1,544	309
GA	391.4	544.2	152.8	21.3	487	684	197
HI	51.5	64.7	13.2	0.9	58	72	14
IA	109.0	189.2	80.2	2.2	116	200	84
ID	43.4	91.2	47.8	2.7	60	117	57
IL	662.0	755.3	93.3	18.4	669	818	149
IN	264.5	423.8	159.3	10.9	286	475	189
KS	113.2	170.1	56.9	3.6	122	188	66
KY	158.2	274.3	116.1	10.3	177	313	136
LA	223.1	269.0	45.9	10.2	234	305	71
MA	799.0	430.0	(369.0)	1	805	463	(342)
MD	548.0	341.2	(206.8)	7.7	551	402	(149)
ME	64.8	91.5	26.7	1.7	63	104	41
MI	556.2	631.1	74.9	15.3	612	698	86
MN	391.3	325.5	(65.8)	4.6	432	381	(51)
MO	365.9	379.6	13.7	10.5	381	432	51
MS	97.0	180.1	83.1	6.4	113	210	97
MT	41.0	59.1	18.1	2.3	51	70	19
NC	469.7	582.2	112.5	17.4	575	735	160
ND	22.2	39.9	17.7	0.9	20	42	22
NE	67.8	105.1	37.3	2.3	70	114	44
NH	86.2	83.5	(2.7)	1.8	93	102	9
NJ	497.8	509.7	11.9	12.8	532	567	35
NM	75.5	108.5	33.0	4.9	88	126	38
NV	71.9	150.5	78.6	5.3	108	215	107
NY	1,642.6	1,130.6	(512.0)	24.9	1,621	1,190	(431)
OH	663.1	740.0	76.9	20.5	694	803	109
OK	105.3	226.5	121.2	7.7	119	254	135
OR	194.6	235.3	40.7	7.6	229	291	62
PA	885.1	816.5	(68.6)	17	889	882	(7)
RI	81.6	67.3	(14.3)	1.4	91	73	(18)
SC	134.2	295.3	161.1	10.1	171	364	193
SD	32.4	48.1	15.7	1.3	31	53	22

Continued

Table	Continued						
	2012				2025		
State	Supply	Demand	Gap	2014 PPACA demand impact	Supply	Demand	Gap
TN	300.4	390.7	90.3	12.4	358	466	108
TX	1,026.8	1,279.8	253.0	66.1	1,241	1,645	404
UT	134.3	149.1	14.8	4.3	160	191	31
VA	382.5	473.4	90.9	12.2	435	571	136
VT	31.7	41.4	9.7	0.7	34	48	14
WA	351.9	409.2	57.3	6.7	411	508	97
WI	255.4	375.8	120.4	6.4	287	430	143
WV	83.2	133.6	50.4	4.1	88	145	57
WY	15.0	32.5	17.5	0.9	15	37	22
United States	16,366	18,180	1,814	520	18,060	21,440	3,380

Abbreviation: PPACA = Patient Protection and Affordable Care Act.
[a] State numbers might not sum to US totals because of rounding.

hours of patient care activity each week. We assume that the proportion of neurologist time spent in patient care remains constant over time.

Defining and estimating current demand. Demand for neurologists is derived from patient demand for services, which is determined in part by patients' willingness and ability to pay for services given patient needs and cost of services. Provider demand is influenced by care delivery patterns. For example, to the extent that primary care providers refer patients to a neurologist rather than try to provide the care themselves, there will be an increased demand for neurologists. Likewise, greater use of advanced practice providers in neurology practices allows neurologists to focus on areas of greatest patient need, thus reducing the overall number of neurologists required to provide care to a given population. There are no established criteria for quantifying demand for physician time; therefore, determining whether there are too many, too few, or about the right number of providers is somewhat subjective.

Nevertheless, for this study demand does not equal "need," where need is based on a clinical definition taking into account patient epidemiologic considerations combined with assessment of how care could best be provided to the patient. Likewise, demand for neurology services does not necessarily equate to use of services, especially in geographic areas with reduced access to neurologists because of supply constraints.

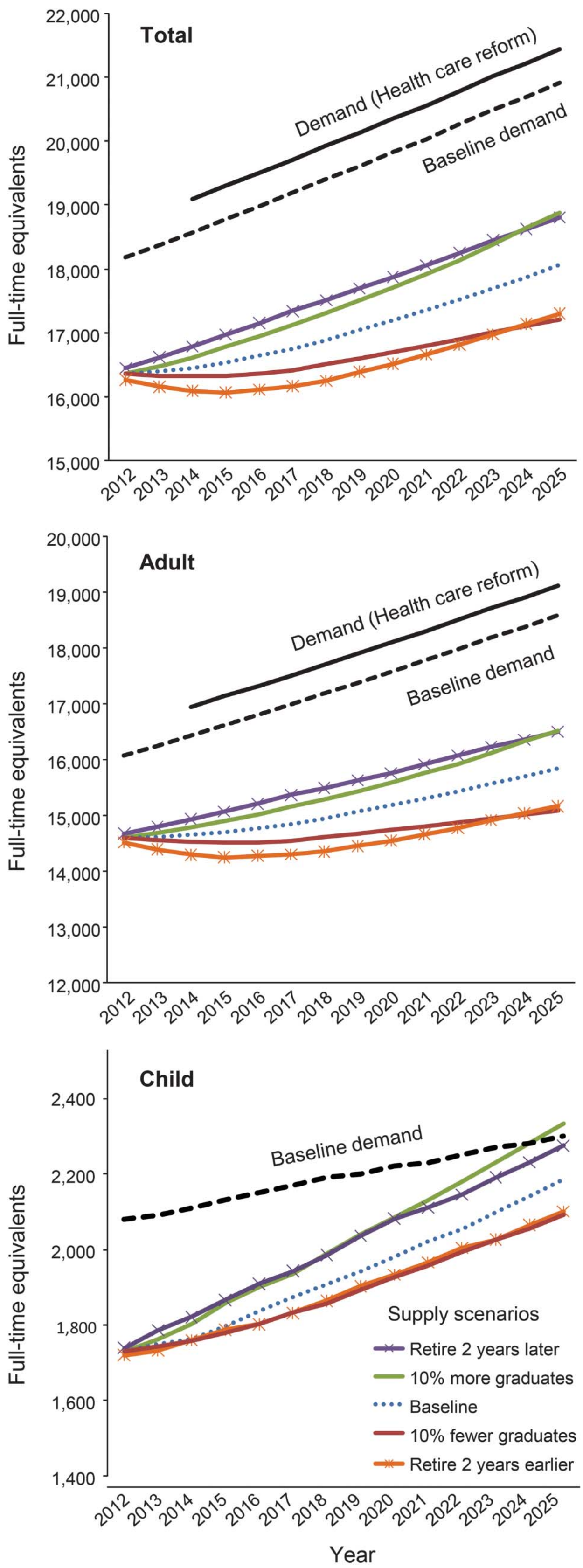
Anecdotal evidence from neurologists we interviewed as part of this study consistently indicated difficulty hiring neurologists or nurse practitioners with training in neurology. While no estimate of the magnitude of a current national shortfall exists, demand appears to exceed supply as indicated by excessive wait times to see a neurologist, difficulty hiring neurologists, and number of practices no longer accepting new Medicaid beneficiaries.[1–5] That is, we would require more neurologists to reduce the waiting times to see a neurologist to 1–2 weeks from the present wait of 1 month.

Current national demand for neurologists is difficult to estimate directly, but mathematically demand equals current supply plus (minus) any current shortage (surplus). Current supply can be estimated for 2012. Indicators that a shortfall exists are evident (e.g., abnormally long wait times for appointments) but the magnitude of the shortfall is unknown. If one assumed that national supply and demand were in equilibrium in 2012 (i.e., no shortfall), then comparison of current supply to estimated case-mix adjusted demand in each state would suggest that in 12 states supply exceeds demand, in 3 states (Michigan, Ohio, and Florida) supply and demand are in equilibrium, and in 35 states supply is below demand. Approximately 62% of the nation's population lives in a state where supply is below that required to provide the current national average pattern of care.[16] To bring neurologist supply in these 35 states up to a level sufficient to provide the level of care afforded to the population in Michigan, Ohio, and Florida would take an additional 1,634 neurologists (or approximately 10% more neurologists than current supply). However, even among the 12 states where supply exceeds the level needed to provide the current national average level of care, there are indications of challenges hiring new neurologists. Massachusetts has double the ratio of neurologists per population as the national average, and a 2010 Physician Workforce Study sponsored by the Massachusetts Medical Society indicates the state has a severe shortage of neurologists.[23] Any such shortage in a state with the highest number of neurologists per capita might be explained by the large number of neurologists at nationally recognized academic medical centers in Massachusetts who draw patients from throughout the region. Still, the findings for Massachusetts reiterate that current national supply is insufficient to meet demand. The above findings suggest the nation could readily use an additional 10% adult neurologists, and based on average wait time the current shortfall of child neurologists is substantially greater. For modeling purposes, we assume a 10% shortfall of adult neurologists and a 20% shortfall of child neurologists.

RESULTS The forecasting equations for health care use (see appendix e-1) indicate statistically significant increases in use of neurology services associated with higher age, presence of the various neurology conditions, having insurance, and living in a metropolitan area. Non-Hispanic whites and blacks have significantly higher utilization among adults relative to Hispanics and non-Hispanic other races. Smoking is associated with lower rates of ambulatory visits, but higher rates of emergency visits.

Substantial geographic variation exists in adequacy of supply. Our analysis of the 2012 AMA Masterfile suggests that nationally there are an average of 5.2

Figure 2 Comparison of alternative supply and demand scenarios: 2012–2025



neurologists per 100,000 population. Rates range from 12.1 (Massachusetts, which has a large number of academic medical centers) to 2.6 (Nevada and Wyoming). Using projected demand for each state after simulating demand for a representative sample of the population in each state, we compare supply and demand in 2012 (figure 1, table).

Controlling for demographics and the other health risk factors included in the analysis but assuming that patterns of care use and delivery remain unchanged over time, at the national level, demand grows by approximately 2,740 FTEs, from approximately 18,180 in 2012 to 20,920 by 2025. This includes growth in demand of 220 child and 2,520 adult neurologists.

Under PPACA, an estimated 30 million adults across the United States could gain medical coverage starting in 2014.[24] Because individual states have some leeway in how they implement PPACA, the total impact on demand for neurologist services is unknown. However, if the current health care use patterns of adults who would gain medical coverage change to patterns of privately insured adults who have similar health risk characteristics, an additional 520 adult neurologists could be needed starting in 2014 (table).

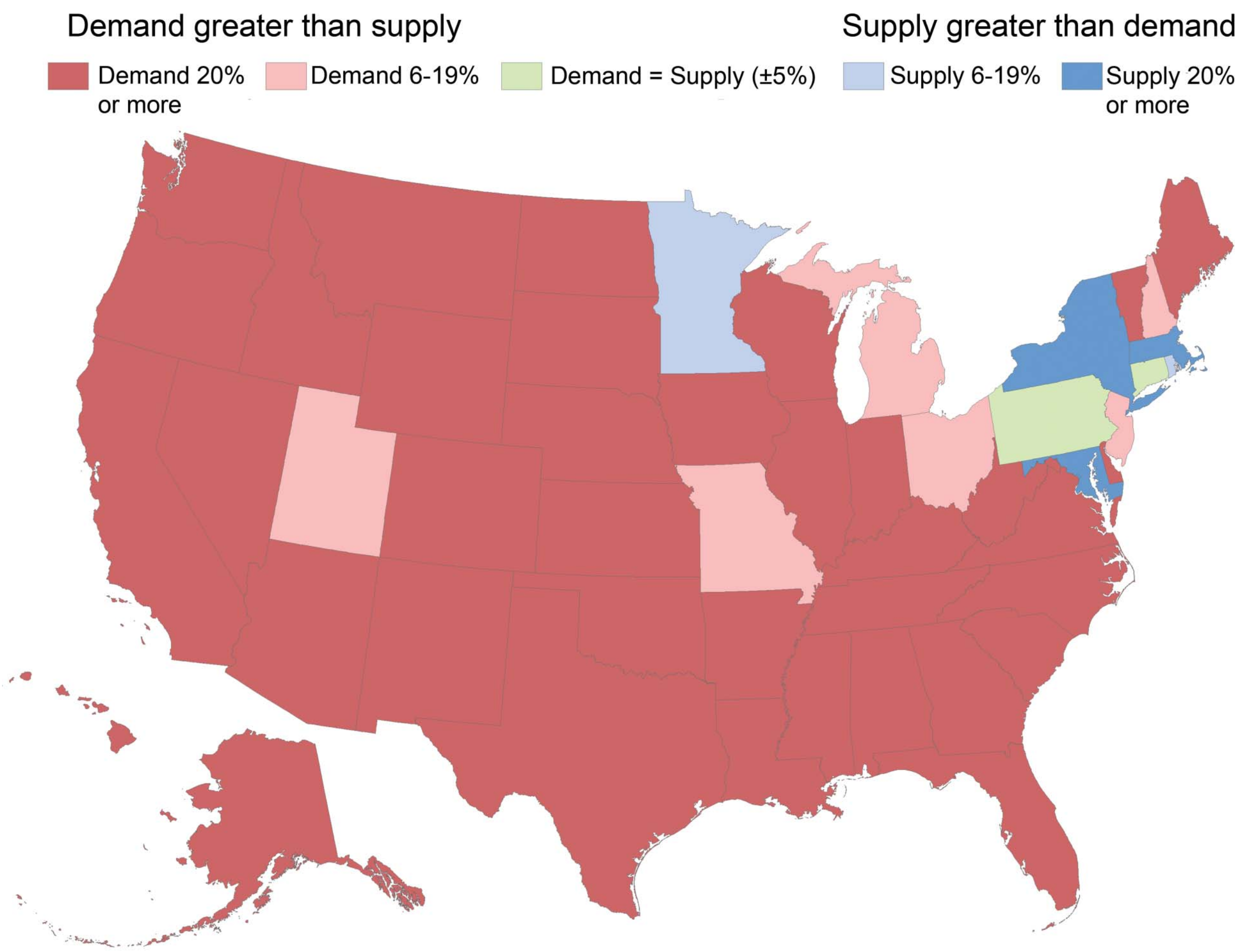
If care utilization patterns for patients in non-metropolitan areas were similar to patterns for similar patients in metropolitan areas, an additional 460 FTE neurologists would be needed in non-metropolitan areas (but this amount is part of the assumed current national shortfall).

Taking into account changing demographics and associated increase in prevalence of neurologic conditions, the national shortfall rises from 11% (the overall shortfall reflecting 10% for adult and 20% for child neurologists) in 2012 to 16% in 2025. With the impact of PPACA, the shortfall rises to 19% by 2025. Even if one assumed that supply and demand currently were in equilibrium at the national level, demand is projected to grow faster than supply.

A comparison of the various supply and demand scenarios projected suggests that even under the most optimistic supply scenario national provider shortfalls are likely to persist (figure 2). For adult neurology under the baseline scenarios, the national shortfall is projected to grow. While supply of child neurologists is growing at a slightly faster rate than is demand, a shortfall is projected to persist through 2025. State-level shortages are projected to persist and grow more severe over time (figure 3).

DISCUSSION This study highlights a current substantial national shortfall of neurologists, especially pediatric neurologists, and even greater shortfalls in select states. Reports of difficulty filling neurologist

Figure 3 Estimated supply and demand for neurologists: 2025 (including Patient Protection and Affordable Care Act impact)



positions, long wait time for scheduling new and follow-up visits, low access to care by Medicaid patients, and our sensitivity analysis all point toward a current national shortfall. Through 2025 demand for neurologists is projected to grow faster than supply, creating a serious limitation of access to care for those patients with neurologic disease. The magnitude of the future shortfall may be even greater than suggested by our findings. As more residents subspecialize (e.g., in sports medicine, as hospitalists, and in neurointensive care), there may be even fewer neurologists to provide care to patients with chronic conditions.

The primary strengths of this study include the following: 1) use of recent data with sufficient sample size to provide reliable estimates of key model parameters; 2) use of state-of-the-art workforce projection models; and 3) ability to forecast state and national supply and demand taking into account geographic variation in prevalence of neurologic conditions. The primary limitations include the following: 1) lack of quantified estimate of the magnitude of the current shortfall, although there is evidence that demand exceeds supply; 2) uncertainty of how care delivery patterns might change over time with emerging care delivery models and greater reliance on nurse practitioners and physician assistants; 3) uncertainty of whether low (and possibly decreasing) Medicare reimbursement rates will affect specialty choice for new physicians, as well as the impact of continued low reimbursement rates on physician retirement patterns; 4) uncertainty of whether changes in technology or medical intervention will change the way that care is used or delivered; and 5) the overestimation of present and future supply of neurologists when one factors in the duties of neurologic house staff, neurologists in administration positions, and academic neurologists whose capability of seeing patients is curtailed by other responsibilities. Another uncertainty is how expanding enrollments at existing allopathic and osteopathic medical schools and the development of new medical schools will affect the neurology workforce supply.[25,26] While we model the supply implications of high graduate and low graduate scenarios, potential large reductions in funding for graduate medical education could reduce the number of new graduates by levels even greater than our low graduate scenario.[27] This study does not assess neurologist distribution below the state level, and this is an area for future research.

Interviews with neurologists suggest that care delivery patterns likely will change over time, but the net impact on demand for neurologists is unclear. Under an Accountable Care Organization delivery model coupled with the Patient-Centered Medical Home concept, it is possible that neurologists might play more of a consultative role in patient care management. That is, neurologists might have less direct interaction with patients while providing consultation to primary care doctors and nurse practitioners. Such a scenario might decrease the demand for neurologists. However, the nation is not producing sufficient numbers of new primary care physicians to keep up with demand, many primary care physicians receive relatively little training in basic neurologic diagnosis and in caring for patients with chronic neurologic conditions, and the American Board of Internal Medicine no longer requires a rotation in neurology over a 3-year period of training. Consequently, a greater portion of primary care services might be delivered by nurse practitioners and physician assistants whose training in neurologic disease is even more limited, suggesting that a decrease in demand for neurologists associated with emerging care delivery models seems less probable than either the same or more demand.

Another trend affecting demand for neurologists is greater use of advanced practice nurses and physician assistants. Neurologists interviewed as part of this study indicated that many neurology practices are relying increasingly on nurse practitioners to provide follow-up care to patients, but face difficulty finding extenders with sufficient neurology training.

Despite the study limitations, the models and methods used provide supportive evidence that in many states there is an inadequate supply of neurologists, and that over time the shortfall will persist and increase. These findings underscore the importance of some combination of increasing the supply of neurologists, increasing the supply of nurse practitioners or other physician extenders who can assist with caring for patients with neurologic disease, and finding innovative ways to deliver care that improves provider productivity.

An article discussing the clinical implications of the current and future US neurology workforce will appear in an upcoming issue of *Neurology*®.

AUTHOR CONTRIBUTIONS

T.M. Dall: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data, acquisition of data, statistical analysis, study supervision. M.V. Storm: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data, acquisition of data, statistical analysis. R. Chakrabarti: study concept and design, analysis and interpretation of data, statistical analysis. O. Drogan: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data, acquisition of data, study supervision and coordination, obtaining funding. C.M. Keran: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data, acquisition of data. Dr. Donofrio: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data. Dr. Henderson: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data. Dr. Kaminski: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data. Dr. Stevens: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data. Dr. Vidic: drafting/revising the manuscript for content, study concept and design, analysis and interpretation of data.

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DISCLOSURE

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The Workforce Task Force Report: Clinical implications for neurology

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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 product[1] (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

Supplemental data at www.neurology.org

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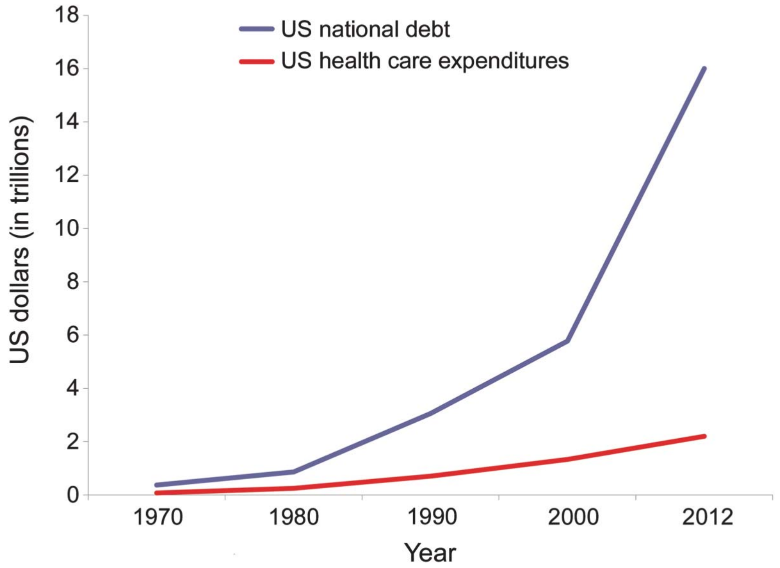
Figure 1 US national debt and health care expenditures (1970–2012)[2]



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 (WFTF) in 1999[10] 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 report[11] 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.

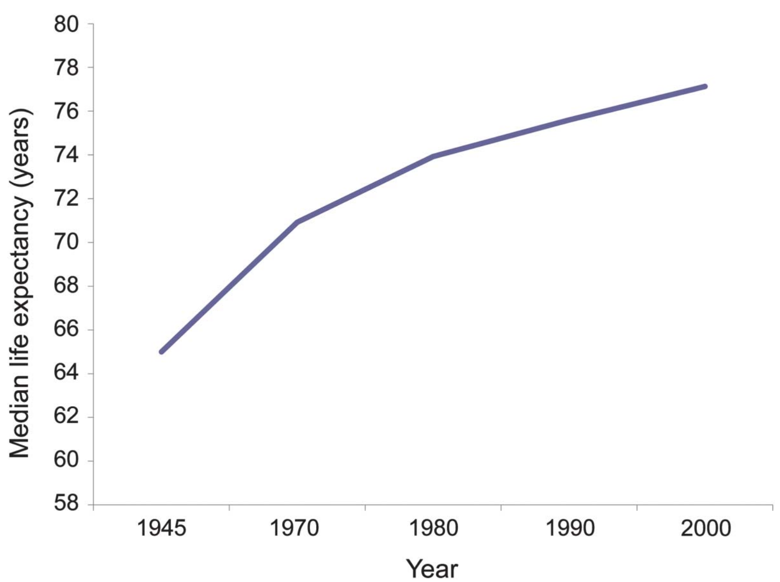
The summary WFTF report estimates there are 16,366 neurologists in 2012 and projects an increase to 18,060 by 2025.[12] One important trend that has changed since the 1999 report is the increased percentage of women neurologists. Figure 3[11] illustrates the age and demographic differences in the neurology 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]

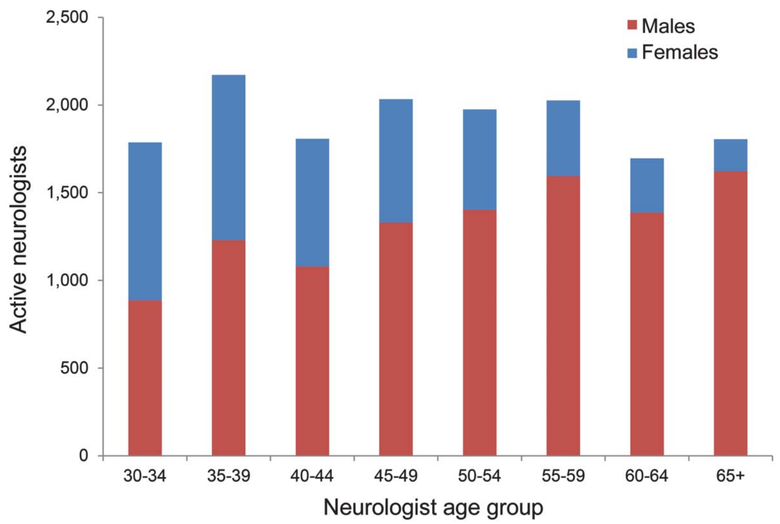
IMPLICATIONS AND FORECAST FOR NEUROLOGY IN 2025 **Changing neurology workforce demographics: Women in neurology.** As of 2012, there had been an increase in the percentage of women in the current neurology workforce[11] compared to historical data[10] (figure 3). In younger age groups, however, men and 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 data[2] and Centers for Disease Control and Prevention and Senate reports.[3]

Figure 3 2012 active neurologists in the workforce by age group and by sex[11]



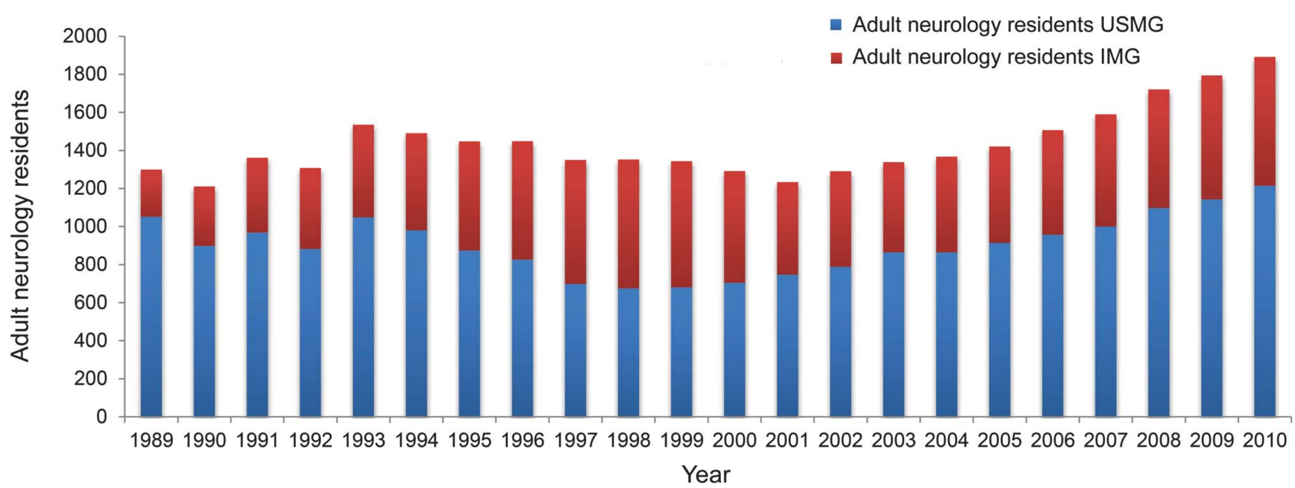
school admissions have resulted in equal numbers of male and female medical students, the neurology workforce has become more balanced. The summary WFTF report[12] shows that women neurologists tend to work fewer hours in direct patient care than their male counterparts for reasons that are not entirely 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 database[16]).

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 Craft[5] 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	1.1—Leverage high demand by better reimbursement with high value care (value = quality/cost) within PPACA systems of care
	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
	1.3—Consider expansion of ARNP/PA models for Medicare/Medicaid level E&M-coded reimbursement
	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
2. Demand exceeds supply	2.1—Improve access for acute neurologic disorders, and for outpatient care consider health care delivery redesign (number 5, below)
	Telestroke and teleneurology[25]—ARNP/PA model for inpatients and outpatients (improve throughput)
	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
3. Documentation "escalation"	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
	3.2—Virtual teleneurology patient follow-ups: reduction in face-to-face physical visits using (HIPAA-compliant) audiovisual interfaces
	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
	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
4. Future workforce concerns	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
	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
	4.2—PPACA notes some contingencies for education loan funding[7]
	4.3—Student loans for medical training, continued or expansion of government student loan repayment (public health) programs to help offset medical training debt
5. Health care delivery requires redesign	5.1—Consider alternative models for health care delivery, especially if demand is extremely high and supply is "saturated"
	Teleneurology/telestroke have provided some data (especially telestroke) in terms of safety and feasibility to provide care to rural and underserved areas[24–27]
	ARNP/PA model for new Medicare patients to help some of the imbalance in future supply and demand
	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 versa[22]
	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])
	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 management[14])
	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 trained[41]
	5.6—Patient "apps" run on portable digital assistants, iPhones, and Android phones monitor disease progression, monitored by physician remotely[36]

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. Policymakers 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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