

Spreading the Gospel: Leveraging technology to improve acute stroke care

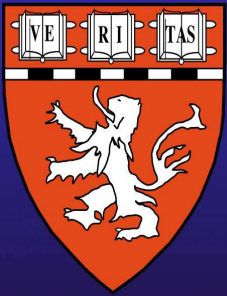
Lee H. Schwamm, MD, FAHA

Associate Professor of Neurology

Harvard Medical School

Director, TeleStroke & Acute Stroke Services

Massachusetts General Hospital



Disclosures

- MA DPH Stroke Systems Consultant

Challenges

- Stroke care fragmented and poorly implemented
- Inefficient care delivery
- Acute stroke care resource intensive and difficult to provide, limited access
- No easy to use tools available to measure and improve stroke care

THINK GLOBALLY,
ACT LOCALLY,
PANIC INTERNALLY



GLASBERGEN

Copyright 2005 by Randy Glasbergen. www.glasbergen.com

Today is Tue Oct 23

Highlights

- The Stroke Service is getting a new look and a fresh coat of paint. Please use the tabs at the top of the page to navigate this site. Thanks for bearing with us as we keep updating this site.

More Info

- [Acute Stroke Service](#)
- [Meet the Stroke Service physicians](#)
- [View our Disclaimer](#)



Take the Tour...



Coming soon...

You will be able to take a virtual tour of the MGH facilities as you follow the progress of a patient with stroke.

To get up to speed on stroke topics, may we suggest the following links:

- [Basic stroke facts](#)
- [Glossary of stroke terminology](#)
- [Useful Links](#)
- [Meet the Stroke Service physicians](#)

Telestroke @ MGH...

Massachusetts General Hospital has long been a leader in pioneering new treatments to help its patients. Telestroke is no different...see what the neurologists of the MGH Stroke Service are doing today to help patients tomorrow.

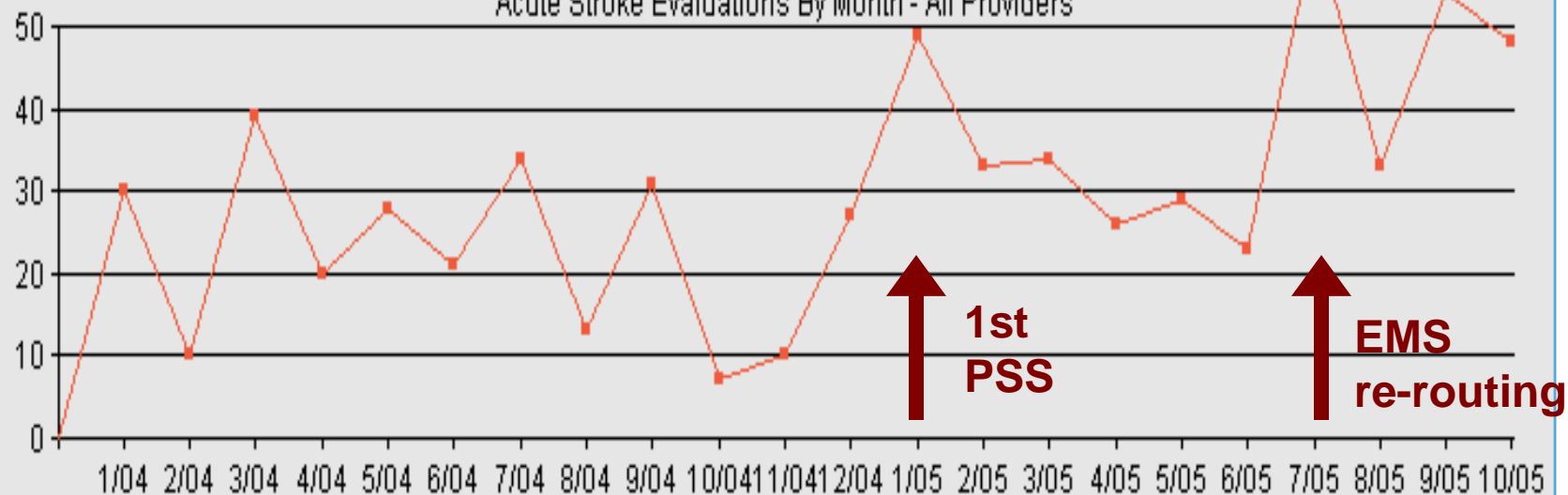
- [A high-tech link to Boston aids Vineyard stroke victims](#)
- [Telemedicine allows Doctors to Examine Patients with Videos](#)
- [Top Doctors can be there in a Heartbeat](#)
- [WBZ's For Your Health - Telemedicine and Stroke](#)

Stay tuned for a new site dedicated to this exciting field!



Graph applet by GraphsCharts.com

Acute Stroke Evaluations By Month - All Providers



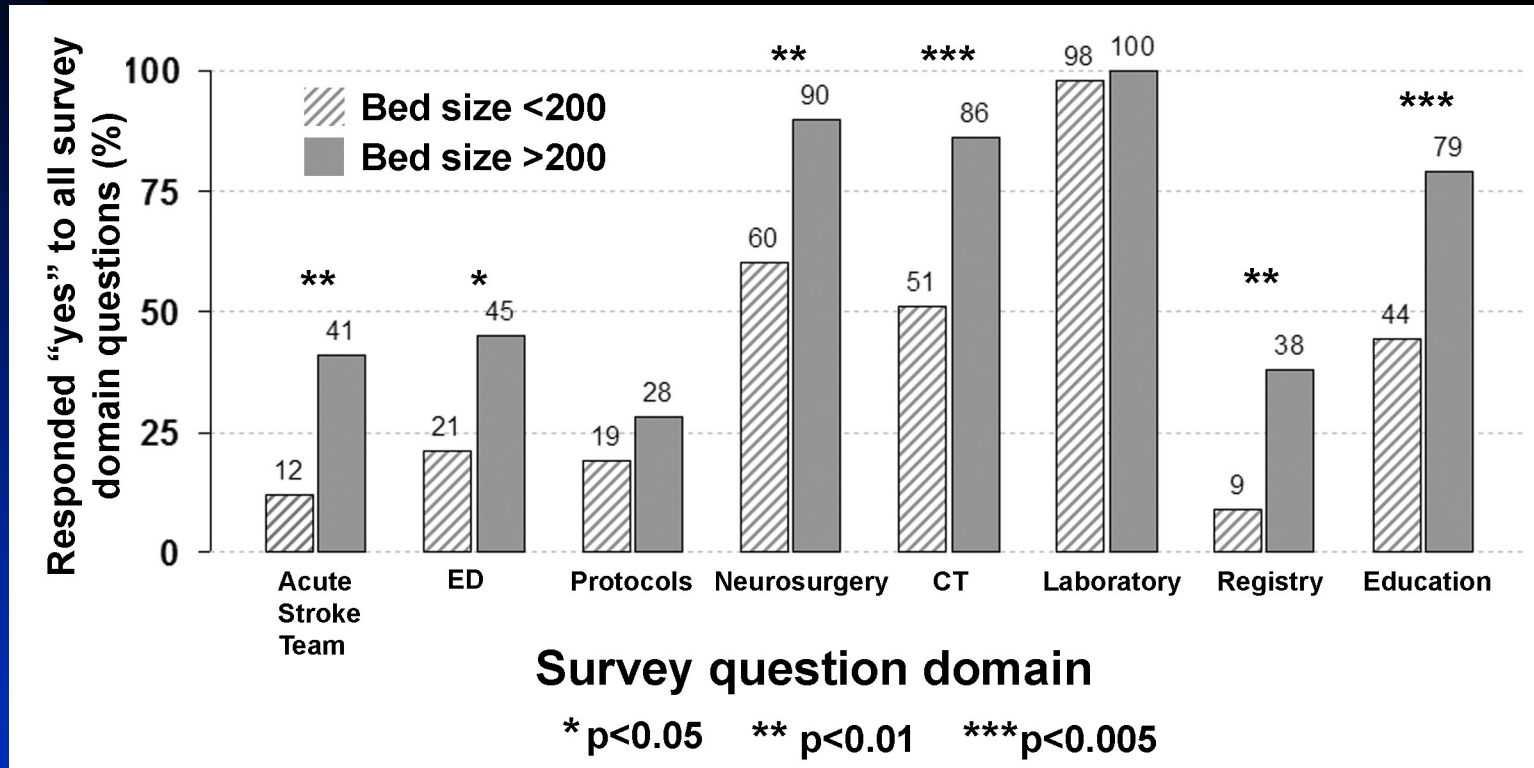
Diagnosis Statistics (For 01/01/2004 - 10/25/2005)

Diagnosis	# of Consults	% of All Consults	# Received t-PA	% Received t-PA
Acute ischemic stroke	390	59	103	26.41
Other	116	17.55	0	0
N/A	55	8.32	0	0
Subacute ischemic stroke	39	5.9	0	0
ICH	24	3.63	0	0
TIA	15	2.27	0	0
Seizure	14	2.12	0	0
SAH	4	0.61	0	0
Cardiac arrest	4	0.61	0	0

MASS DPH regulations

- Work with Dept of Public Health and State Hospital Association to create
 - ◆ Point of entry plan for EMS
 - ◆ regulations to license hospitals as primary stroke services
 - ◆ Requires full hospital commitment and adherence to NINDS guidelines
 - ◆ Mandatory reported data collection and QI
 - ◆ consensus measures of performance

Smaller bed size and rural hospitals are less likely to have acute stroke resources



- Smaller hospitals (<200 beds, 43/72) more likely rural hospitals (p<0.0001).
- Smaller hospitals, surveyed in 2003, less likely to express interest in achieving state-based designation as a Primary Stroke Service (p=0.01).

Data presented at 2006 International Stroke Conference, Orlando, FLA.

“Never, ever, think outside the box”



“Never, ever, think outside the box.”

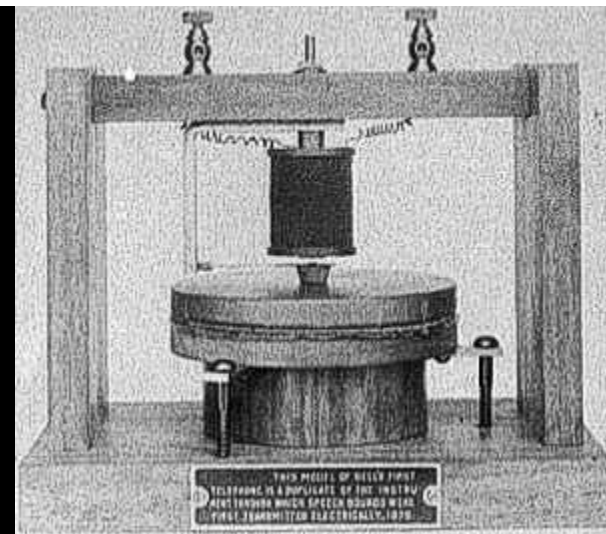


How should we think of TeleStroke?

When Bell began in 1880, the telegraph had been an established means of communication for 30 years. Although highly successful, it was basically limited to sending and receiving only one message at a time.

<http://inventors.about.com/library/inventors/bltelephone.htm>

MGH TeleStroke



Dr Martin Cooper of Motorola calls his rival, Joel Engel at Bell Labs in April 1973.



The “TeleStroke” Paradigm

Bedside Stroke Encounter

- Review history
- NIHSS
- Review Head CT
- Discuss Diagnosis & plan with MD & family



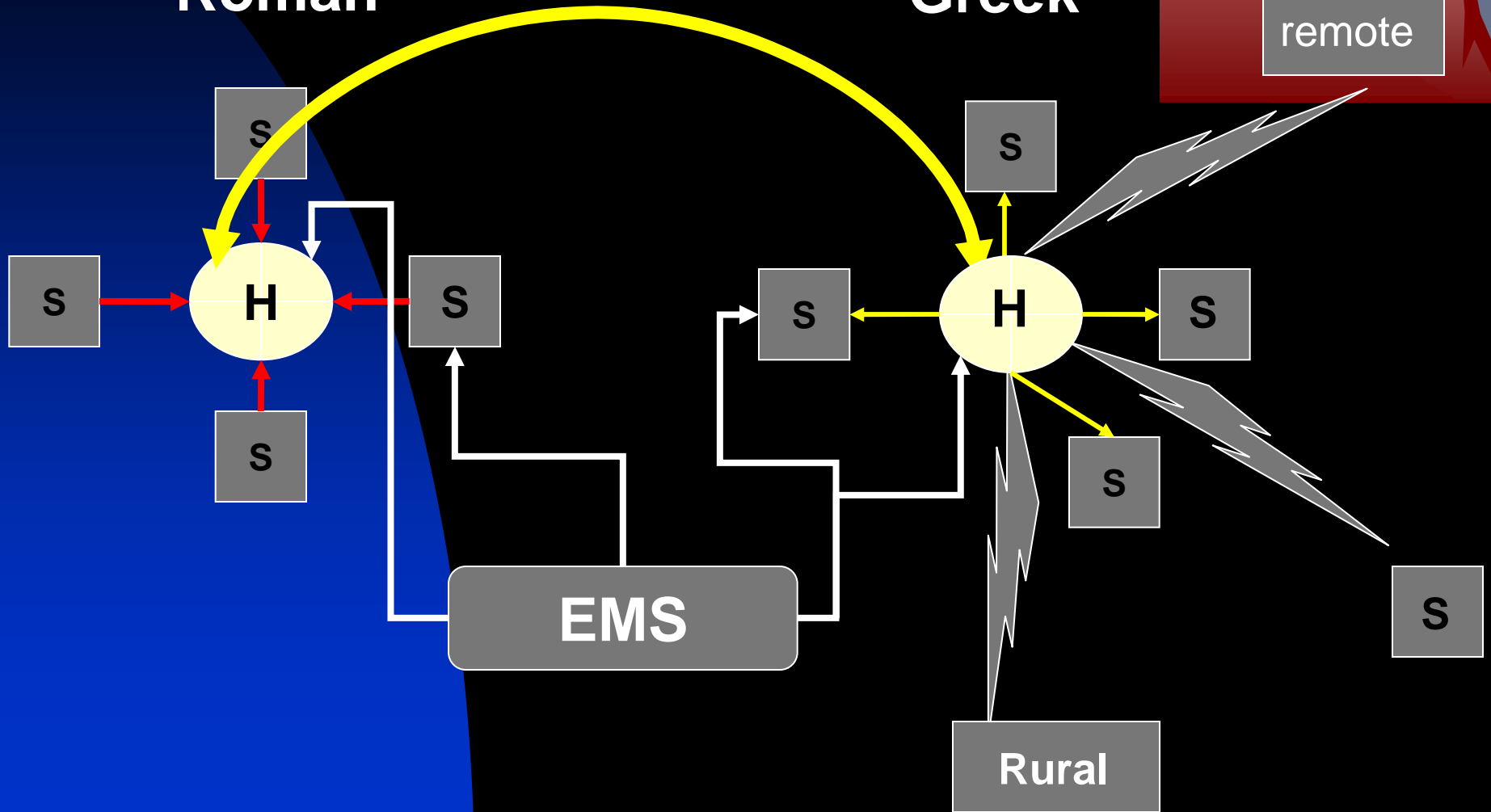
TeleStroke Encounter

- Review history
- NIH-TSS
- Review Head CT w/Teleradiology
- Discuss Diagnosis & plan w/MD & Family

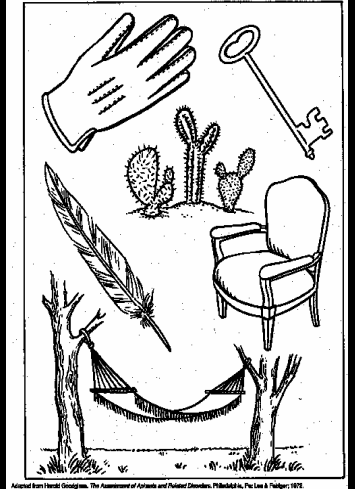
Stroke Team Design

“Roman”

“Greek”



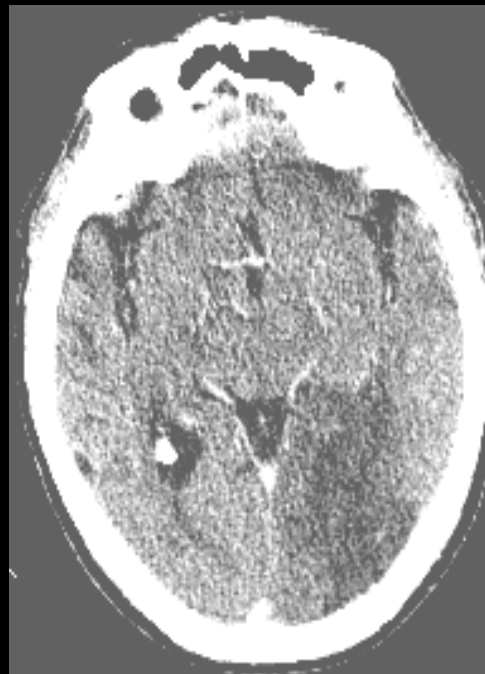
Acute Stroke Consult 4/11/99 2:00 am



“85 year old RHWM s/p CABG w/ quadriplegia, coma...”

PT Weight _____

MOTOR		SENSORY		Babinski	
		R <input type="checkbox"/>	L <input type="checkbox"/>	Visual Fields:	
R	L	RU	LU	RL <input type="checkbox"/>	LL <input type="checkbox"/>
		OD <input type="checkbox"/>	OS <input type="checkbox"/>	Shade in areas of visual loss	
Shaded Areas = weakness		Shaded areas = numbness			
Radiology		Test Results			
Time	Study				
	Cspine				
	CXR				



MASSACHUSETTS GENERAL HOSPITAL
PROCEDURE CONSENT FORM

PATIENT IDENTIFICATION STAMP

PATIENT: _____
UNIT NO: _____
PROCEDURE: _____

I have explained to the patient/family/guardian the nature of the patient's condition, the nature of the procedure, and the benefits to be reasonably expected compared with alternative approaches. I have discussed the likelihood of major risks or complications of this procedure including (if applicable) but not limited to loss of limb function, brain damage, paralysis, hemorrhage, infection, complications from transfusion of blood components, drug reactions, blood clots and loss of life. I have also indicated that with any procedure there is always the possibility of an unexpected complication.

Additional comments (if any):
Dr. _____ has explained to me (or my family member) why they believe a stroke is happening and which of the available methods would be most likely to improve my condition. They have explained the risks and benefits of the drugs and techniques available to dissolve blood clots in the brain and possible alternative treatments. They have recommended the off-label use of **INTRA-ARTERIAL** urokinase (clot-dissolver) through the artery to dissolve the blood clot. This requires general anesthesia.

Cerebral Angiography and Intra-Arterial Thrombolysis with General Anesthesia
The risks include:

1. Death, Stroke or permanent neurologic injury (paralysis, coma, etc)
2. Worsening of stroke symptoms from swelling or bleeding in the brain
3. Bleeding in other parts of the body
4. Need for blood transfusions to replace blood or clotting factors
5. Other unexpected complications
6. Vessel injury including rupture, possibly requiring surgery
7. Kidney failure or allergic reaction to contrast dye
8. Adverse reaction to medications
9. Infection
10. Airway damage (including injury to teeth)
11. Inability to extubate (come off the breathing machine)
12. Heart attack

All questions were answered and the patient/family/guardian consents to the procedure.

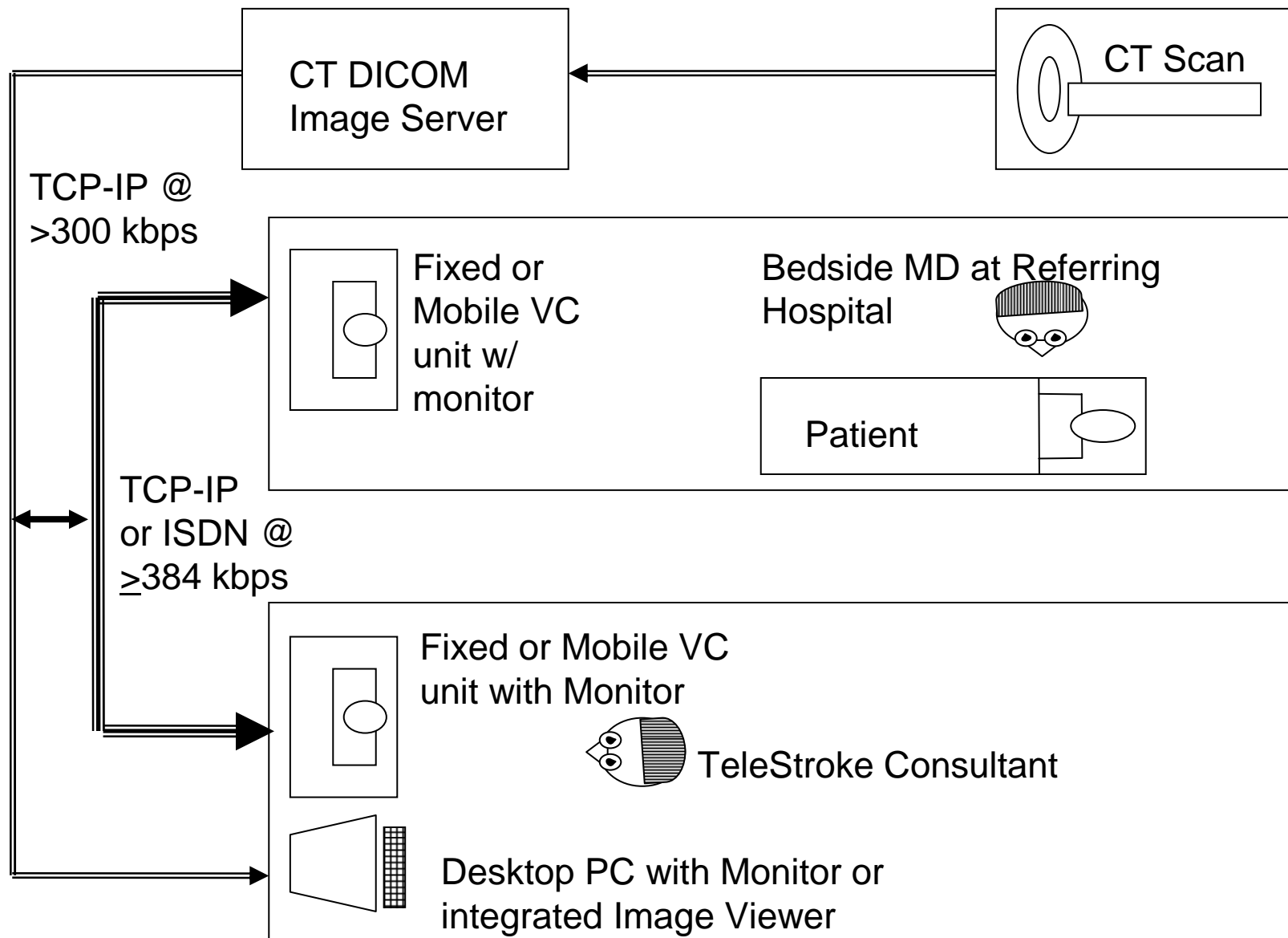
(Physician's Signature) M.D. DATE: _____

Dr. _____ has explained the above to me and I consent to the procedure.

I understand that Massachusetts General Hospital is an academic medical center and that residents, fellows and students in medical and allied disciplines may participate in this procedure. In addition, I understand that tissue, blood or other specimens removed for necessary diagnostic or therapeutic reasons may subsequently be used by the Hospital or members of its Professional Staff for research or educational purposes.

(patient's/family's/guardian's signature)
(If patient's signature cannot be obtained, indicate reason in comments section above.)

PCFRM NO. 10485 5/94 LHM 100 PAD



TeleStroke Point-to-Point Link

Feasibility of remote exam: NIHTSS

- Validity of NIH TeleStroke Scale (NIH-TSS) in sub-acute patients over a TeleStroke link¹
- Ability to perform real-time NIHTSS with high inter-rater reliability²⁻⁴

¹Shafqat S. *Stroke*. 1999;30:2141-2145

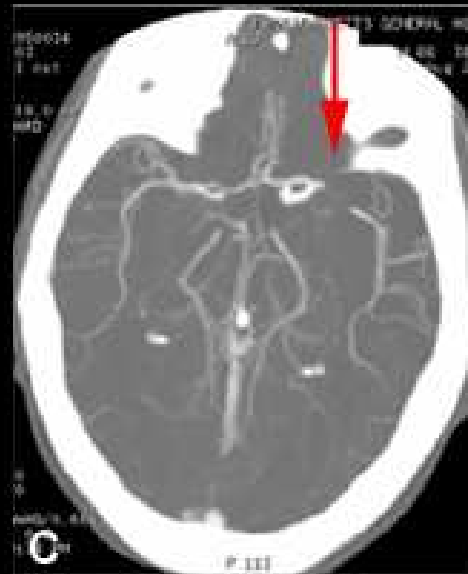
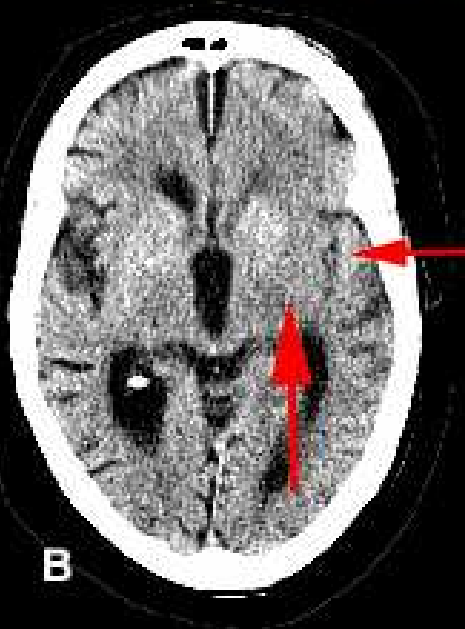
²Craig JJ. *J Telemed Telecare*. 1999;5:177-181

³Wang S. *Stroke*. 2003;34:e188-191

⁴Handschu R. *Stroke*. 2003;34:2842-2846

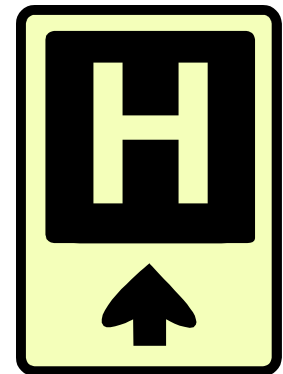
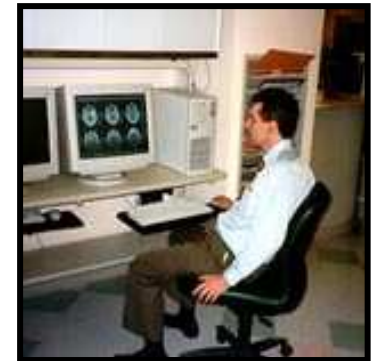
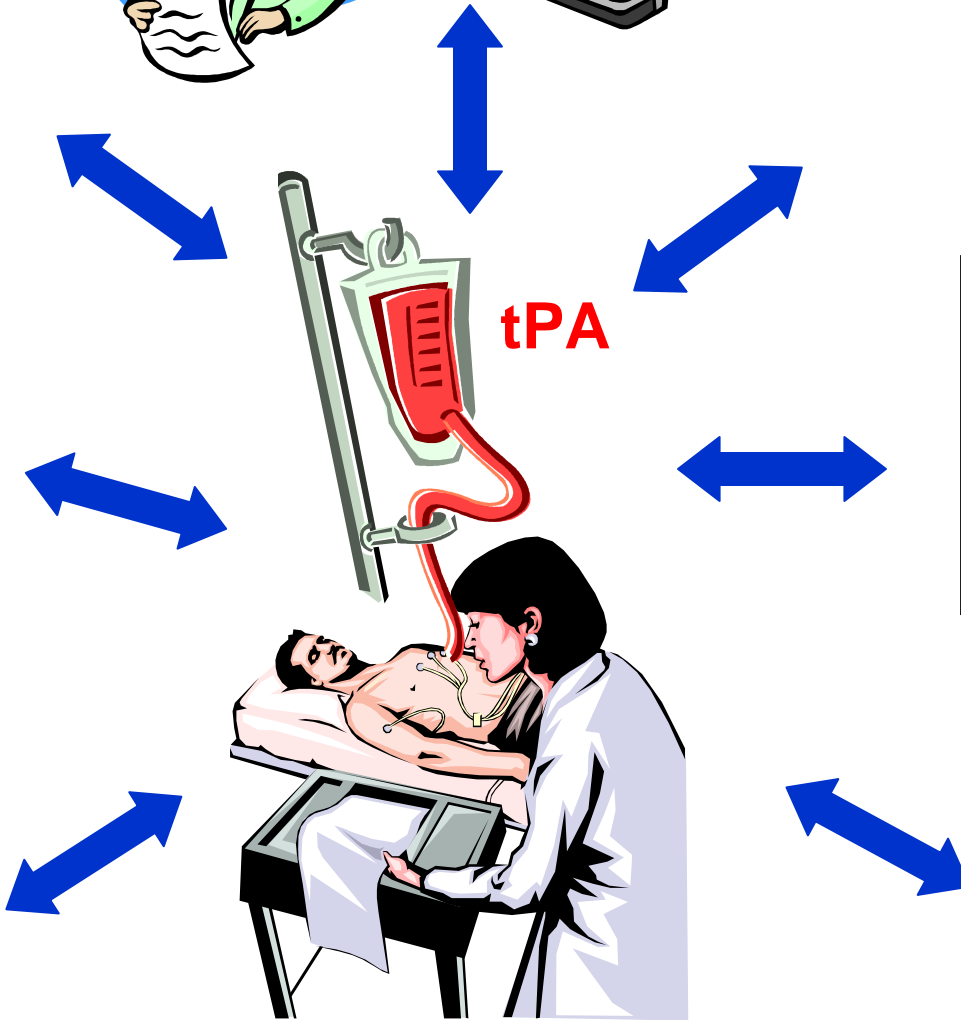
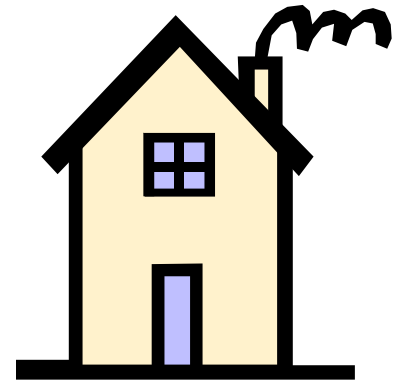
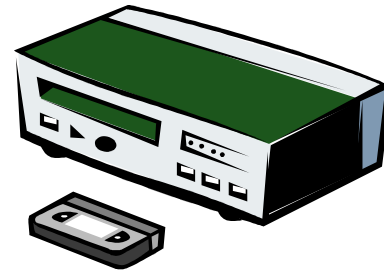


**88 RHBM
with acute
onset
aphasia and
hemiparesis
at outlying
hospital**



Remote Support for Acute Stroke Evaluation from US to Middle East (April 2002)





CT interpretation for tPA exclusions

- Ability to identify exclusions to IV tPA in real-time⁵
- Neurologist vs. radiologist readers^{2,4}
- Low-cost browser-based systems for DICOM image review
- **High mortality among CT protocol violators treated with tPA^{1,3}**

¹Hacke. *JAMA*. 1995;274(13):1017-25.

²Schriger DL. *JAMA*. 1998;279:1293-1297

³Buchan AM. *Neurology*. 2000;54:679-684

⁴Johnston KC. *Telemed J E Health*. 2003;9:227-233

⁵Schwamm LH. *Acad Emerg Med*. 2004;11:1193-1197

Imaging Conclusions

- Stroke neurologist interpretation of compressed non-contrast CT on desktop system was **identical** to Neuroradiologist for determining imaging criteria in t-PA eligibility
- Reducing the number of physician experts required to support acute stroke care may **increase** the likelihood of therapy

Safety of IV tPA remote approval

- Buffalo, NY- ISDN 3/12 pts @ 256 kbps received IV tPA.
- Ability to administer tPA safely in a variety of different environments and technology platforms¹⁻⁵
- Physician-extenders⁶ (e.g. APRN)

¹LaMonte MP. *Stroke*. 2003;34:725-728

²Wiborg A. *Stroke*. 2003;34:2951-2956

³Schwamm LH. *Acad Emerg Med*. 2004;11:1193-1197

⁴Wang S. *Stroke*. 2004;35:1763-1768

⁵Audebert H. *Stroke* 2005;36(2):287-91

⁶Choi JY. *Telemed J E Health*. 2004;10:S90-94

Patients who present early get appropriate treatment

- Twelve of 26 (46%) TeleStroke consultations began within the 3 hour window
- Of the 8 potentially eligible acute strokes, 6 (75%) received IV tPA and the remaining 2 were not treated due to mild deficits (NIHSS 1, 3)

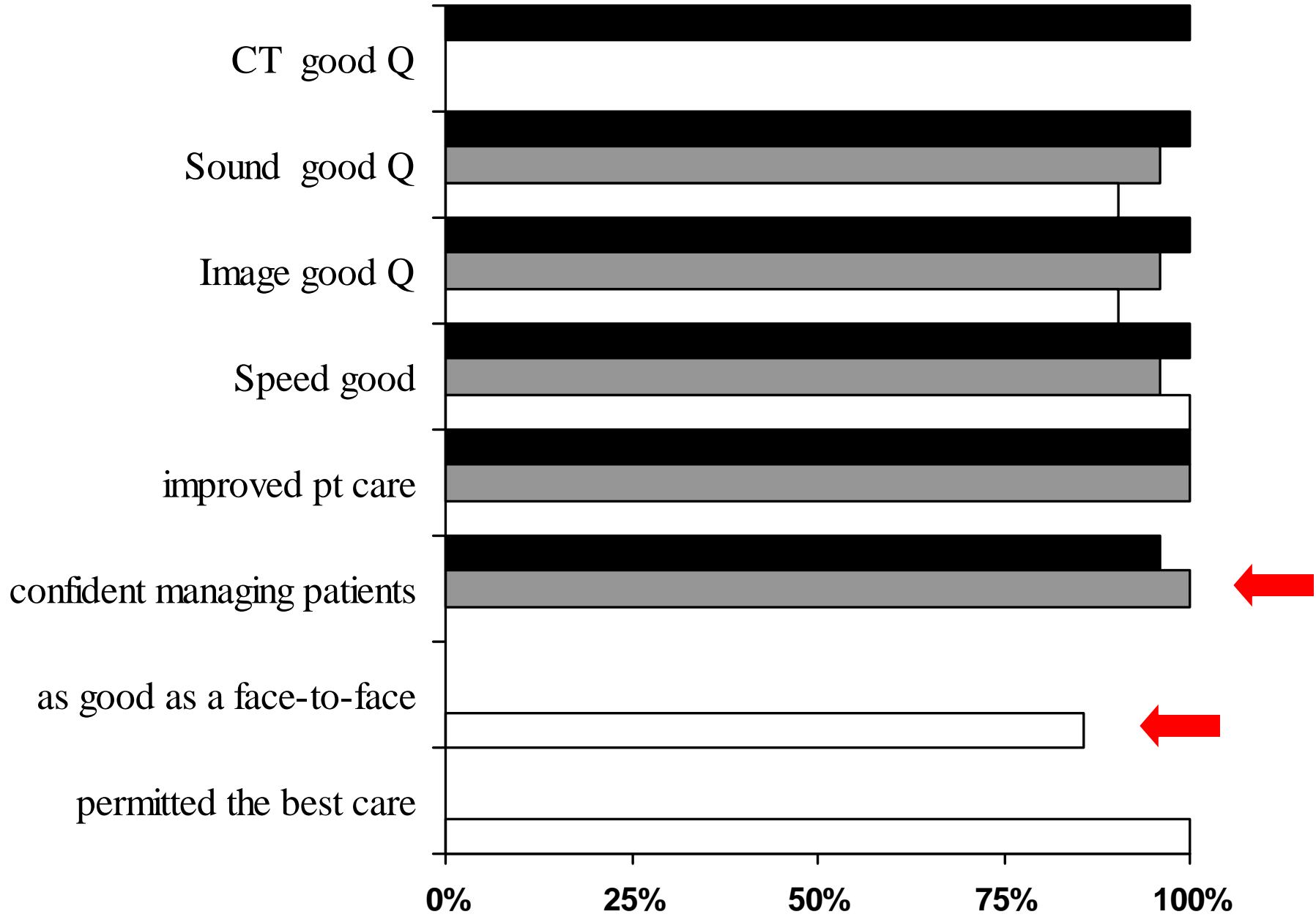
Patients were treated and transferred without protocol violation

- 12 of 26 patients were urgently transferred for further management, including all 6 patients receiving IV tPA.
- EMS transport records in patients treated with tPA and revealed no violation of NINDS guidelines.

Impact of TeleStroke

- During the 27 month intervention, 6/106 (5.6%) patients admitted with ischemic stroke received tPA, compared with 0/100 (0%) admitted during the prior 2 year period (5.6% vs. 0%; $p=0.03$)

Agreement



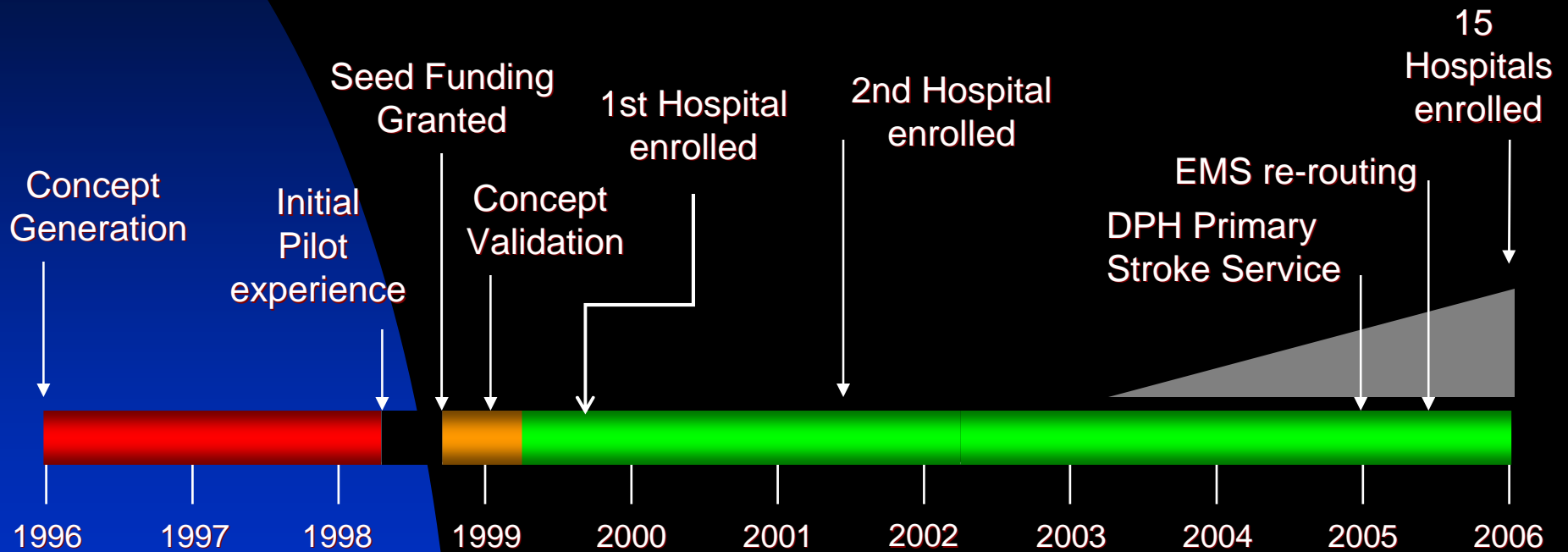
IV tPA?

Gov't
Regulator

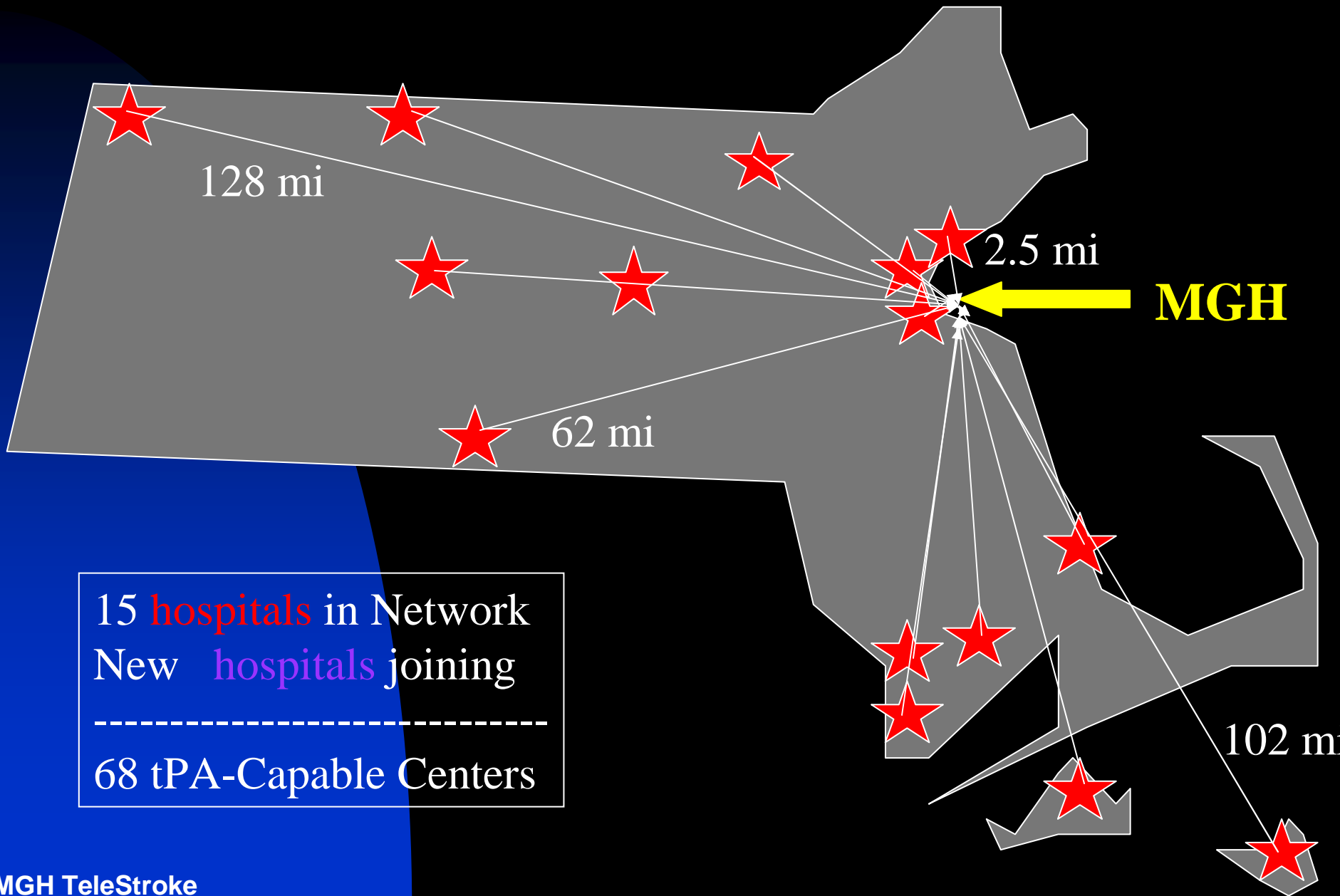
Hospital



MGH TeleStroke Center History



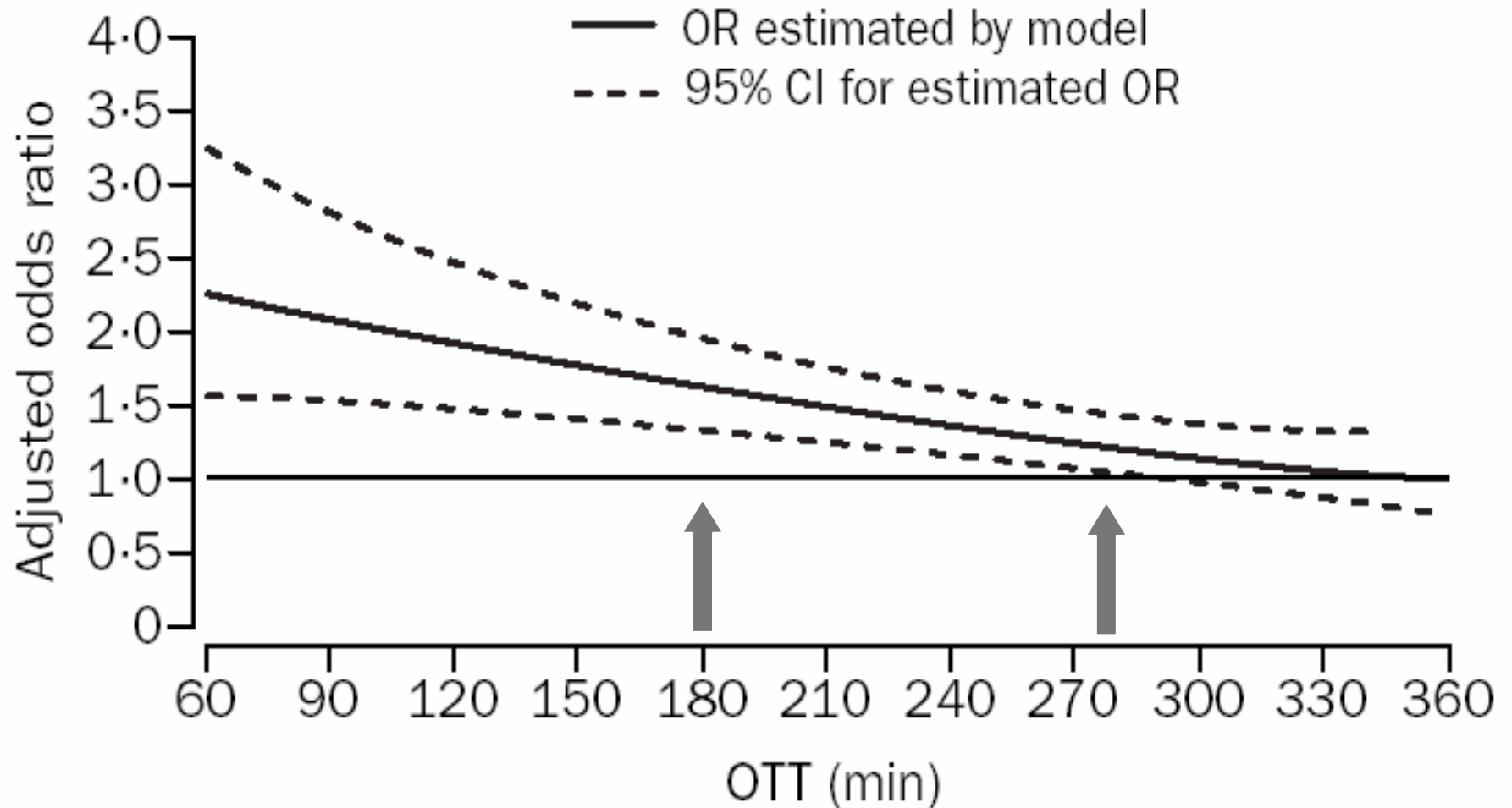
Distribution of TeleStroke Hospitals in Massachusetts



15 hospitals in Network
New hospitals joining

68 tPA-Capable Centers

Meta-Analysis: Earlier tPA is Still Better

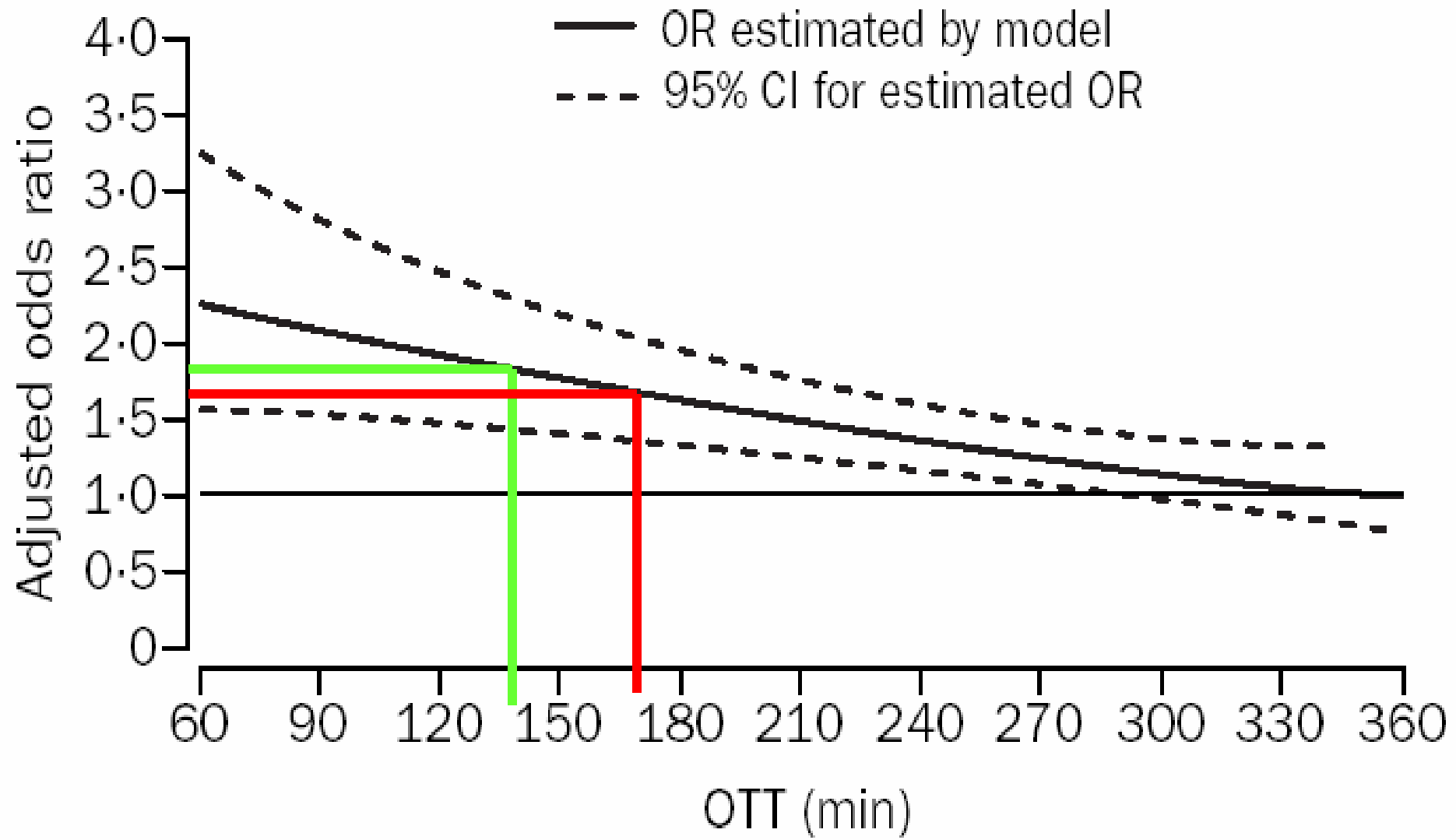


Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. Lancet 2004; 363: 768–74

Comparison of TeleStroke and Conventional Care

Stroke Center	Patient Population	Sample	Symptom-to-Door (min)	Door-to-Consult (min)	Consult-to-Needle (min)	Symptom-to-Needle (min)
MGH (TeleS)	Rural	Received tPA(n=6)	← 36 →	← 70 →	← 36 →	= 142
REACH (TeleS)	Rural	Received tPA (n=12)	← 71 →	← 45 →	← 18 →	= 134
TEMPiS (TeleS)	Rural	Received tPA (n=106)	← 65 →	← 15 →	← 61 →	= 141
Ontario* (Tx-tPA)	Rural	Received tPA (n=23)	← 34 →	← 89 →	← 49 →	= 172
Houston (Conv)	Urban	Received tPA (n=269)	← 67 →	← 70 →		= 137

Usual (**ship** & drip) vs. TeleStroke (**drip** & ship)



Telemedicine for Primary Stroke Centers & IV tPA

- Virtual Acute Stroke Team
- Facilitate stroke clinical trials
- Improve subacute stroke care
- Develop regional approaches to stroke management
- In 2003, < 10% of US hospitals met full criteria for a PSC



*"Bad news, Phil—due to federal funding cutbacks,
we can't afford to put your head back on."*

Financial sustainability

- Costs of infrastructure
- Costs of labor and maintenance
- Reimbursement restrictions
- Single payer vs. **multiple payers**
- Cost savings of tPA delivery/case and of avoiding inappropriate use
- Government funding vs. **shared-cost model**

IN THE SENATE OF THE UNITED STATES

MAY 18, 2005

Mr. COCHRAN (for himself, Mr. KENNEDY, Mr. WARNER, Ms. CANTWELL, Ms. COLLINS, and Mr. DAYTON) introduced the following bill; which was read twice and referred to the Committee on Health, Education, Labor, and Pensions

A BILL

To amend the Public Health Service Act to improve stroke prevention, diagnosis, treatment, and rehabilitation.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

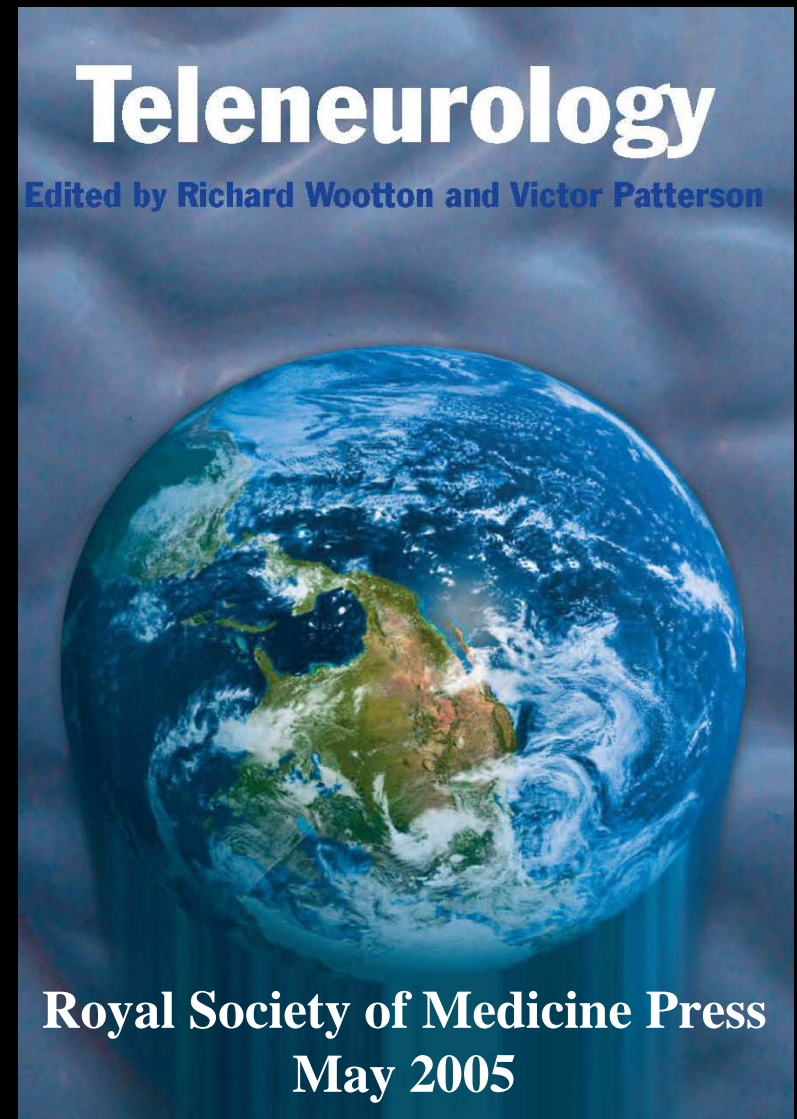
4 This Act may be cited as the “Stroke Treatment and
5 Ongoing Prevention Act of 2005”.

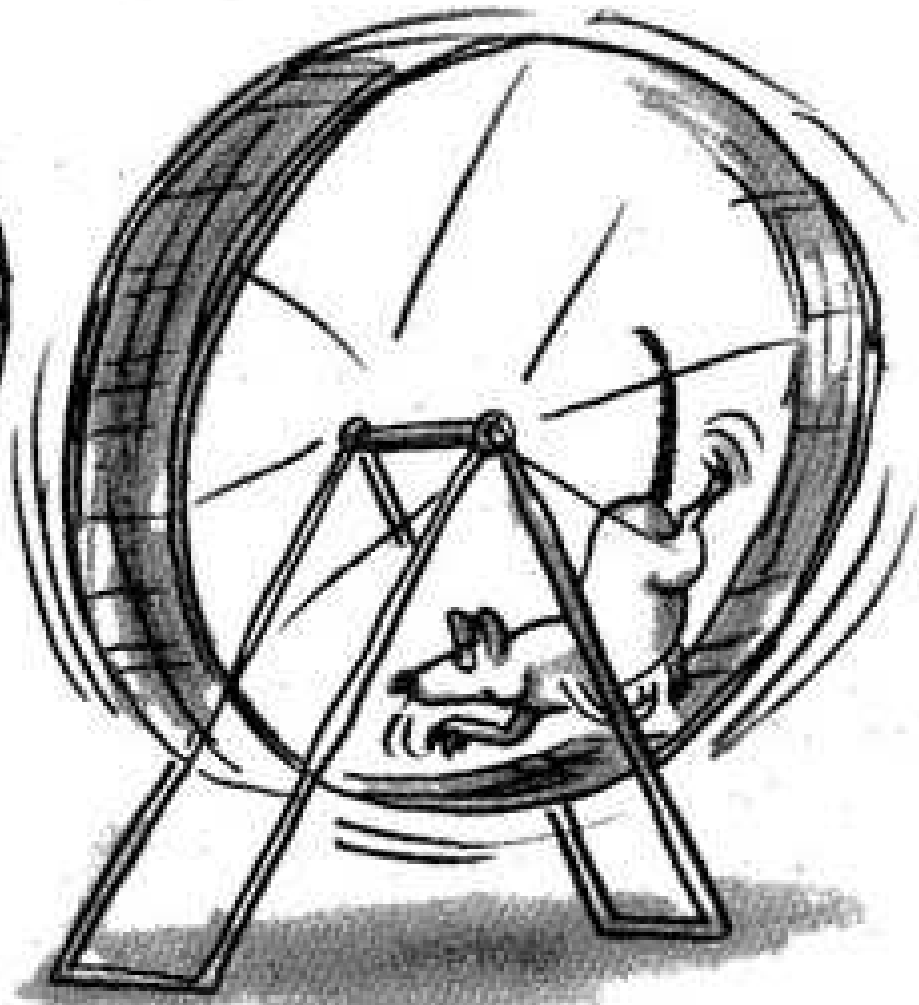
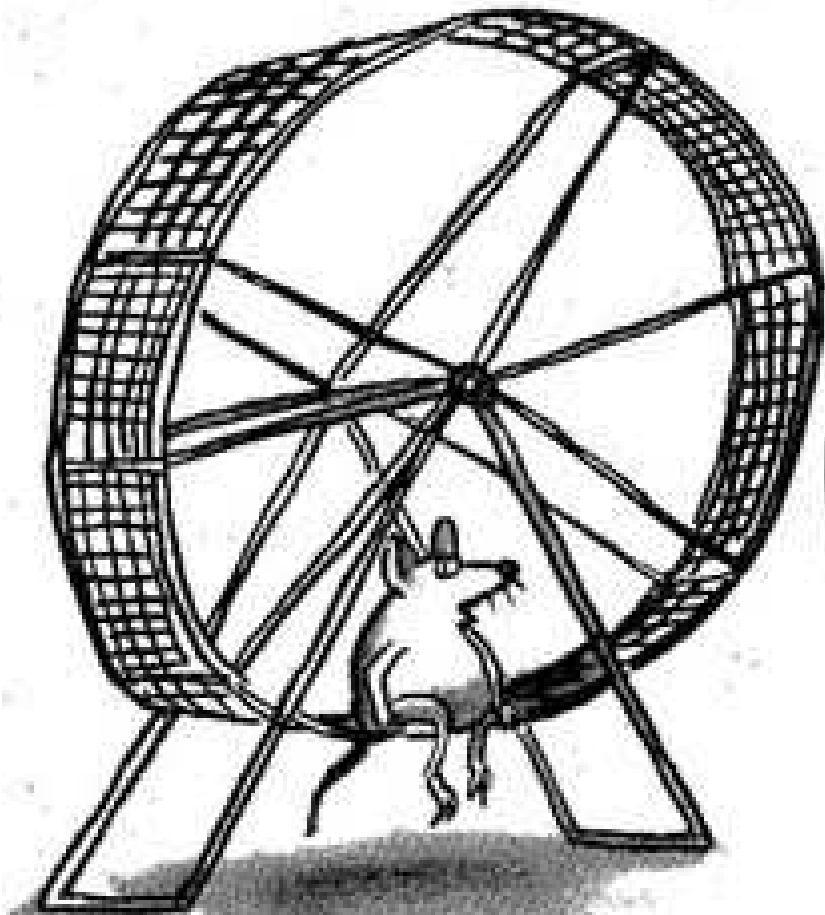
Malpractice

- Archiving of consults
- Coverage of TeleStroke activities by insurance carrier
- Cost of not providing tPA evaluation capabilities (lawsuits and lost opportunities)

More than just stroke...

- **Stroke**
- General Neurology
- Epilepsy
- Sleep
- Rehabilitation
- Neuroradiology
- Clinical Neurophysiology
- Pediatric Neurology
- Developing World
- Education & Training





KAE

"I had an epiphany."

• •



Acknowledgements

Team

MGH Neurology and Stroke Team

MGH Information Technology

MA DPH

Office of Emergency Medical Services

Participating hospitals

Key Personnel

Stroke and telestroke fellows

John Glaser, Joe Kvedar, Stephanie Prady, John Lester, Scott Leonard, Chris Fusco, MT Shore, Brian Murphy

Paul Dreyer, Janet Prvu, Gail Pamieri and the Primary Stroke Service Advisory Committee

Louise Gouyette

Stroke Service Directors