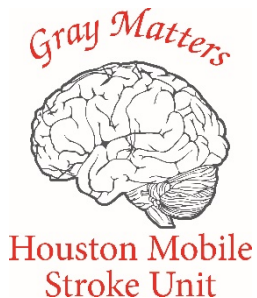


Delivering Acute Stroke Therapy in the Pre-Hospital Environment in Houston, Texas, U.S.A.

David Persse, MD FACEP
Public Health Authority
Physician Director, EMS
Houston, Texas



Mobile Stroke Unit

- Standard 12 foot ambulance
- Diagnostic Equipment
 - ✓ Portable CT scanner (CereTom)
 - ✓ Point-of-care laboratory
 - ✓ Teleradiology/Teleneurology connection
- All management is S. O. C.



Steps in Establishing the MSU

March 2013-Feb 2014

- Full time Medical Director and Project Manager take ownership
- Funding
- Purchase and buildout
- Collaborative agreements with stakeholders (UT, MHH, other CSCs, EMS)
- Policies, Guidelines and Procedures; System for accountability
- State and City inspection and licensing
- Radiation safety inspection and certification
- Insurance on vehicle and personnel
- Staffing
- Supplies and equipment
- Secure location, power, office
- EMS education
- EMS communication pathway
- HIPPA compliant grid for CT transmission
- Study protocol developed; CRFs and MOP. Grant funding sought
- IRB approval

Steps in Establishing the MSU

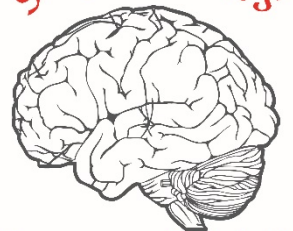
Full time Medical Director and Project Manager to take ownership



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glasbergen.com

“This is a major project of utmost importance, but it has no budget, no guidelines, no support staff, and it’s due in 15 minutes. At last, here’s your chance to really impress everyone!”

Gray Matters



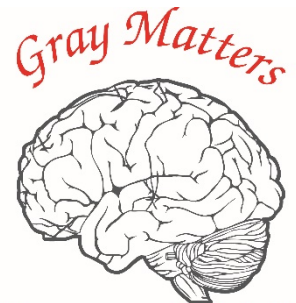
**Houston Mobile
Stroke Unit**

Steps in Establishing the MSU

Funding

From March 2013– May 2014

-Successfully raised \$1.8 million from community businesses and leaders



Houston Mobile
Stroke Unit

Steps in Establishing the MSU

Purchase and Buildout



Stroke Unit

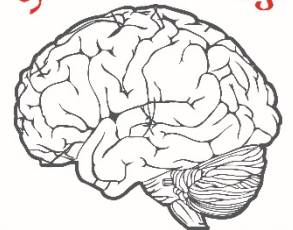
Steps in Establishing the MSU

Collaborative agreements with stakeholders

- Support from Local EMS
- University of Texas Medical School
- All Comprehensive Stroke Centers (MHH, TMH, BSLCHI, HH)
- Houston Mobile Stroke Unit Consortium



Gray Matters



**Houston Mobile
Stroke Unit**

STROKE – Suspected Neurological Event

Pre-hospital Guideline



Signs and Symptoms

~Facial drooping – one sided
 ~Sudden arm or leg weakness – one sided
 ~Slurred speech or speech difficulty
 ~Sudden confusion or trouble understanding
 ~Sudden trouble seeing in one or both eyes
 ~Sudden trouble walking, dizziness, loss of balance or coordination
 ~Sudden severe headache with no known cause

History

~Time last known well
 ~Any sign of seizure activity?
 ~Any trauma before onset of symptoms?
 ~Any recent illness, surgeries or trauma?
 ~List of all current meds, especially anticoagulants

Increase suspicion with these High Risk Groups

~Hx of seizures
 ~Diabetics
 ~Prior stroke
 ~Hypertension
 ~Atrial fibrillation

Does the patient have one or more of the signs and/or symptoms above?

Yes

Does pt have an unstable airway or EMS unable to maintain airway?

Yes

RAPID TRANSPORT
To closest emergency room

No

Treat according to individual EMS protocol for pt presentation

Cardiac monitoring

Supplemental oxygen to keep saturation >94%

If pt is hypotensive (SBP<120mmHg)
 Place head of the stretcher flat

If pt is hypertensive (SBP>220 mmHg)
 Consult medical control

Obtain glucose reading

If glucose is <60 mg/dL, administer glucose per local protocols

If IV solution is administered, isotonic or normal saline is most appropriate

1. Symptom onset within 6 hours
AND
2. Time to arrival at CSC is less than 30 minutes
AND
3. Patient has one of the following:
 - a. Not alert – requires persistent, strong or painful stimulation to make movements or talk
 - b. No or very minimal movement of one arm or hand
 - c. Intubated

No

Yes

RAPID TRANSPORT
To closest Designated Stroke Center

RAPID TRANSPORT
To closest Comprehensive Stroke Center or Primary Stroke Center with advanced neurosurgical capabilities

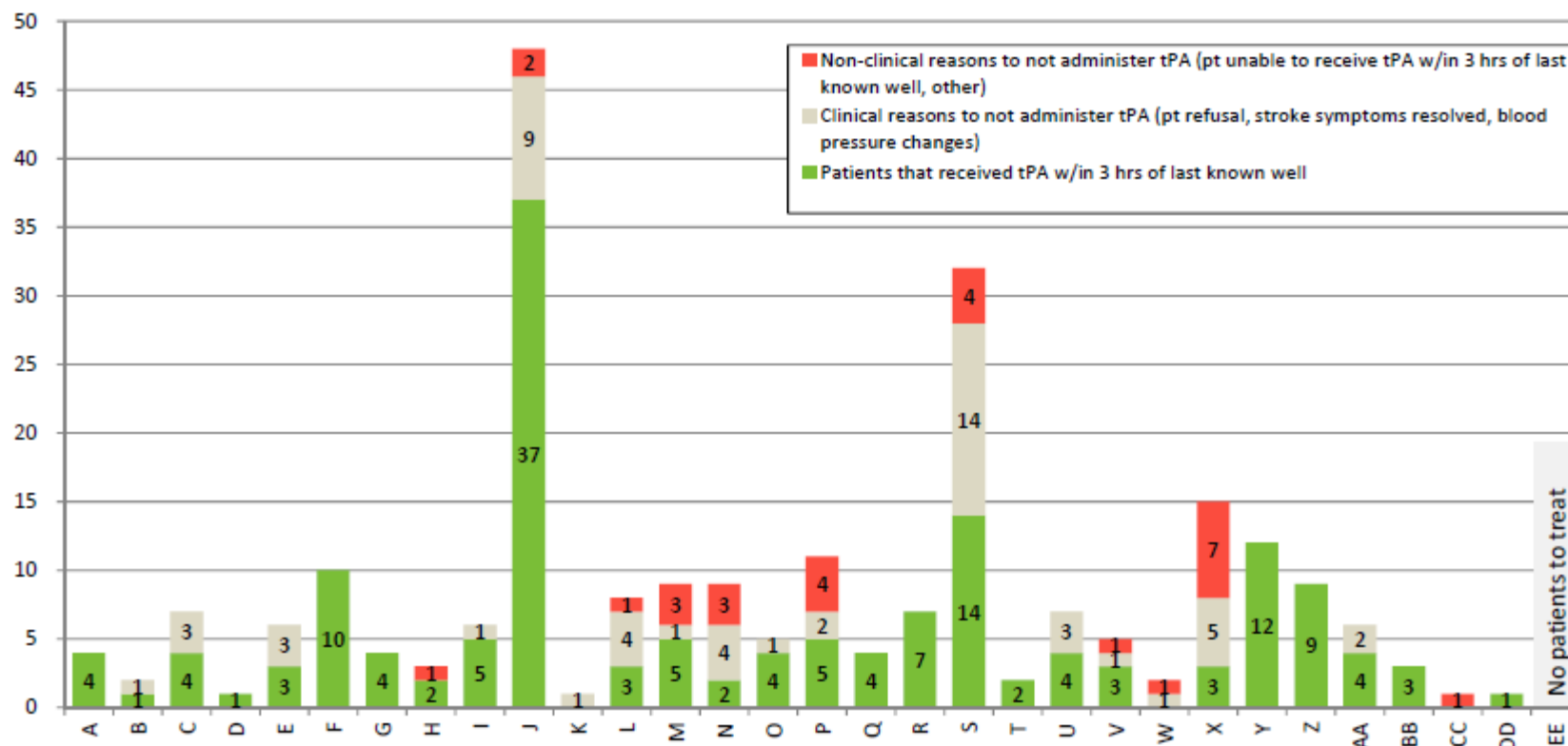
- Call receiving Stroke Center and request **CODE STROKE**
- Continue algorithm during rapid transport
- **DO NOT DELAY TRANSPORT TO PERFORM INTERVENTIONS**



CEO REPORT

SETRAC Ischemic Stroke Data - Quarter 1 2014

Eligible Patients Treated With tPA Within 3 Hours of Last Known Well

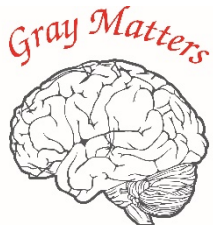


Regional Data		
Total number of stroke (infarct) patients	1,987	
Total number of ischemic strokes	1,665	83.8%
Total number of tPA eligible patients presenting to ED w/in 2 hours of last known well	240	14.4%
Total number of patients receiving intravenous tPA w/in 3 hours of last known well	156	65.0%
Total number of patients not receiving tPA	84	35.0%
- Pt refusal	10	11.9%
- Stroke symptoms resolved	44	52.4%
- Blood pressure changes	1	1.2%
- Pt unable to receive tPA w/in 3 hrs of last known well	6	7.1%
- Other	22	26.2%

Steps in Establishing the MSU

Develop Accountability System

- Write and implement physician standing orders/protocols
- Adult ALS protocols (SZ, MI, airway)
- Develop guidelines for staff expectations including QA, QI for all equipment, maintenance & certifications.



Steps in Establishing the MSU

Licensing and Inspections



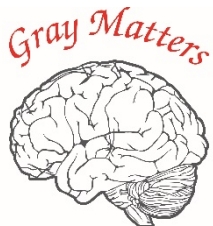
- Ambulance Provider License



- Ambulance Provider License
- Ambulance Driving Permit



- Radiation Safety Protocols, Application & Certification
- Radiation Safety Inspection



Houston Mobile
Stroke Unit

Steps in Establishing the MSU

Communication and Technology Systems

- ✓ Dispatch Pathway Development with 3 different cities
- ✓ Houston Fire Dept. Radios and Pagers
- ✓ Dispatch numbers and phones
- ✓ Mobile Data Terminal – to track location and times
- ✓ HIPPA compliant DICOM Sharing grid for sharing CT images



atters

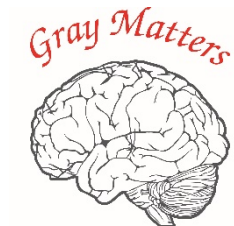


Mobile
Unit

Steps in Establishing the MSU

MSU Training

- ACLS training of MSU staff
- Stroke Teams at 3 CSC Facilities (ER, Research, Stroke Coordinators)
- 2200/4000 Houston Fire (FR, Paramedics, Dispatch and Call Receivers)
- All incoming Houston Fire Cadets
- West University Dispatch and Fire/EMS
- Bellaire Dispatch and Fire/EMS
- Southeast Texas Advisory Council (SETRAC)



Houston Mobile
Stroke Unit

Steps in Establishing the MSU

Staffing

Who is inside?

- Licensed Vascular Neurologist
with an ACLS
Certification
- Critical Care/ER trained
Registered Nurse
with ACLS
certification
- Licensed Paramedic
with ACLS
certification
- Licensed CT radiology
technician with
BLS certification
- Telemedicine Doc!!

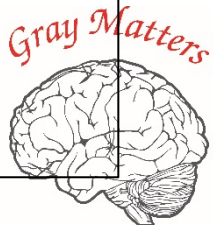


BEST-MSU Study

Benefits of Stroke Treatment Delivered Using a
Mobile Stroke Unit Compared to Standard
Management by Emergency Medical Services

AIMS

1. Determine the logistics and clinical outcomes of MSU vs SM in the U.S.—speed, #, first hour.
2. Can MD be replaced by Telemedicine?
3. What is the Cost-Effectiveness ?



How Reliable is TM in a Mobile Stroke Unit?



Telemedicine Reliability??: Wu et al—PURSUIT study, Stroke 45:2014



A: Remote vascular neurologist performing stroke evaluation; B: RP-Xpress mounted on stretcher in ambulance; C: Remote assessment in ambulance with EMS assistance; D: Remote assessment on-scene in patient home with EMS.

Table 1: Data Analysis

	Live Assessments (n = 34)	Recorded Assessments (n=33)
RELIABILITY		
Intra-class correlation (95% CI) for NIHSS	0.997 (0.992-0.999)	0.993 (0.975-0.999)
VALIDITY		
Matched Scripted NIHSS \pm 2 points	88%	70%
Clinical Data points Obtained (12 items)	96%	96%

Cost Projection

Cost of CT Scanner	\$ 375,000
Ambulance Retrofit	\$ 60,000
TM equipment	\$ 30,000
<u>Cost of added paramedic and TM coverage X 5 yrs</u>	<u>\$1,000,000</u>
Total fixed and continuing costs for 1 MSU X 5 yrs	\$1,465,000



VS

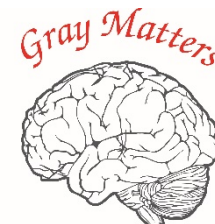


Less than the cost to sustain an endovascular program!

Lifetime cost per stroke: \$ 200,000

Therefore, cost neutral if:

1 MSU results in 7 more patients completely recovering over 5 yrs



Houston Mobile
Stroke Unit



Dispatch by:

- Dispatch center: only if stroke pathway.

OR

- On-scene EMT (identify possible stroke → rendezvous)

OR

- We monitor EMS radio and add ourselves on





About 2-4 runs/day
1 rt-PA treatment per 7 calls

rt-PA Exclusions:

- Time (too long or uncertain),
- Too mild
- Too sick
- Mimics
 - Hypoglycemia
 - Seizure
 - Migraine
 - Psychiatric

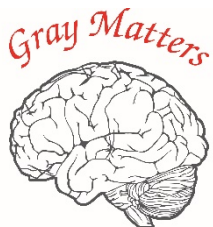
BEST-MSU enrollments- First Two Years

- **136** Treated with rt-PA (2.7/wk, 135/yr)
- 67 More Transported (but not treated)
 - ICH
 - Sz
 - Too mild
 - Uncertain onset time
 - Other (tumor, cerv. spond.)
- Avg. on-scene time- **21 min**
- Symptom onset to t-PA treatment
 - **42%** 0-60 min (vs 0% control)
 - **37%** 61-80 min (vs 20% control)
 - 21% 81-270 min (vs 80% control)



Conclusions

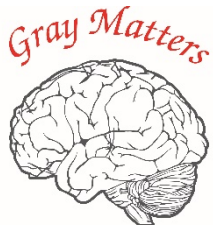
- Pre-hospital triage and treatment will be the next quantum leap forward in speeding treatment and improving outcomes
- Before this strategy is widely implemented in the U.S., we need more data on feasibility, outcomes and costs
- These are the Aims of the BEST-MSU study



Final Thought...

A Stroke is like a GSW to the brain...

except that we can reverse a Stroke!



Houston Mobile
Stroke Unit