BRIEF PRE-HOSPITAL STROKE SYSTEM ANALYSIS

SYSTEM:
A REGULARLY INTERACTING OR INTERDEPENDENT GROUP OF ITEMS FORMING A UNIFIED WHOLE

COMPONENTS OF THE SYSTEM
OBJECTIVE OF THE SYSTEM

![Modified Rankin Scale Diagram]

CHARACTERISTIC OF THE SYSTEM

![Analysis Table]

ANALYSIS OF THE SYSTEM

Pre-Hospital Component
Patients with more severe strokes seek care earlier.
People with less severe strokes seek care later.
64% take EMS (variable 12% in some).
10% of patients are treated within 90 min.
1.4% of patients are treated within 60 min.

People who have more severe strokes are more likely to call 911.
**RECOGNIZE SYMPTOMS**

But they still wait a really long time.

Smith and Isaacs measured onset to 911 at average of 150 min in 1998.

The system has not improved.

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**Why So Late?**

**• Positive Predictors**

- More Severe
- Previous stroke or witnessed stroke
- Exposure to stroke education

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**• Negative Predictors**

- Denial: “It’s not a stroke”
- Less Severe: “It’s not bad enough”
- Didn’t trust their judgement
  - Called a doctor or a friend => delay
- Unfamiliar with symptoms
  - Being familiar did not increase use of EMS
  - “Nothing you can do.”
Krebes evaluated 207 "stroke" calls.

The most common item "suspected stroke mentioned by caller".
ACTIVATE EMS

EMS Sensitivity
5, 10, 12, 13, 14, 15, 16, 17, 18, 19
Avg: 70%

EMS sensitivity increases if EMS dispatch indicating suspicion for "stroke."
Which is dependent on the patient indicating suspicion for "stroke."

ACTIVATE EMS

EMS Positive Predictive Value
5, 8, 9, 12, 13, 14, 15, 16, 17, 18, 19, 20
Avg: 50%

Not improving
Training does not improve accuracy.
**RESPONSE**

**Scene Time**

Over time EMS is very consistent (17 +/- 3). Trend towards improvement, but really? 20 years we save 4 minutes? Really?

**Time from 911 to ED Arrival**

Surprisingly consistent despite the wide geographic area (39 +/- 2 min). 106: Reading, OH
95: San Francisco, CA
98: Chapel Hill, NC
18: Rochester, MN

**TRANSPORT TO AND NOTIFY STROKE**
ACTIVATE EMS
The Endovascular Revolution of 2015

NOTIFY
Mr Clean (Multicenter Randomized Clinical Trial of Endovascular treatment for Acute Ischemic stroke in the Netherlands)
1 Jan 2015

For Anterior LVO <6 hrs from LKW IA t-PA +/- retrieval is better than IV t-PA alone

NOTIFY
ESCAPE-HoA
11 Feb 2015

For anterior LVO, <12 hrs, with small core and high NIHSS >0-1, IV t-PA alone
11/20/2018

NOTIFY

ESCAPE Trial
11 Feb 2015
For anterior LVO, <12 hrs, with small core infarct retrieval > IV t-PA alone
STOPPED EARLY

NOTIFY

EXTEND-IA
11 Feb 2015
For anterior LVO, <6 hrs, with small core infarct retrieval > IV t-PA alone
STOPPED EARLY
11/20/2018

NOTIFY
DAWN Trial
4 Jun 2018

For anterior LVO, <6 hrs, with small core infarct retrieval + IV t-PA alone

STOPPED EARLY

WE GET IT
EMS comes under pressure to identify large vessel occlusive strokes

Bypass of t-PA hospitals without endovascular capabilities becomes problematic

LKW
L-PA exclusions
Baseline mRS 0-2

NOTIFY
Two Pre-Hospital stroke scales emerged to identify large vessel occlusive strokes

RACE (Rapid Arterial Oclusion Evaluation)
Based on NIHSS

LAMS (Los Angeles Motor Score)
Based on APIS
NOTIFY
RACE adopted but continues to be challenged.
Higher sensitivity
Lower specificity

Problems:
Stroke represents < 2% of calls, 5, 9, 12, 15, 17
Overall Sn=70 (better with more severe strokes)

MOBILE STROKE WALTERS
Inclusion:
18-80 years old
Positive Stroke Screen by EMD
Onset <2.5 hrs
No exclusions to t-PA
< 30 km from the hospital
Setting
0800-2200 weekdays
0800-1800 weekends
Nov 2008 – July 2011
Week on/Week off

Time: Onset to t-PA
MSU 72 min
ED 152 min
Saved 80 min

Looks great!
MOBILE STROKE WALTERS

Onset to Alarm (Min)
MSU: 34
ED: 79
Difference: 45

Alarm to t-PA
MSU: 38
ED: 73
Difference: 35

NIHSS @ 7 days
MSU: 2
ED: 4

Number of patients who received t-PA
MSU: 23%
ED: 17%

No increased risk of complications
MOBILE STROKE EBINGER

On Board:
ED/Neurologist
Paramedic
Radiology tech

Work Schedule:
07:00-23:00
Mon – Sun odd weeks

Inclusion:
Dispatched by EMD
<4 hrs from LKW

MOBILE STROKE EBINGER

Onset to Alarm (Min)
STEMO: 51
ED: 42
Difference: 9

Alarm to t-PA
STEMO: 51
ED: 26
Difference: 25
(4.2% increase of MRs of 0-1 at 90-Projected 2)

NIHSS for both was 8 on arrival

MOBILE STROKE EBINGER

Total EMS Activations: 6182
Total Ischemic Strokes: 2111
PPV of EMD: 34%
Consistent with previous measures
implies a Sn of about 30%
Missing 50% of EMS strokes

Punch Line: 10x more t-PA < 60 min
62 vs 16

The major difference in proportions between the group treated after deployment of the mobile emergency medical unit (STEMO) and the group treated with conventional care can be observed within the first 60 minutes of arrival (p<0.05)
MOBILE STROKE GROTIA (BEST MSU)
Houston 2015
5 mile operational radius
Dispatched by EMD impression of “stroke”
Paramedic and Radiology Tech
Use of telestroke (working well)
Now also showing in Cleveland, Denver, Memphis, and NYC

MSU EVALUATION
At a start up cost of 1 million dollars
In a high density population area
In a limited operational radius
For about 50% of the ischemic stroke patients (not changing despite effort)
For about a 25 min savings implying +3% increase chance of mRS 0-1
When patients wait 150 – 300 minutes to call 911

BRIEF PRE-HOSPITAL STROKE SYSTEM ANALYSIS
WHERE WOULD YOU PUT YOUR MONEY?