

The Key to the Future

Pre-Hospital Data and its use in Stroke Management

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Disclosure

- Employee of Intermountain Healthcare
- Trained at University of Utah
- Not all slides are my own

Objectives

- Overview of Stroke
- Stroke Chain of Survival
- Pre-hospital data in Stroke
- Future use of pre-hospital data in stroke management

Ischemic Stroke

- ~780,000 strokes a year
- 3rd leading cause of death
- Leading cause of adult disability
- \$65.5 billion in 2008
- 15% are preceded by a TIA
- 100,000 recurrent strokes a year
- African American > Hispanic > Caucasian
- Risk increases with advancing age

Stroke in Utah

Fact or Myth?

Stroke is not common in Utah because of healthy lifestyles

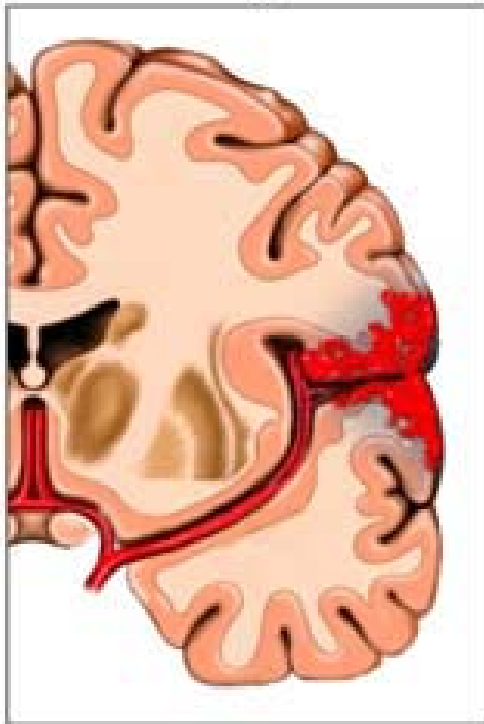
Myth!

Utah is the 1st most “heart healthy” state
Utah is the 25th most “stroke healthy” state

What is a Stroke?

Hemorrhagic – 15%

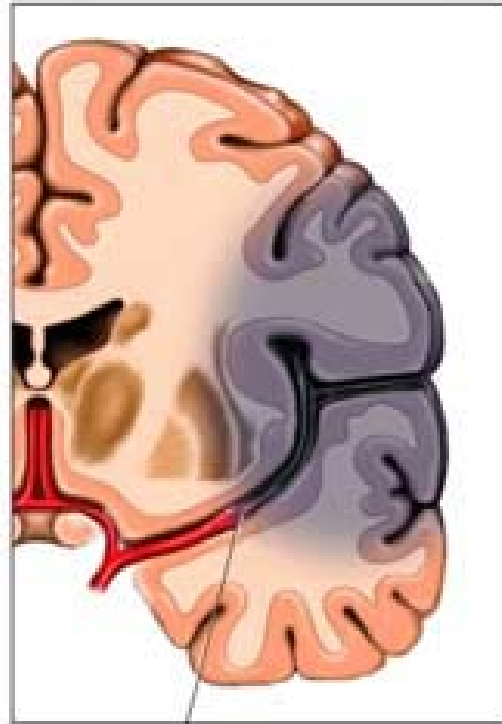
Hemorrhagic Stroke



Hemorrhage/blood leaks into brain tissue

Ischemic – 85%

Ischemic Stroke



Clot stops blood supply to an area of the brain

Clinical Presentation

- Sudden onset
- Maximal at onset
- Vascular risk factors
 - Heart Disease
 - Hypertension
 - Hyperlipidemia
 - Diabetes
 - Tobacco
- Symptoms
 - Weakness
 - Numbness
 - Headache “Worst headache of my life”
 - Speech difficulty
 - Clumsiness
 - Dizziness
 - Intractable nausea/vomiting
 - Vision Loss

[Serene Branson](#)

Golden Hour of Stroke: Facts

- Stroke treatment is time-limited
- Stroke kills 2 million brain cells per minute
- Earlier treatment prevents disability
- Arrival in “The Golden Hour” improves chances of a good outcome
- Golden hour arrival is more frequent in EMS transported patients
- Golden hour arrival:
 - West/Northeast >Midwest/South

“The Walmart Stroke”

91F at the photo counter at Walmart started to drift to the left. Had L arm > leg weakness.

- Onset: 1225-1230
- Medical History:
 - Hypertension
 - Atrial Fibrillation
 - GERD
 - Osteoporosis
- SocHx: lives independently, “drives to church, senior center, presbyterian ladies group, and ‘red hats’”

The Stroke Chain of Survival:

Detection

Dispatch

Delivery

Door

Data

Decision

Drug



Seven Step Stroke Chain of Survival and Recovery

Pre-Hospital:

1. Detection
2. Dispatch
3. Delivery

In-Hospital:

4. Door
5. Data
6. Decision
7. Drug

General Population
(Detection)

EMS System
(Detection, Dispatch, Delivery)

Hospitals
(Door, Data, Decision, Drug)



1. Detection: Early Recognition

- Early treatment of stroke depends on the victim, family members, or other bystanders detecting the event.
- ~40-75% of patients know at least one symptom
- ~89% say they would call 911 first
 - 75% actually call a friend/family member first
- Only 25% recognize 911 as means of arriving faster
- ~50% “wait it out” or “not bad enough”
- Larger Deficits:
 - Increased use of EMS
 - Increased arrival in the Golden Hour

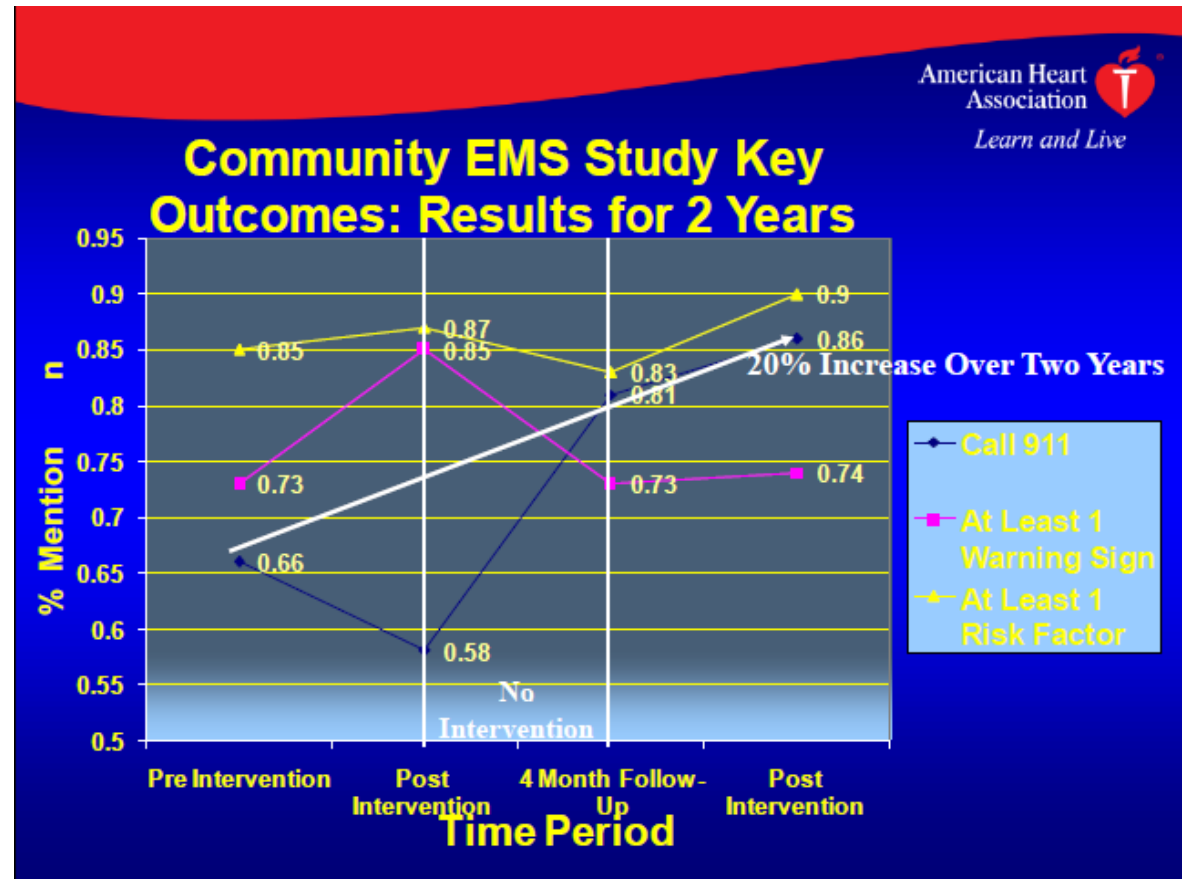


1. Detection: Early Recognition

- Improving Awareness:
 - Government
 - Not-For-Profit (AHA/ASA)
 - Industry
- 3 Keys
 - What it is
 - What to do
 - Why do it
- Audience – bang for the advertising buck
 - Old
 - Young
 - Middle age
 - High Risk
- Cost
 - Multimedia spots
 - Print spots
 - Mailers
- Sustainability?

1. Detection: West Virginia Experience

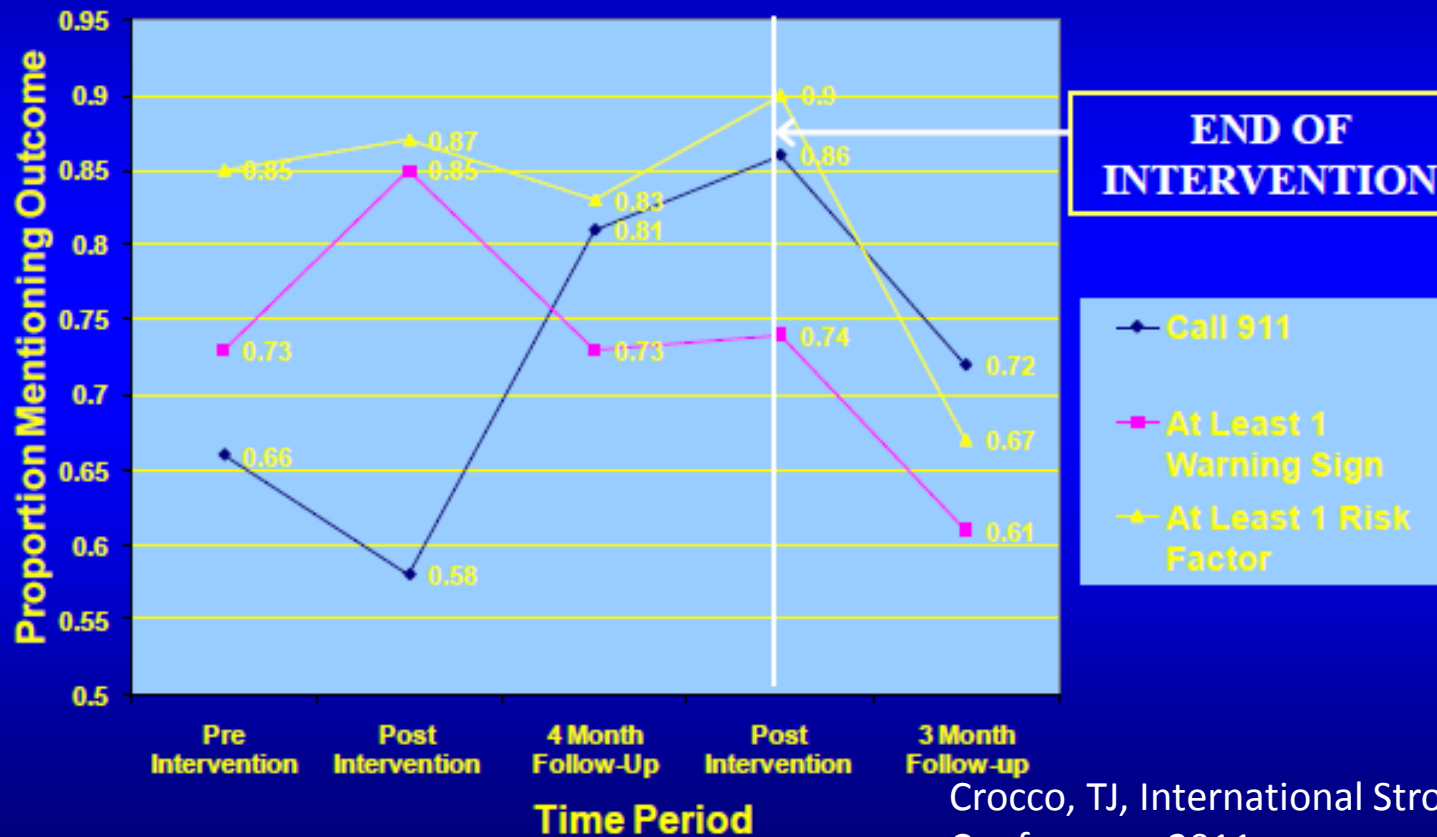
- EMS – directed
- Identified sites
- Distributed the educational materials
- 2 year intervention



Crocco, TJ, International Stroke Conference, 2011

1. Detection: West Virginia Experience

Community EMS Study Results for 2 Years Plus Long Term Follow-Up After Intervention Cessation



Crocco, TJ, International Stroke Conference, 2011



1. Detection: Early Recognition

- Stroke victims and their families must be taught to activate the EMS system as soon as they detect stroke signs or symptoms.
- The Walmart Stroke
 - Onset 1215-1230
 - Call to EMS: “Immediately” time undocumented family reports 1230



2. Dispatch: *Early EMS Activation and Dispatch*

- “First, First Responders” Jeffrey Clawson
- EMS dispatchers must appropriately recognize and prioritize the call to ensure a rapid response within the EMS system.

Emergency Medical Dispatchers: Assigning Dispatch Urgency

- Porteous et al, 1999
 - Of cases in which patients used the word “stroke” during the 911 call, 48% classified as “CVA”
 - Of cases classified as “CVA”, 31% dispatched as code 3 (high priority)
- Mosley et al, 2007
 - 100% of those identified as stroke dispatched as “lights & sirens”
 - Cases dispatched “lights & sirens” had a significantly faster response time than those dispatched nonurgently (median 11 min versus 24 min).
- Rosamond et al, 2005
 - 31% of stroke/TIA cases were identified as stroke by EMD
 - 79% of calls dispatched as high priority



2. Dispatch: *Early EMS Activation and Dispatch*

- Procedure
 - Do we use one? Do you use one? Do we know?
- MPDS
 - Most widely used dispatch system
 - Uses exact language prompts
 - Measurable/reproducible

Abbreviations

Additional Info

Limitations Warning

Stroke Diagnostic Tool

➔ I want you to get close enough to ask her/him three questions.
Tell me when you're ready.

Ready

Ask her/him to smile.

**Answer
Selected****(Wait)** Was the smile equal on both sides of her/his mouth?

- Normal smile
- Slight difference in smile (possible difference)
- Only one side of mouth or face shows a smile (obvious difference)
- Cannot complete request at all

0

Ask her/him to raise both arms above her/his head.

(Wait) What was s/he able to do?

- Both arms raised equally
- One arm higher than other (both raised unequally)
- Only one arm raised
- Cannot complete request at all

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Ask her/him to say, "The early bird catches the worm."

(Wait) Was s/he able to repeat it correctly?**(Clarify)** Was it slurred, garbled, or not understandable?

- Said correctly
- Slurred speech
- Garbled or not understandable speech
- Cannot complete request at all

0

Finished

Close



2. Dispatch: *MPDS protocol use in San Diego*

- EMD recognition vs. Paramedic recognition
 - Discharge Dx by neurologist
 - 882 patients vs. 477 patients
 - EMD used MPDS vs. Paramedics used Cincinnati
 - Sensitivity 83% vs. 44%
 - PPV 42% vs. 40%
- LA experience
 - EMD sensitivity 41% PPV 45%

Ramanujam, 2007

Buck, 2009




2. Dispatch: *Early EMS Activation and Dispatch*

- Data points:
 - Time of Call
 - Protocol
 - Dispatcher
 - Compliance with protocol
 - Dx/sx code used
 - Urgency of dispatch
 - Who was dispatched
 - Time of dispatch to EMS providers



2. Dispatch: *Early EMS Activation and Dispatch*





3. Delivery: *Pre-hospital Transport and Management*

Players: Paramedics/EMT's

Training: Variable

Roles:

- Rapid identification of stroke symptoms
- Rapid transport to Stroke facility
- Pre-arrival notification of Stroke facility

- Data collection?



3. Delivery: *Identifying Stroke Symptoms in the Field*


Screening tools:

- Cincinnati Pre-hospital Stroke Screen
- Los Angeles Pre-hospital Stroke Screen
- Melbourne Ambulance Stroke Screen
- Ontario Pre-hospital Stroke Screen

3. Delivery: *Pre-hospital Transport and Management*

The Cincinnati Pre-hospital Stroke Scale

1. Facial Droop (smiling asymmetry)
2. Arm Drift (hold hands out in front of self at 90 degrees)
3. Speech (repeat a phrase)



3. Delivery: *Pre-hospital Transport and Management*

Other Supportive Measures:

- Intravenous access.
- **Finger stick blood glucose**
- Blood Draw
- EKG monitoring
- **Exact time of onset.** If not known, time Last Known Well/Last Seen Normal (LKW/LSN)
- Medications (bring the bottles if on-hand)
- Next of Kin contact number (preferably Cell phone of spouse/child who can make decisions)

NOTE: **DO NOT DELAY** for this data!!

3. Delivery: *Pre-hospital Transport and Management*

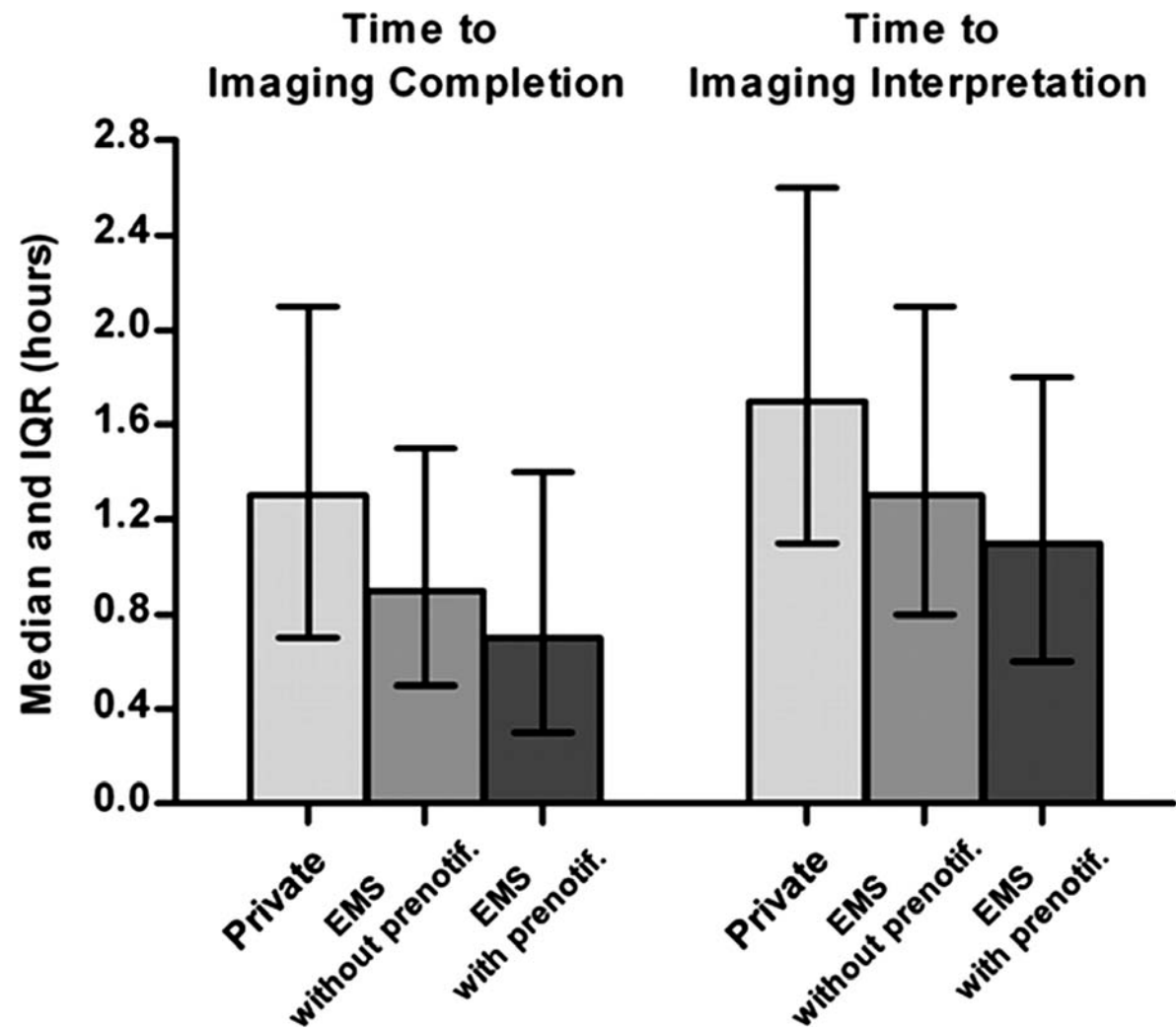
Early Notification:

- Early notification enables personnel to prepare for the imminent arrival of a stroke patient.
- ED preparation
- CT scanner notification
- Neurologist mobilization






Median in-hospital delay times (and interquartile range [IQR]) by arrival mode, North Carolina Stroke Care Collaborative, 2008 to 2009.



Patel M D et al. Stroke 2011;42:2263-2268





3. Delivery: *Pre-hospital Transport and Management*

- What about treatment times?
- Kim, SK *European Journal of Neurology* 2009
- Pre and Post-intervention assessment
 - Pre-notification of incoming stroke patient
 - DTN times
 - % of patients getting thrombolytics
- DTN time 28.9 min vs. 47.7 min
- % getting Tx 6.5% vs. 14.3%

Door to Thrombolytics

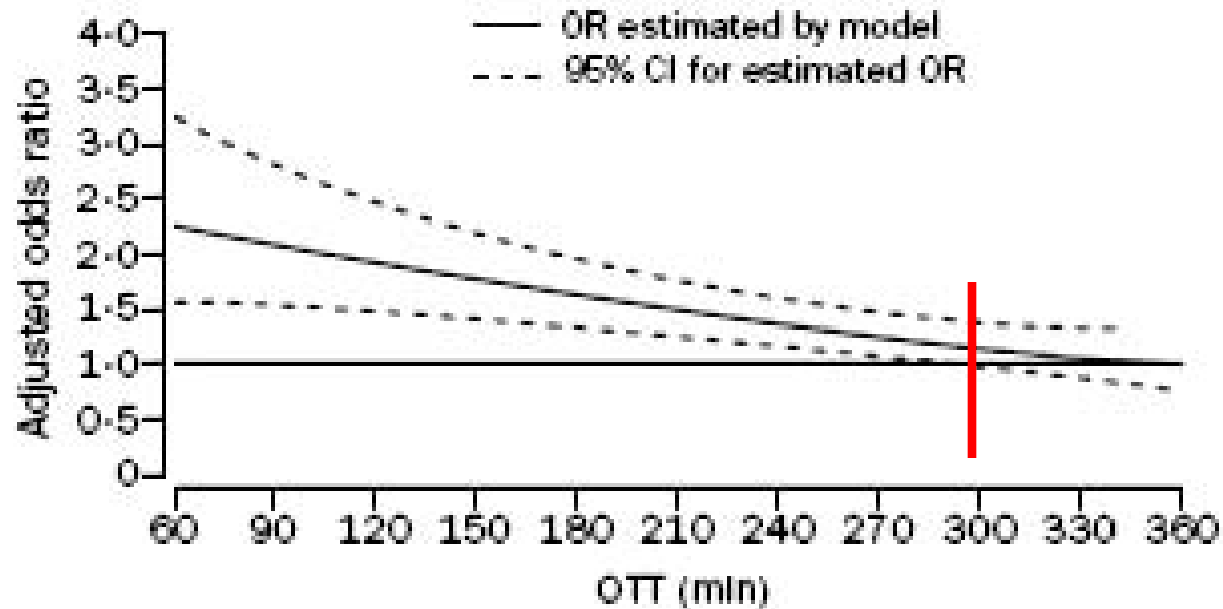



Figure 3: **Model estimating odds ratio for favourable outcome at 3 months in rt-PA-treated patients compared with controls by OTT**

(Lancet 2004; 363: 768–74)

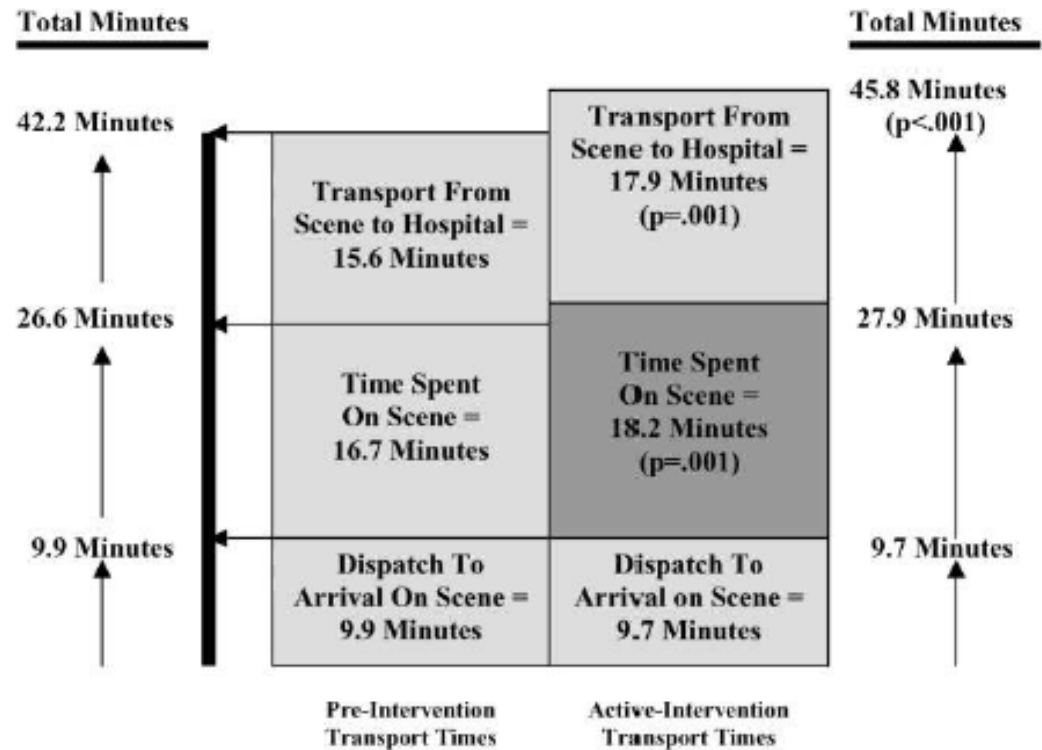


3. Delivery: *Pre-hospital Transport and Management*


- EMS use and “The Golden Hour”
 - 79% of patients arriving in GH are by EMS
 - 55% in 121-180 minute window
 - EMS arrival in the GH correlates with increased TPA usage

3. Delivery: *Pre-hospital Transport and Management*

- EMD/EMS protocol for stroke patients
- HoPSTO study
- System-wide education campaign
 - Community
 - EMS
 - Hospitals
 - Implemented LAPSS
- BUT...What did it do overall?



Poisson, S ISC 2011



3. Delivery: *Pre-hospital Transport and Management*

- The Walmart Stroke
- Onset time: 1215-1230
- Call time: undocumented, ~ 1230
- Dispatch time: 1233
- Dispatch Code: 028 = Stroke
- Dispatch Urgency: Code 3
-
- En route: 1240
- Arrive at scene: 1243
- Leave Scene 1250
- Delivery: 1302
- To Hospital Urgency: Code 3
- Contacted Hospital: In Transit (10 minute notice)

What is the Future of Pre-Hospital Data in Stroke Care

1. Getting what the Trauma girl has

Stroke Regionalization

Destination determined by matching level of need and facility abilities



Transport Protocol

- Current transport protocol

- ❑ Transport to a Stroke Receiving Facility (American Fork Hospital, IMC, Mountain View Hospital, Riverton, Timpanogos Hospital or Utah Valley Regional Medical Center) if they will arrive at the facility in less than 120 minutes from the confirmed onset of the stroke like symptoms.
- ❑ Transport to the Primary Stroke Center for Utah County (IMC or Utah Valley Regional Medical Center) if they would arrive at a stroke-receiving center later than 120 minutes from the confirmed onset of the stroke like symptoms.
- ❑ If you are unable to confirm the time of onset of the stroke like symptoms or they started more than 12 hours prior to transport then transport to the closest appropriate facility or to the facility of the patient's choice.

- Stroke Receiving Facilities

- American Fork
- Timpanogos Regional
- Utah Valley Regional
- Mountain View

- Primary Stroke Center

- Utah Valley Regional

EMS Triage of Stroke Patients

Current Model

- EMS → SRF
- SRF → Treat/Transfer
or Transfer PSC
- PSC treats/manages
- What about the patient who can't be treated at SRF?

Future Model?

- EMS → Triage Stroke patients
- EMS → determines facility based on criteria
- If meets criteria → PSC
- PSC treats/manages
- Criteria:
 - Exlcusion for IV TPA
 - Severity

NIHSS – Plain English

User-friendly
Modified wording

1a. Level of Consciousness (Alert, drowsy, etc.)	0 = Alert 1 = Drowsy
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NIH Stroke Scale <i>in plain English</i>		NIH Stroke Scale	
3. Visual Fields (Both eyes open, count 1/2/5 fingers/detect movement, 4 visual fields)	0=Normal visual fields 1=Blind upper <u>or</u> lower field one side. 2=Blind upper <u>&</u> lower field one side. 3=Blind in both eyes/4 fields	3. Visual Fields (Introduce visual stimulus/threat to pt's visual field quadrants)	0 = No visual loss 1 = Partial Hemianopia 2 = Complete Hemianopia 3 = Bilateral Hemianopia (blind)

7 <u>Coordination</u> (Finger-to-nose, heel-to-shin) Score <u>only</u> if not caused by weakness.	0=Normal or no movement 1=Clumsy in one limb 2=Clumsy in two limbs	7 <u>Limb Ataxia</u> (Finger-nose, heel down shin)	0 = No ataxia 1 = Present in one limb 2 = Present in two limbs
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5b. Arm Weakness— Right
(Pt. holds arm at 90° if sitting, 45° if supine for 10 sec.)

1= Drifts down
2= Drifts down
3= Can move
4= No movement

6b. Leg Weakness— Rt
(Pt. holds leg straight out if sitting, 30° if supine) 5 sec.

1=Drifts down, does not hit bed
2= Drifts down to hit bed
3= Can move but can't lift
4= No movement

NIHSS - PE

Pt # (Expert score)		Pt 1 (5)		Pt 3 (7)		Pt 5 (12)		Overall		
	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Sig
NIHSS-T	31	3.0	1.7	2.6	2.3	3.0	2.9	2.9	2.3	0.176
NIHSS-PE-T	31	2.7	1.4	1.6	2.1	3.6	2.6	2.6	2.2	
NIHSS-U	30	3.1	3.2	4.4	3.1	4.4	2.1	4.0	2.9	
NIHSS-PE-U	30	2.0	1.1	2.5	1.8	4.7	2.8	3.0	2.0	

- Untrained NIHSS – PE users performed similar to Trained NIHSS users.

NIHSS – Plain English

Reliability	NIHSS	NIHSS-PE
Omega Heise & Bohrnstedt	0.964	0.974
Alpha Cronbach	0.854	0.849

Validity	NIHSS	NIHSS-PE
Concurrent Validity (Total Score Correlation of NIHSS-PE to NIHSS)	-----	0.977
Heise & Bohrnstedt Validity (Correlation with 1 st factor)	0.979	0.977

Future Stroke Transport Protocol?

- Stroke Screen (Cincinnati) - If positive, then:
- Grab and Go – Code 3
- Triage
 - Hx/Timing
 - Severity
- Re-direct to higher level of care if indicated
- Collect/report data
- Receive feedback
- Change practice as dictated by data

2. Utah State Stroke Registry



North Carolina Model

- Data Collection
 - Polaris
 - Local monitoring
 - Provider Feedback
- Stroke Education
 - Dispatch level
 - EMS level

Personnel ID	Patients	Stroke Screen	Glucose Level	Thrombolytic Screen	Scene Time of <10 minutes	Documentation of Symptom Onset	Cardiac Rhythm
PXXXXXX	3	3 (100%)	3 (100%)	1 (33%)	2 (67%)	3 (100%)	3 (100%)
PXXXXXX	5	5 (100%)	4 (80%)	3 (60%)	2 (40%)	5 (100%)	5 (100%)
PXXXXXX	1	1	1	1	0	1	1
EMS System Average	134	129 (96%)	97 (72%)	59 (44%)	40 (30%)	134 (100%)	129 (96%)
State Average	5198	4836 (93%)	4521 (87%)	214 (4%)	1985 (38%)	2850 (55%)	3399 (65%)

Brice, ISC 2011

Silos of Data



In the Field

- Onset time
- Call time
- Dispatch time
- Compliance
- Dispatcher
- On scene time
- En route time
- Pre notification
- Glucose
- Stroke Screen
- Onset documented
- NIHSS-PE completed
- Agency name
- Hospital



In Hospital

- Door to page
- Door to doc
- NIHSS
- Door to CT
- Door to decision
- Door to needle
- Inpatient metrics
- Discharge metrics
- Follow-up scheduled



At Home

- Follow-up compliance
- Medication compliance
- Lifestyle compliance
- Re-hospitalization
- ED visits
- Recurrent stroke
- 90 day mRS

General Population
(Detection)

EMS System
(Dispatch, Delivery)

Hospitals
(Door, Data, Decision, Drug)

General Population
(Detection)

EMS System
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Future Directions

- Establish protocols for EMD and EMS
- Measure compliance with protocols
- Connect data from the care continuum
- Connect patient outcomes with continuum data
- Use Data to Regionalize Stroke Care



The Walmart Stroke

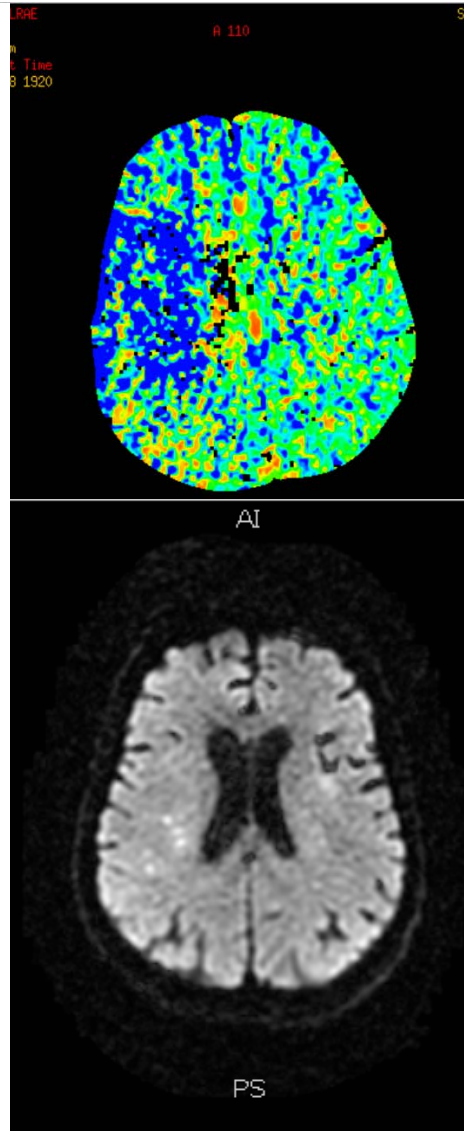
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Hospital Data

- Door to Page: PTA
- Door to Doc: <1 min
- Door to CT: 11 min.
- Door to NIHSS: 5 min. (7)
- Door to Needle: 24 min.
- Hospital metrics: 100% compliant
- Discharge metrics: 100% compliant

The Walmart Stroke



Discharge Disposition:
Home

Summary

- Pre-hospital data is essential in effective stroke care
 - Recognition
 - Urgent transport
 - Pre-notification
- Improved care is enhanced by accurate data
- Sharing of data in the future is imperative

Questions?

