Community Education in Stroke

9/27/18

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Disclosures

- NINDS StrokeNet RCC PI (U24-NS107233)
- AHRQ E-SPEED PI (R18-HS025359)
- PCORI CEERIAS PI (AD-1310-07237)
Outline

• Background
• Barriers to stroke preparedness
• Prior community interventions
• CEERIAS study
• Future directions
Acute Stroke Treatments

**tPA**

1. Blood clot formation
2. tPA injected intravenously
3. Blood clots dissolving
4. Restored blood flow

**Thrombectomy**

- Left MCA occlusion
- Cerebral angiogram before (left) and after (right) mechanical thrombectomy of a proximal artery occlusion in the left MCA
- Mechanical thrombectomy devices
  - Coil retriever
  - Aspiration device
  - Stent retriever
  - Access through femoral artery
Potent Effects on Outcomes

20% absolute benefit (NNT 5)
Under-utilization Nationwide

- tPA = Tissue Plasminogen Activator
- ERT = Endovascular Recanalization Therapy

Schwamm LS Stroke 2014; Menon B Stroke 2015; Smith EE CQCO 2018

Change in EVT Over Time
At EVT-Capable Hospitals

% Potentially Eligible* Treated

Publication of Pivotal RCTs
P<0.001 for change in slopes

*Defined as Last Known Well to ED arrival ≤4.5 hrs and NIHSS ≥6

Calendar Year and Quarter
Time Dependence

Impact of Optimized Stroke Care

- Improved access and efficiency of patient care
  - Increased use of acute stroke therapies
- Fewer peri-stroke complications
- Reduced morbidity and mortality
- Improved long-term outcomes
- Reduced health care costs
Barriers to Acute Stroke Delivery

• **Community**
  - Delayed recognition of stroke symptoms
  - Reluctance to call EMS

• **Prehospital**
  - Geographic access to stroke centers
  - Screening errors

• **Hospital**
  - Process errors and delays
  - Resource limitations

• **Patient**
  - Refusal and contraindications
  - Vascular access
Improving Access: Stroke Centers

- **Comprehensive Stroke Center**
  - Academic medical center;
  - Tertiary care facility; EVT; NICU; neurosurgery

- **Primary Stroke Center**
  - Wide range of hospitals;
  - standard stroke care; stroke unit;
  - use TPA

- **Acute Stroke Ready Hospital**
  - Rural hospitals; basic care;
  - drip and ship;
  - use tele-technologies
Access to Stroke Centers in US

Song S. Stroke 2012

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# Reducing Hospital Delays

<table>
<thead>
<tr>
<th>Study Period</th>
<th>Preintervention (n = 27,319)</th>
<th>Postintervention (n = 43,850)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPA DTN time, median (IQR), min</td>
<td>77 (60-98)</td>
<td>67 (51-87)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>tPA DTN time ≤ 60 min, % (95% CI)</td>
<td>26.5 (26.0-27.1)</td>
<td>41.3 (40.8-41.7)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>End of each period</td>
<td>29.6 (27.8-31.5)</td>
<td>53.3 (51.5-55.2)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Improvement in tPA DTN time ≤ 60 min, % per year (95% CI)</td>
<td>1.36 (1.04-1.67)</td>
<td>6.20 (5.58-6.78)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>In-hospital all-cause mortality, %</td>
<td>9.93</td>
<td>8.25</td>
<td>0.89 (0.83-0.94)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Discharge to home, %</td>
<td>37.6</td>
<td>42.7</td>
<td>1.14 (1.09-1.19)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Independent ambulatory status, %</td>
<td>42.2</td>
<td>45.4</td>
<td>1.03 (0.97-1.10)</td>
<td>.31</td>
</tr>
<tr>
<td>Symptomatic intracranial hemorrhage within 36 h, %</td>
<td>5.68</td>
<td>4.68</td>
<td>0.83 (0.76-0.91)</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

*Note: All values are shown as median (IQR) or percentage (95% CI), with statistical significance indicated by P values.*

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Fonarow G JAMA 2014
Barriers to Acute Stroke Delivery

- Received tPA: 4%
- Viable exclusion: 12%
- Hospital failure: 7%
- Overnight stroke: 8%
- Patient delay: 69%

Douglas VC. Neurology 2005
Stroke Chain of Survival

- Community
  - Detection
  - Dispatch
  - Delivery
  - Door
  - Data
  - Decision
  - Drug
  - Disposition

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Outline

• Background
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• Future directions
90% of 9-1-1 activations for stroke are made by bystanders.

60% of stroke patients arrive by EMS.

Less among minorities, men.
• Pre-requisites to calling 911
  ➢ Knowledge
  ➢ Attitudes/perceptions of risks/benefits
  ➢ Social and cultural norms
  ➢ Mistrust of healthcare
  ➢ Self-efficacy

➢ Prior studies have largely failed to translate knowledge into behavior
Stroke Knowledge

• Knowledge of risk factors, warning signs, and treatments lower among minorities
  ➢ Literacy, education, language
  ➢ Not improving or minimally improving over time
  ➢ Despite public education campaigns

Table 3. Comparison of Knowledge of Stroke Warning Signs and Risk Factors Between Survey Years, Greater Cincinnati/Northern Kentucky Population

<table>
<thead>
<tr>
<th>No. of correct risk factors known</th>
<th>1995 (N=1880)</th>
<th>2000 (N=2173)</th>
<th>2005 (N=2156)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>606 (32.2%)</td>
<td>620 (28.5%)</td>
<td>624 (28.9%)</td>
</tr>
<tr>
<td>1</td>
<td>827 (44.0%)</td>
<td>899 (41.4%)</td>
<td>829 (38.4%)</td>
</tr>
<tr>
<td>2</td>
<td>398 (21.2%)</td>
<td>571 (26.3%)</td>
<td>600 (27.8%)</td>
</tr>
<tr>
<td>3</td>
<td>49 (2.6%)</td>
<td>83 (3.8%)</td>
<td>103 (4.8%)</td>
</tr>
</tbody>
</table>

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<tr>
<th>No. of correct warning signs known</th>
<th>1995 (N=1880)</th>
<th>2000 (N=2173)</th>
<th>2005 (N=2156)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>845 (45.0%)</td>
<td>689 (31.7%)</td>
<td>689 (32.0%)</td>
</tr>
<tr>
<td>1</td>
<td>612 (32.6%)</td>
<td>606 (27.9%)</td>
<td>575 (26.7%)</td>
</tr>
<tr>
<td>2</td>
<td>321 (17.1%)</td>
<td>618 (28.4%)</td>
<td>553 (25.6%)</td>
</tr>
<tr>
<td>3</td>
<td>102 (5.4%)</td>
<td>260 (12.0%)</td>
<td>339 (15.7%)</td>
</tr>
</tbody>
</table>

Kleindorfer 2009
Other Barriers

- **Low perceived risk**
  - “I have things under control and am not at risk”
- **Low perceived severity**
  - “it will go away or get better”
  - “it’s not that bad to go to the hospital”
- **Socio-cultural factors**
  - Mistrust of healthcare
  - Fatalism/acceptance
  - Belief in alternative treatments
  - Costs/financial burdens
- **Low self-efficacy**
  - “there is nothing I can do about it”
  - “I need to check with someone else first”
Barriers to Calling 9-1-1

- Rather Go with Family/Friend
- No Perceived Benefit
- Fear of Police
- Fear of Being Taken to Wrong Hospital
- Financial Reasons
- Fear of Being Wrong

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Mass Media

• **Mass media campaigns**
  - FAST mnemonic most commonly used
  - National, regional, and local initiatives around the globe
  - Some were purely public but others mixed professional (paramedics, doctors, nurses) and public education
  - **Modest temporary effects in knowledge** increase and some showed increase in ED presentations
  - **Difficult to sustain** due to costs, competing health priorities
  - Not tailored to subgroups
  - Does not address other barriers

Mellon 2015; LeCouturier 2010
• Quasi-experimental pre-post studies
  ➢ ASPIRE study in Baltimore-Washington DC
  ➢ Community and professional intervention provided including pre-hospital routing changes
  ➢ 531 community interventions, reaching >10,256 participants; 3,289 intervention evaluations were performed, and 19,000 preparedness bracelets and 14,000 stroke warning magnets were distributed
  ➢ A doubling of patients arriving < 3 hours noted and increase in tPA use in the post-intervention period
Controlled Studies

- Controlled pre-post studies
  - Temple TLL Project in East Texas
  - Community and professional education
  - An intervention and control community
  - Mixed intervention: personal, media

Morgenstern 2002

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• 1 community RCT

- Berlin, Germany
- Intervention included a personalized letter, bookmark, and sticker describing stroke warning signs and appropriate help-seeking behaviors

Muller-Nordhorn 2009

**RCT**

**Men**

**Women**

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## CBPR

### Community-based interventions

<table>
<thead>
<tr>
<th>Method of Peer Leader Delivery</th>
<th>Workshop 1</th>
<th>Workshop 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>Recognize that stroke is an emergency and treatable</td>
<td>Recognize that stroke is an emergency and treatable</td>
</tr>
</tbody>
</table>
| **Read**                      | Stroke is common in Flint  
For tPA, the faster you call 911 the better  
Overcoming barriers to calling 911  
Coping with stress  
Review: calling 911 |
| **Audio**                     | What is a stroke  
Stroke is common among African Americans  
African Americans have greater post-stroke disability  
Stroke is treatable: tPA is a clot-buster medicine  
Call 911 to get help | What to expect when you call 911  
Waiting for help to arrive  
Navigating the Emergency Department  
Stroke risk factors  
Stroke prevention: hypertension |
| **Interactive activities**    | Think F.A.S.T.  
tPA Activity  
Workshop review: discussion | What to expect when you call 911: Discussion  
Stroke role play  
Workshop review: discussion |
| **Video media**               | Stroke Clips: F.A.S.T.  
Signs of Stroke Music Video | Signs of Stroke Music Video |

`tPA` indicates tissue plasminogen activator.
Youth-based community interventions

- Use music (Hip-Hop Stroke), cartoons/anime (Manga), and other culturally tailored messaging
- Targeting 4th-9th graders (9-14 years old)
- Increased knowledge in youth and parents but usually waned with time
- Still only assessed behavioral intent in pre-post surveys and not actual outcomes (EMS use, ED arrival times)
- Plans for cluster randomized trials underway to assess behavioral/clinical outcomes
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CEERIAS Study

Goal to increase EMS use by engaging in community-based networks and implementing a social contract with residents ("make a pledge")
Plan with your family:
Agree today to call 911 when stroke signs occur even if the patient objects at the time: Make a Pact to Act FAST
Pact to Act FAST

• Planning for stroke emergency like one does for fire emergencies
• Teach basic message (FAST) but also engage in personal discussions (using real-life data and stories)
• Utilize trusted community networks in Chicago
  ➢ Churches
  ➢ Schools
  ➢ Community centers
• Trained as “stroke promoters”
• Get residents to “pledge” in front of family, neighbors, coworkers
Community Engagement

Over 80 community partners in CEERIAS

Chicago Hispanic Health Coalition

American Heart Association
American Stroke Association

Holy Cross Hospital

Advocate Trinity Hospital

Center for Faith and Community Health Transformation

ASAFE HAVEN

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SSEEEO
Stroke Survivors EMPOWERING Each Other
Promoter Training
Intervention Implementation

- Trained 242 “stroke promoters” from community organizations
- Distributed >110,000 Pact to Act FAST Cards and other FAST materials (magnets, wallet cards)
- Received >38,000 Pacts to Act FAST from Southside Chicago residents over 1 year

Figure A. Stroke admission rate
Figure B. Percent of Pacts completed by ZIP code
Time series: a sequence of data points being recorded at specific times.

Example of time series data: monthly EMS arrival rate over a 60-month period.

Interrupted time series (ITS) is a special type of time series where an intervention occurred at a specific point and the series is broken up by the introduction of the intervention.

Interrupted time series analysis is used to evaluate the longitudinal effects of an intervention at a population level.

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**Interrupted Time Series**

![Graph showing interrupted time series with pre-intervention, intervention, and post-intervention phases, along with expected values (no intervention) and changes in level and slope.](image-url)
Outcomes

• Behavioral change
  ➢ % AIS patients arriving < 3 hours
  ➢ % AIS patients arriving by EMS
  ➢ Comparison between target community and control communities in Chicago and St. Louis

• GIS analysis of EMS calls
  ➢ EMS calls overall pre- and post-CEERIAS
  ➢ EMS calls with suspected stroke pre- and post
  ➢ Geospatial weighted regression (GWR) adjusting for age, race-ethnicity, risk factors, neighborhood SES, insurance, and crime
### Results: Early Arrival

**ITS regression model for early arrival at the intervention hospital and comparison to north side hospitals and St. Louis hospitals**

<table>
<thead>
<tr>
<th></th>
<th>Intervention Hospital</th>
<th>Comparison with north side Chicago hospitals</th>
<th>Comparison with Saint Louis hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Arrival (&lt;3 hours)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>β±SE</strong></td>
<td>0.29±0.030</td>
<td>-0.15±0.030</td>
<td>0.03±0.03</td>
</tr>
<tr>
<td><strong>P-value</strong></td>
<td>&lt;.0001</td>
<td>0.0003</td>
<td>0.309</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>-0.002±0.001</td>
<td>0.005±0.005</td>
<td>-0.003±0.001</td>
</tr>
<tr>
<td><strong>P-value</strong></td>
<td>0.230</td>
<td>0.016</td>
<td>0.057</td>
</tr>
<tr>
<td><strong>Level change</strong></td>
<td>-0.001±0.052</td>
<td>-0.04±0.068</td>
<td>0.03±0.05</td>
</tr>
<tr>
<td><strong>P-value</strong></td>
<td>0.982</td>
<td>0.531</td>
<td>0.517</td>
</tr>
<tr>
<td><strong>Slope change</strong></td>
<td>0.005±0.003</td>
<td>-0.003±0.005</td>
<td>0.007±0.004</td>
</tr>
<tr>
<td><strong>P-value</strong></td>
<td>0.124</td>
<td>0.560</td>
<td>0.072</td>
</tr>
</tbody>
</table>

Note: Intervention hospital (black line); north side Chicago hospitals (gray line), Saint Louis hospitals (red line)
## Results: Early Arrival

Subgroup analysis for early arrival at the intervention hospital by age, gender, and race

<table>
<thead>
<tr>
<th>Early Arrival (&lt;3 hours)</th>
<th>β±SE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;66 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level change</td>
<td>0.05±0.06</td>
<td>0.455</td>
</tr>
<tr>
<td>Slope change</td>
<td>0.008±0.004</td>
<td>0.036</td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level change</td>
<td>-0.006±0.08</td>
<td>0.943</td>
</tr>
<tr>
<td>Slope change</td>
<td>0.01±0.005</td>
<td>0.028</td>
</tr>
<tr>
<td>African-Americans</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level change</td>
<td>-0.06±0.06</td>
<td>0.319</td>
</tr>
<tr>
<td>Slope change</td>
<td>0.009±0.004</td>
<td>0.037</td>
</tr>
</tbody>
</table>

~1%/month increase in early arrival in these subgroups
## Results: EMS use

<table>
<thead>
<tr>
<th>ITS regression model for EMS arrival at the intervention hospital and comparison to north side hospitals and St. Louis hospitals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention Hospital</td>
</tr>
<tr>
<td>EMS Arrival</td>
</tr>
<tr>
<td>Intercept</td>
</tr>
<tr>
<td>Time</td>
</tr>
<tr>
<td>Level change</td>
</tr>
<tr>
<td>Slope change</td>
</tr>
</tbody>
</table>

No effect on EMS use for confirmed stroke
Results: GIS

Pre-CEERIAS (1/1/14-2/16/15)

Post-CEERIAS (4/1/16-4/14/17)

Cold Spot - 99% Confidence
Cold Spot - 95% Confidence
Cold Spot - 90% Confidence
Not Significant
Hot Spot - 90% Confidence
Hot Spot - 95% Confidence
Hot Spot - 99% Confidence

All EMS calls

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Results: GIS

Pre-CEERIAS
(1/1/14-2/16/15)

Post-CEERIAS
(4/1/16-4/14/17)

Paramedic suspected stroke calls

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Outline

• Background
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Priorities

- Community engagement to tailor message
- Sustainability plans should be adopted
  - Schools, churches, community organizations
  - Hospitals
  - Social media
- Fidelity and reproducibility are critical
- Controlled studies are needed
  - Cluster randomized RCTs are gold standard
- Outcomes need to be actual behaviors
  - EMS use for confirmed stroke may miss false positives wherein the intended behavior occurred
- Policy level interventions
  - Cost of ambulance remains an issue in some areas
Thank You!