State of the State Stroke Response and Care in North Carolina

January 9, 2017

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Introduction

- In late 2014 and early 2015, several clinical trials studying catheter-based stroke treatments revolutionized the way advanced stroke centers treat certain stroke patients who present acutely with moderate-to-severe stroke
- For stroke physicians, it has become clear that the current systems of care in place need to be re-imagined and re-engineered in order for all North Carolinians to have access to these new treatments
- The Stroke Advisory Council, with the support of the JWTF, is poised to lead efforts to develop new the systems of stroke care needed in the state

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Background

1. A brief overview of stroke and acute stroke care (pre-2015)
2. Stroke systems of Care
   - Development of stroke systems of care in NC
3. New treatment for certain ischemic strokes
4. New systems of care are needed
5. Current barriers
6. Stroke Advisory Council priorities

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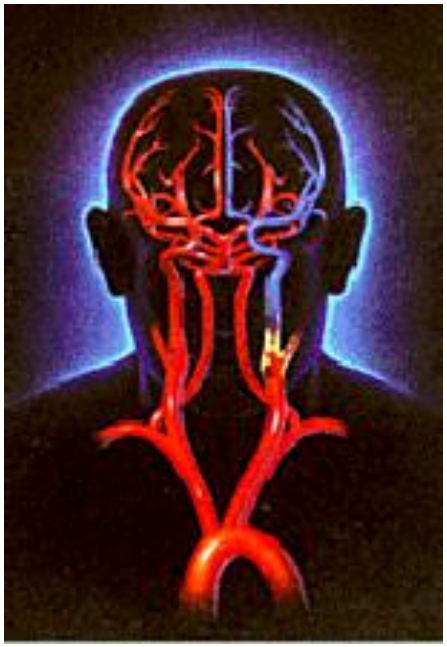
What is a STROKE?



Definition:

A *stroke* is an illness of sudden onset causing *injury to the brain* that results from occlusion or rupture of a blood vessel that supplies a specific region of the brain

- Ischemic Strokes
  - blood vessel occlusion
- Hemorrhagic Strokes
  - blood vessel rupture

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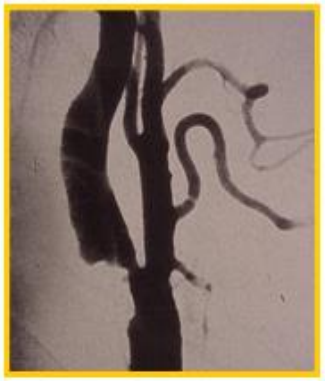
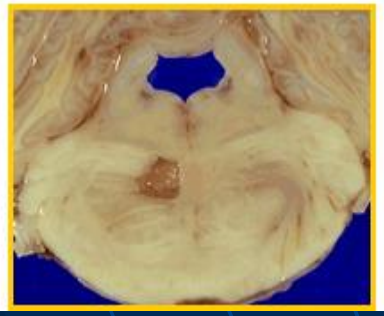
STROKE SUBTYPES

Ischemic Stroke (83%)

Atherothrombotic Cerebrovascular Disease (20%)



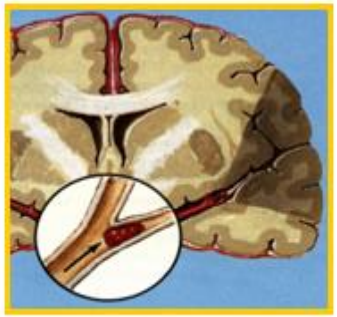
Lacunar (25%) Small vessel disease



Cryptogenic (30%)

?

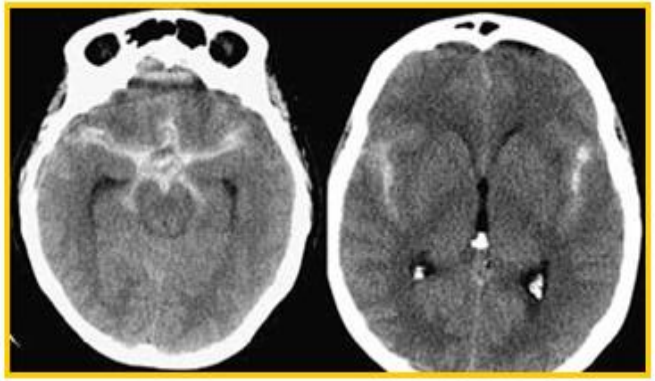
Embolism (20%)



Hemorrhagic Stroke (17%)

Intracerebral Hemorrhage (59%)

Subarachnoid Hemorrhage (41%)

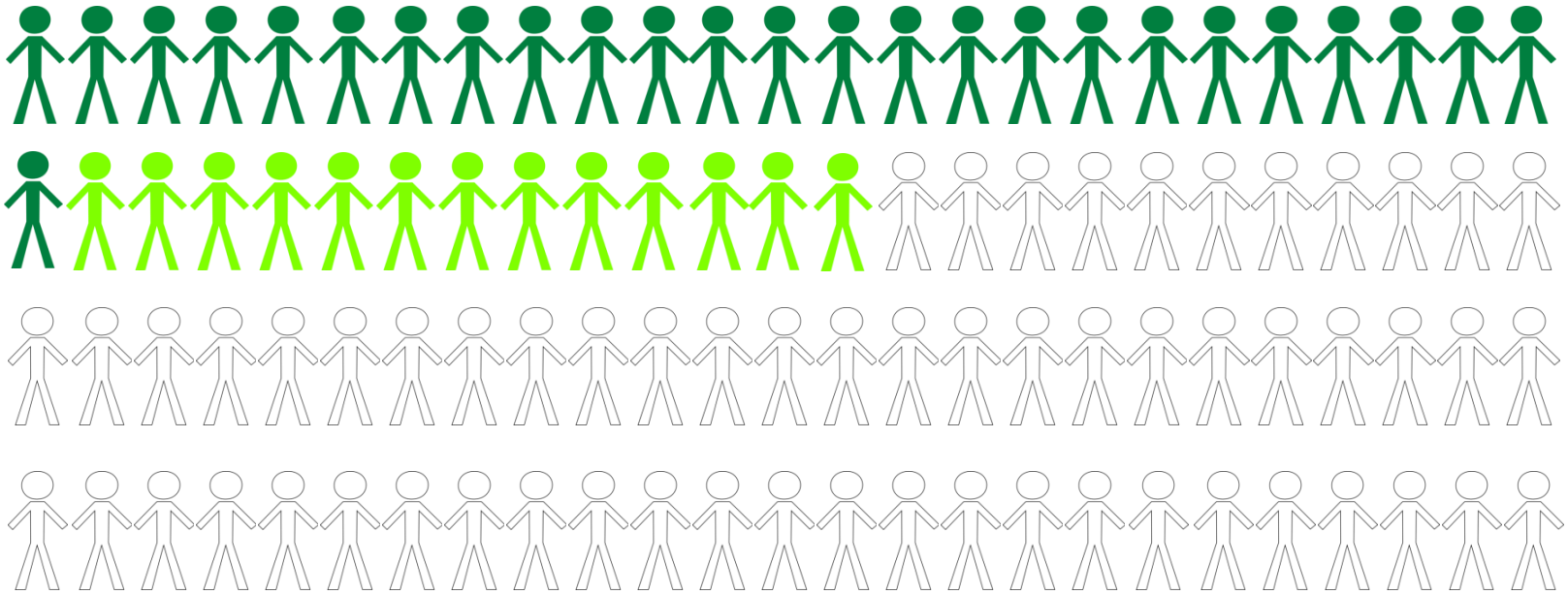


Albers GW et al. *Chest*. 1998;114:683S-698S.
Rosamond WD et al. *Stroke*. 1999;30:736-743.

Treatments Vary by Stroke Type

- Ischemic: open up the vessel
  - Treatment window: from minutes to a few hours from onset
  - Initial treatment can be started at most hospitals
  - Advanced treatments only performed at specialized hospitals
- Subarachnoid hemorrhage: find and repair the aneurysm
  - Treatment window:
  - Hours to days from onset
  - Reserved for specialized hospitals
- Intracerebral Hemorrhage: generally supportive care, sometimes clot evacuation (rare and risky)
  - Most smaller hospitals uncomfortable caring for these patients

The treatment standard: IV alteplase within 3 hours of ischemic stroke onset



- Without alteplase treatment, you have a 26% chance of excellent recovery (functioning at your pre-stroke level of function) in 3 months.

Benefits:

- With alteplase treatment, you have a higher (39%) chance of excellent recovery in 3 months. In other words, 13 additional people will have excellent recovery for every 100 patients treated with alteplase, compared to patients not treated with alteplase.
- This means that you are at least 30% more likely to have an excellent recovery within 3 months with alteplase compared to no alteplase.

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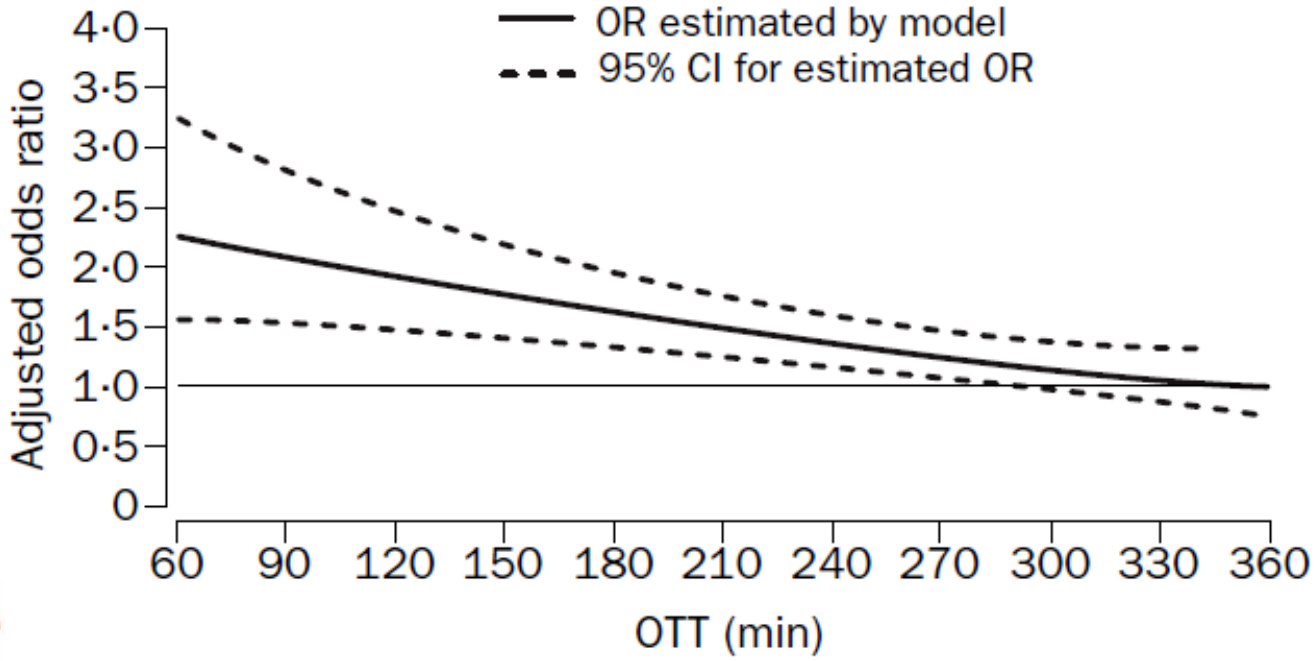
Statistics derived from: National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. N Engl J Med 1995;333:1581-1587.

IV alteplase: “the sooner, the better”

The odds ratio for favorable outcome at 3 months in patients treated with alteplase decreases as a function of the interval between stroke onset and onset of the treatment (OTT)



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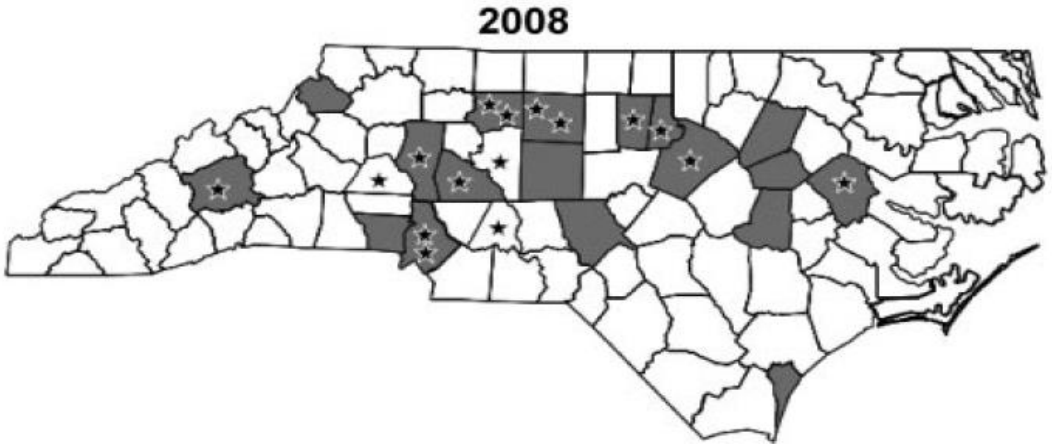
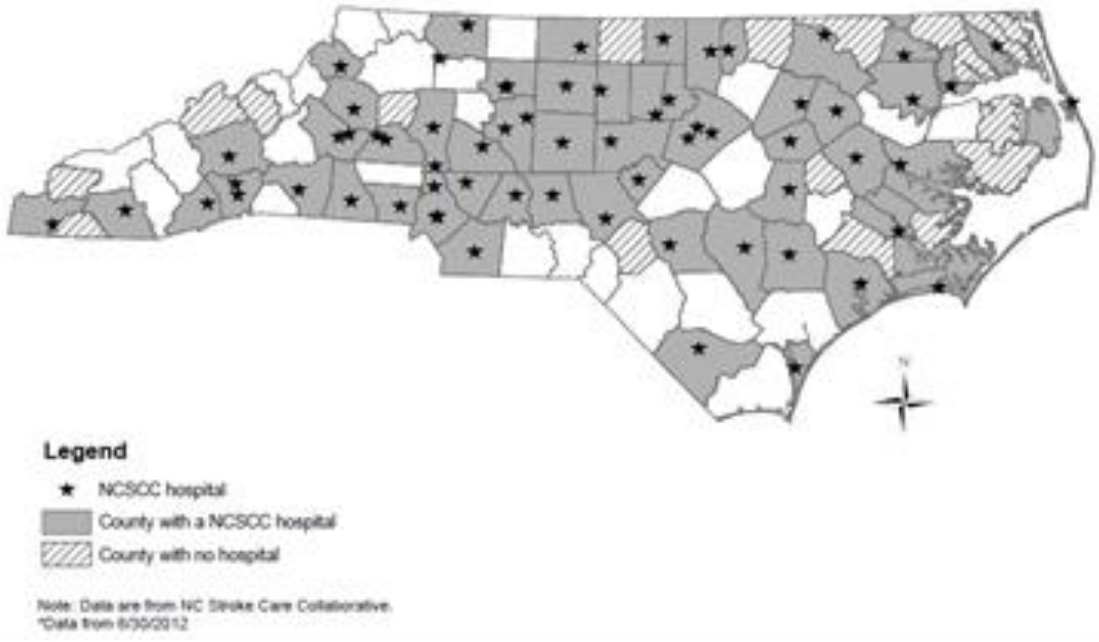
Source: Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. Lancet. 2004; 363(9411):768-74

"Basic" stroke treatment hospitals 2008



Stroke. 2010;41:778-783

NC Stroke Care Collaborative hospitals 2012



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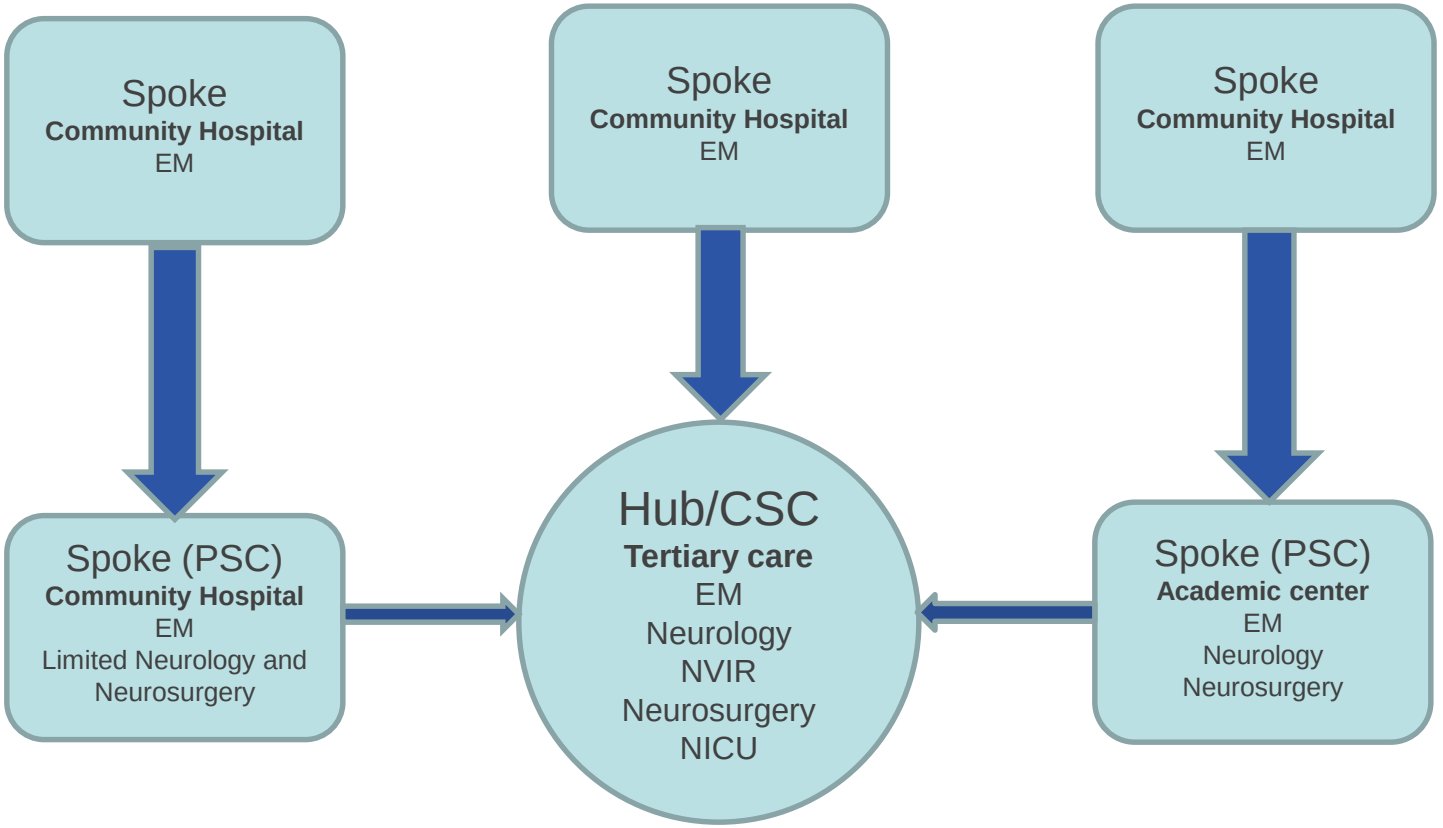
Stroke Systems: Hubs and Spokes



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The AHA/Joint Commission Stroke Certification Program

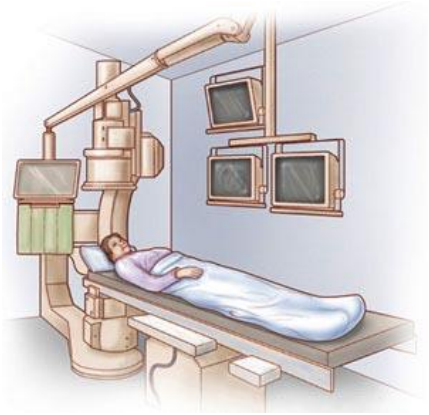
Acute 'Stroke Ready' Hospital (ASRH)	Primary Stroke Center (PSC)	Comprehensive Stroke Center (CSC)
• Basic Care • Telestroke • Diagnosis of stroke, administration of alteplase, protocols for transfer • Smaller, rural hospitals	• Standardized stroke care • Stroke Unit, use alteplase • 1000+ PSCs Nationwide	• Additional technology and resources to care for complex stroke patients (large ischemic strokes, ICH, SAH) and interventions associated • Includes additional, more rigorous standards; all of the Primary Stroke Center Certification Standards still apply • Approx. 100 CSCs Nationwide
(Still in early implementation)	**Approximately 30 in NC**	**4 in NC**
	• Stroke Unit, no NSICU requirement • MRI, MRA, CTA • Neurosurgery available within 2 hours • No endovascular required • No volume requirements • No research requirement	• Stroke unit and NSICU • MRI, CTA, MRA, angiography available 24/7 • Neurosurgery 24/7 • Endovascular 24/7 • Specific volume requirements • Research requirement

Endovascular Stroke Treatment Strategies

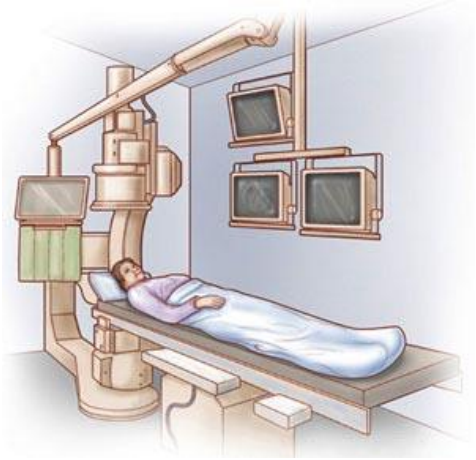
Combination Therapy:

IV + IA

followed by



IA Therapy Alone



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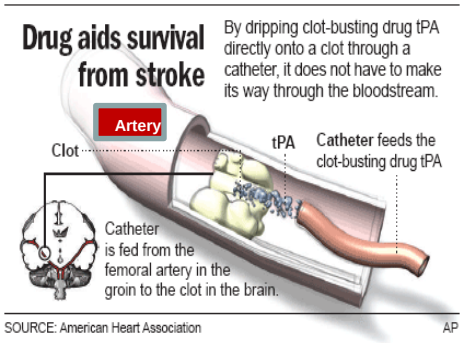
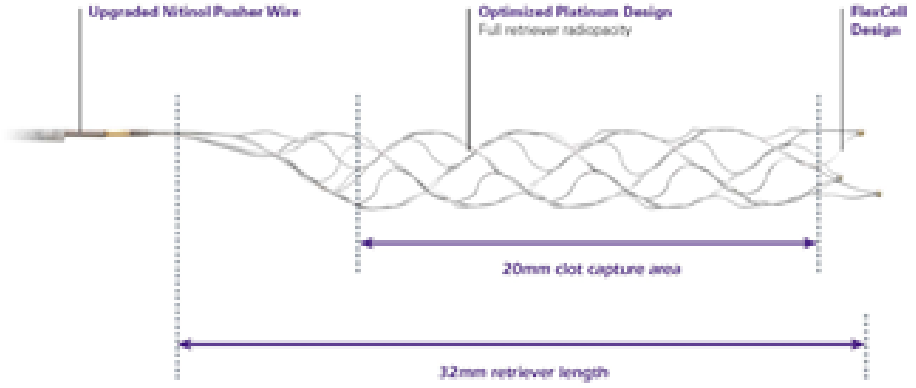
Endovascular Stroke Treatments

- IA alteplase



- Penumbra System

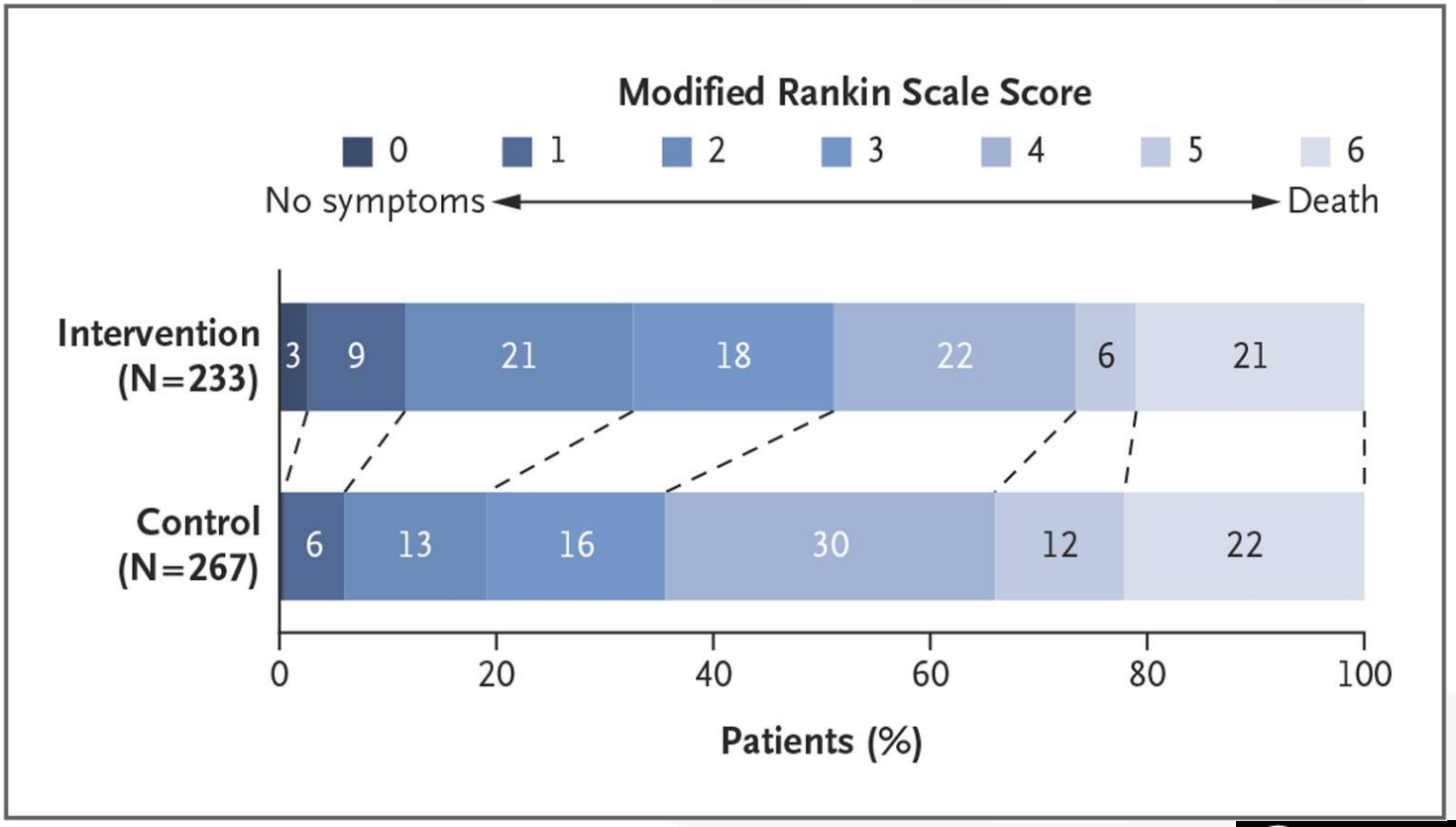
- "Stentrievers"
  - Solitaire
  - Trevo



Trevo® XP ProVue Retriever 4x20mm Specifications
Image courtesy of Stryker Neurovascular

MR CLEAN: Modified Rankin Scale Scores at 90 Days

- Endovascular treatment vs. best medical management
- Endovascular treatment initiated within 6 hours

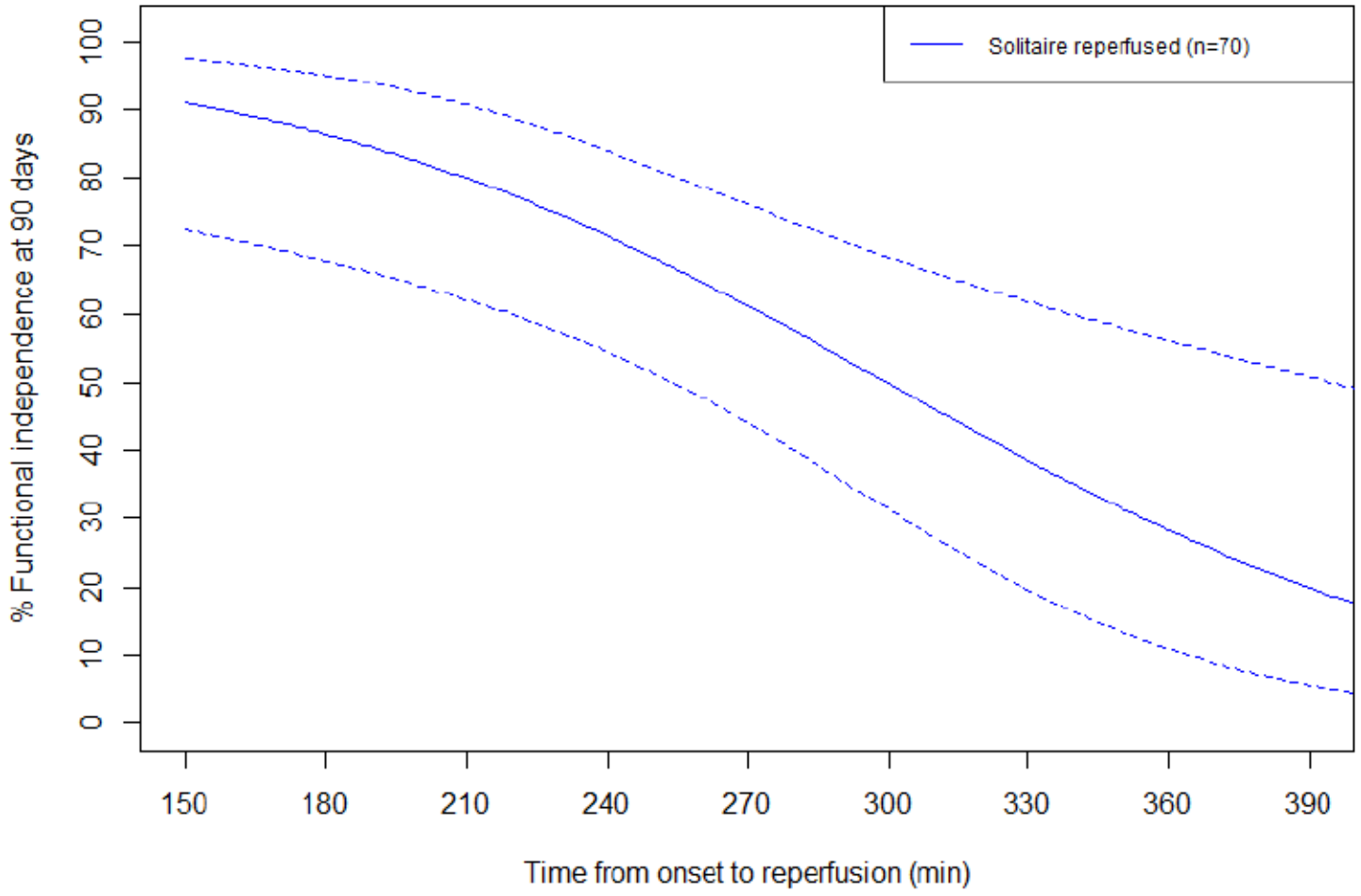


N Engl J Med 2015; 372:11-20.

IV+IA Trial Summaries

	# patients	IV tPA (%)	treatment initiation (h)	advanced imaging	mRS <= 2 (%)	sICH (%)	Mortality (%)
MR CLEAN	500	89	6	no	32.6 vs. 19.1 *	7.7 vs. 6.4	18.9 vs. 19.4
ESCAPE	315	76	12	yes	53.0 vs. 29.3, p<0.001	3.6 vs. 2.7	10.4 vs. 19.0, p= 0.04
EXTEND-IA	70	100	6	yes	71 vs. 40, p=0.01	20 vs. 9	0 vs. 6
SWIFT PRIME	196	100	6	yes*	60 vs. 35, p<0.001	0 vs. 3	9 vs. 12
REVASCAT	206	73	8	no	43.7 vs. 28.2 *	1.9 vs. 1.9	18.4 vs. 15.5

SWIFT PRIME: Time to Reperfusion Affects Functional Independence



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Goyal et al. **Good Outcome After Successful Recanalization is Time Dependent in the SWIFT PRIME Randomized Controlled Trial. 2016 International Stroke Conference.**

Endovascular Ischemic Stroke Treatments

- Treatment from patients with blockage accessible by the devices
  - Moderate to severe strokes
- Data from trials primarily supports combination therapy (IV+IA)
- Data supports a 6 hour window (onset to treatment initiation), with best outcomes seen with earlier treatment

Pros:

- Better outcomes than with IV alteplase alone
  - Better outcomes means less disability and lower long term health care costs
- Longer treatment window

Cons:

- Treatment window is still relatively short
  - Minutes matter – still need to treat with IV alteplase locally, if possible
- Treatment is limited to specialized centers
  - Overloads already stressed CSCs
  - Strain on the current patient transport systems

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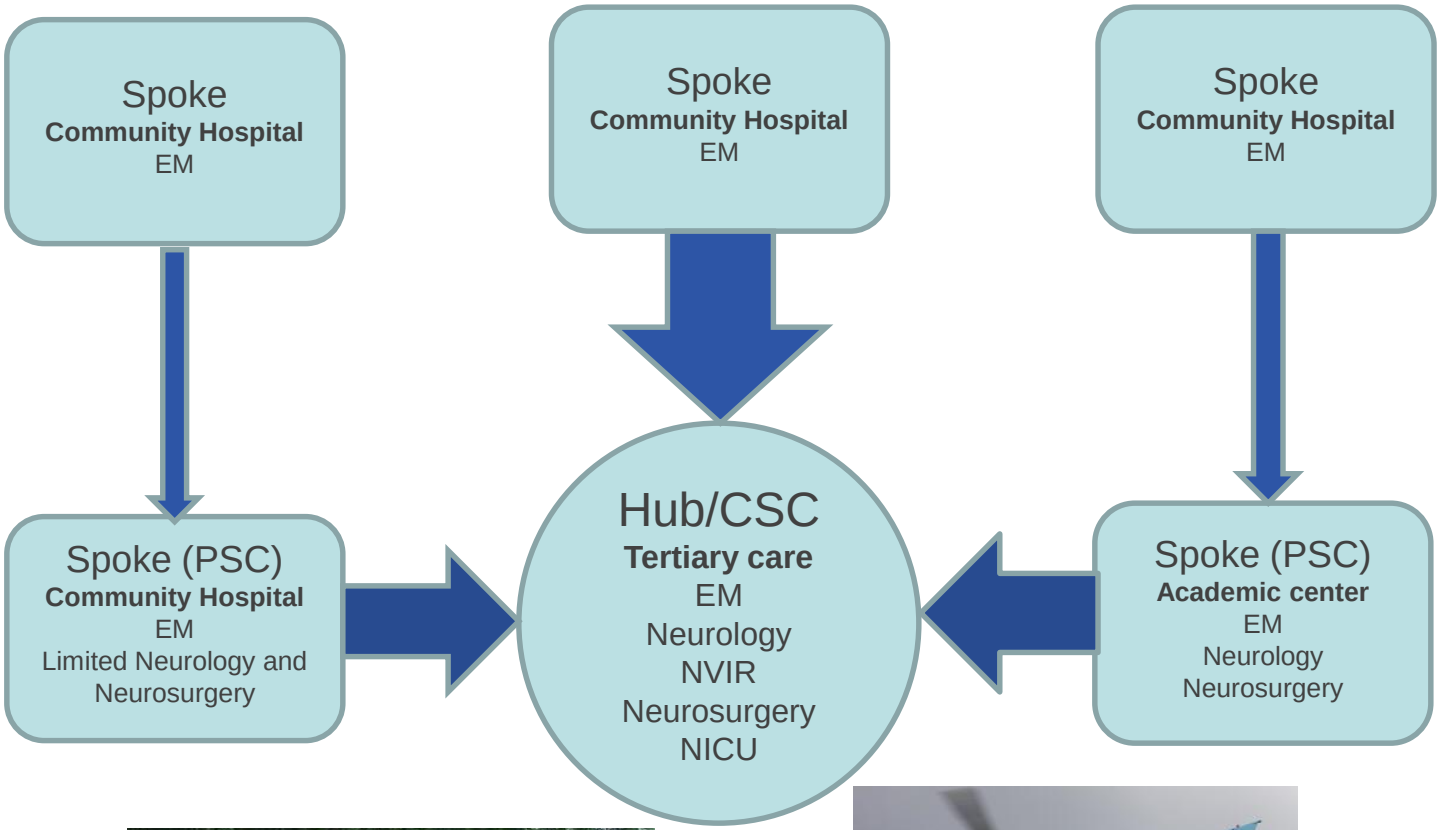
Stroke Systems: Greater dependence on inter-hospital transport and hubs



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Hurdles to Developing New Systems of Stroke Care

- Spokes
  - Limited knowledge of current treatments
  - Limited resources to optimize local processes
- Transport systems already strained
  - Additional need for ALS transport units
  - Limited resources currently available
- Hubs (CSCs)
  - ? 10 hospitals in NC capable of advanced interventions
  - Cost prohibitive for most other hospitals
  - Bed availability
  - Strain on current staff

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Stroke Advisory Council Priorities

1. Work with advanced interventional hospitals to better determine the current volumes of interventional cases and collect experiences (hurdles and best practices)
2. Collaborate with DPH, CMS, Medicaid, and other payers to determine health care cost savings realized by the treatments
3. Work with spoke hospitals to perform a needs assessment (focus on education and referral processes)
4. Work with Office of EMS and local transport agencies to perform a needs assessment
5. Educate the broader group of health policy makers and stakeholders on current and future needs
6. Convene a group to begin work on a coordinated state-wide plan

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