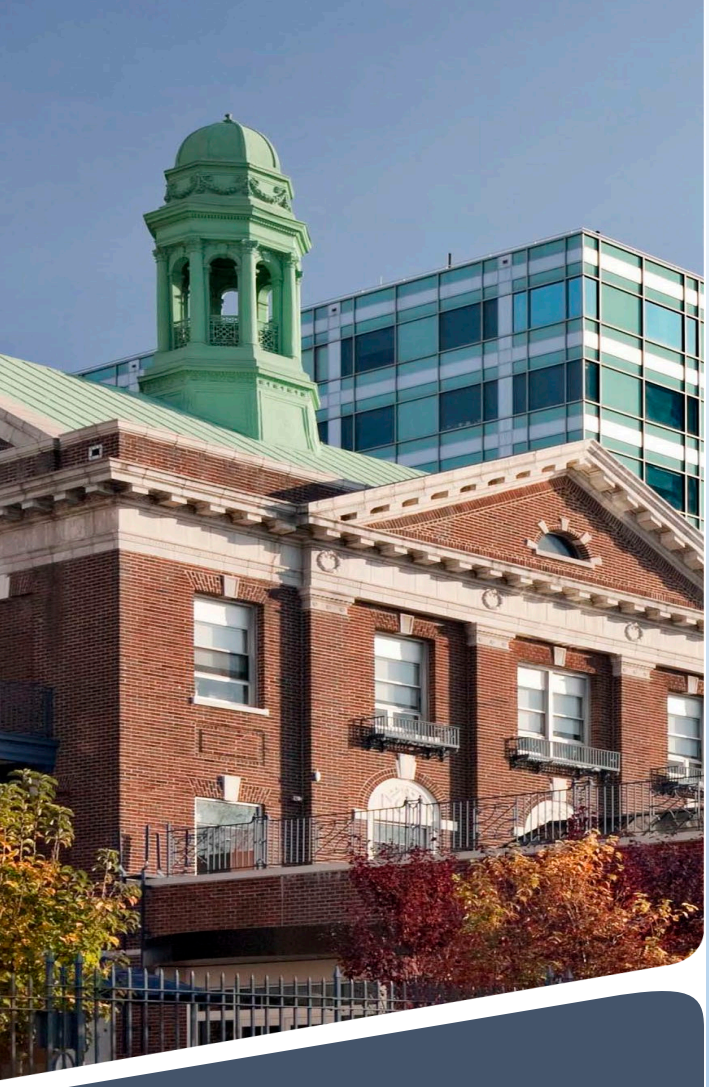

Overview of Diagnosis in Stroke

Ava L. Liberman, MD
Assistant Professor
Department of Neurology
Montefiore Medical Center, Albert Einstein College of Medicine
E-mail: avliberm@montefiore.org

Disclosures

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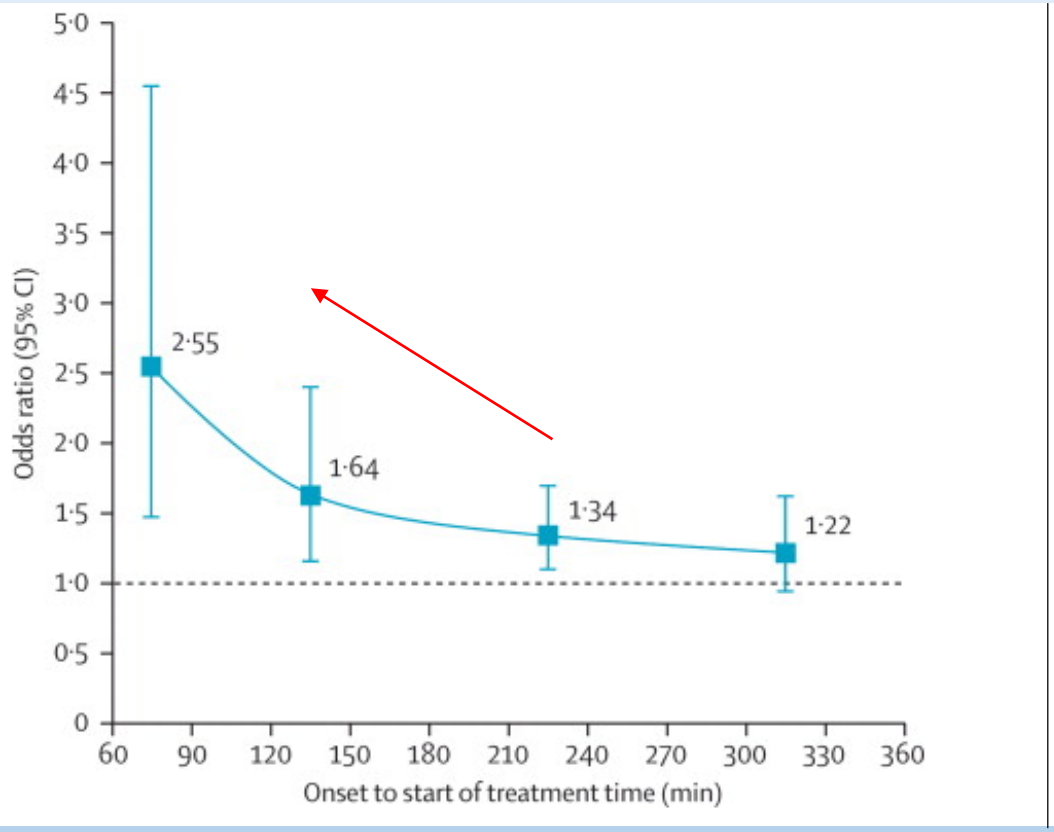
Stroke Definition and Diagnosis

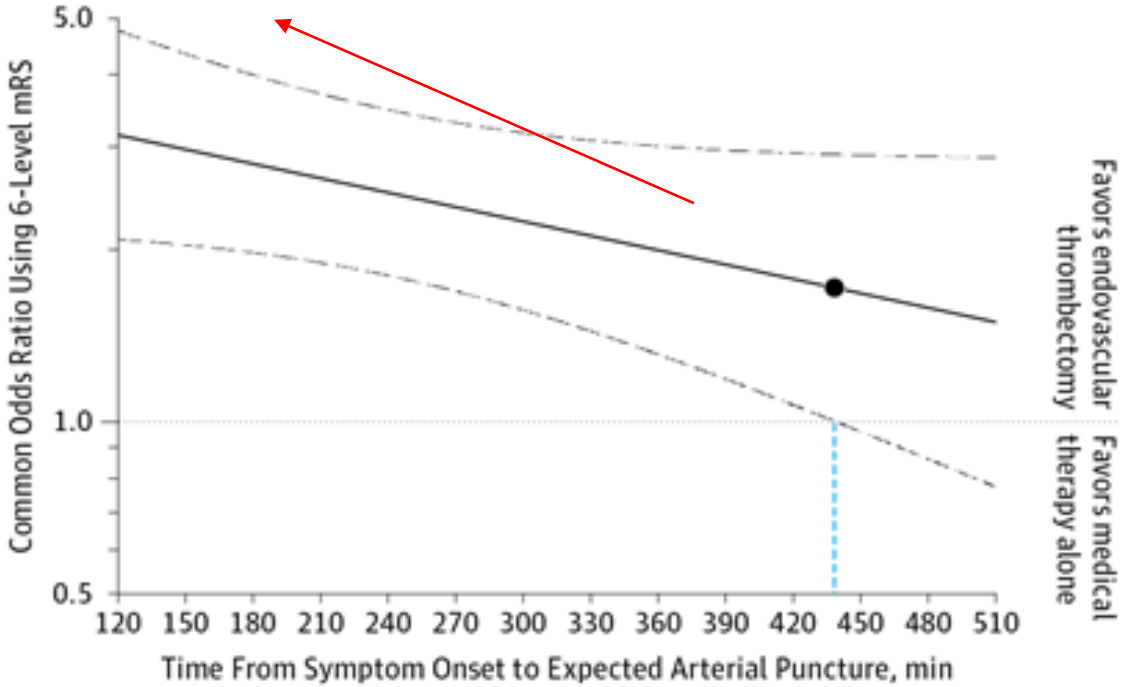
- Neurological impairment caused by a disruption in the blood supply to a region of the brain
  - Ischemic stroke
  - Intracerebral hemorrhage
  - Subarachnoid hemorrhage
- Fundamentally, stroke is a CLINICAL DIAGNOSIS that is augmented by radiological imaging
  - Imaging is essential to distinguish ischemia from hemorrhage
  - But, for ischemic strokes, imaging accuracy is imperfect
    - Non-contrast head CT at 3 hours is 47%-53% sensitive and more than 80% specific
    - For small ischemic strokes, magnetic resonance imaging (MRI) imperfect sensitivity
- Time-sensitive diagnosis

Campbell BC at al, *JNNP*. 2013
Wintermark M et al. *Radiology. 2009*
AHA/ASA, *Stroke*.. 2013.

“Time is brain”: need for rapid treatment in acute ischemic stroke



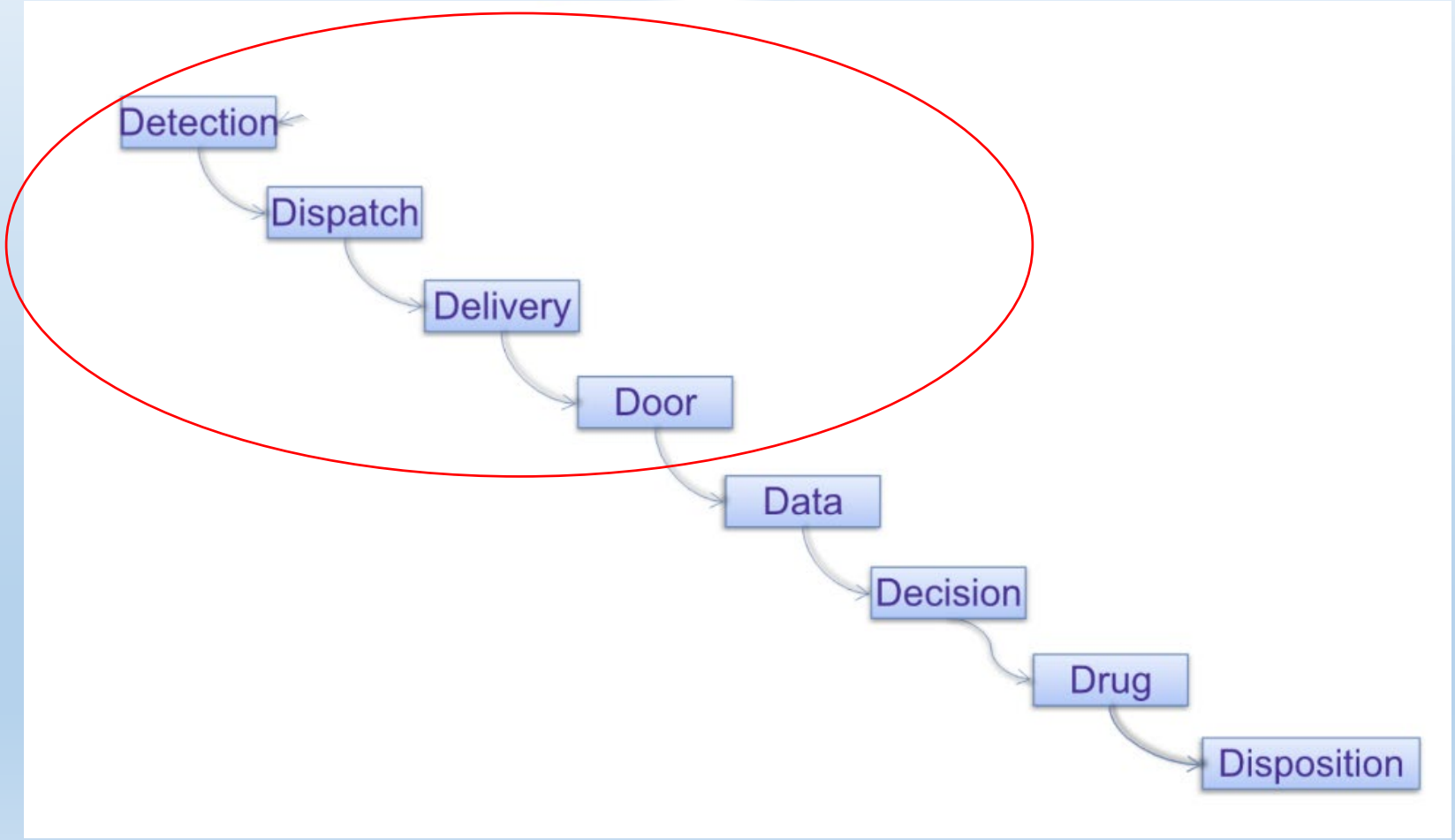
- Relation of stroke onset to IV tPA and excellent functional outcome



- Relation of stroke onset to groin puncture and less disability for endovascular therapy

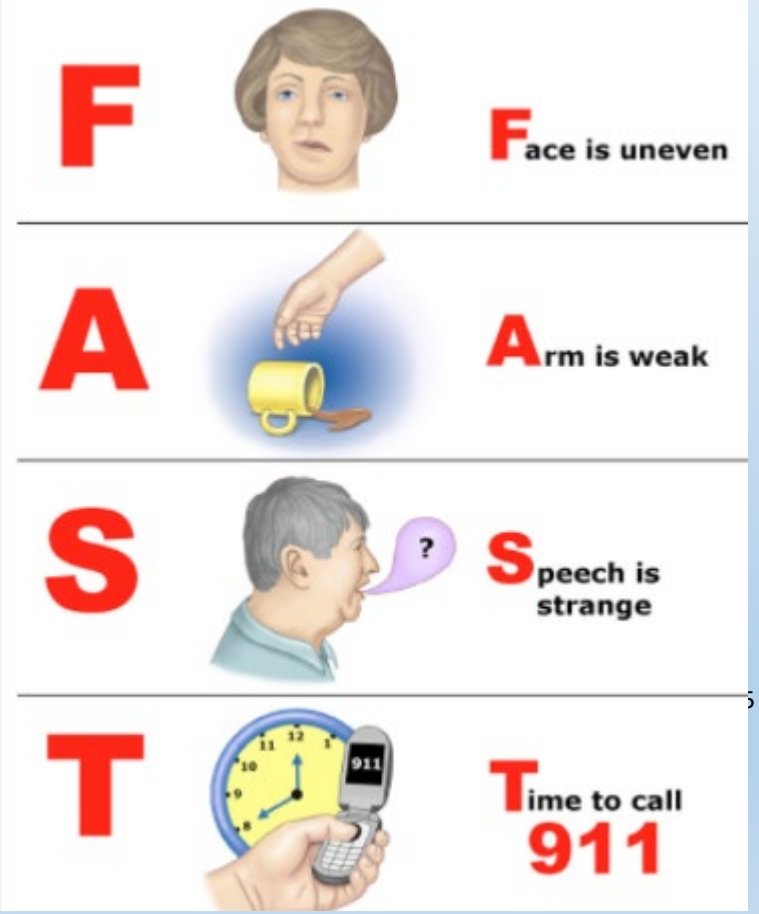
Saver. *Lance*t. 2010 & *JAMA* 2016

Stroke Chain of Survival



Prabhakaran S *NIH Stroke Net*. 2018

Delays: Community-level and Patient-level



Minor/atypical symptoms & transient ischemic attack (TIA)

- 3,668 participants who reported a physician diagnosis of stroke/TIA in a US population based study → only 59% sought medical care initially

  Howard VJ et al. *Ann Neurology.* 2008

  - "Non-consensus" or atypical TIA were less likely to seek medical attention on the day of the event

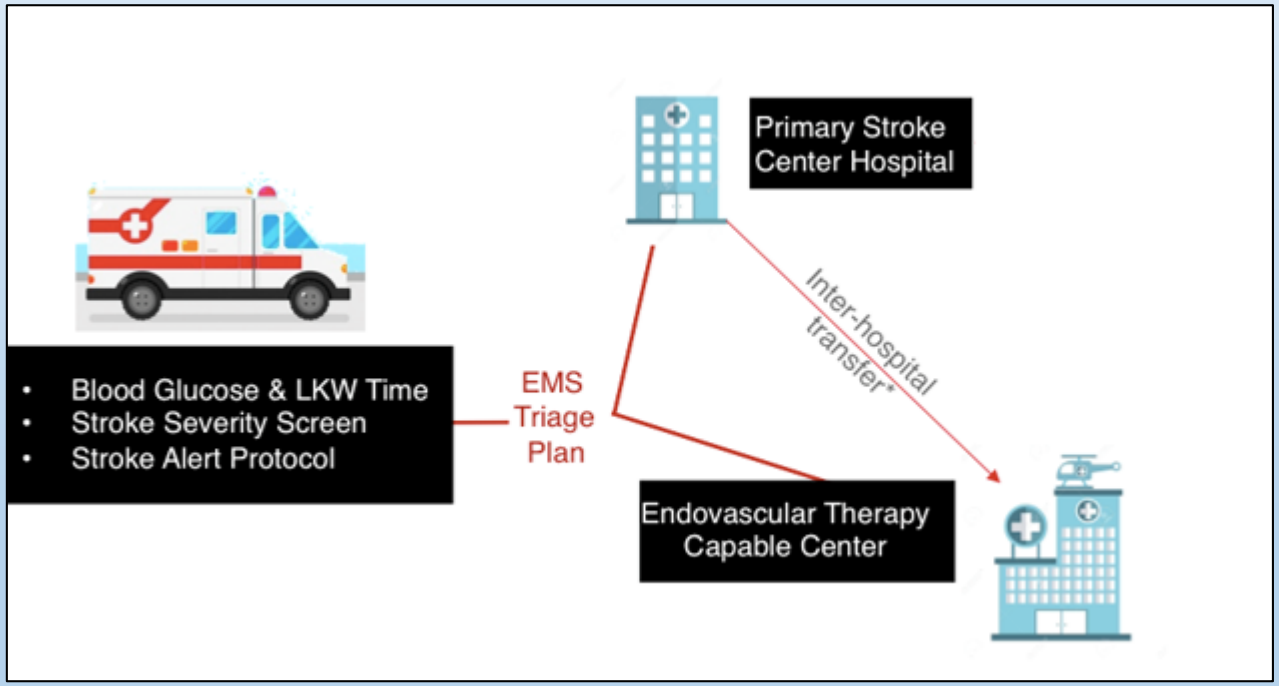
    Tuna MA et al. *Lancet.* 2021

- Among patients with TIA and minor stroke, correct perception of initial symptoms significantly declined after the FAST campaign (from 37.3% to 27.6%) in UK

  Wolters et al. *JAMA Neuro.* 2018

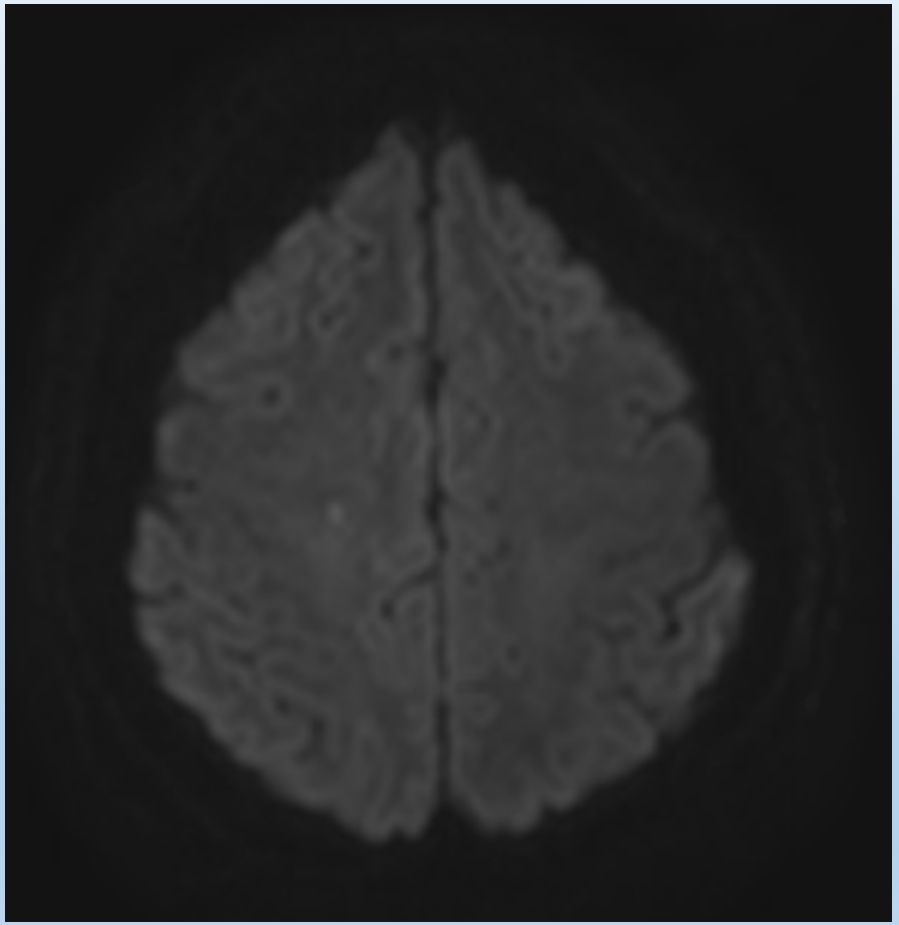
Delays: Dispatch to (the right) Door

- Dispatcher stroke detection is variable
  - Positive predictive value 42-68%
- Emergency medical services ability to detect stroke and/or large vessel occlusion is also highly variable
- Key caveat: only 59% of strokes use EMS



Jia J et al. *Front Neurol.* 2017.
Oostema et al. *Prehospital Emergency Care* 2019.
Oostema et al *Cerebrovasc Dis*. 2016
Mattila. *Int J Stroke*. 2019
Mochari-Greenberger et al. *JAMA.* 2015.

Wide spectrum of cerebrovascular disease

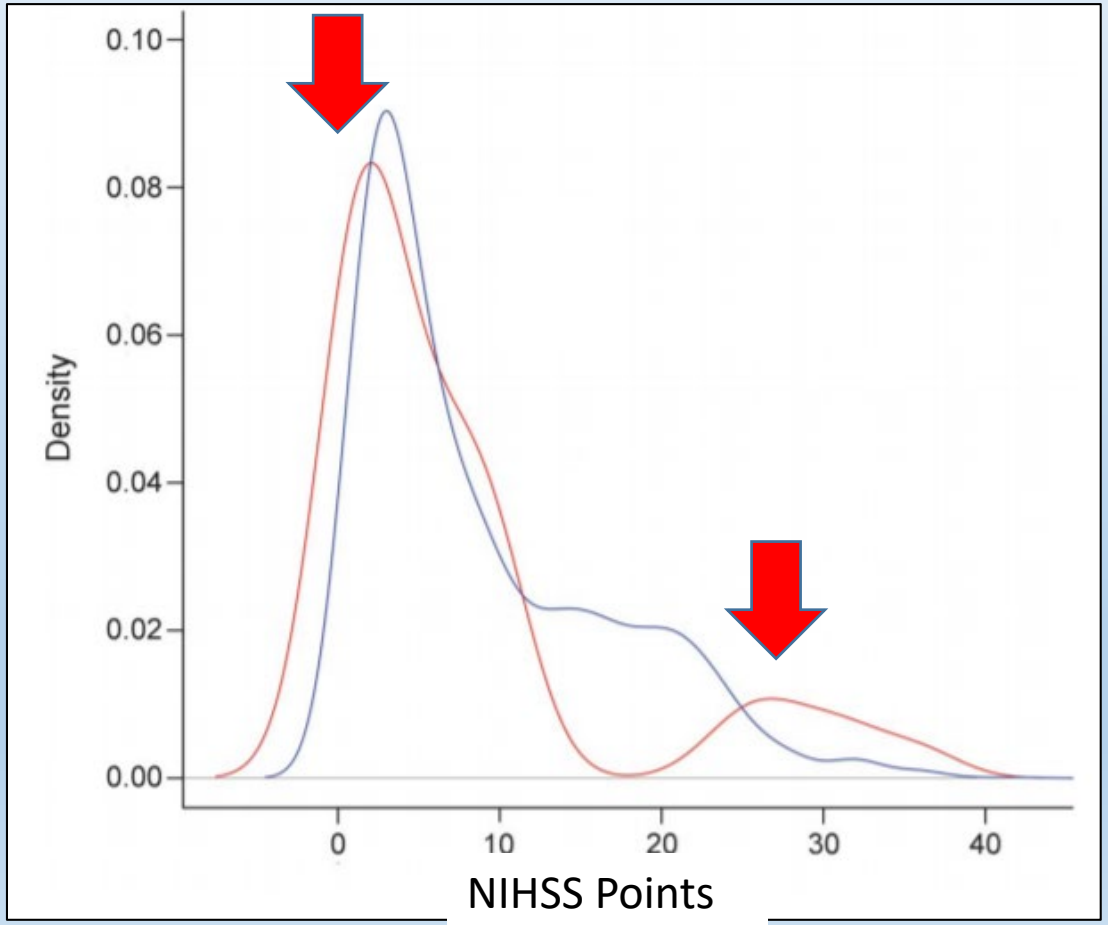


Transient events

Small infarct

Devastating large hemorrhages

Stroke misdiagnosis (false-negatives) occur at both ends of the clinical spectrum



Richoz et al. *Neurology.* 2015

Rate of ED false-negatives

- Approximately 8.7%

Tarnutzer AA et al, *Neurology.* 2017

Delicate balance in the acute stroke setting

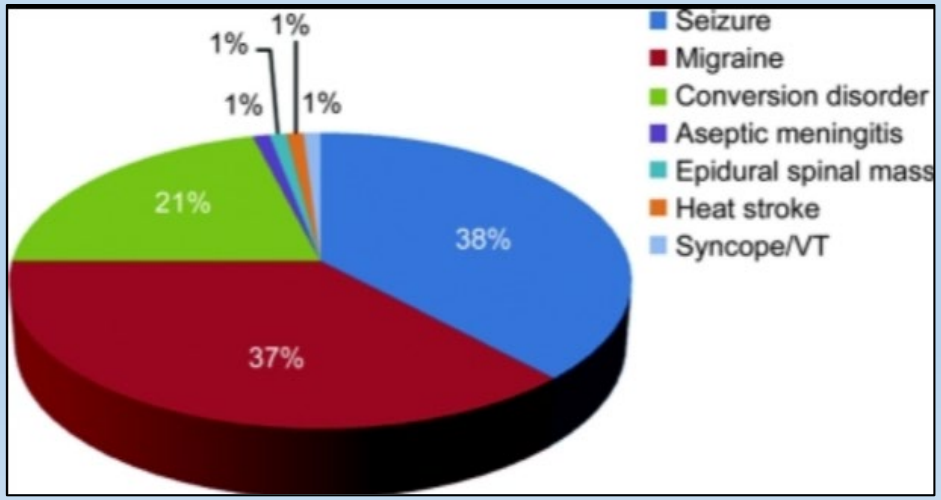
Swift or sure?

The acceptable rate of neurovascular mimics among IV tPA–treated patients

Minutes matter in acute brain ischemia. Actions taken in the critical first moments after hospital presentation shape the course of patients' lives for the remainder of their years. Once the infarct is completed, reperfusion therapy is futile. Therapy long delayed is therapy denied. However, conditions that mimic acute cerebral ischemia are not uncommon, and thrombolytic therapy carries potential risk. The stroke physician must balance the clinical principles of *primum non tardare* and *primum non nocere*,[1] the need for speed and the need for accuracy.

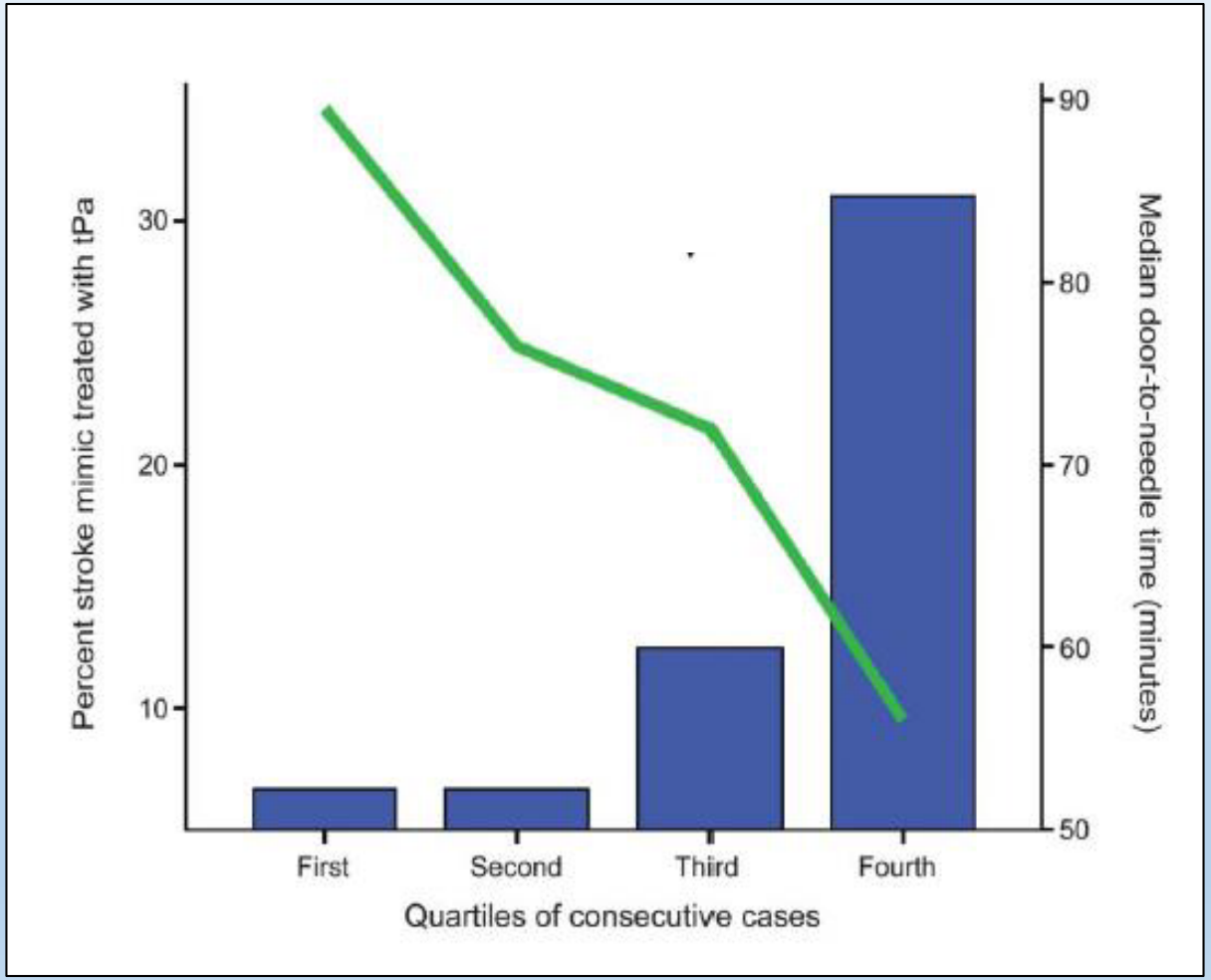
Saver J et al. *Neurology*. 2010

Conditions that mimic stroke



Chernyshev OY et al. *Neurology*. 2010

Stroke mimics (false-positives)



Liberman, AL et al. *Neurol Clin Pract.* 2015

Misdiagnosis related harms

- Among treated stroke mimics, low risk of hemorrhagic complications (0.5%) and angioedema (0.3%)
- Failure/delayed diagnosis of true underlying condition
- Costs to the healthcare system

Rate of ED false-positives

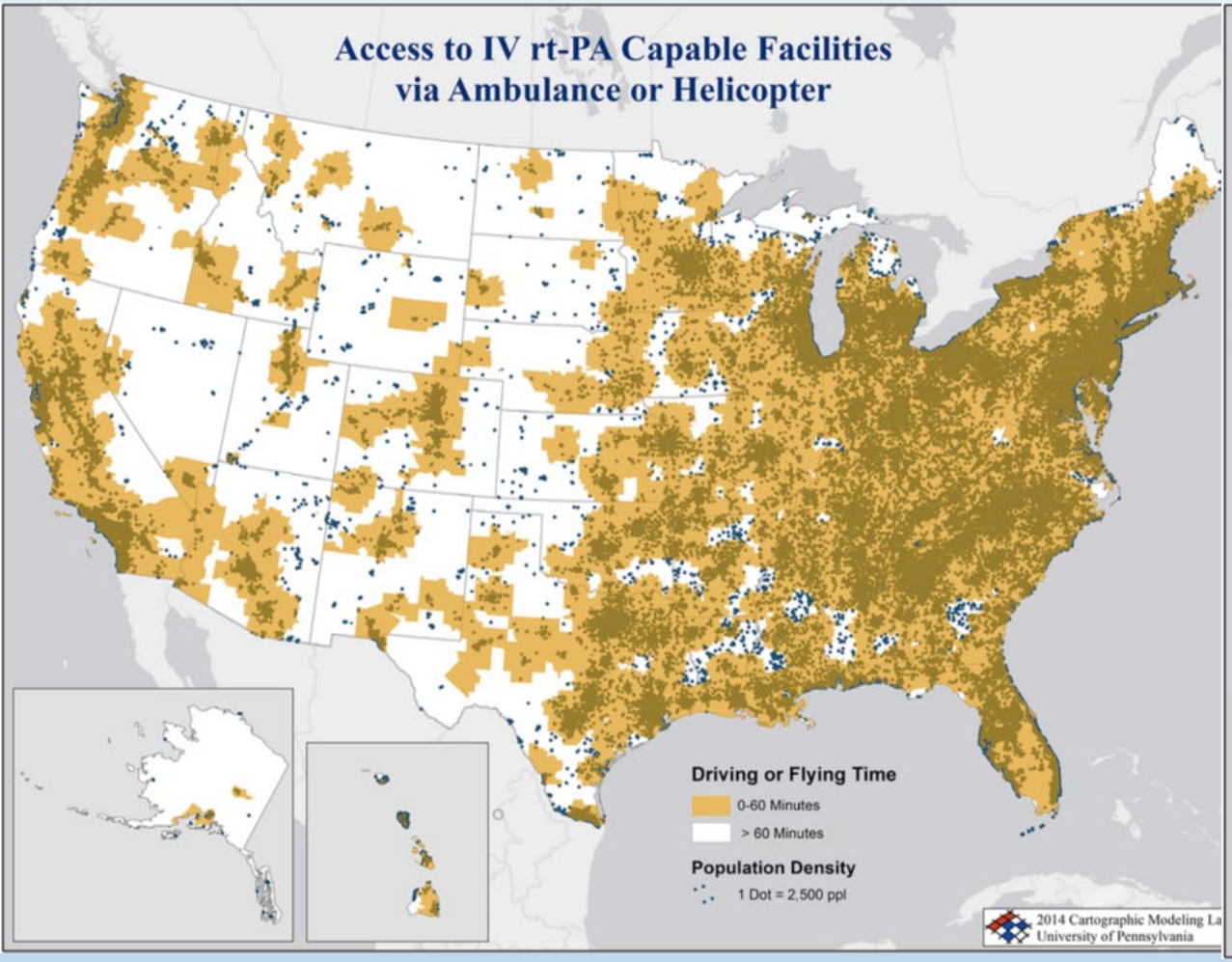
- Approximately 7.3%

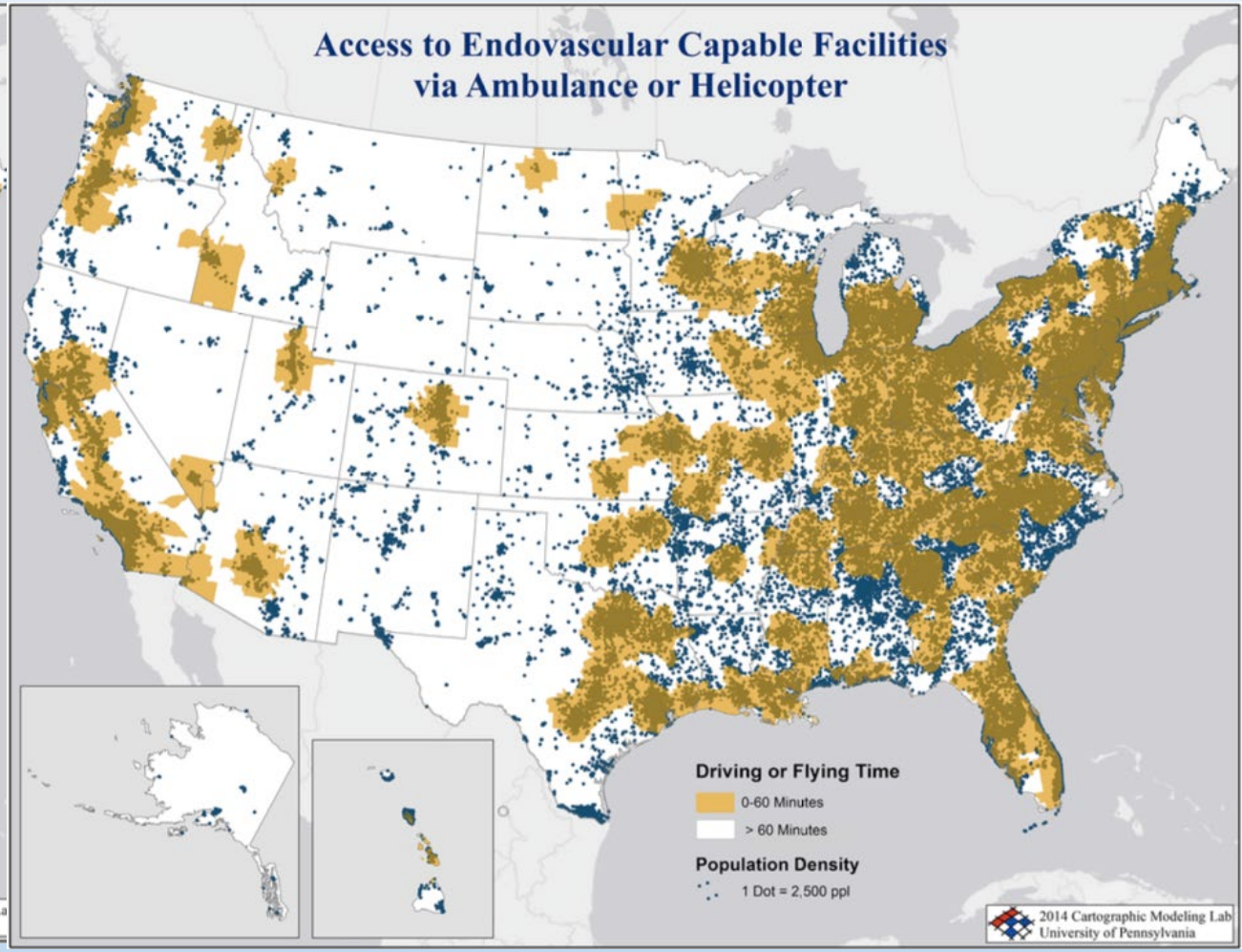
Tsivgoilis G et al. *Stroke.* 2015
Tarnutzer AA et al, *Neurology.* 2017

Future directions

- Diagnosis at earlier steps in the stroke chain of survival
  - Improving community and patient detection
- Tools at the door for diagnosis
- Appreciating the clinical spectrum of stroke
- Adaptable interventions

Acute Stroke Local and Regional Factors





- No one size fits all model will work

Adeoye et al. *Stroke*. 2014

Thank you!