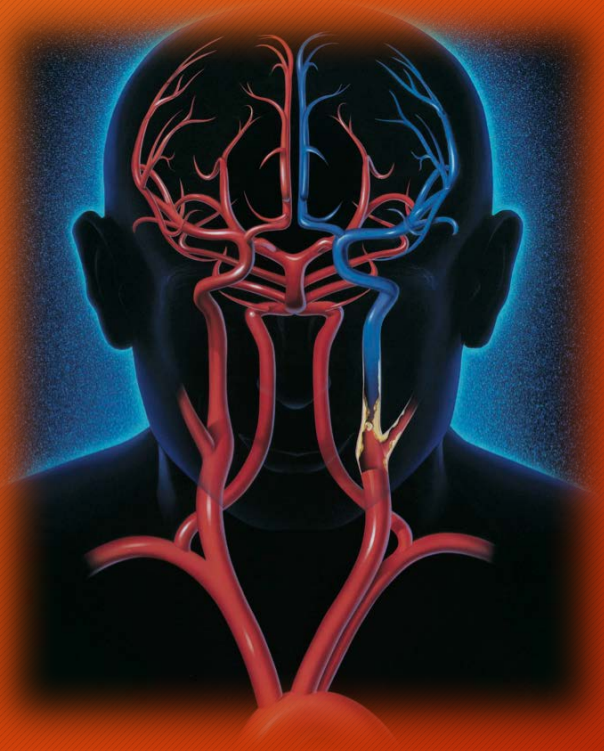
Stroke Care in 2020

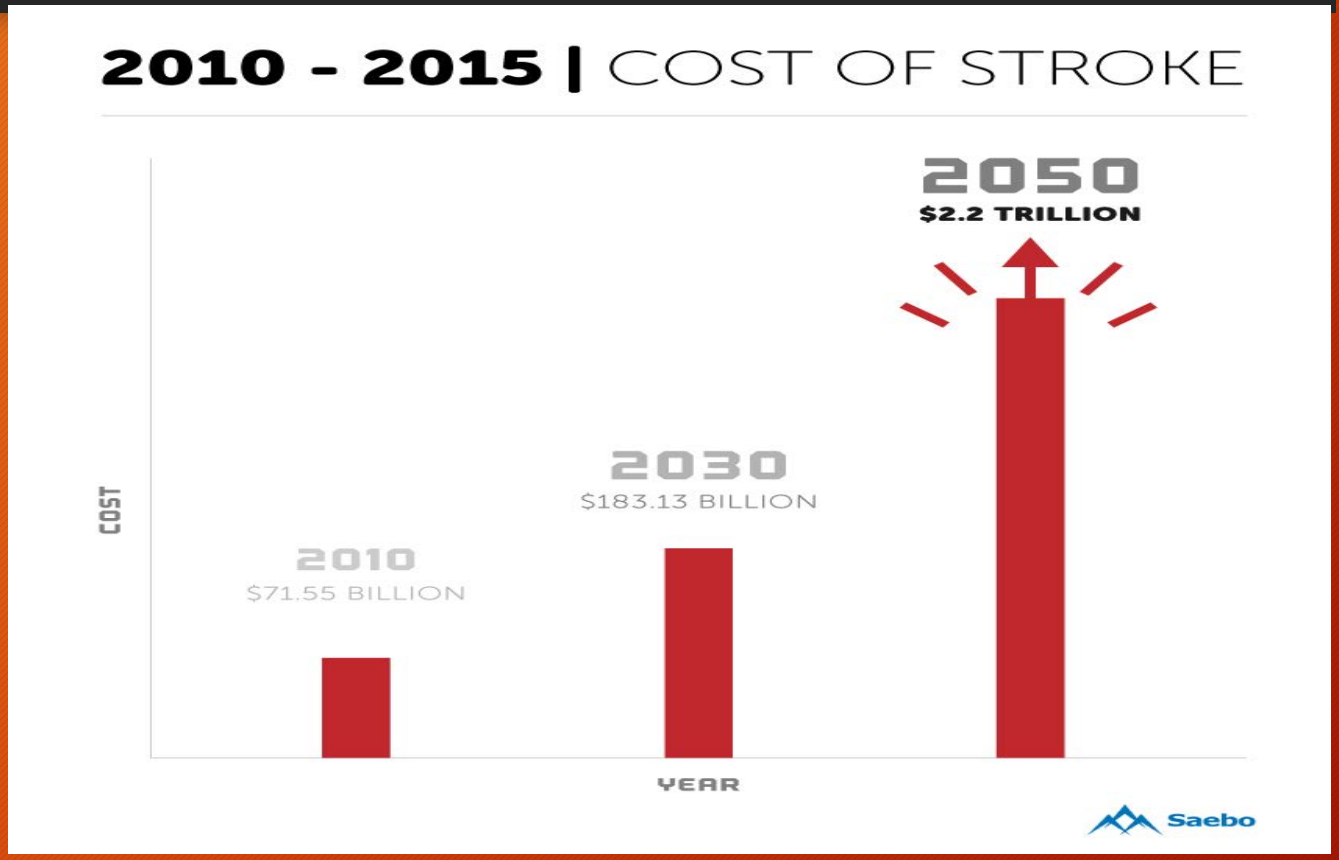


Arbi Ohanian, M.D.
Huntington Hospital Comprehensive Stroke Center

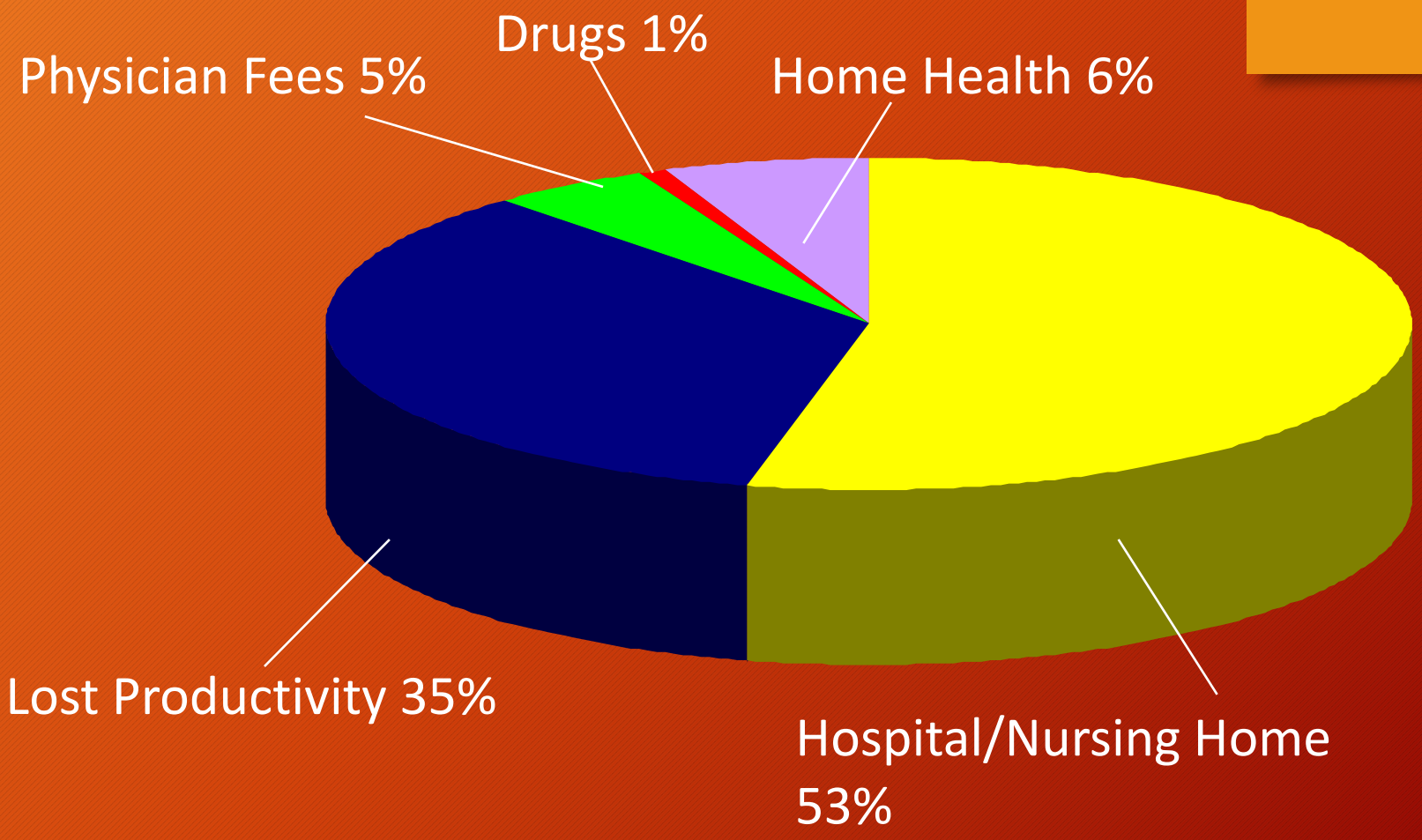
Stroke: A Public Health Crisis

- #1 cause of adult disability in the US
- 5th leading cause of death (140,000 Americans per year)
- ~800,000 new strokes each year
- Every 40 seconds someone suffers a stroke
- >6 million stroke survivors
- 1 in 6 Americans will be affected
- 90% will be left with permanent disability

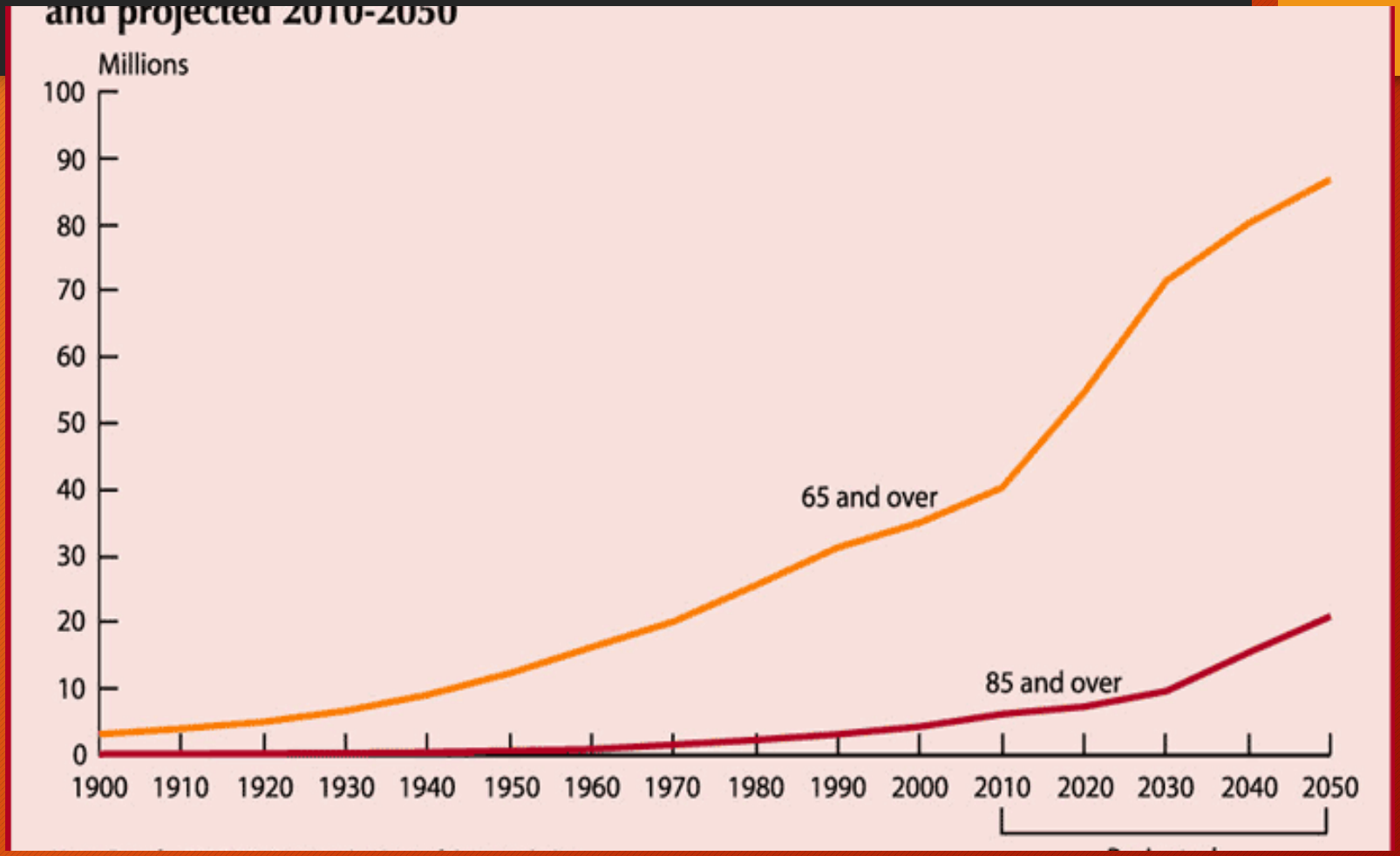
Economic Burden



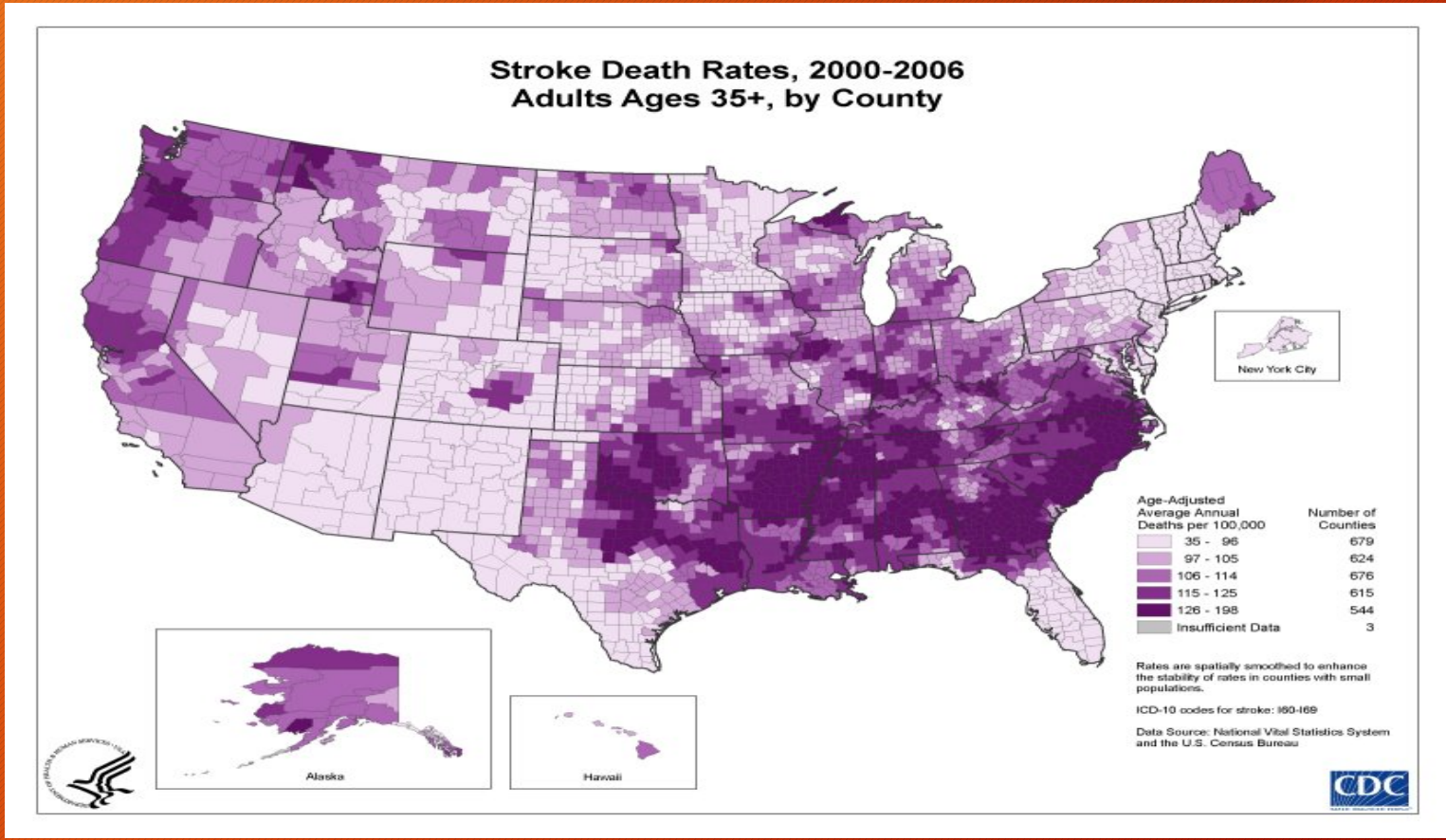
STROKE COSTS



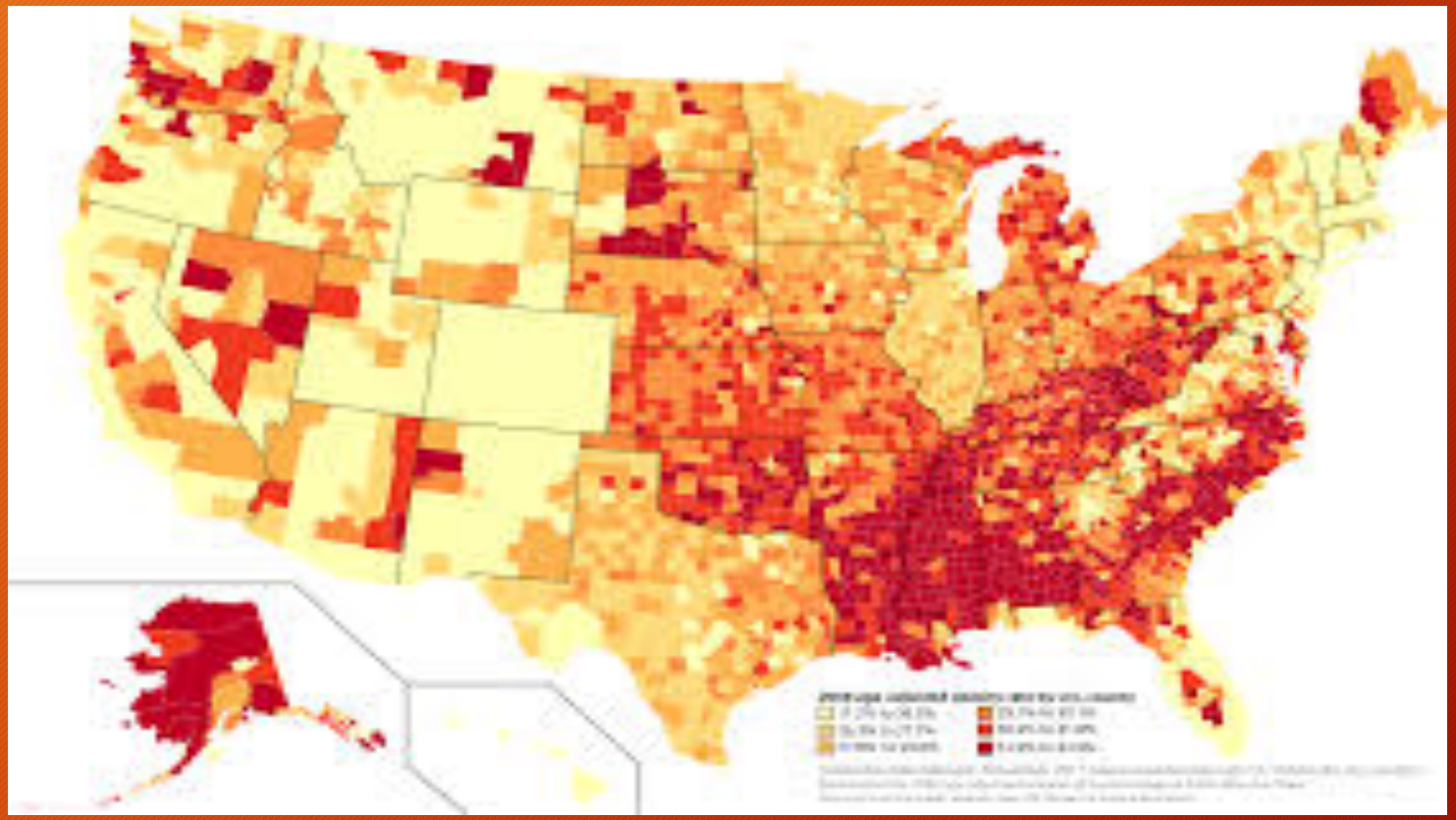
THE AGING POPULATION



Stroke Distribution



Obesity Map



Disability at 6 Months After Stroke

- Framingham Heart Study
  - Stroke survivors >65

Need help w/ ADLs - 26%

Need help walking - 30%

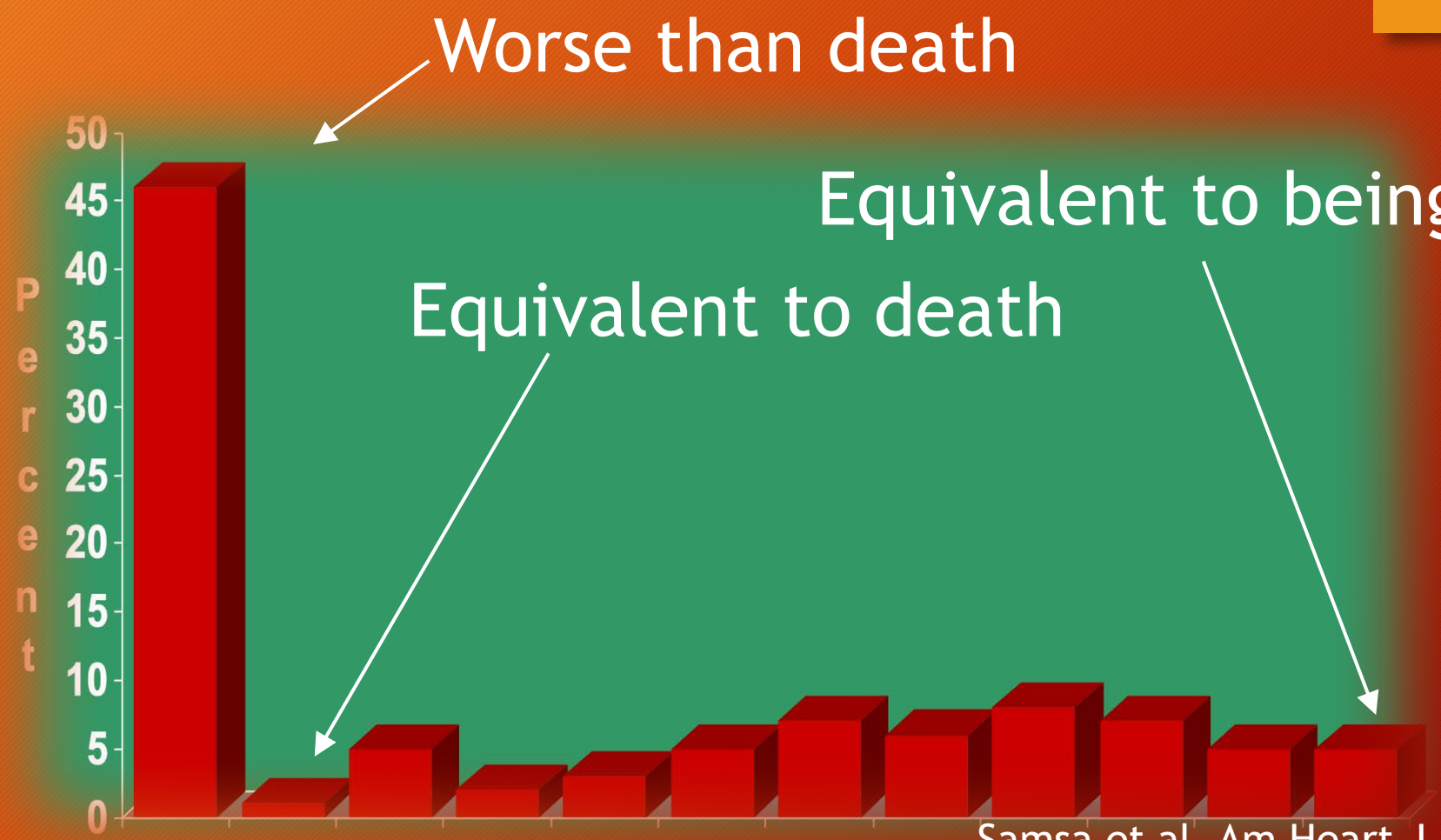
Institutionalized – 26%

Hemiparesis – 50%

Aphasia – 19%

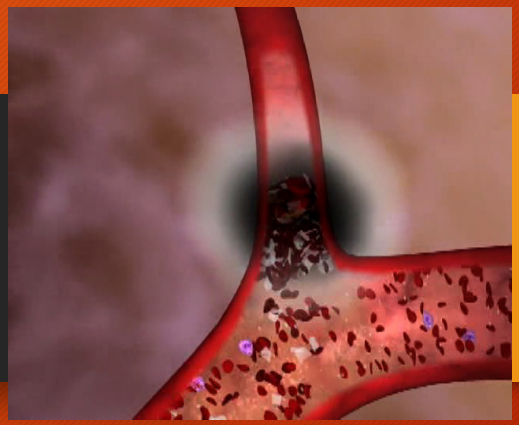
Johnston SC, et al. *Neurology.* 2003;60(9)

How Bad is a Major Stroke?



Samsa et al, Am Heart J 1998

Definition



- Stroke is the rapid loss of brain function as a result of the brain being deprived of blood flow.

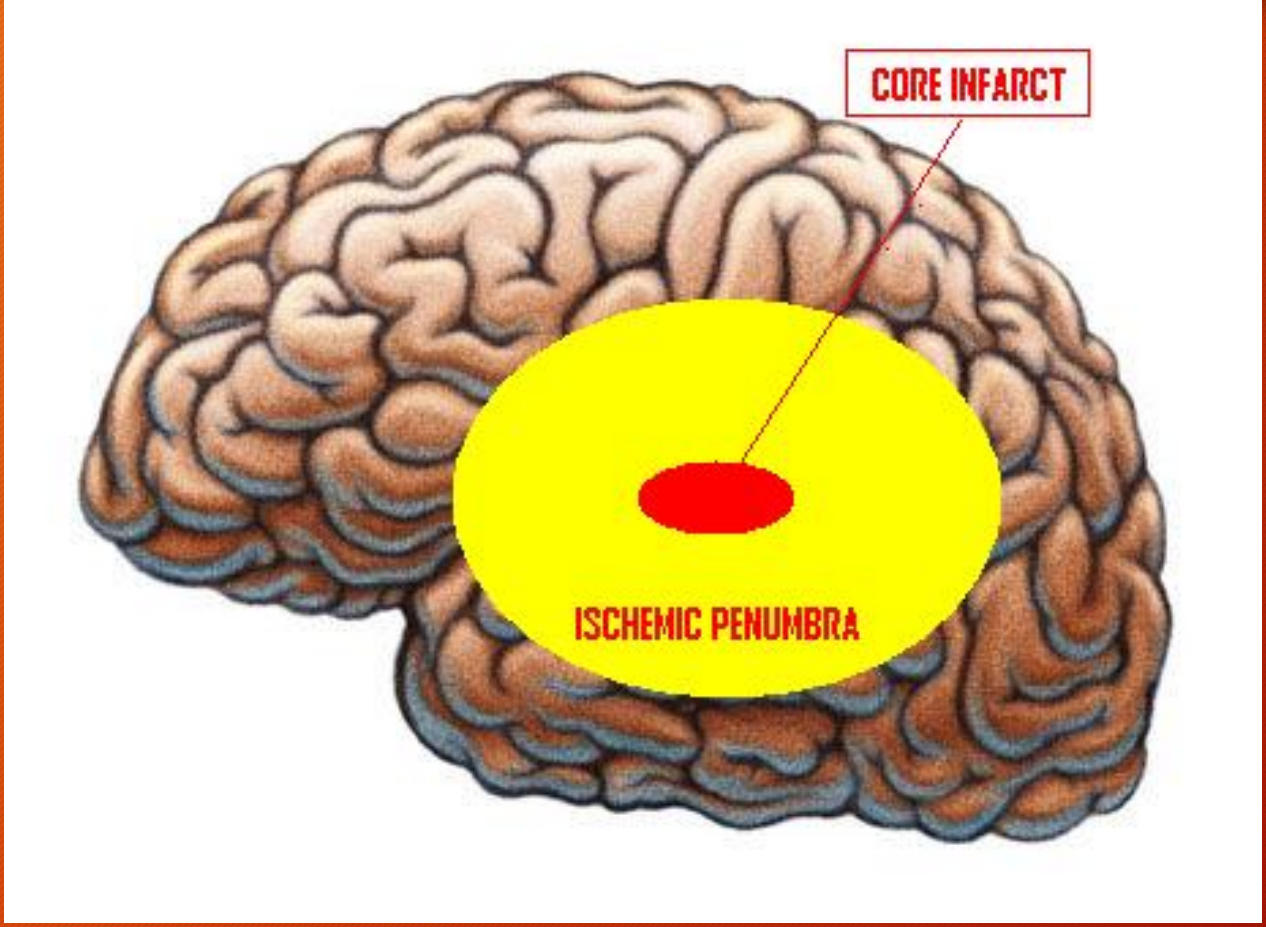
- Can occur as a result of a blood clot, a drop in blood pressure, or hemorrhage into the brain.

Time Is Brain!!!

- 1.9 million brain cells/minute
- 4.5 hour time window for IVtPA
- 24 hour time window for thrombectomy

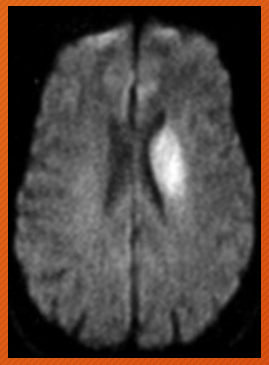
Saver J. 2006 Jan;37(1):233-6

Ischemic Penumbra



Multimodal Diffusion- Perfusion MRI

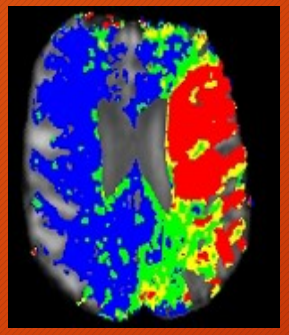
DWI



Tissue Status

Bioenergetic Compromise

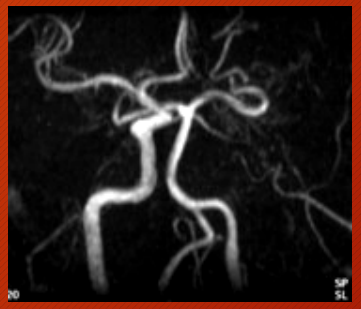
PWI



Perfusion Status

Hemodynamic Compromise

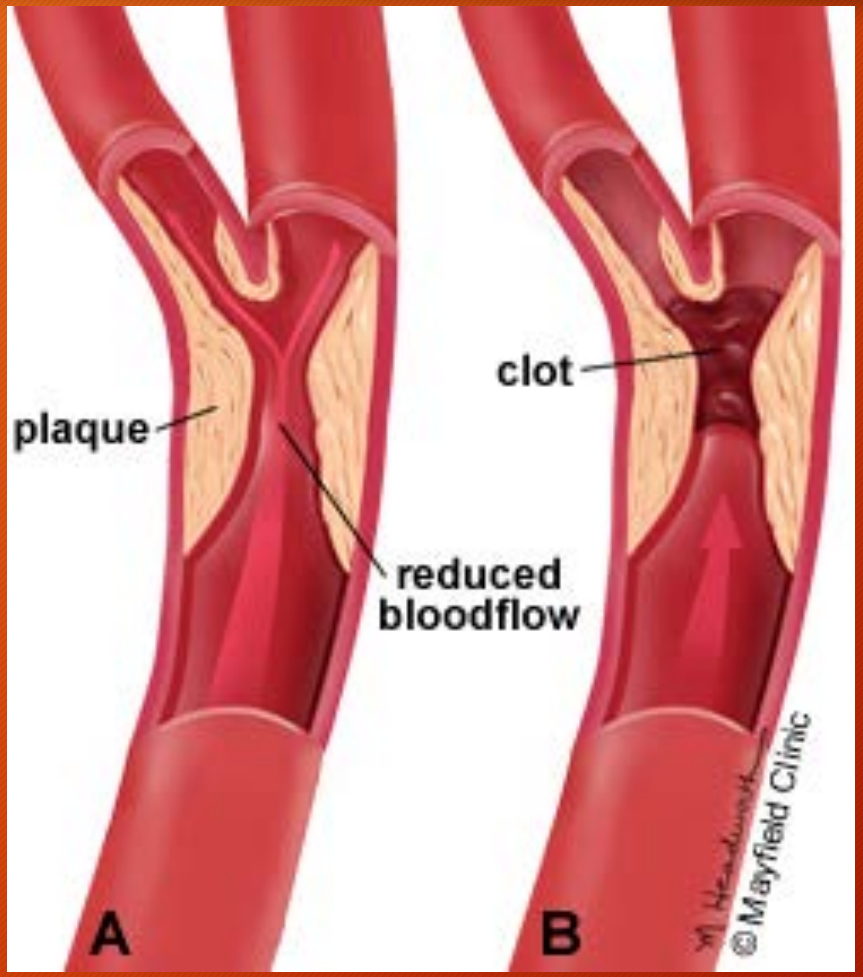
MRA



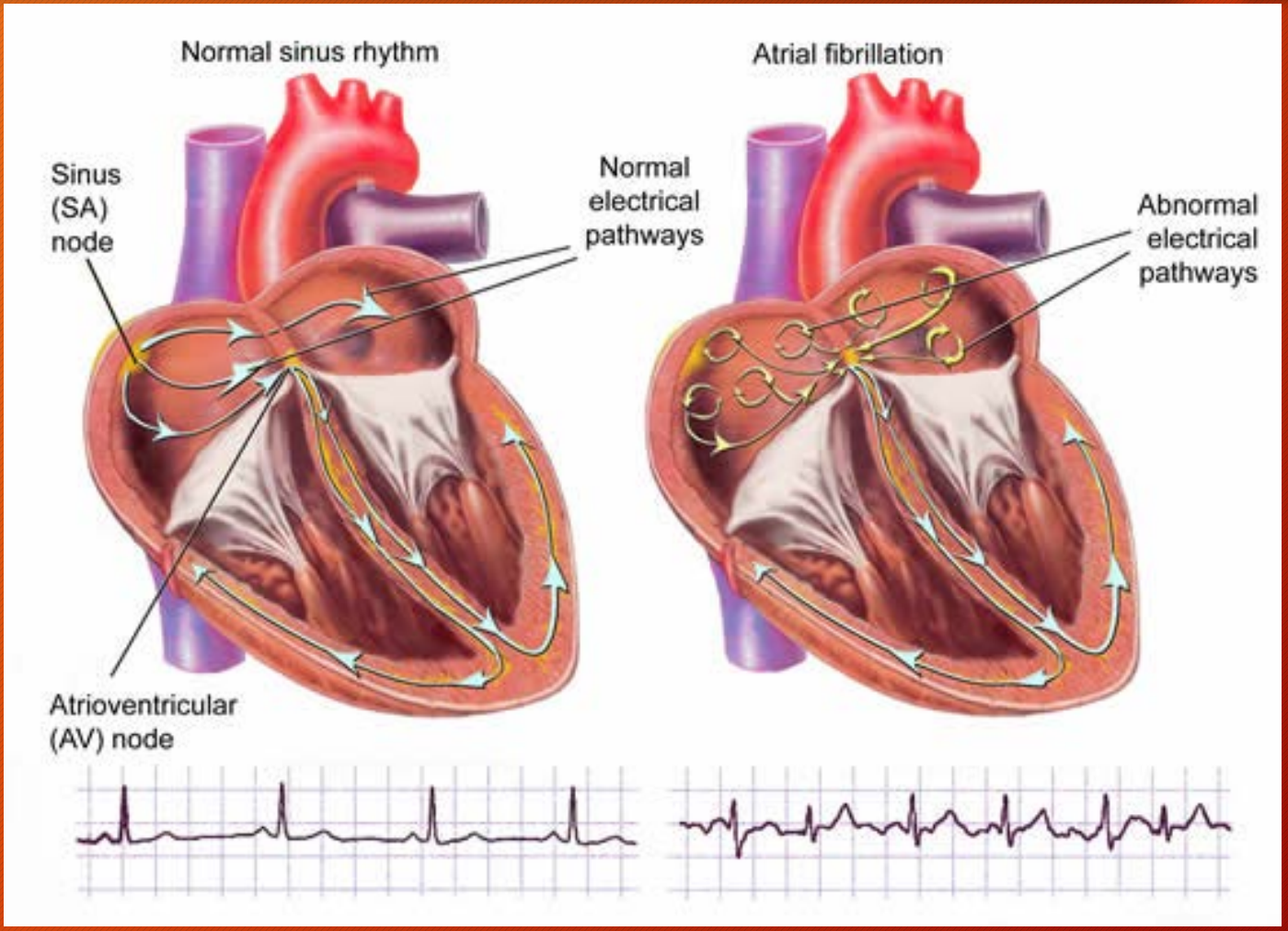
Vessel Status

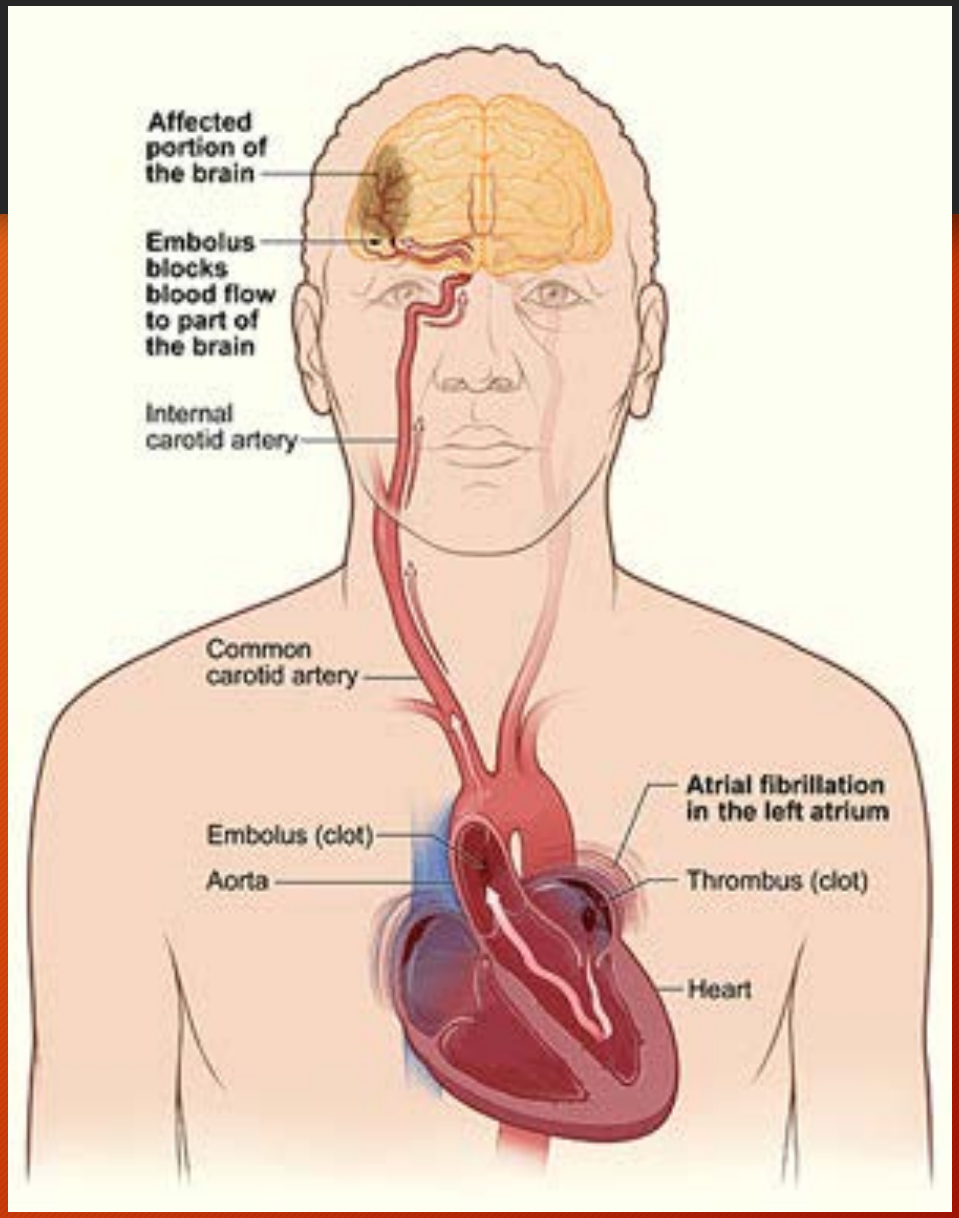
Occlusions or Stenoses

Large Vessel Disease



Cardioembolism




Affected portion of the brain
Embolus blocks blood flow to part of the brain
Internal carotid artery
Common carotid artery
Atrial fibrillation in the left atrium
Embolus (clot)
Aorta
Thrombus (clot)
Heart

Acute Stroke Care 1990
Therapies with FDA Approval or Positive Trials

- Ischemic Stroke
  - None
- Intracerebral Hemorrhage
  - None
- Subarachnoid Hemorrhage
  - Nimodipine
- Intraventricular Hemorrhage
  - None

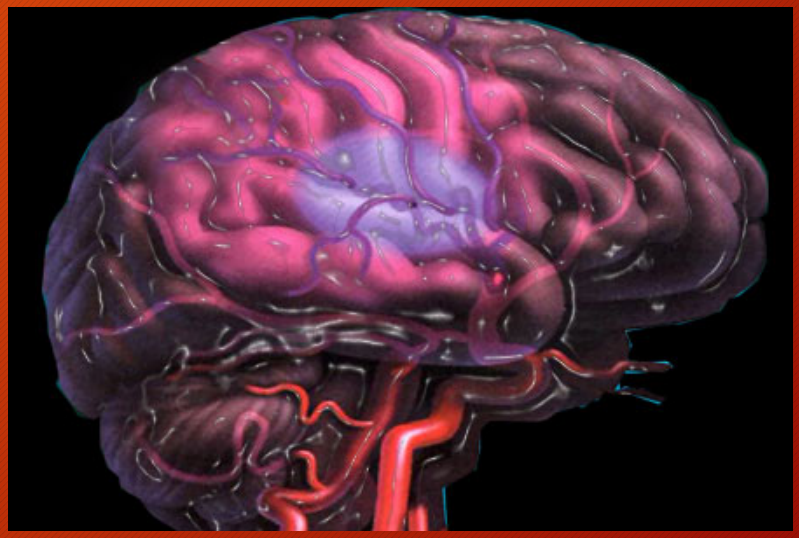
Acute Stroke Care 2020
Therapies with FDA Approval or Positive Trials

- Ischemic Stroke
  - PO aspirin
  - IV tPA < 3 hrs
  - IV tPA 3 to 4.5 hrs
  - MRI based use of IV tPA with indefinite window
  - IA fibrinolysis < 6 hrs
  - IA Merci Retriever < 8 hrs
  - IA Penumbra system <8 hrs
  - IA Retrievable stent < 8 hrs
  - Endovascular temperature control
  - Tenecteplase
  - IA Thrombus aspiration
  - Endovascular temperature control
  - IV Glyburide for reducing edema
- Intracerebral Hemorrhage
  - IV Factor VIIa < 3 hrs
  - Endovascular temperature control
- Subarachnoid Hemorrhage
  - GDC coil, Matrix coil, stent assisted coiling
  - Endovascular temperature control
  - Nimodipine
  - IA angioplasty for vasospasm
- Intraventricular Hemorrhage
  - Intraventricular TPA and drainage
  - Endovascular temperature control

Getting MORE AGGRESSIVE

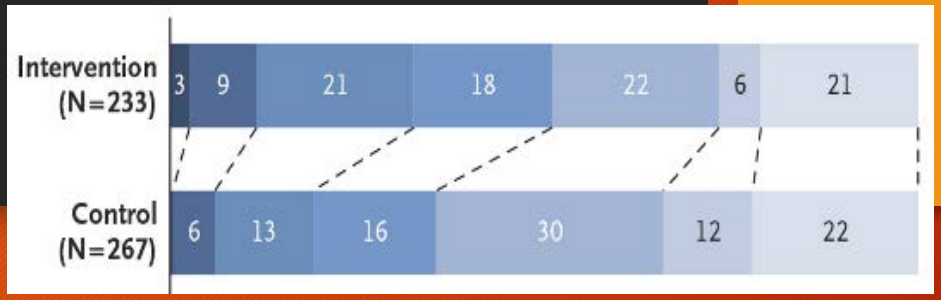
TPA Outside of 3 Hours

- FDA approved for treatment of acute ischemic stroke up to 3 hours
- ECASS 3
- AHA recommendations

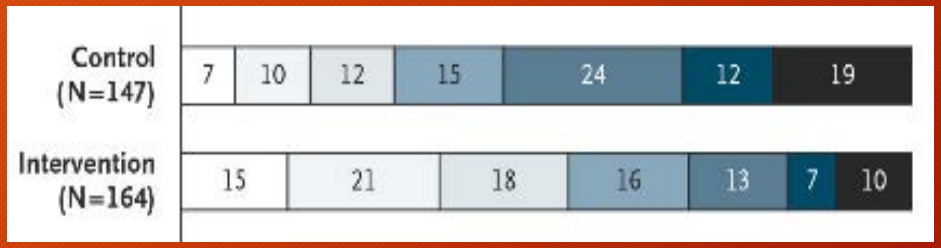


Era of Highly Effective Reperfusion Therapy

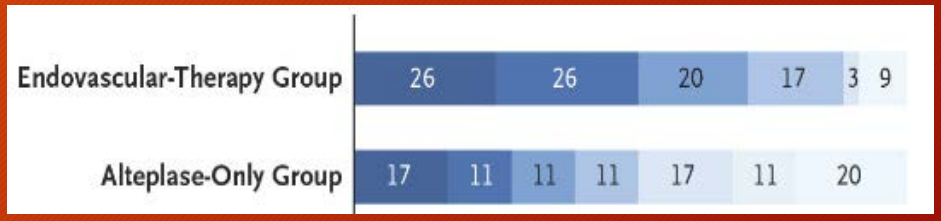
MR CLEAN
A Multicenter Randomized CLinical trial of Endovascular treatment for Acute ischemic stroke in the Netherlands



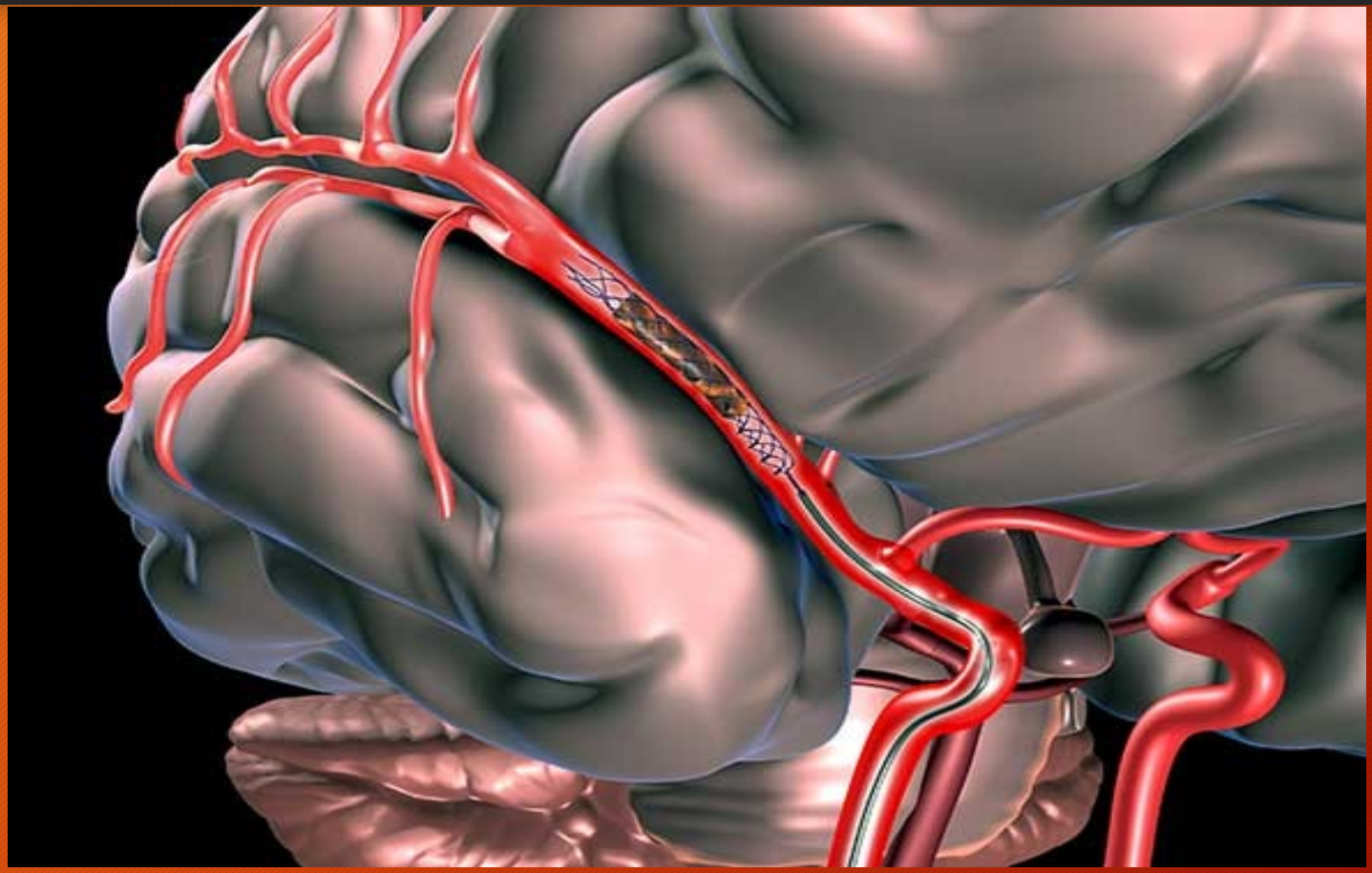
ESCAPE



EXTEND-IA



SWIFT PRIME



Time to Reperfusion Matters in Endovascular Stroke Therapy

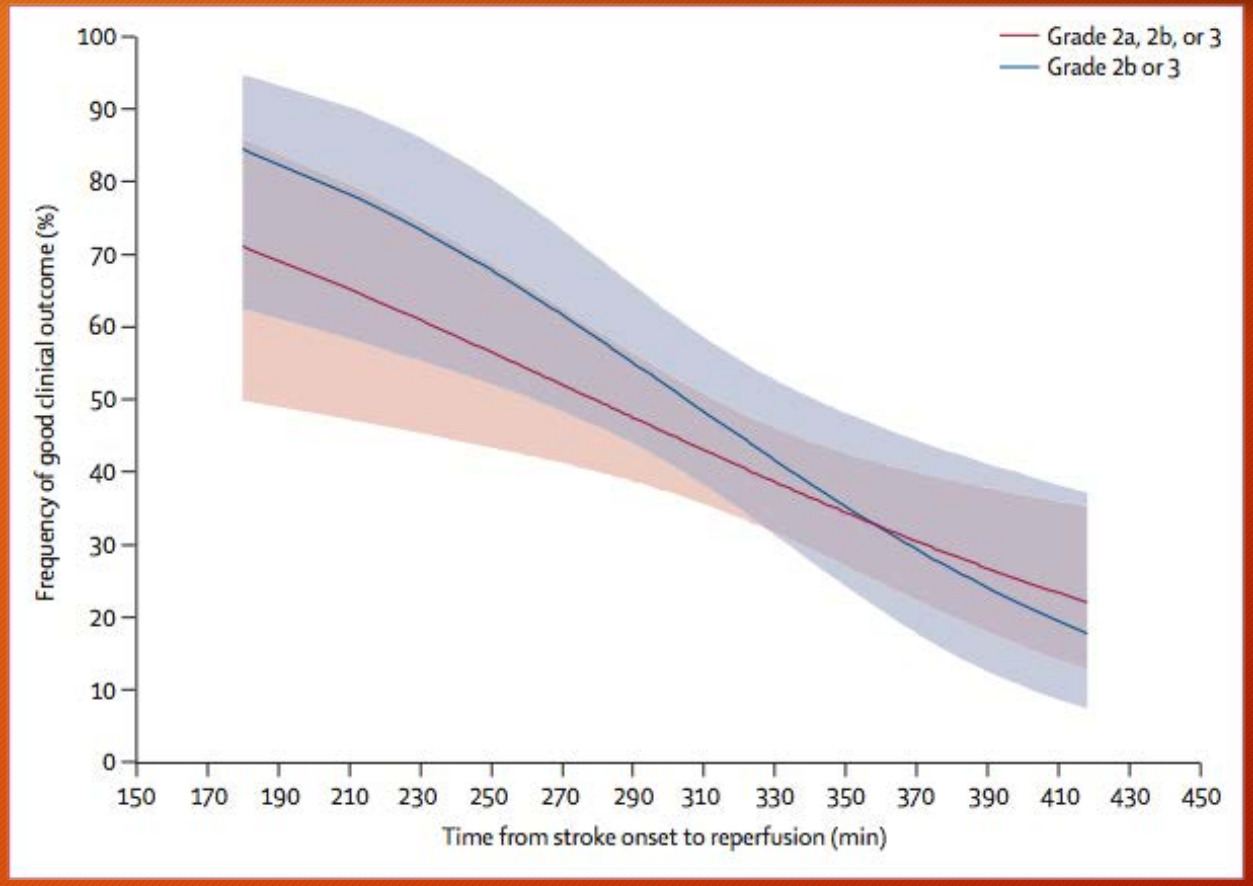


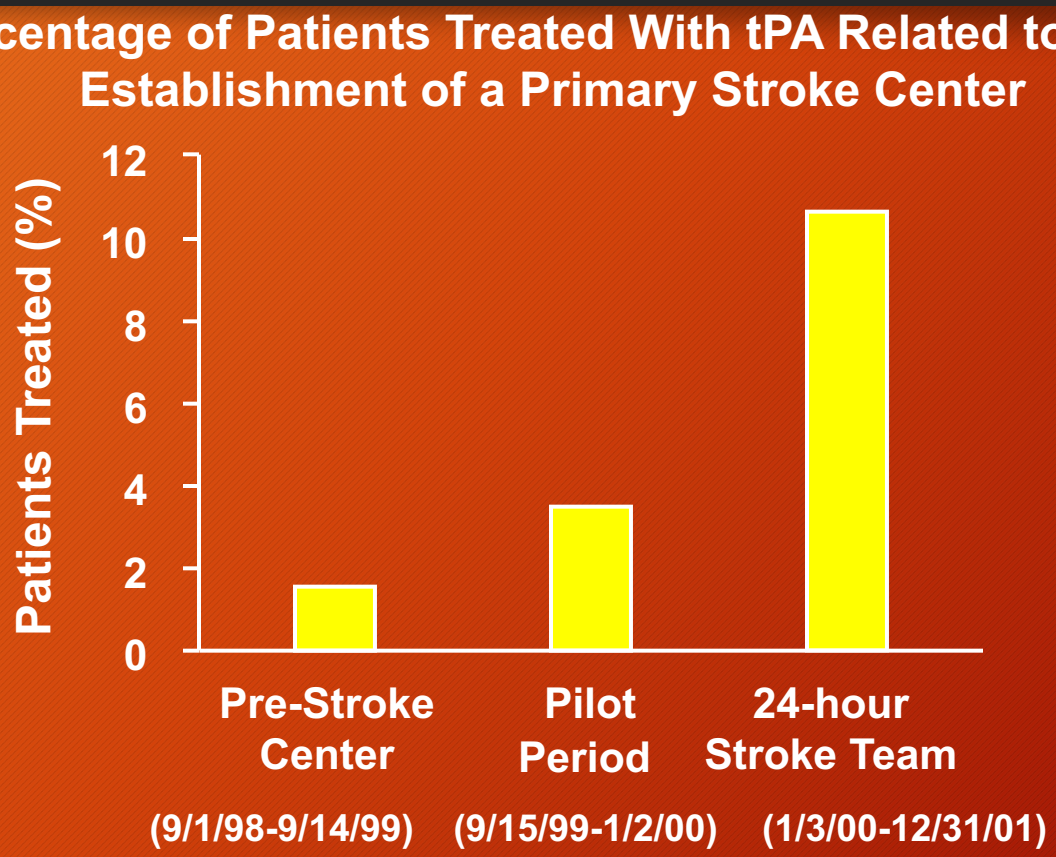
Figure 5: **Probability of good clinical outcome by time as predicted by unadjusted analysis, by reperfusion status**
Shaded areas show 95% CIs. Good clinical outcome was defined as a modified Rankin Scale score of ≤2.

Khatri *et al.* Lancet Neurology **13(6)**, 2014

Frequency of IV TPA Use

- National US estimate: 1-2%
- 30,000 ischemic strokes/month
  - ~500 receive TPA
  - ~29,500 do not

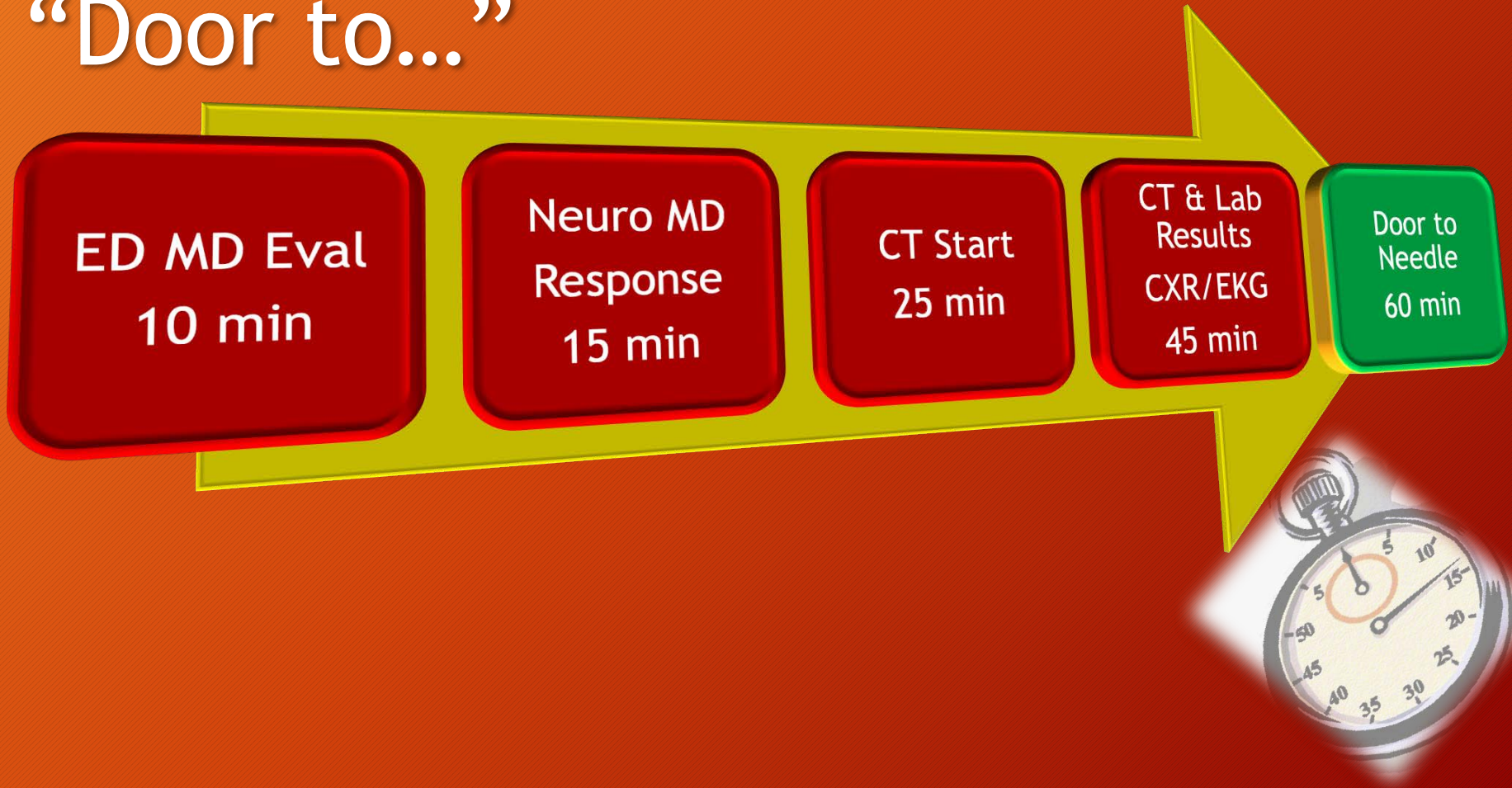
Impact of Establishing a Primary Stroke Center at a Hospital



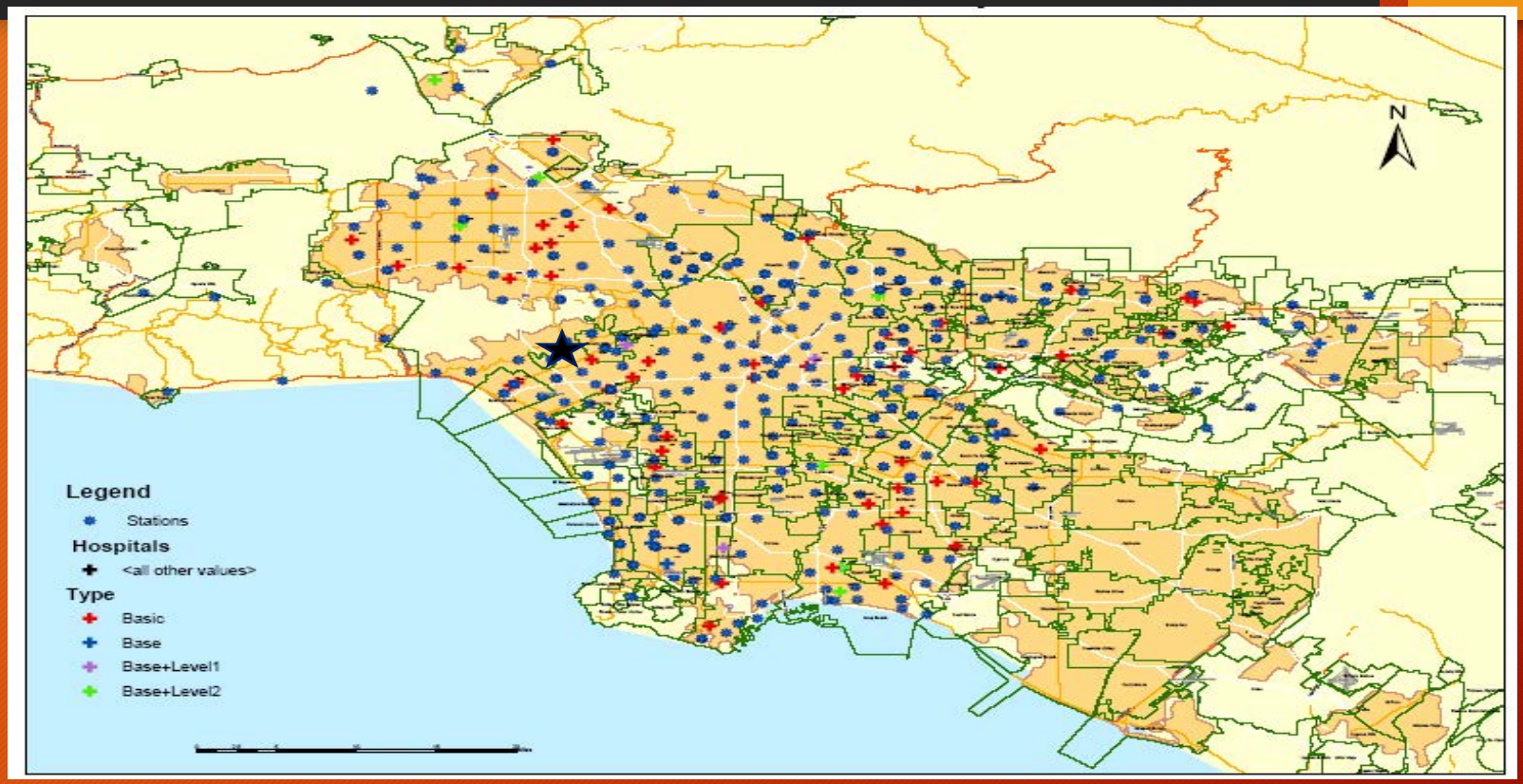
Lattimore SU, et al. *Stroke*. 2003;34:e55-e57.

Time Goals for Acute Stroke Evaluation

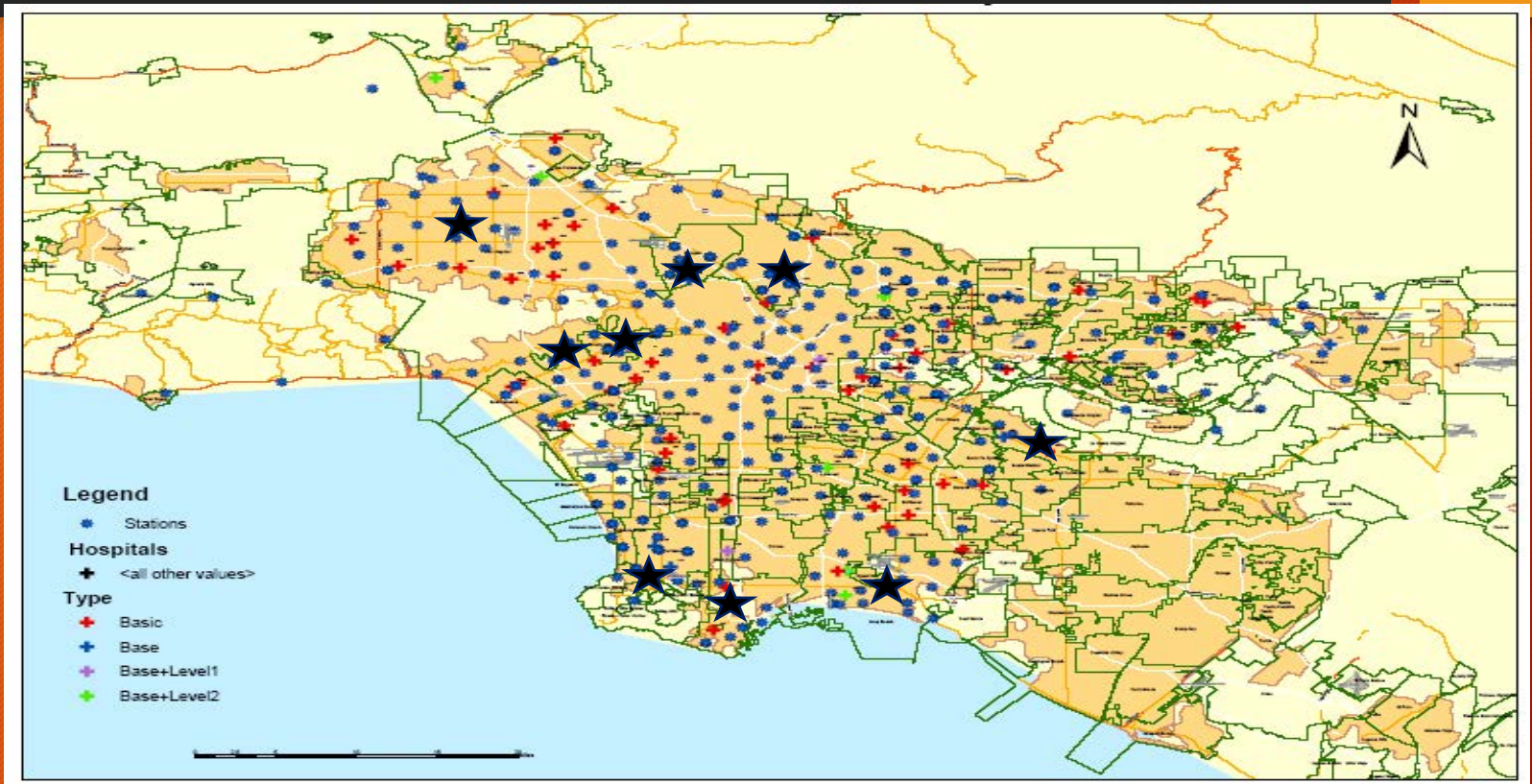
"Door to…"



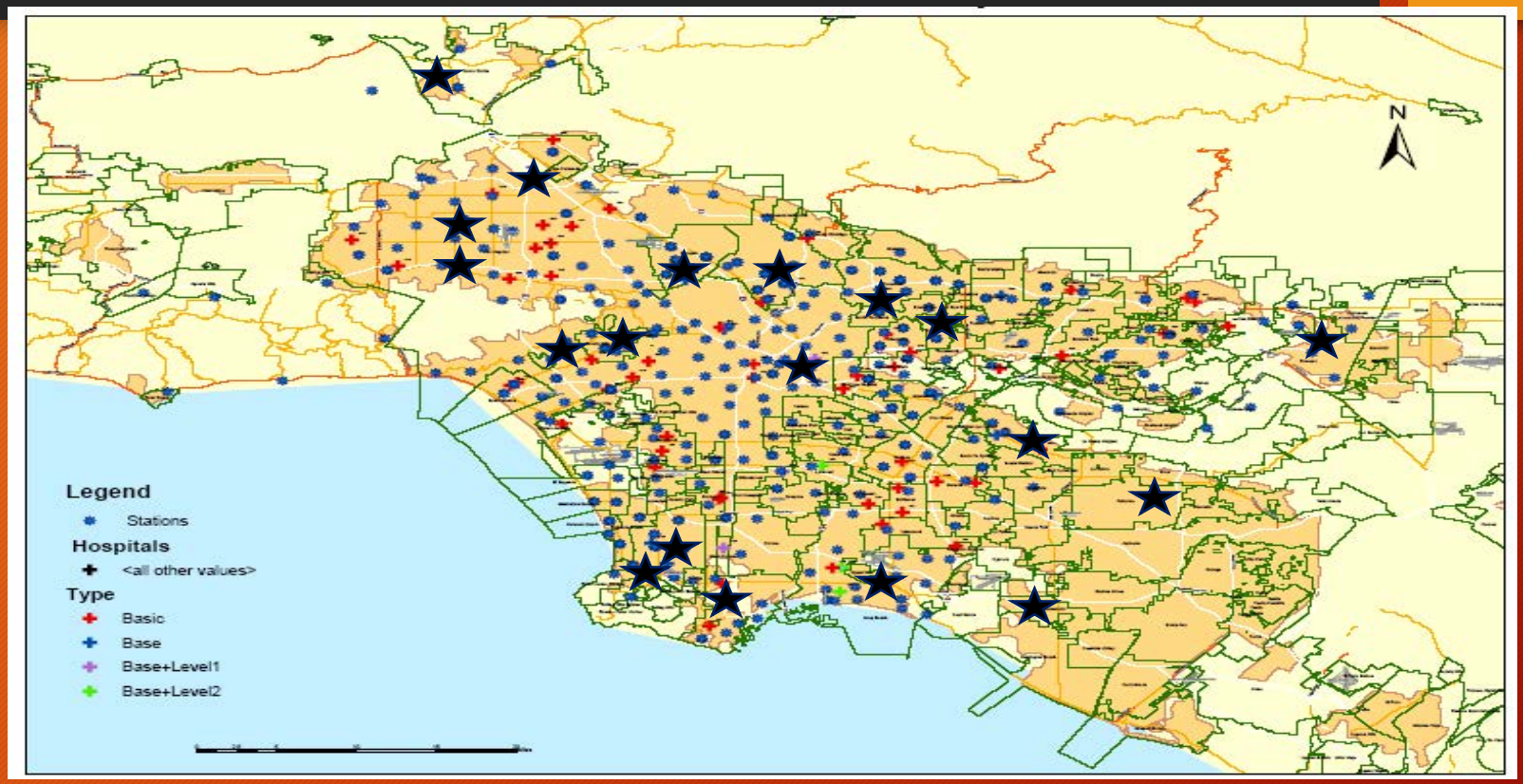
LA County PSCs on 1/2005



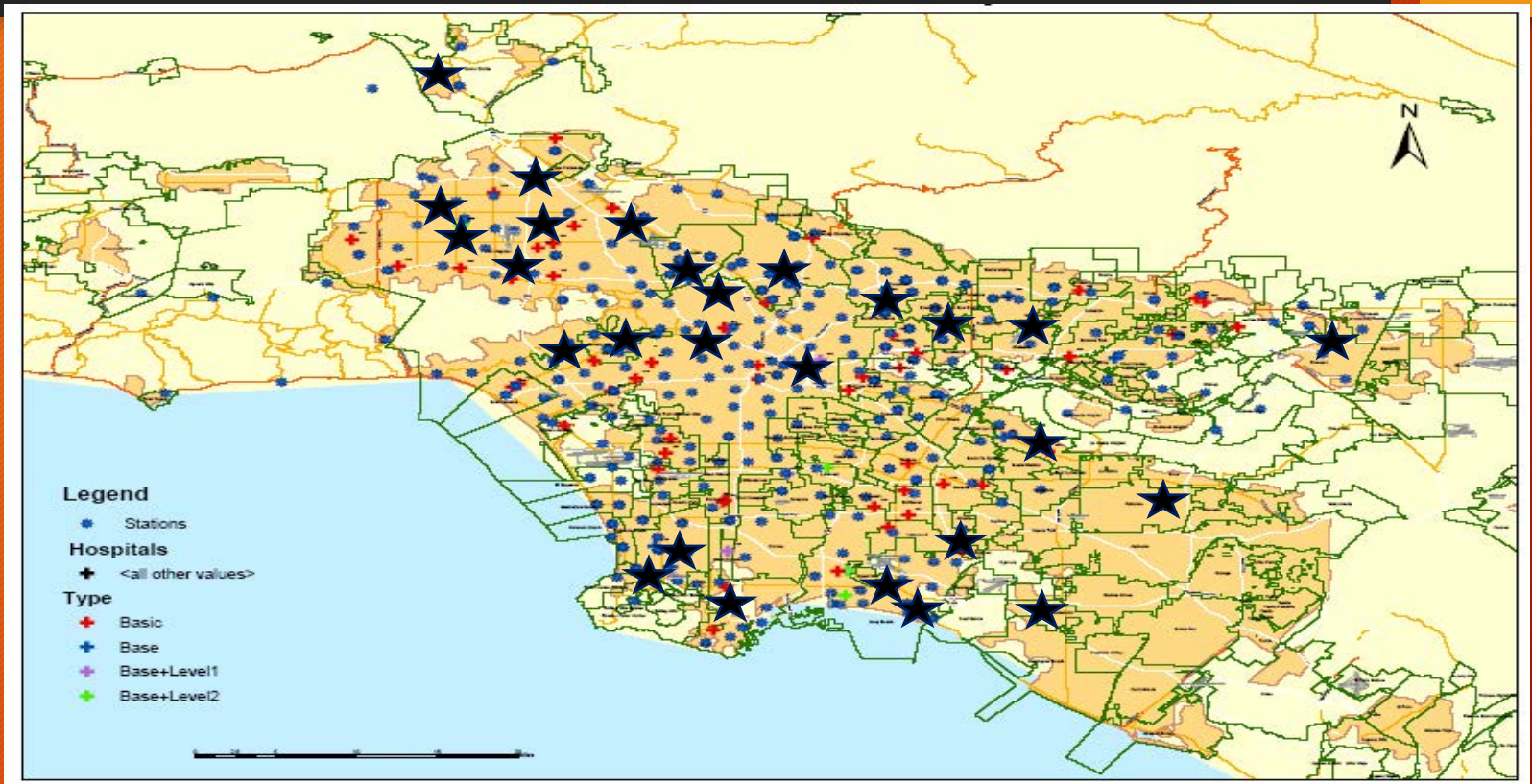
LA County PSCs on 11/2009



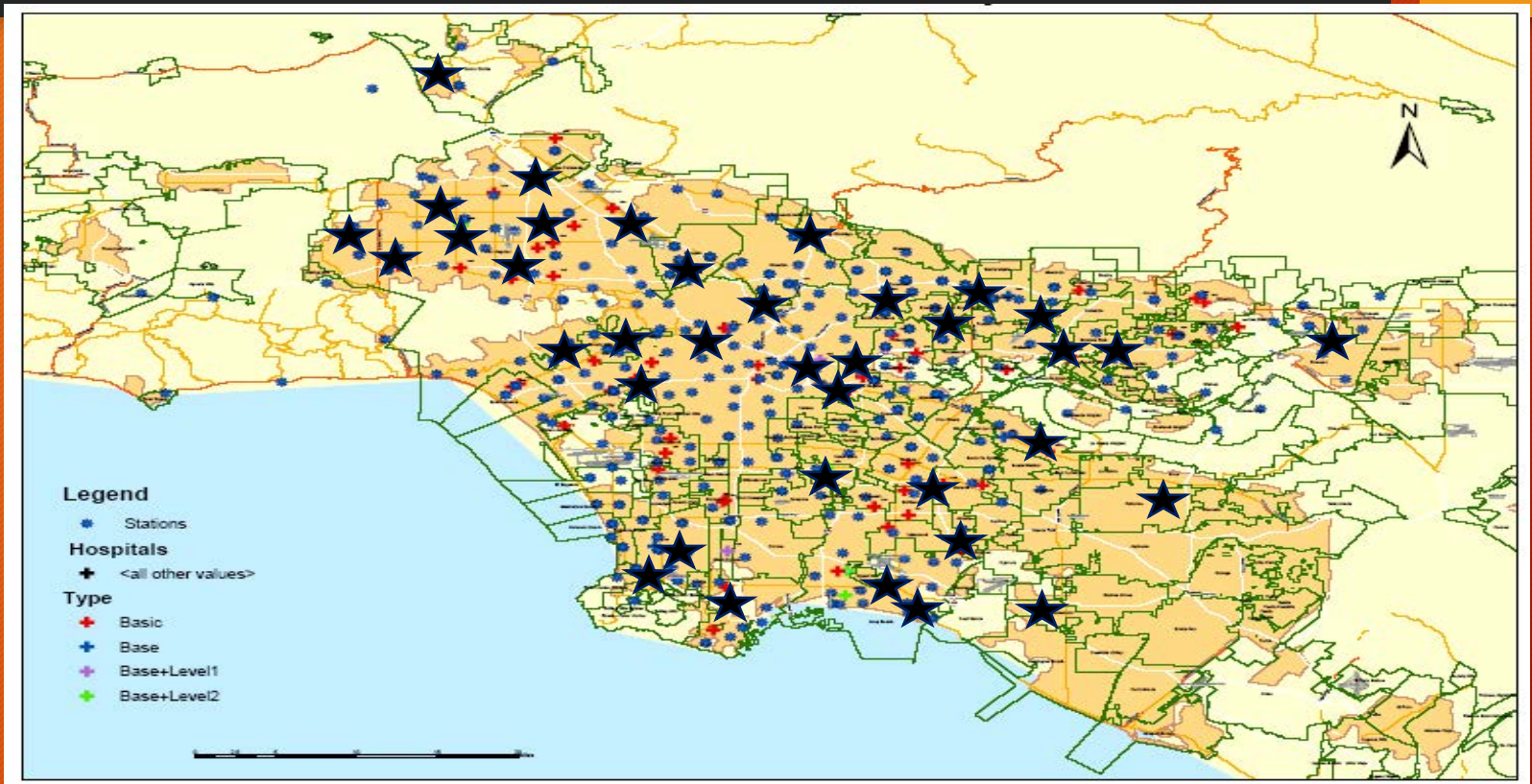
LA County PSCs on 2/1/11



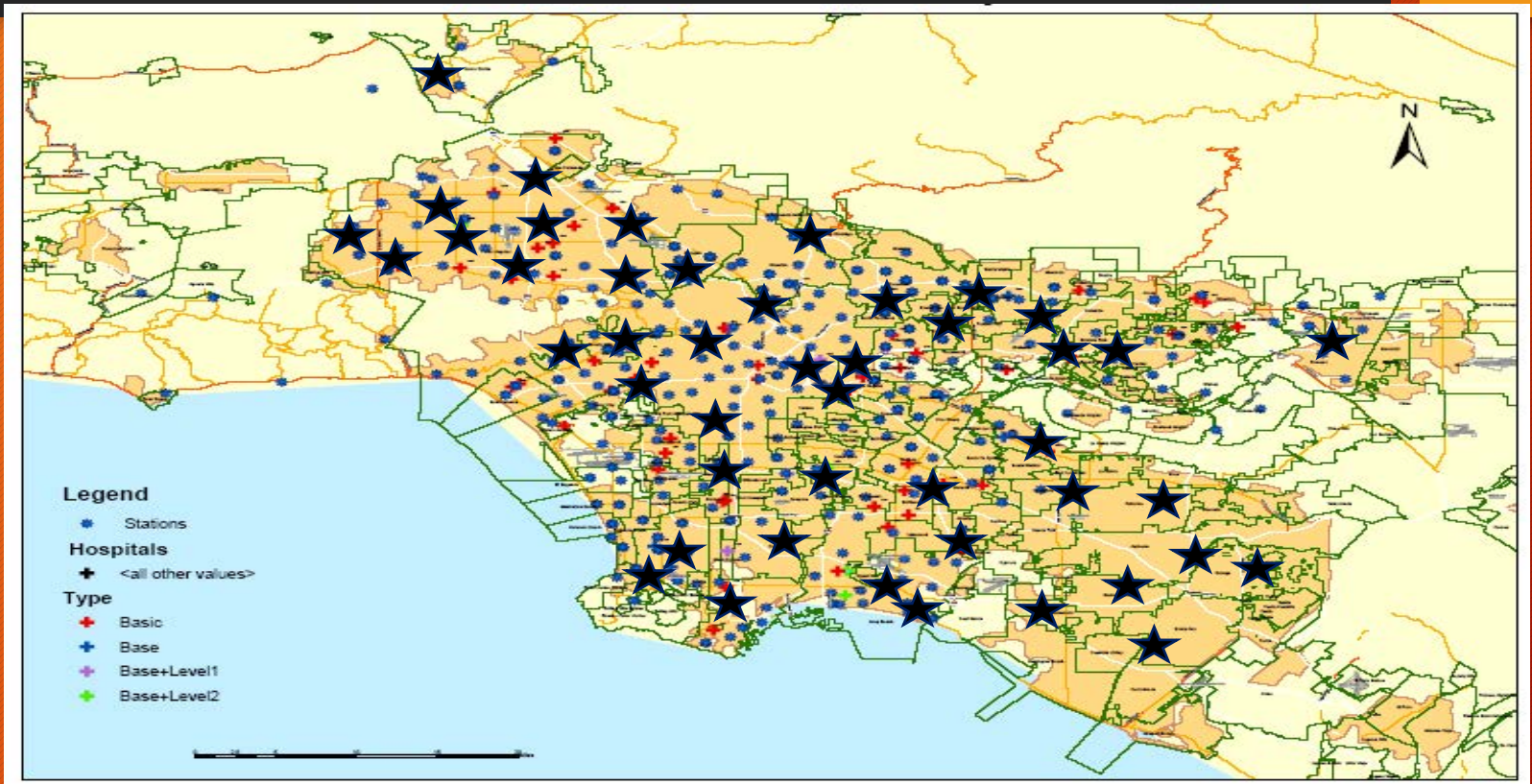
LA County PSCs on 5/1/12



LA County PSCs on 5/5/15



LA County PSCs on 10/1/19



Ideal Model of Acute Ischemic Stroke Care

Symptoms

911

EMS

Neuro-protectants

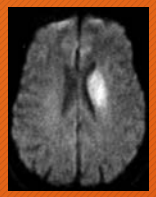
Primary Stroke Center

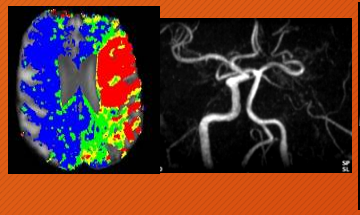
Imaging

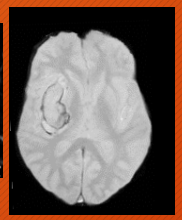
IV Lytic

EMS

Comprehensive Stroke Center

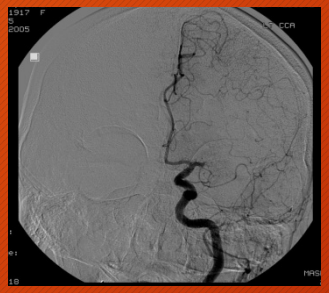






Multi-modal Imaging

Cath Lab



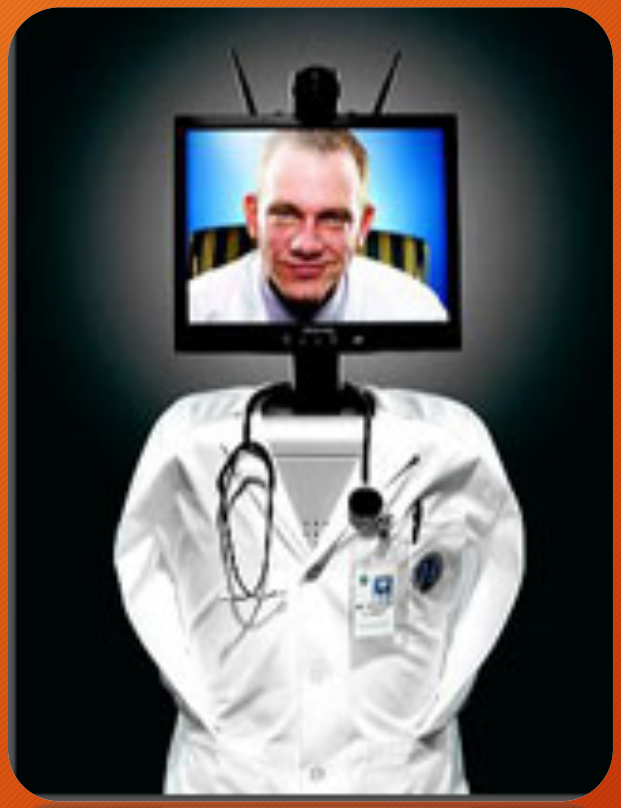
Angiogram

IA Mechanical or Lytic

Neuroprotectants

Dedicated Stroke Unit

Tele-Stroke



- Hospital that is able to coordinate ER services and offers rapid consultations with a neurologist
- Allows quick face-to-face contact between patient & neurologist

Mobile Stroke Unit

- Point-of-Care-based laboratory
- compact CT scan results, reviewed remotely by hospital physicians
- results in early pre-hospital IV-thrombolysis and subsequent bridging therapy later with IA recanalization in the hospital

Price tag- $1 million.
Annual cost for staffing and maintenance: $500K

PREVENTION

Stroke Myths

- MYTH: Stroke is not preventable
  - FACT: 80% of strokes ARE preventable
- MYTH: There is no treatment for stroke
  - FACT: There are multiple treatments if recognized early
- MYTH: Stroke is a disease of the elderly
  - FACT: Although more common in the elderly, stroke can affect any age group.

Stroke Risk Factors

Nonmodifiable

Age, Gender, Race, Heredity

Modifiable

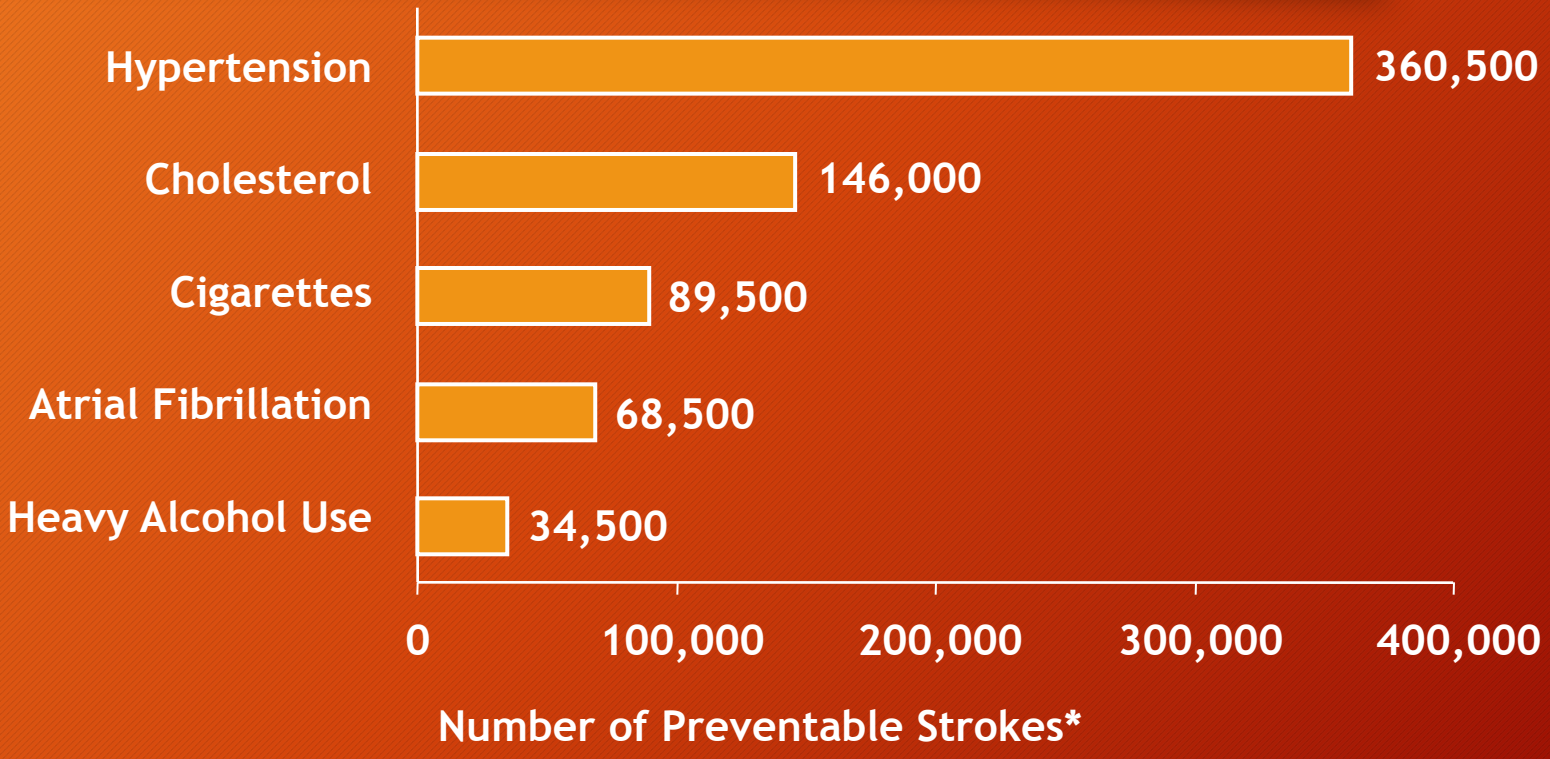
Medical Conditions

- Hypertension
- Cardiac disease
- Atrial fibrillation
- Hyperlipidemia
- Diabetes mellitus
- Carotid stenosis

Behaviors

- Cigarette smoking
- Heavy alcohol use
- Physical inactivity

How Many Strokes in the US Can Be Prevented by Risk-Factor Control?



*Based on estimated 700,000 annual strokes.

Gorelick PB. *Arch Neurol*. 1995;52:347-355.
Gorelick PB. *Stroke*. 2002;33:862-875.

Diet and Stroke Prevention

- High salt diet (5g/day) increases risk of stroke by 23%
- Mediterranean Diet reduces stroke and MI by up to 60%!!!
  - High in beneficial oils (olive, canola, fish)
  - High in antioxidants (vegetables, fruits, balsamic vinegar, omega-3 rich fish….)
  - Whole grains
  - Fruits & vegetables
  - Low in cholesterol, trans-fats, and animal fats

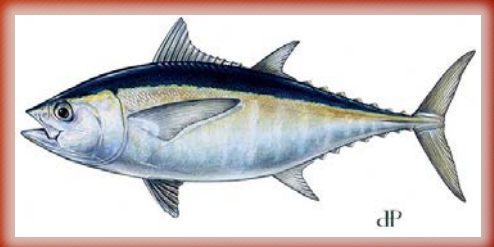
Fischer M et al., Stroke 2006:37:2430-2435

Specific Foods with Possible Stroke Protective Qualities

- Foods rich in polyphenols (blueberries, blackberries, raspberries, strawberries)
- Cocoa may be protective through its anti-hypertensive and anti-inflammatory properties.
- Coffee and tea!
- Fatty fish

Oily Fish

- Mackerel
- Herring
- Salmon
- Tuna



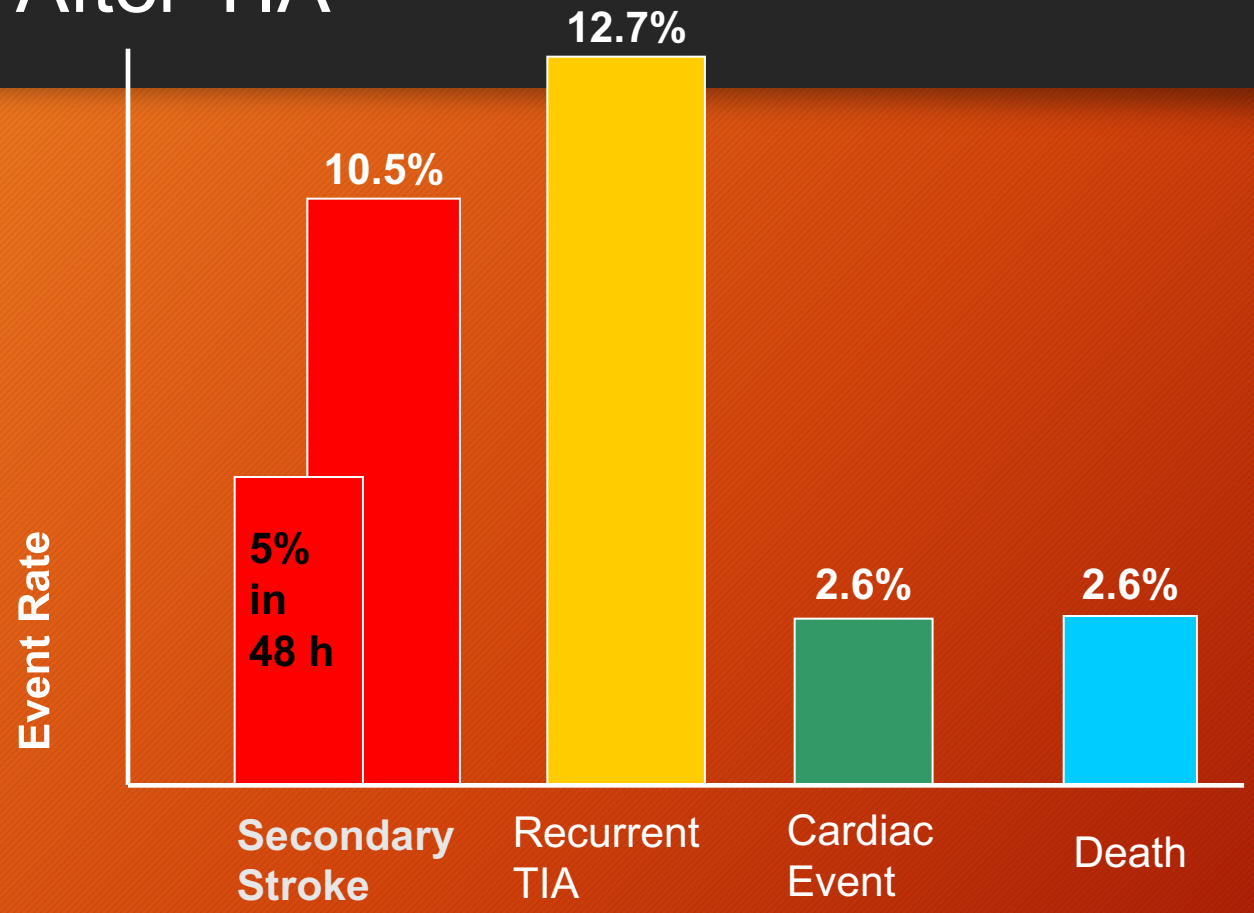
Exercise

- AHA/ASA 150min/week
- 25-30% stroke risk reduction
- Improves blood pressure and diabetic control

Transient Ischemic Attacks

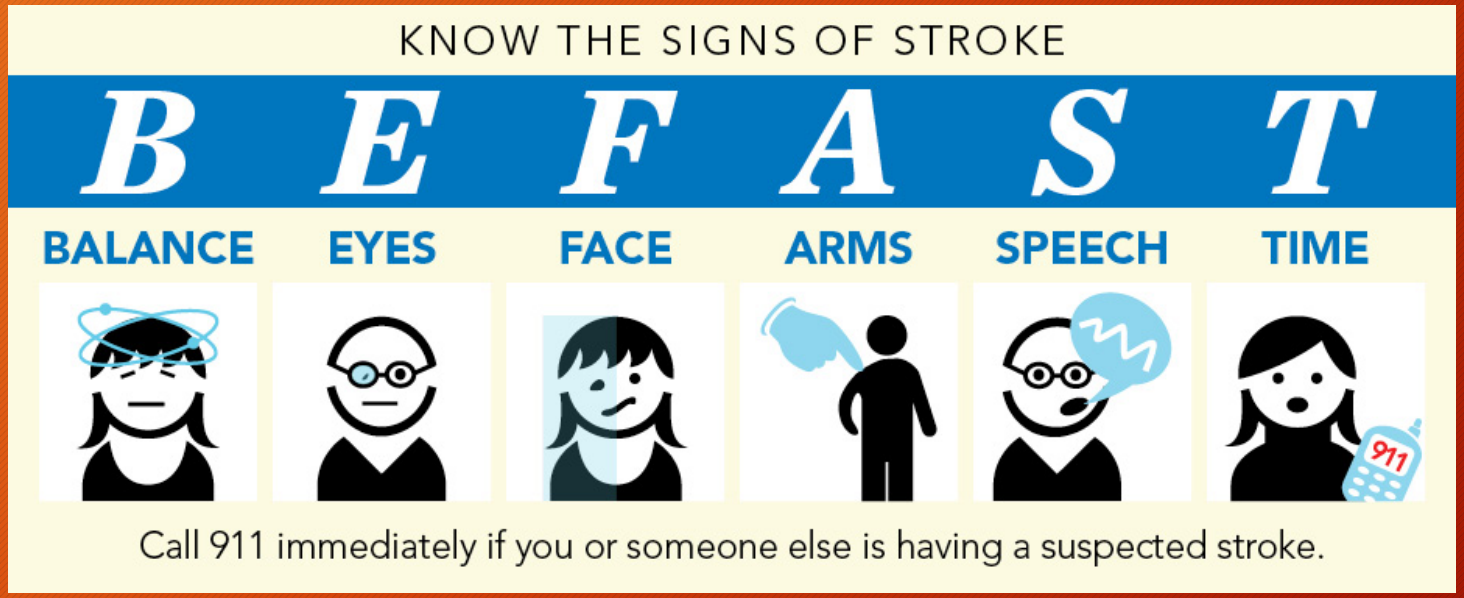
- Transient focal ischemia
- Traditional time definition
  - Duration < 24 hours
  - Actually usually 5-30 minutes
- After TIA, ten times the risk of ischemic stroke
  - Risk highest in first 3 months following TIA
  - 35% stroke risk within 3-5 years after TIA

Vascular Event Risk Within 3 Months After TIA



Johnston SC, et al. *JAMA*. 2000;284:29012906.

Symptoms


KNOW THE SIGNS OF STROKE
B E F A S T
BALANCE
EYES
FACE
ARMS
SPEECH
TIME
911
Call 911 immediately if you or someone else is having a suspected stroke.