Drip and Ship Evidence, Practice, Outcomes

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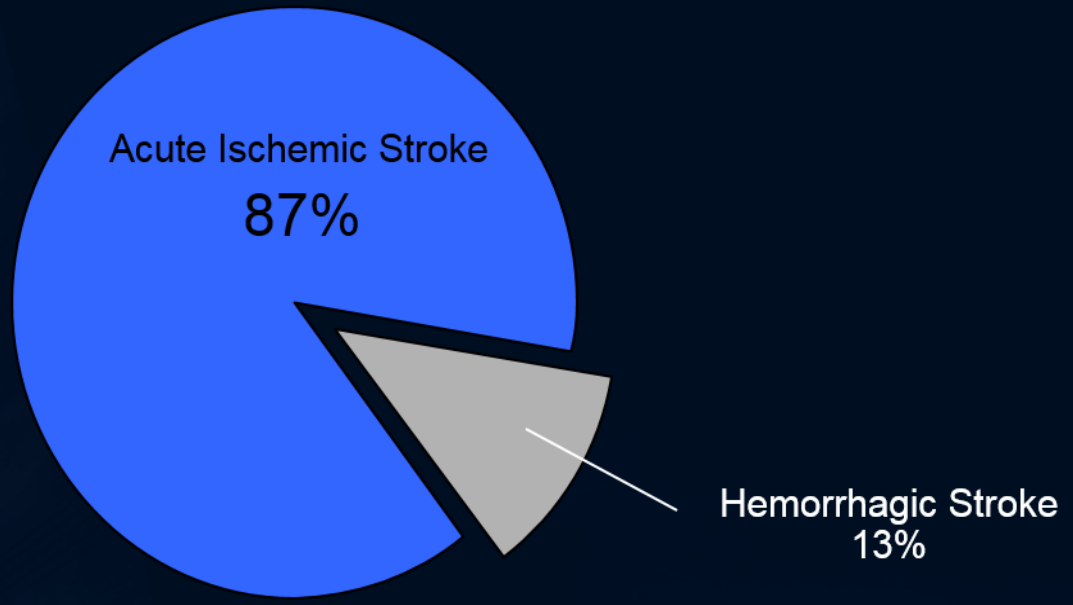
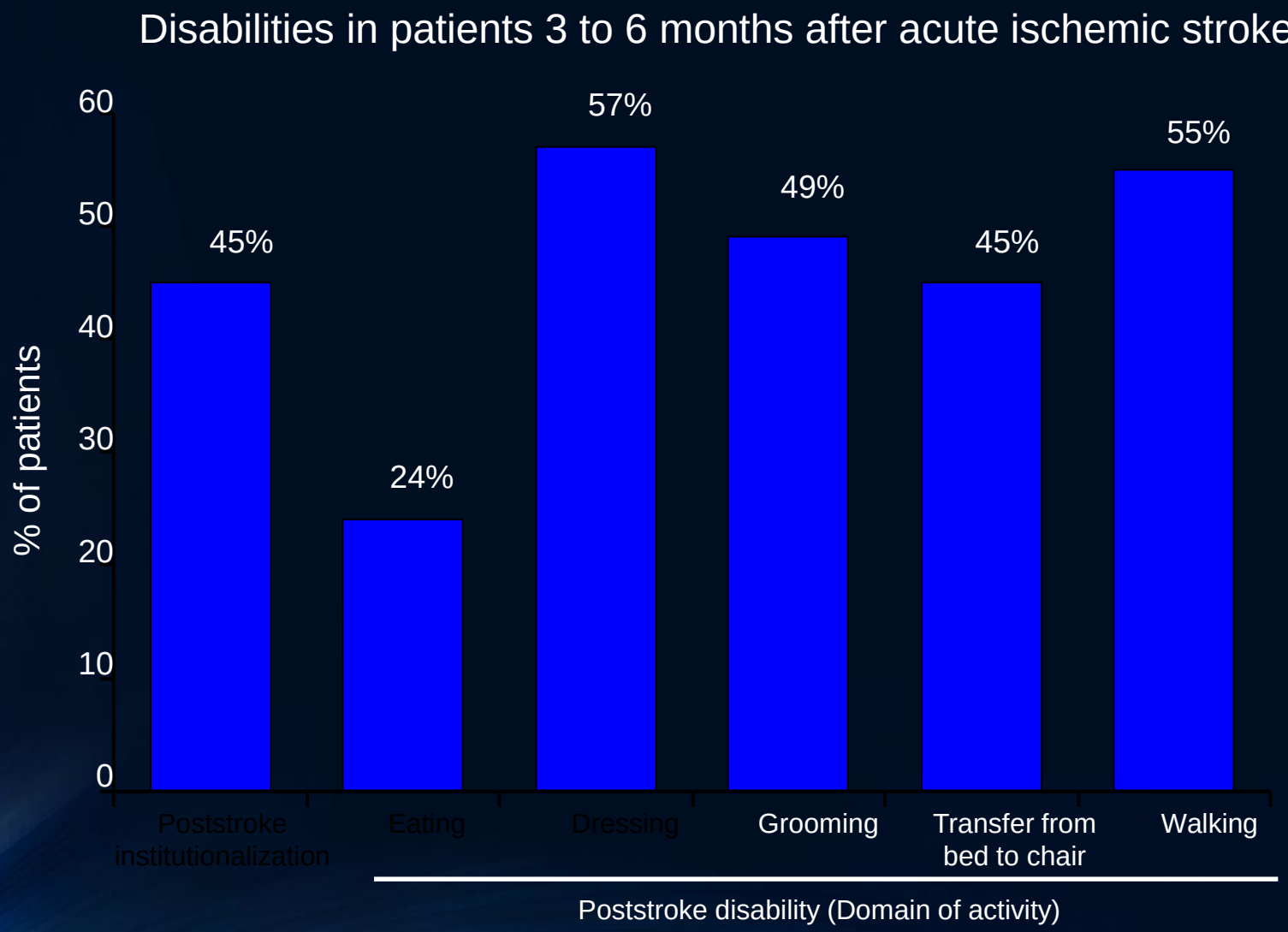
Significance of Stroke

- 800,000 strokes per year
- 85% ischemic – 13% hemorrhagic
- Leading cause of disability
- 5th leading cause of death

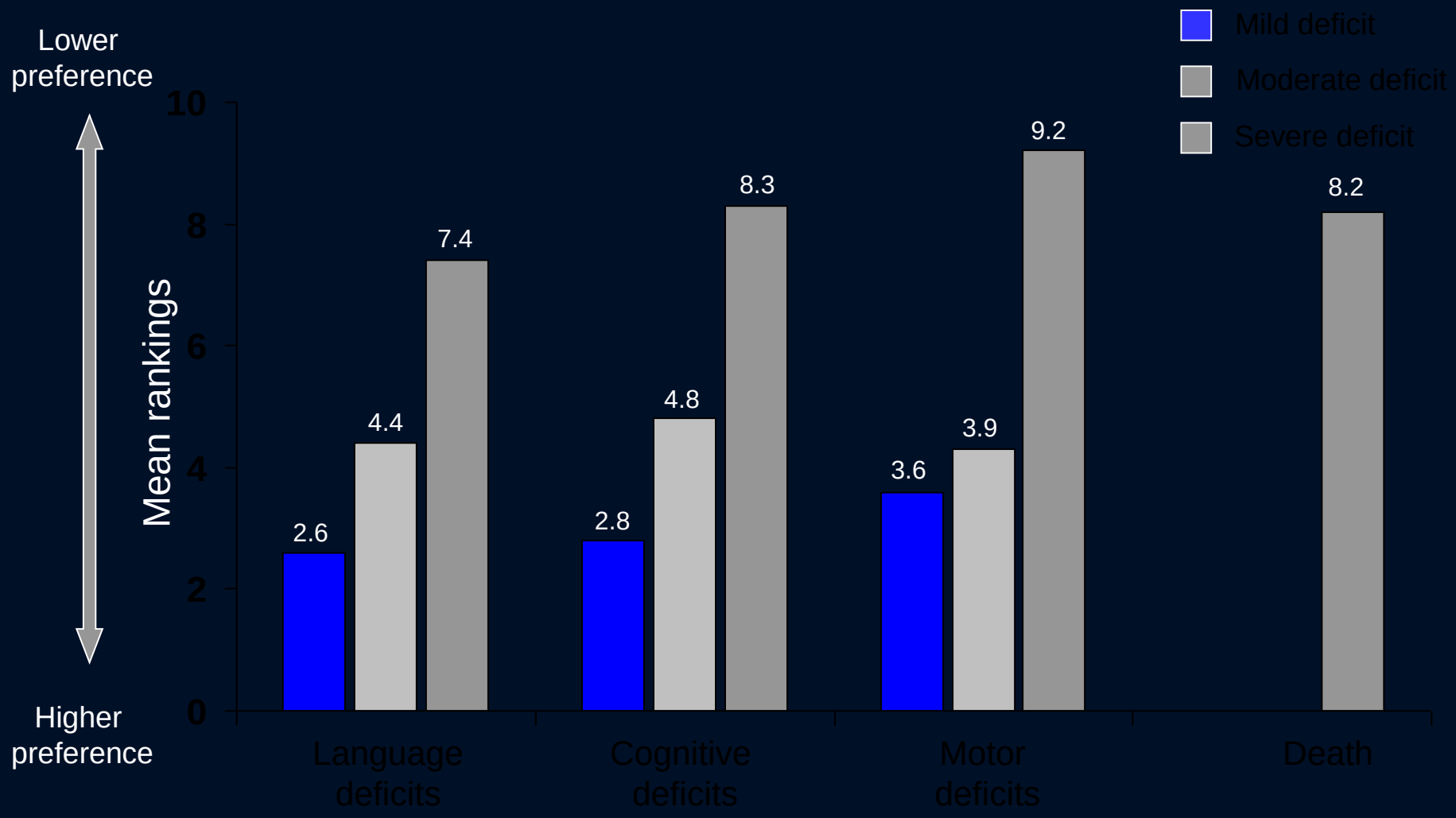


Stroke Is the Primary Cause of Long-Term Disability in the United States



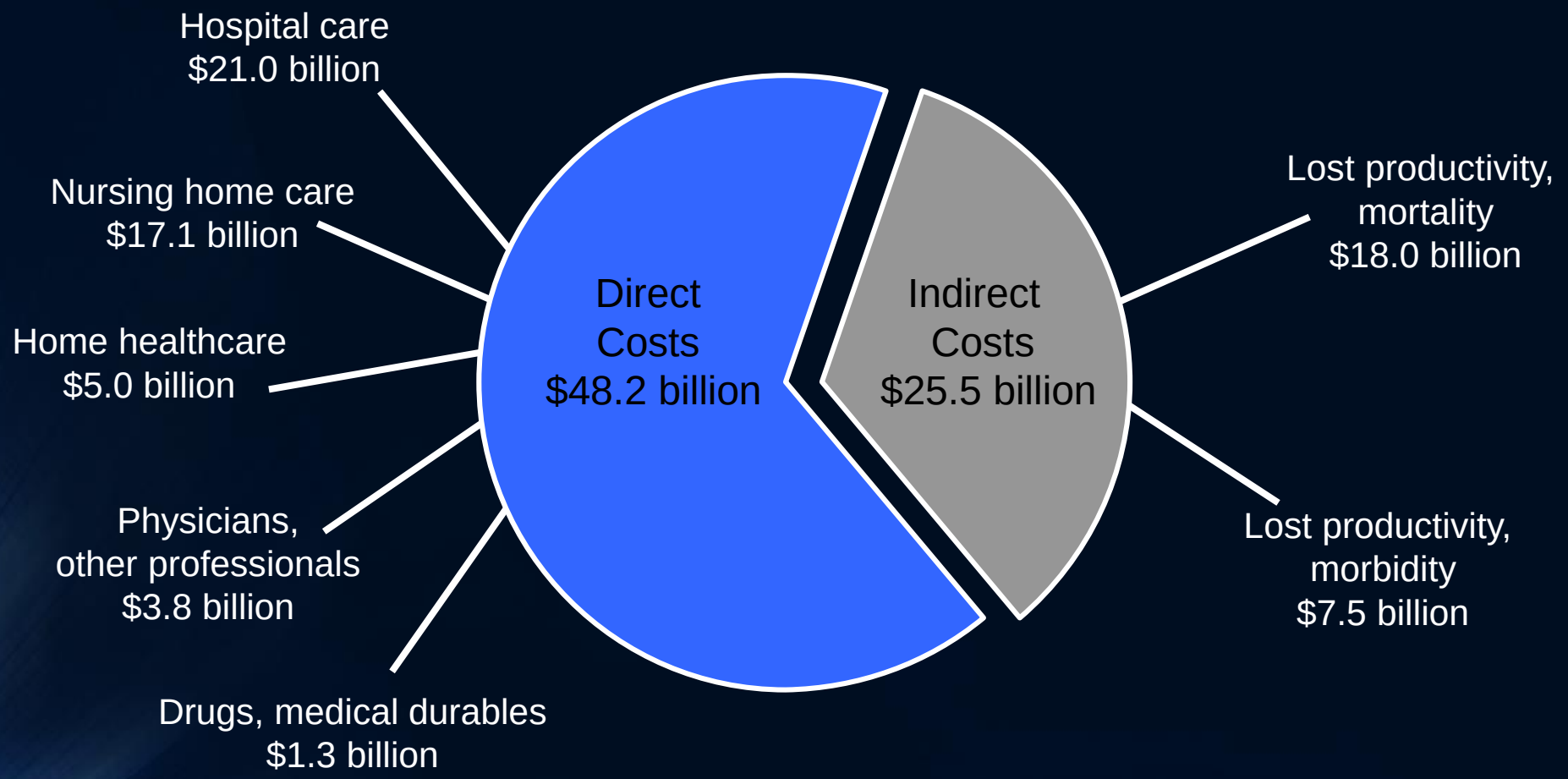
Lloyd-Jones D, et al. *Circulation*. 2010;121:446-e215.
Petrea RE, et al. *Stroke*. 2009;40:1032-1037.

Patients Perceive Severe Stroke Outcomes as Similar to or Worse Than Death



Solomon NA, et al. *Stroke.* 1994;25:1721-1725.

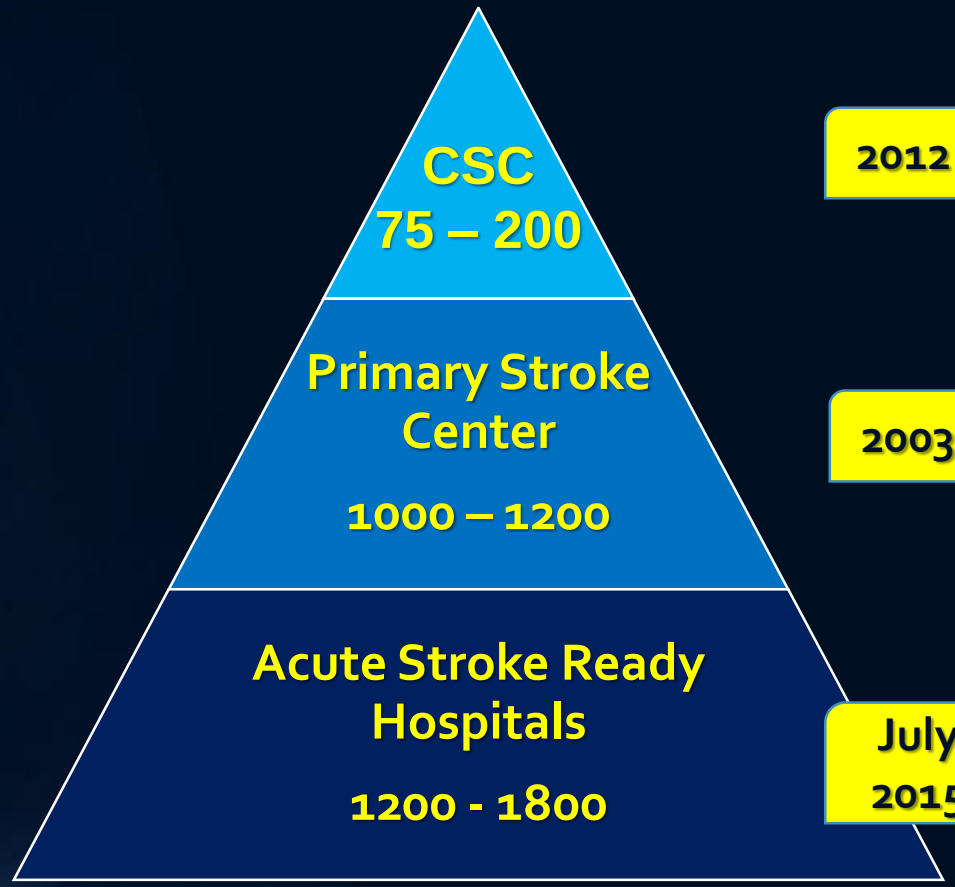
The Direct and Indirect Costs* of Stroke Amount to $73.7 Billion



*Estimated for 2010.

Lloyd-Jones D, et al. *Circulation*. 2010;121:446-e215.

Models of Stroke Care



2012	Academic medical center, tertiary care facility
2003	Wide range of hospitals; standard stroke care; stroke unit; uses tPA
July 2015	Rural hospitals; basic care; drip and ship; use tele-technologies

Stroke is different?

Why isn't this as much of a problem for other conditions (e.g. acute myocardial infarction)?

- Less stroke-trained neurologists
- ED physicians less comfortable with neurologic problems, esp. rt-PA
  - No definitive test that diagnoses stroke
  - No required training during ED residency, therefore less comfortable with neurologic exam and diagnoses
- Complications after rt-PA more common for stroke than for lytic for other conditions, and are life-threatening
- Monitoring for complications requires specialized stroke care and neurosurgical back-up


clinical
data
requirements
informaticians
clinician
need
understand
clinicians
archetype
technical
informatician
reference
represent
right
fit
Clinician
ensure
support
modelers
structure
patient
blind
tend
built
quality
domain
research
many
often
experts
health
purpose
gathered
critical
systems
use
question
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decision
content
development
sharing
little
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good
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know
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surprisingly
first
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clearly
questions
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Yet
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however
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provide
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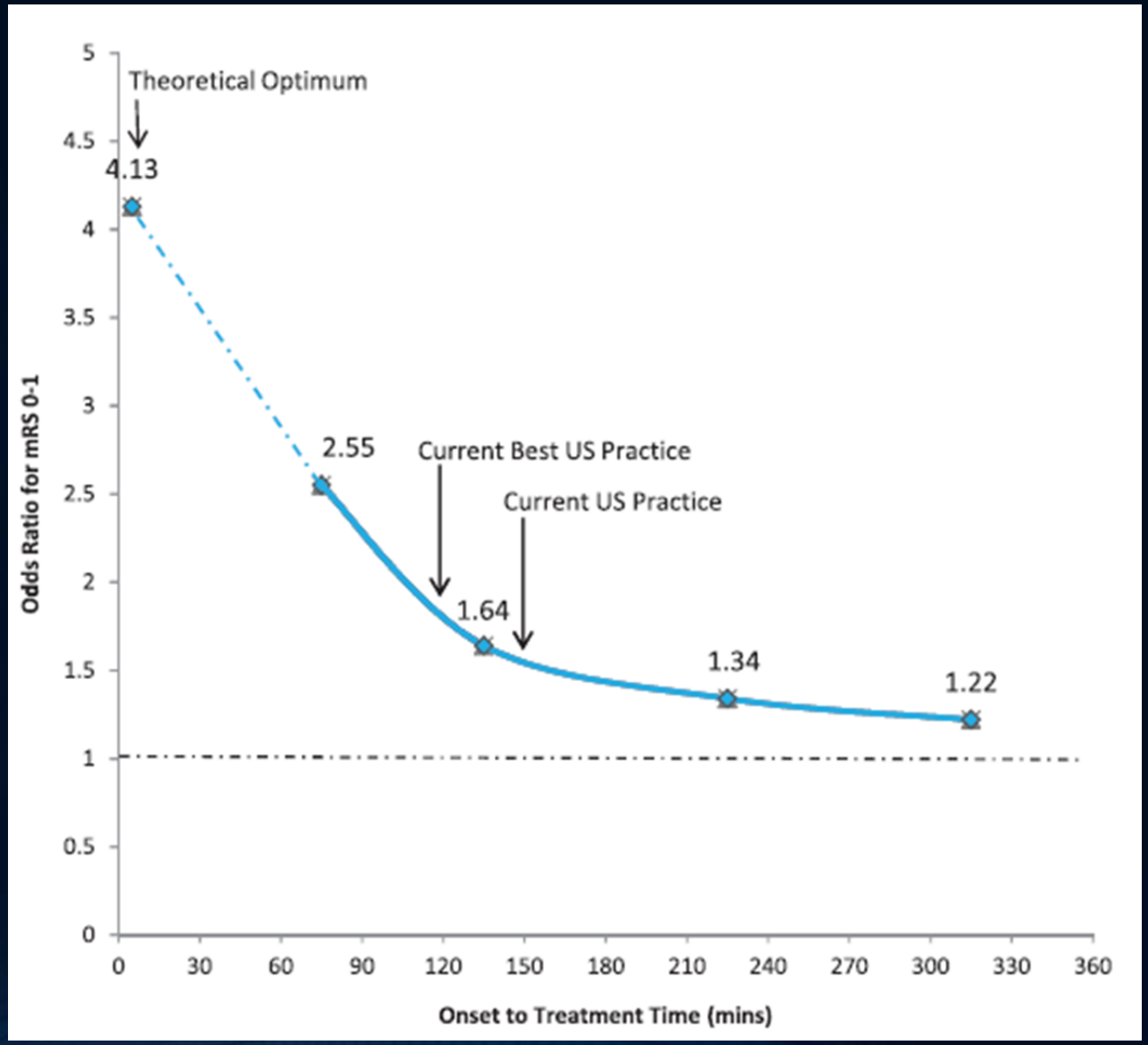
close
surprised
consisting
going
designed
teams
orders
reflected
processes
cross-pollination

TIME = BRAIN


Theoretical Optimum
4.13
2.55
Current Best US Practice
Current US Practice
1.64
1.34
1.22
Odds Ratio for mRS 0-1
Onset to Treatment Time (mins)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
30
60
90
120
150
180
210
240
270
300
330
360

Challenges in Rural Communities

- Small number presenting for treatment
- Delays in presenting after symptom onset
  - Access to care (patient lives distance from facility)
  - EMS volunteer / lack of availability
- EMS may not be trained in pre-hospital screening
- Lack of physician availability
- Lack of neurology consultation
- Lack of uniform procedures
- Lack of access to tPA / reluctance to administer
- Equipment delays – CT Scan, slow CT scanner, lack of 24/7 technologist
- Ancillary service delays – radiology; slow transmission speeds

Drip and Ship

- Use of rt-PA in smaller community and rural hospitals is increasing because of support relationships with regional comprehensive stroke centers, similar to trauma models of care
  - Increased use of telemedicine
- Advances in options for care validate the need for some patients to receive care in primary / comprehensive centers to optimize outcomes

Why ‘Drip and Ship?

- Increase level of care in rural settings
- Provide options for additional clinical support to guide decision making
- Access to second opinion - relationships
- Validation of expertise
- Improved outcomes for patients – decreased mortality and disability

Research and Evidence

"Sheth et. al. analyzed data on 44,667 ischemic stroke patients who received tPA within less than three hours at 1,440 hospitals between 2003–2010. Researchers compared "drip and ship" patients to those who received tPA at the hospital where they were admitted. The investigators found that 23.5% of patients receiving tPA quickly were treated using "drip and ship."

Sheth, K.M., Smith, E. E., Grau-Sepulveda, M. V., Kleindorfer, D., Fonarow, G., & Schwamm, L. H. (2015). Drip and ship thrombolytic therapy for acute ischemic stroke: Use, temporal trends and outcomes. Stroke48 (11). DOI https://doi.org/10.1161/STROKEAHA.114.007506.

Drip and Ship in a Nutshell……

- Assess – identify acute ischemic stroke; r/o hemorrhage
- Decision [treat / do not treat ; transport]
- Administer [Activase® (alteplase)]
- Immediate transport to higher level of care

SIMULATION

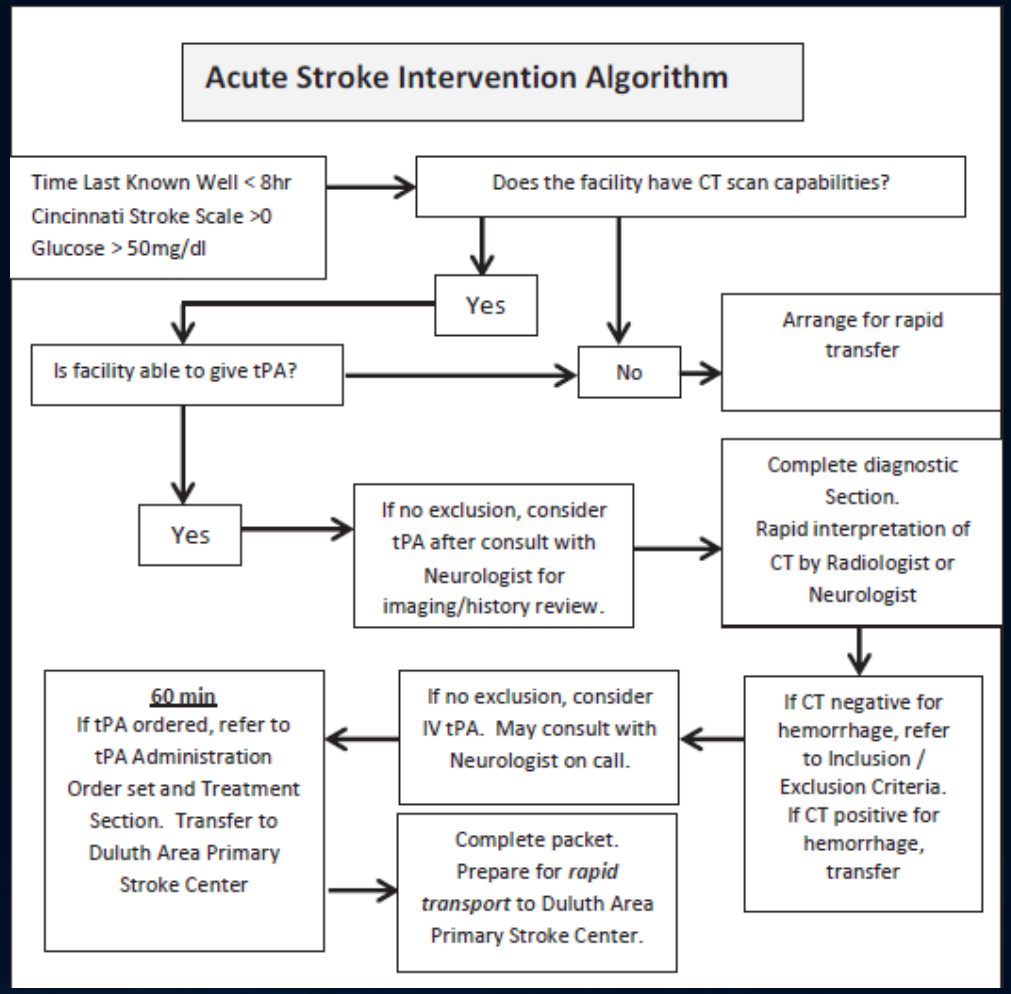
The team demonstrated 7 pieces of team preparedness……can you name them?

- EMS used a screening tool
- Nurses had protocols to start care and call people in
- Nurses notified flight early so weather check and prep could be done
- Protocols were made easy to find with a bright color
- Nurses assigned roles to each prior to patient arrival
- Nurses identified treatment targets
- Nurses prioritized their actions

ASSESSMENT

- ❑ Time last known well: _____
- ❑ Blood Pressure
- ❑ Pulse
- ❑ Vs q 15 minutes with neuro checks
- ❑ Continuous cardiac monitoring
- ❑ Actual weight _____ kg [estimated weight if actual not possible]
- ❑ NIHSS on arrival
- ❑ Keep NPO (including meds)

S.O.P.....Standard Operating Protocol



Additional Data

TIMES

- ED Triage Time
  - _____:_____
- Time Last Known Well
  - _____:_____

DIAGNOSTICS

- CT w/o contrast
  - CT Results
    - ❑ No acute findings
    - ❑ Hemorrhage
    - ❑ New ischemic stroke
    - ❑ Other
- Labs
  - ❑ Glucose
  - ❑ PT/INR if on anticoagulation

SIMULATION

What questions do you have about the stroke exam that the nurse did?

- Why aren't the Glasgow Coma Score and checking pupils enough for stroke assessment?
- What adaptations were used in the NIHSS during this simulation
- Would you send this patient to CT in a wheelchair or on a gurney? Alone or with an RN and wy?
- How did they determine that the patient was stable to go?

Activase® (alteplase) Checklist

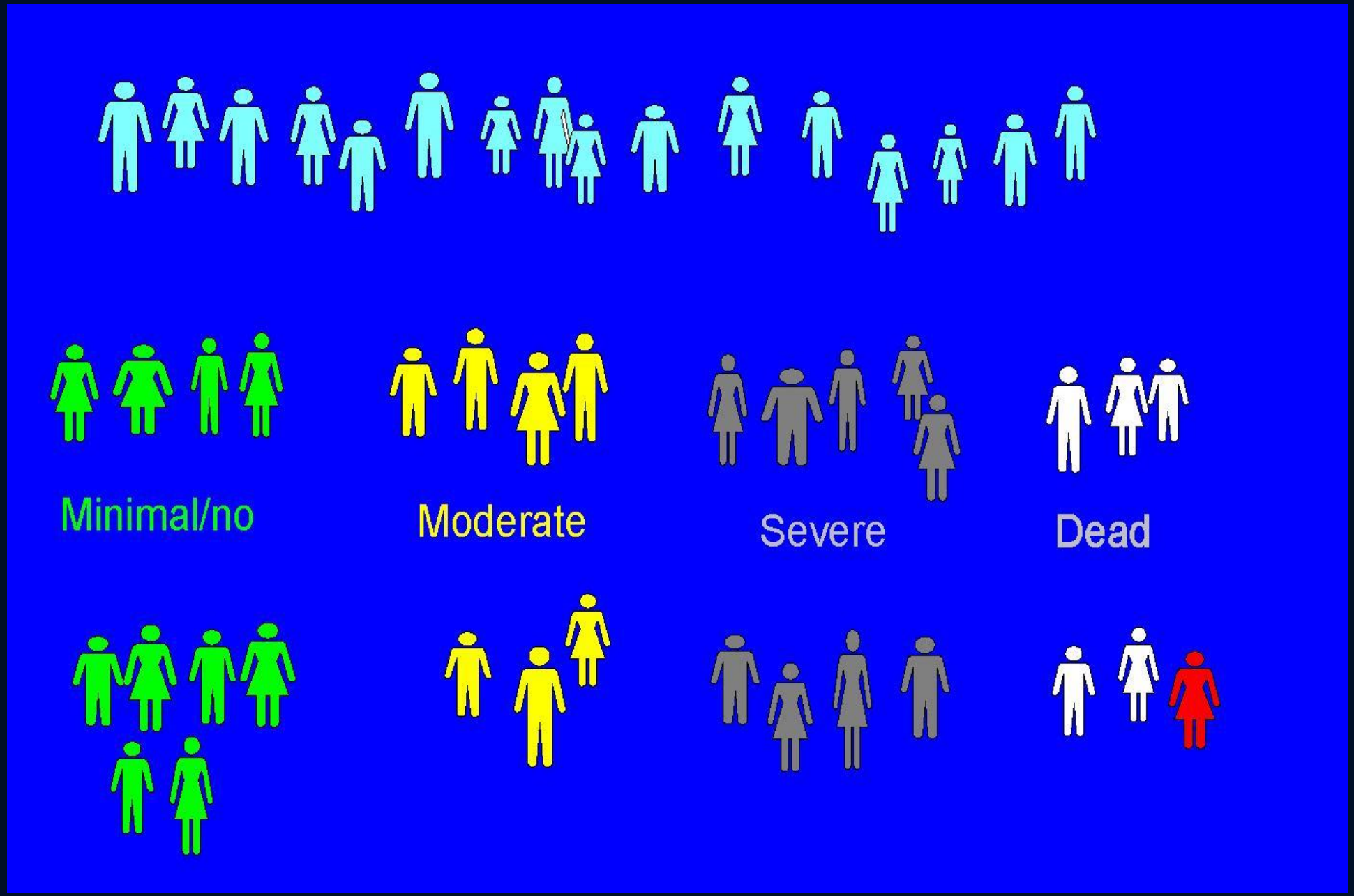
- Onset of Sx to tPA bolus < 4.5 hours
  - If > 3 hours but < 4.5 hours – additional screening protocol met
- No hemorrhage on CT scan
- Thrombolytic Inclusion/Exclusion checklist completed
- No exclusions for administering tPA (alteplase)
- Discussion with patiet/family regarding risks/benefits/alternatives

- ❑ If tPA candidate, initiate tPA orders
- ❑ NPO (including meds) until Dysphagia Screen
- ❑ BP Protocol
  - Ischemic target
  - Hemorrhagic target
- ❑ Baseline O2 sats _____%
  - O2 to keep SATS >92%
- ❑ Two large-bore IV sites
- ❑ Normal Saline TKO

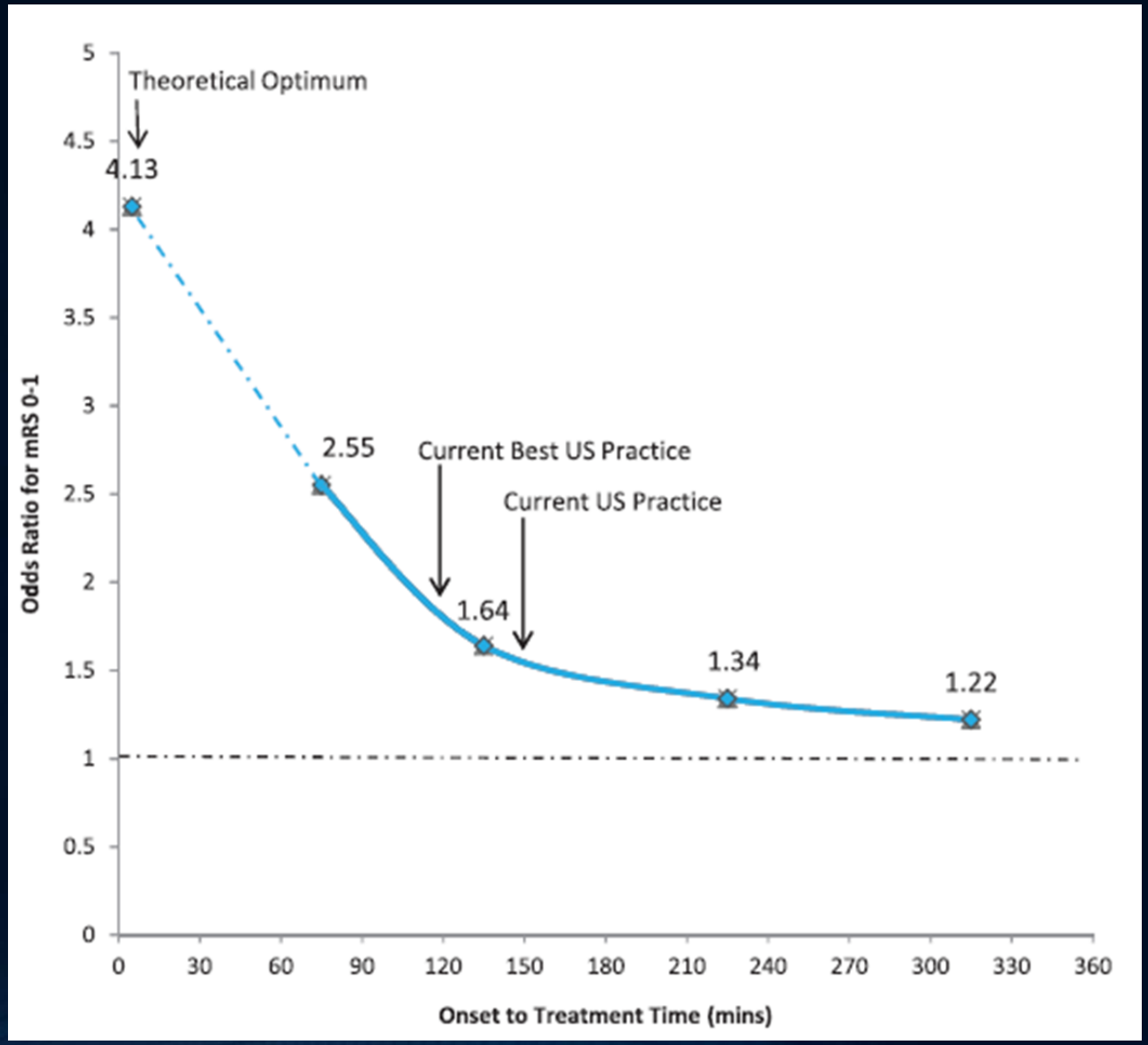
Cost Effectiveness of t-PA

- **Length of Stay significantly shorter** (10.9 versus 12.4 days; p = 0.02)
- **Patients receiving tPA were more likely discharged to home** than to inpatient rehabilitation or a nursing home (48% versus 36%; p = 0.002).
- Markov model estimate: Per 1000 eligible patients, **4 million dollars saved over their lifetimes**
  - increase in hospitalization costs of $1.7 million,
  - decrease in rehabilitation costs of $1.4 million and
  - decrease in nursing home costs of $4.8 million
- The estimated impact on long-term health outcomes was 564 (3 to 850) quality-adjusted life-years saved over 30 years of the model per 1,000 patients.

Fagan, S., Morgenstern, L., Petitta, A., Ward, R., Tilley, B., Marler, J., Levine, S., Broderick, J., Kwiatkowski, T., Frankel, M., Brott, T., Walker, M., and NINDS rt-PA Stroke Study Group, *Cost-effectiveness of tissue plasminogen activator for acute ischemic stroke.* Neurology, 1998. **50**: p. 883-890.


Minimal/no
Moderate
Severe
Dead

TIME = BRAIN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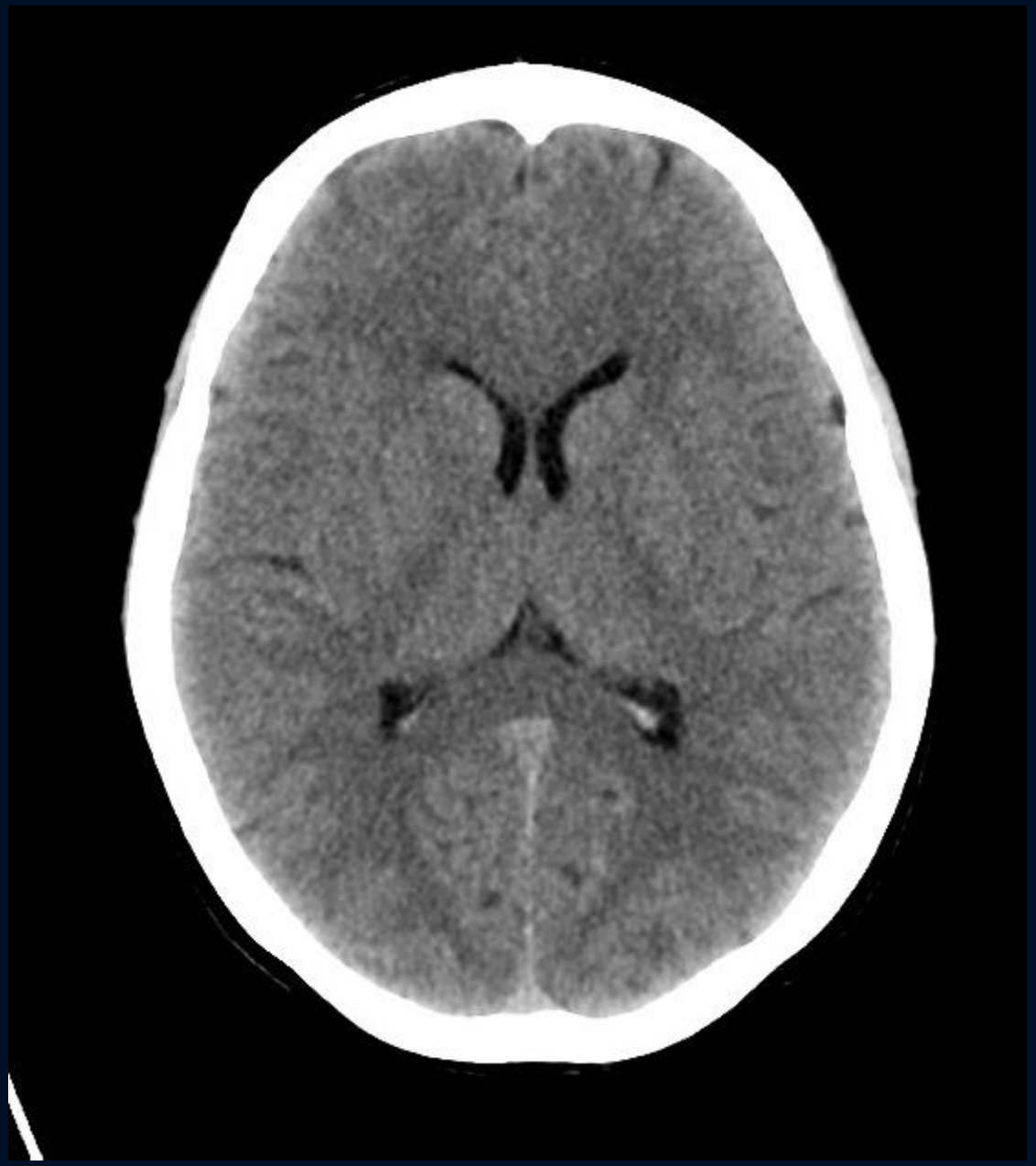
SIMULATION



Activase® (alteplase) Inclusion/Exclusion

Inclusion Criteria

- Ischemic stroke diagnosis with measurable neurologic deficit
- Symptom onset < 3 hours prior to treatment (in some cases – 4.5 hours prior to treatment)
- Age ≥ 18 years

Exclusion criteria [Contraindications]

- Intracranial or intracerebral bleeding, SAH
- Active internal bleeding
- Recent (within 3 months) intracranial or intraspinal surgery or severe head trauma
- Severe uncontrolled hypertension
- Intracranial neoplasm, AVM
- Bleeding diathesis

Treatment within 4.5 hour window

- Patient is ≤ 80 years of age
- Patient does not have a history of diabetes AND stroke
- Patient is not taking warfarin (Coumadin) or any other anticoagulant regardless of INR / coagulation results
- NIHSS is ≤ 25
- Written consent is obtained

Contraindications to tPA Stroke Thrombolysis	Reasonable for use of tPA in Acute Ischemic Stroke Compare Risks to Benefits
☐ Age less than 18 years. ☐ Stroke start unknown or greater than 3.5 hours. (See Extended Time Frame Contraindications) ☐ Any acute intracranial hemorrhage on CT or history of intracranial hemorrhage. ☐ Intracranial or intraspinal surgery or dural puncture in the previous 3 months. ☐ Serious head trauma/stroke in the past 3 months ☐ Coagulopathy, including any novel oral anti-coagulant use. ☐ Warfarin use with INR over 1.7 ☐ LMWH use within previous 24 hrs. ☐ Platelet count less than 100K/mm3. ☐ Known infective endocarditis. ☐ BP 185/110 or more that cannot be reduced and maintained as reduced prior to tPA. ☐ Stroke in the context of aortic dissection. ☐ Intraaxial brain tumor ☐ Ischemic stroke in previous 3 months. ☐ Known gastrointestinal malignancy or bleeding event within previous 21 days.	☐ Presence of known small or moderate sized (less than10mm) unruptured cerebral aneurysm. ☐ Non-STEMI MI, STEMI MI of right or inferior myocardium, ☐ Severely disabling stroke with known left atrial or ventricular thrombus ore pericarditis. ☐ Presence of an extra-axial intracranial neoplasm ☐ Seizure at stroke onset. ☐ Early ischemic changes other than frank hypodensity. ☐ Stroke as complication of cardiac or cerebral angiographic procedures who meet usual eligibility criteria. ☐ History of diabetic hemorrhagic retinopathy
Potentially Harmful. Compare Risks to Benefits	Extended Time Frame (Stroke start 3-4.5hrs) Contraindications
☐ Major surgery in previous 14 days ☐ History of non-pharmacologic bleeding diathesis or coagulopathy ☐ Major trauma in previous 14 days. ☐ Puncture of a non-compressible artery within the previous 7 days. ☐ Severe disabling stroke in patient with known unruputured untreated intracranial vascular malformation. ☐ Currently pregnant or postpartum less than 14 days. Urgent OB/GYN consultation is recommended. ☐ Sickle Cell disease. ☐ Past gastrointestinal or genitourinary bleeding ☐ STEMI MI of left anterior myocardium in previous 3 months. ☐ Patients with current systemic malignancy, life expectancy greater than 6 months and no concurrent coagulation abnormality, systemic bleeding, or recent surgery ☐ Presence of known moderate to large sized (more than10mm) unruptured cerebral aneurysm	☐ Age over 80 years with history of both diabetes and prior stroke. ☐ NIHSS score over 25 ☐ Any anticoagulant use of any kind ☐ Evidence on imaging of infarct size more than 1/3 hemisphere.

Dosing Activase® (alteplase)

TOTAL DOSE CALCULATION

(0.9 mg/kg body weight – not to exceed 90 mg)

0.9 x 85 kg = 76.5 mg total dose

IV BOLUS CALCULATION – 10% TOTAL DOSE

0.10 x 76.5 = 7.65 mg bolus

IV INFUSION CALCULATION – 90% of TOTAL DOSE

68.85 mg

- Dr. Wasson did not consult a neurologist – is it mandatory to do so? What skill set must Dr. Wasson have in order to take the lead in this case?
- What were the strengths or weaknesses of his consent process?
- What is the purpose of controlling BP before and after Activase® (alteplase)?
- What are the meds used to control BP? Why is Nitro not a good choice?

Drip and Ship Summary

- EMS engagement
- ED assessment including standard elements
- Telemedicine if available
- Standard diagnostics
- Complete Activase® checklist
- Initiate treatment
  - Monitor response to treatment per algorithm
- Early call to transport team (ground or air)

Protocol-driven care improves outcomes and prevents medical complications


QUESTIONS?