Stroke Systems of Care

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Objectives

- Understand the Stroke System of Care
- Understand the function of an Acute Stroke-Ready Hospital
- Challenges of acute treatment of stroke in Alaska

Stroke Systems of Care

- Acute Stroke-Ready Hospital
- Primary Stroke Center
- Comprehensive Stroke Center

Acute Stroke-Ready Hospital

- Stroke protocol
- EMS & ED
- Laboratory and neuroimaging
- Telemedicine

Formation and Function of Acute Stroke–Ready Hospitals Within a Stroke System of Care Recommendations From the Brain Attack Coalition

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Background and Purpose—Many patients with an acute stroke live in areas without ready access to a Primary or Comprehensive Stroke Center. The formation of care facilities that meet the needs of these patients might improve their care and outcomes and guide them and emergency responders to such centers within a stroke system of care.

Methods—The Brain Attack Coalition conducted an electronic search of the English medical literature from January 2000 to December 2012 to identify care elements and processes shown to be beneficial for acute stroke care. We used evidence grading and consensus paradigms to synthesize recommendations for Acute Stroke–Ready Hospitals (ASRHs).

Results—Several key elements for an ASRH were identified, including acute stroke teams, written care protocols, involvement of emergency medical services and emergency department, and rapid laboratory and neuroimaging testing. Unique aspects include the use of telemedicine, hospital transfer protocols, and drip and ship therapies. Emergent therapies include the use of intravenous tissue-type plasminogen activator and the reversal of coagulopathies. Although many of the care elements are similar to those of a Primary Stroke Center, compliance rates of ≥67% are suggested in recognition of the staffing, logistical, and financial challenges faced by rural facilities.

Conclusions—ASRHs will form the foundation for acute stroke care in many settings. Recommended elements of an ASRH build on those proven to improve care and outcomes at Primary Stroke Centers. The ASRH will be a key component for patient care within an evolving stroke system of care. **(*Stroke*. 2013;44:3382-3393.)**

Key Words: acute stroke ■ cerebrovascular disease ■ stroke

Table 1. Comparison of Elements in an Acute Stroke–Ready Hospital and Primary Stroke Center

Element	ASRH	PSC	Comment*
Acute stroke team	15-min response time	15-min response time	Minimum of 2 members
Stroke protocols	Revise annually	Revise annually	Applies to all types of strokes
Emergency medical services	Training in field assessment tools for stroke	Training in field assessment tools for stroke	At least 2 h of stroke-related education annually
Emergency department	Written protocols for treatment and stabilization; 4 annual h of stroke education	Written protocols for treatment and stabilization; 8 annual h of stroke education	Physician and nurse education for key staff
Laboratory testing, ECG/chest radiograph	Test results available within 45 min of ordering	Test results available within 45 min of ordering	Testing available 24/7
Brain imaging*	Test completed and read within 45 min (60 min for MRI)	Test completed and read within 45 min (60 min for MRI)	Head CT or MRI acceptable; service available 24/7
Stroke unit	Not required unless patients are admitted	Required for admitted patients; should include protocols and telemetry	Specific monitoring protocols even if not admitted
IV tPA†	Door-to-needle time of ≤60 min	Door-to-needle time of ≤60 min	IV tPA available 24/7
Neurosurgical services‡	Available within 3 h	Available within 2 h	Can be onsite or by transfer of patient
Initiation of telemedicine link	Within 20 min of when it is deemed medically necessary	Respond within 20 min of link request if serving as a hub	Type of link will vary by service vendor; same response times for receiving hub CSC
Telemedicine/teleradiology equipment	Onsite to transmit	Onsite and offsite to receive	Applies to a CSC if they will be a hub site
Transfer of patients to PSC or CSC	Patient leaves within 2 h of ED arrival (or once medically stable)§	Not applicable in most cases unless transferred to a CSC	Mode of transportation will vary

ASRH indicates Acute Stroke–Ready Hospital; CSC, Comprehensive Stroke Center; CT computed tomography; ED, emergency department; IV tPA, intravenous tissue plasminogen activator; and PSC, Primary Stroke Center.

*Comments apply to the ASRH recommendations unless otherwise noted.

†See Performance Metrics section for further details.

‡Neurosurgical coverage might include having a neurosurgeon at the hospital or transfer of the patient to another facility where a neurosurgeon is available and can be onsite.

§Exceptions include factors beyond the control of the ASRH, such as weather delays, mechanical issues, etc.

Table 2. Examples of Emergent Care and Treatment Elements of an ASRH

Care Element	Purpose	Comments
Stabilize vital signs	Prevent clinical deterioration	Oxygenation and blood pressure management are key elements
Diagnose stroke type	Determine acute treatment options	May use teleradiology/telestroke
Assess stroke severity	Important for acute treatment options and outcomes	Different scales based on stroke types; serial assessments needed
IV tPA protocol	Improves outcomes for acute ischemic stroke	Standard of care
Reversal of coagulopathy	Prevent expansion of hemorrhage	Various treatment options
Treatment of elevated ICPs	Prevent neurological worsening	Medical and surgical options
Treatment of seizures	Prevent medical complications	IV agents may be needed

ASRH indicates Acute Stroke–Ready Hospital; ICP, intracranial pressure; and IV tPA, intravenous tissue plasminogen activator.

Table 3. Examples of Technical Parameters for Telemedicine Systems Related to Stroke*

Imaging or Data Element	Requirement	Comment
Speed	20 frames/s or higher	Bidirectional audio and video
Resolution	720p at 1 Mbps	1080p preferred for images
Latency	≤500 ms	Dependent on type of connection
Images	Full color	Full zoom and pan features
Screen size	≥13 inches or more	iPhone size may not be sufficient
Security	Encryption needed	Meets state and Federal standards
Connections/ formats	Fixed ISDN or IP (private or public)	DICOM for images
Redundancy	≥1 back-up system	Applies to sender and receiver facility

DICOM indicates digital imaging and communications in medicine; IP, internet protocol; and ISDN, integrated services digital network.

*Different telemedicine systems may have various technical parameters and requirements; the above are examples of some of the key parameters and performance levels.[35–37,44]

Table 4. Possible Performance Metrics for an ASRH

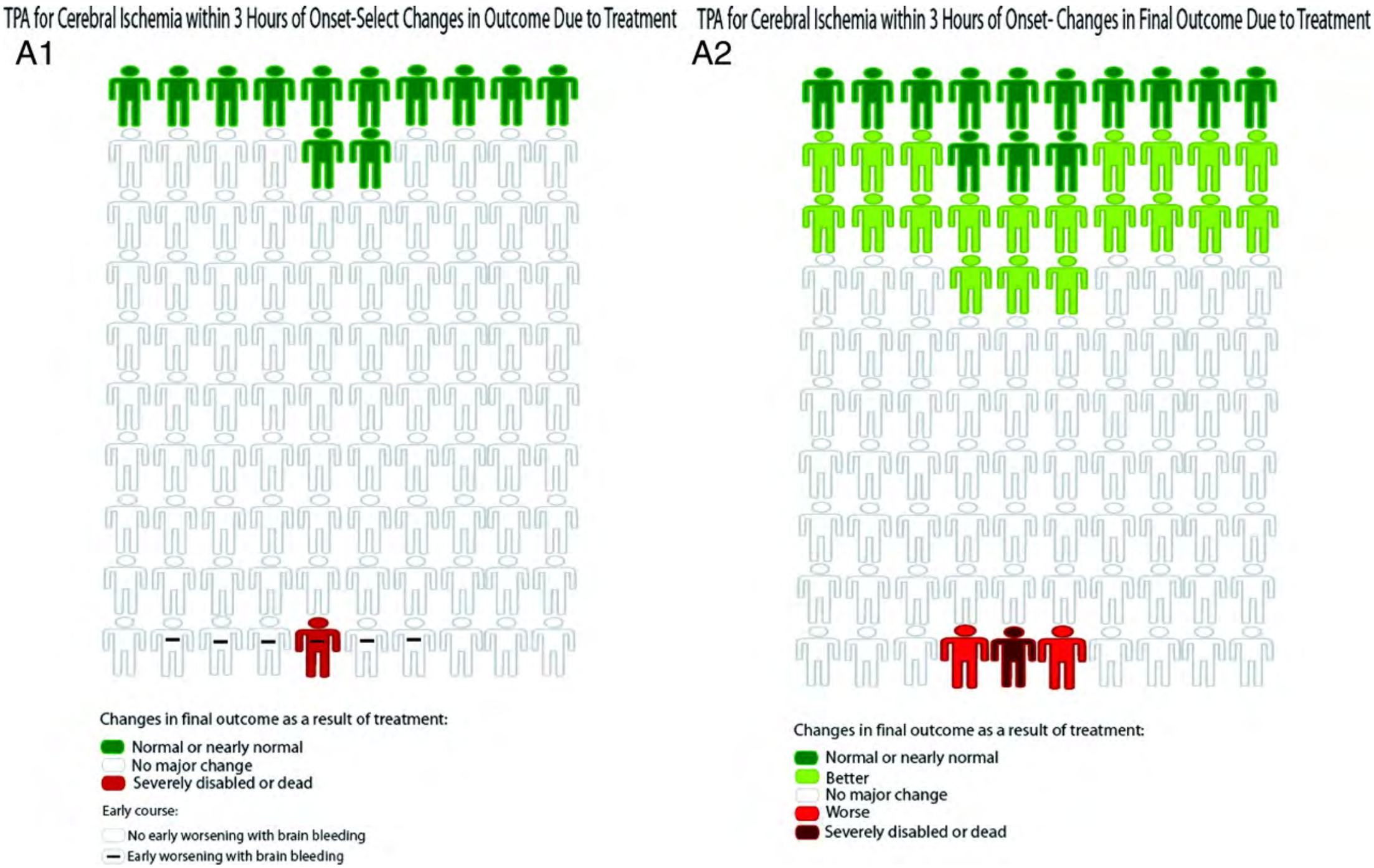
Element	Metric	Comment
IV tPA use in eligible patients	Percentage of eligible patients treated with IV tPA	Measured by TJC for PSCs and CSCs
Stroke severity scale done in ED	Percentage of patients with documented score	Important to guide therapy and severity adjust outcomes
Time to first brain image	Door to image time	Applies to all stroke types
Door-to-needle time for IV tPA	ED arrival to IV bolus initiation	National quality standard
Time to begin coagulation reversal therapy	Time from diagnosis of cerebral hemorrhage to beginning therapy	May be a CSC performance metric; only applies to hemorrhag strokes
Time to initiate telemedicine link	Time from diagnosis to establishment of link	Link to predesignated PSC or CSC
Time to initiate patient transfer	Time from door to transport	Applies to air or ground transfers

ASRH indicates Acute Stroke–Ready Hospital; CSC, Comprehensive Stroke Center; ED, emergency department; IV tPA, intravenous tissue plasminogen activator; PS
Primary Stroke Center; and TJC, The Joint Commission.

Challenges of Treating Stroke in Alaska

- Awareness
- Volume
- Competence
- Time

Figure I. Decision matrix figures illustrating the benefits and risks of intravenous TPA in the <3-hour window based on data from the 2 NINDS-TPA trials.



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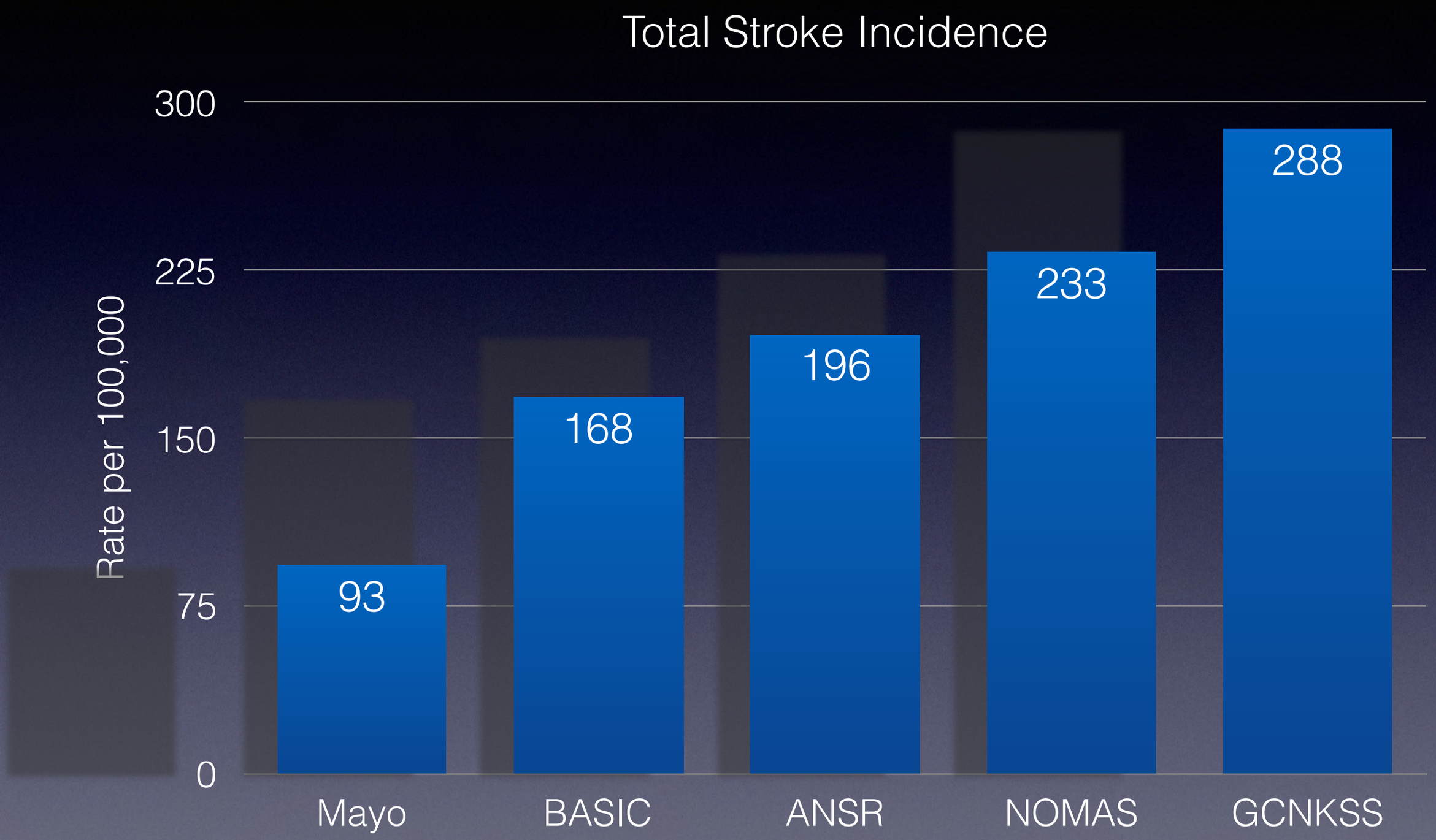
Total Stroke Incidence
300
225
150
75
0
Rate per 100,000
93
168
196
233
288
Mayo
BASIC
ANSR
NOMAS
GCNKSS