



EMS FOR STROKE THE FIRST LINE OF DEFENSE

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INTRODUCTION

This presentation aims to supplement and enhance prehospital stroke management techniques for Emergency Medical Services (EMS) professionals.

It is organized into 3 chapters and includes an appendix with additional information. Each chapter ends with a case study that you can use to test yourself on the information covered in that chapter.



AT THE END OF THIS PRESENTATION, **YOU WILL BE ABLE TO:**

- Describe the importance of recognizing stroke urgently and acting quickly
- Detail the role of EMS in prehospital stroke management
- Describe the importance of timely arrival
- Distinguish between the types of stroke centers
- Describe the impact of stroke disability on patients and their families
- Utilize materials to spread stroke awareness



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CHAPTER 1



What Is Stroke?

LEARNING OBJECTIVES FOR THIS CHAPTER

- Understand the incidence and impact of stroke
- Describe 2 types of stroke
- Identify stroke symptoms

STROKE: A MAJOR CAUSE OF MORBIDITY AND MORTALITY IN THE US¹



Strikes about 795,000 people a year¹



Occurs on average every 40 seconds¹



Leads to over 142,000 deaths a year¹



Results in death on average every 4 minutes¹



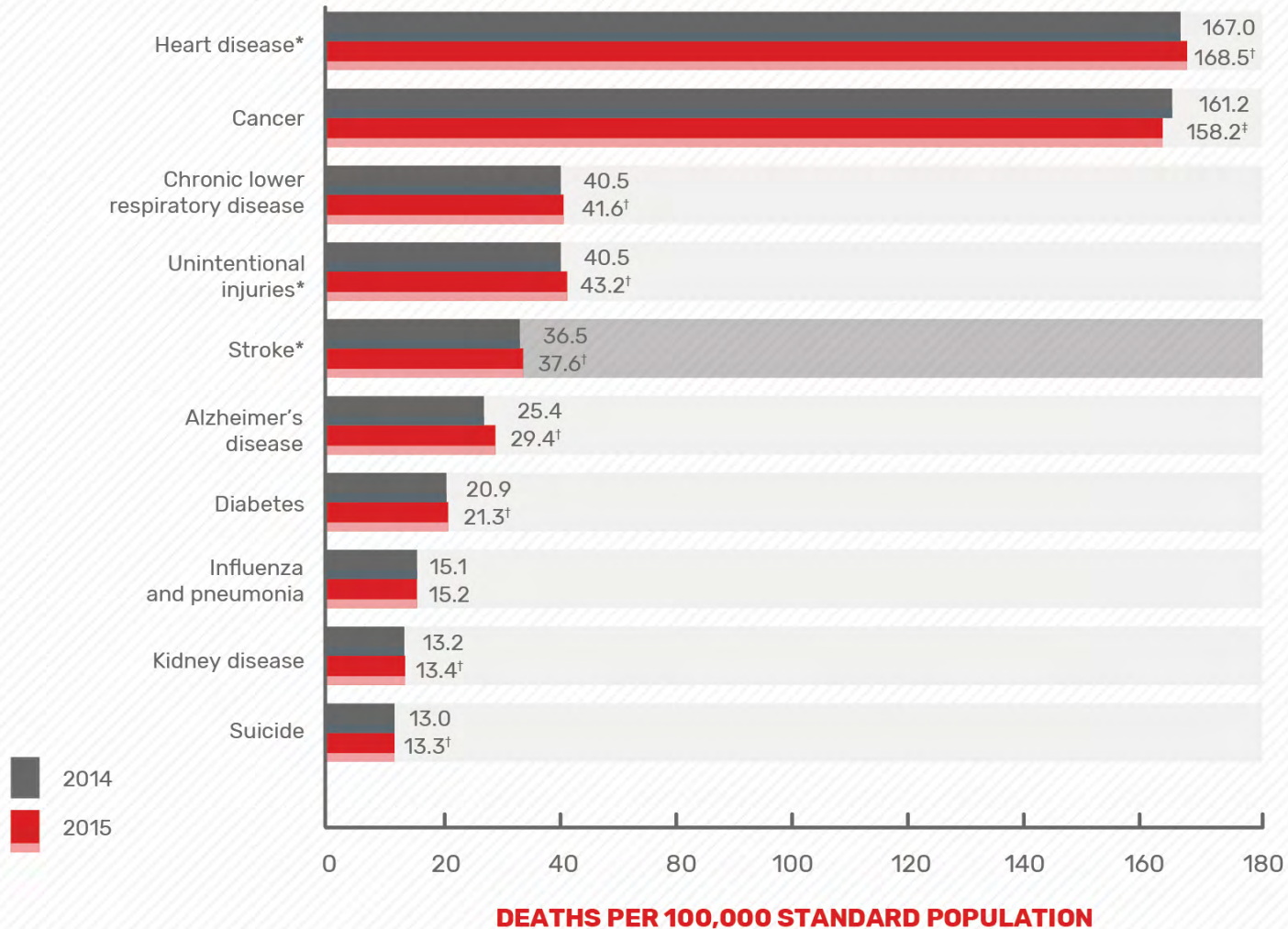
Leading cause of serious, long-term disability¹



Cost projected to more than double between 2015 and 2035¹

Reference: 1. Benjamin EJ, et al. *Circulation*. 2019. doi:10.1161/CIR.0000000000000659.

STROKE IS THE FIFTH LEADING CAUSE OF DEATH IN THE US¹



*EMS has a direct effect in these cases.

[†]Statistically significant increase in age-adjusted death rate from 2014 to 2015 ($P < 0.05$).

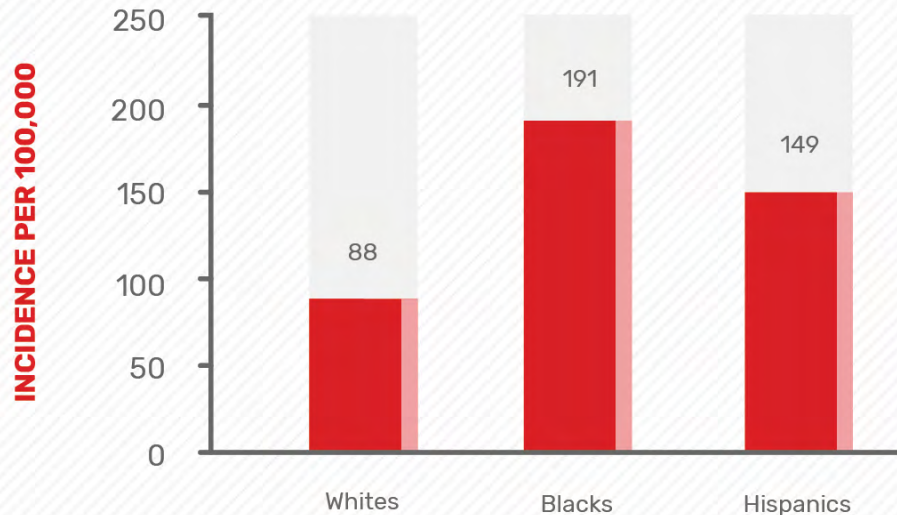
[‡]Statistically significant decrease in age-adjusted death rate from 2014 to 2015 ($P < 0.05$).

Reference: 1. Xu J, et al. *NCHS Data Brief*. 2016.

STROKE PREVALENCE BY RACE/ETHNICITY¹⁻⁴

The risk of stroke varies with race and ethnicity

ANNUAL AGE-ADJUSTED INCIDENCE OF FIRST ISCHEMIC STROKE



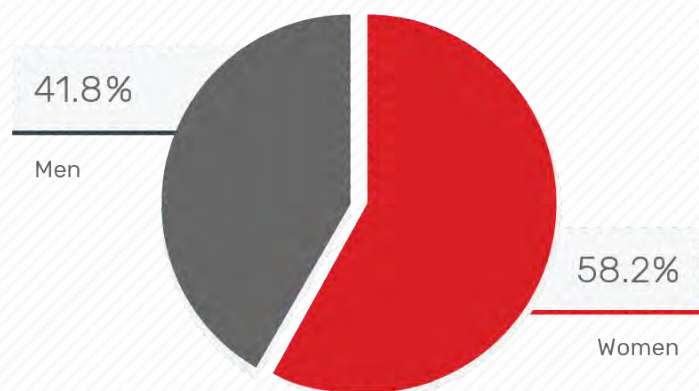
- Blacks have more than double the incidence of first ischemic stroke and are more likely to die from stroke than any other racial/ethnic group^{1,2,4}
- Hispanics have a high incidence of first stroke compared with whites³

References: **1.** Benjamin EJ, et al. *Circulation*. 2019. doi:10.1161/CIR.0000000000000659. **2.** Centers for Disease Control and Prevention website. <http://www.cdc.gov/stroke/facts.htm>. **3.** White H, et al. *Circulation*. 2005;111:1327-1331. **4.** Yang Q, et al. *MMWR*. 2017;66.

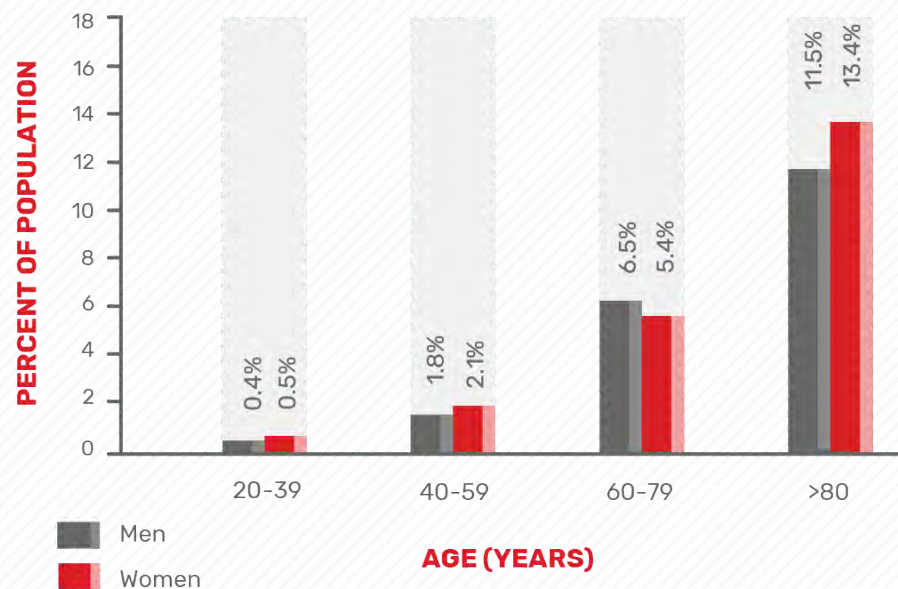
STROKE PREVALENCE BY SEX¹

Stroke affects men and women differently

TOTAL STROKE DEATHS¹



PREVALENCE BY SEX¹



- In 2016, 82,787 women and 59,355 men died due to stroke¹

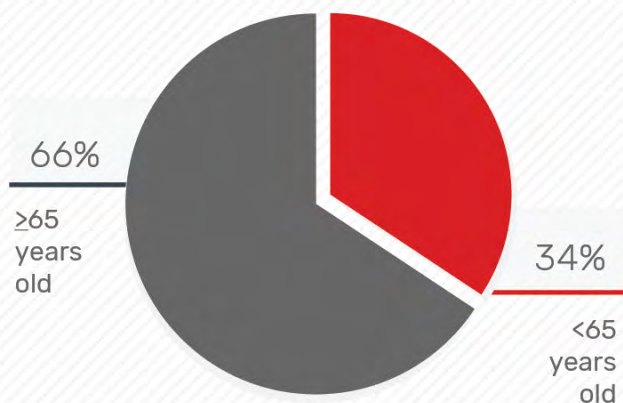
- Each year, approximately 55,000 more women than men have a stroke¹

Reference: 1. Benjamin EJ, et al. *Circulation*. 2019. doi:10.1161/CIR.0000000000000659.

STROKE PREVALENCE BY AGE¹⁻³

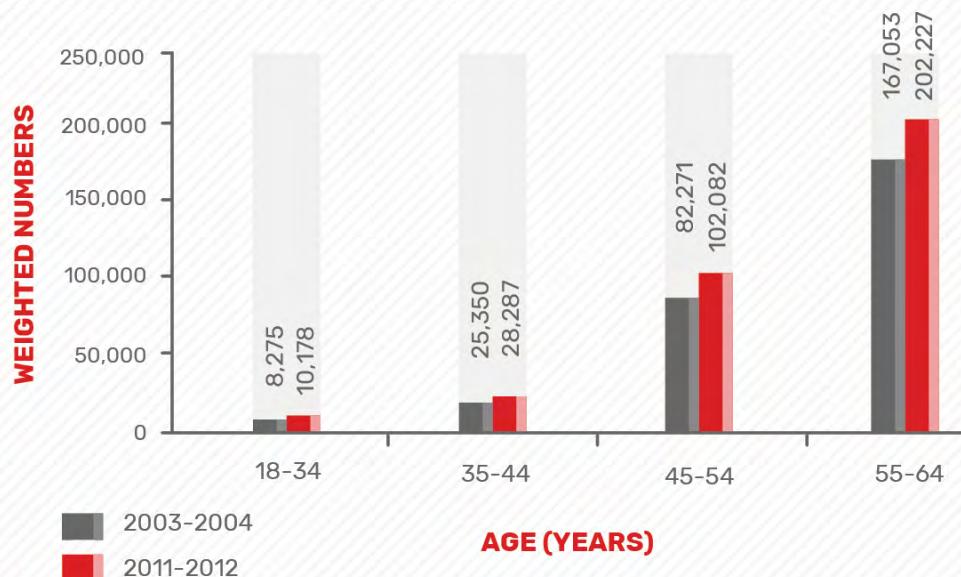
The incidence of stroke in younger people is increasing¹

PEOPLE HOSPITALIZED FOR STROKE²



- In 2009, over one-third of people hospitalized for stroke were under the age of 65²

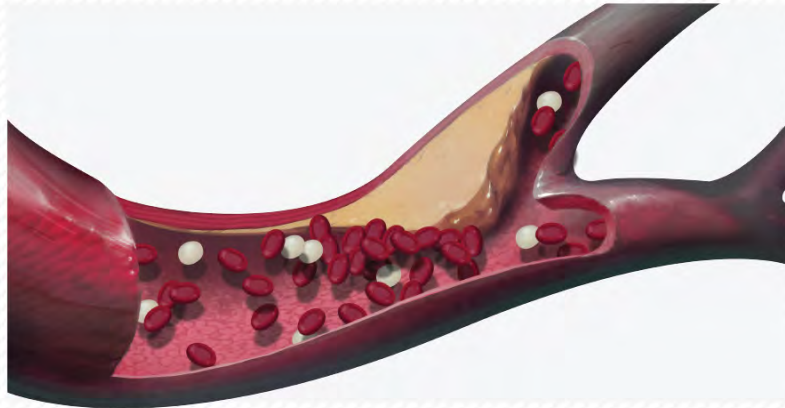
PREVALENCE OF ACUTE ISCHEMIC STROKE IN PEOPLE UNDER 65^{3,*}



- The acute ischemic stroke hospitalization rate in people under 65 has increased over time³
- The number of people 18 to 64 years old who have had a stroke is predicted to increase over time¹

*Weighted numbers of reported strokes from the Healthcare Cost and Utilization Project dataset; adapted from George MG, et al. *JAMA Neurol.* 2017;74(6):695-703.

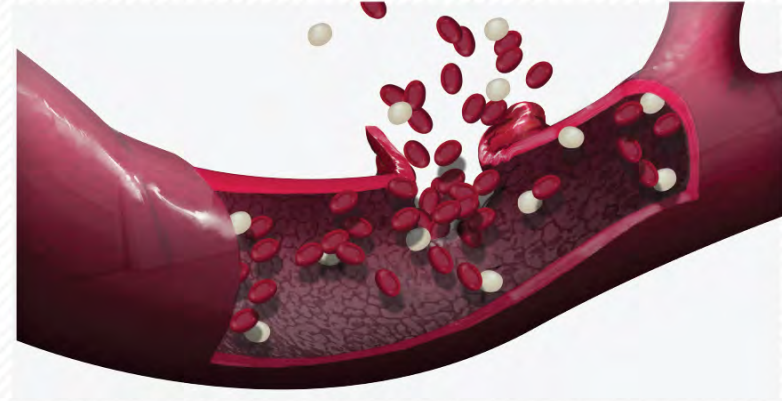
TYPES OF STROKE¹⁻⁴



ISCHEMIC STROKE

Fatty plaque or a clot blocks blood flow, starving cells of oxygen⁴

- 87% of strokes are ischemic⁴



HEMORRHAGIC STROKE

A blood vessel leaks or breaks⁴

- 13% of strokes are hemorrhagic⁴



Stroke management varies depending on both the severity and the type of stroke.²

References: **1.** Benjamin EJ, et al. *Circulation*. 2019. doi:10.1161/CIR.0000000000000659. **2.** Crocco TJ, et al. *Prehosp Emerg Care*. 2007;11:313-317. **3.** González RG. *AJNR Am J Neuroradiol*. 2006;27:728-735. **4.** National Stroke Association website. https://www.stroke.org/wp-content/uploads/2018/12/NSAM-2017_Stroke-101_v3_AQ_pdfversion.pdf.

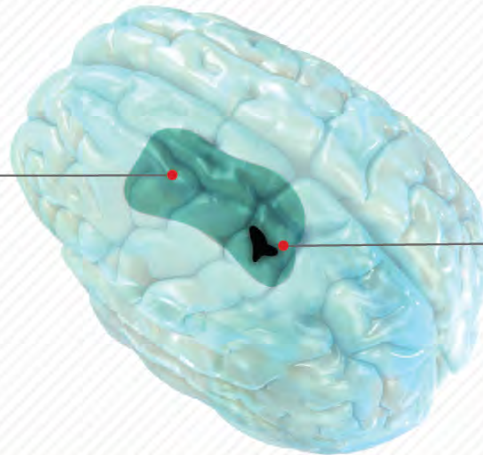
GOAL FOR ISCHEMIC STROKE: SAVE THE PENUMBRA

The penumbra is an area of potentially salvageable tissue beyond the blood-starved infarct^{1,2}

- The infarct expands in the penumbra over time, increasing the area of irreversible brain damage³
- The average stroke patient can lose tens of thousands of brain cells every second⁴

Penumbra

- Potentially salvageable tissue around the infarct
- Supported by collateral blood flow^{1,2}



Area of infarct

- Permanently damaged by lack of blood flow¹

Image is for illustrative purposes only.



As the infarction expands, the area of irreversible brain damage increases—**TIME IS BRAIN.**³

IDENTIFYING STROKE^{1,2}

Stroke presents in many ways, with varying intensity

Common signs and symptoms of stroke appear suddenly^{1,2}:

- Numbness or weakness of the face, arm, or leg
- Confusion, trouble speaking or understanding
- Trouble seeing with one or both eyes
- Trouble walking, dizziness/vertigo, loss of balance or coordination
- Sudden severe headache with no known cause



Other symptoms²:

- Respiratory abnormalities
- Difficulty swallowing
- Nausea and vomiting



How can EMS professionals help educate the public on these stroke symptoms?

SUMMARY¹⁻⁷

Stroke facts:

- ✓ Stroke is the fifth leading cause of death in the United States¹
- ✓ Approximately 87% of strokes are ischemic; 13% of strokes are hemorrhagic²
- ✓ Stroke presents in many ways with variable intensities³
- ✓ Stroke is a major cause of morbidity and mortality in the United States⁴
- ✓ The penumbra is the tissue surrounding an infarction that can be either irreversibly damaged or potentially salvaged, depending on time to treatment⁵⁻⁷

References: **1.** Centers for Disease Control and Prevention website. <http://www.cdc.gov/stroke/facts.htm>. **2.** National Stroke Association website. https://www.stroke.org/wp-content/uploads/2018/12/NSAM-2017_Stroke-101_v3_AQ_pdfversion.pdf. **3.** Jauch EC, et al. *Stroke*. 2013;44:870-947. **4.** Benjamin EJ, et al. *Circulation*. 2019. doi:10.1161/CIR.0000000000000659. **5.** Donnan GA, Davis SM. *Lancet Neurol*. 2002;1:417-425. **6.** González RG. *AJNR Am J Neuroradiol*. 2006;27:728-735. **7.** Thomas SH, et al. *N Engl J Med*. 2006;354:2263-2271.



TEST YOURSELF!

**Scenario: A 65-year-old woman collapses
at a shopping mall**



YOU ARRIVE ON THE SCENE

- The 65-year-old woman is confused but can respond to your questions
- She can move her right arm and leg slightly, but with great difficulty
- She feels pulsating and throbbing pain on one side of her head
- Her speech is slurred
- Her mouth is dry
- All of these signs and symptoms began in the last half hour

What tells you this might be a stroke?



CHAPTER 2



The Role of EMS

LEARNING OBJECTIVES FOR THIS CHAPTER

- Understand AHA/ASA Guidelines for EMS management of stroke
- Discuss continuous quality improvement as well as the role of EMS professionals in carrying out best practices for stroke care
- Identify 4 levels of hospitals that can treat stroke

THE ROLE OF EMS IN THE MANAGEMENT OF ACUTE STROKE^{1,*}

Prehospital notification

EMS personnel should provide prehospital notification to the receiving hospital that a suspected stroke patient is en route so that the appropriate hospital resources may be mobilized before patient arrival. (Class 1; Level of Evidence B-NR).¹

–AHA/ASA 2018 Guidelines

En route, EMS should inform the hospital of²:

- Time of stroke symptom onset or time patient was last seen normal
- Patient's medical history
- Medication patient is currently taking



How often do you prenotify a hospital in case of suspected stroke? What are the challenges of prenotification?

*Emergency medical personnel should first follow their institution's protocols and processes.

AHA = American Heart Association; ASA = American Stroke Association.

References: 1. Powers WJ, et al. *Stroke*. 2018;49(3):e46–e110. 2. Jauch EC, et al. *Stroke*. 2013;44:870–847.

ON SCENE*

EMS guidelines for management of patients with suspected stroke^{1,2}

- Manage CABs (chest compression-airway-breathing); give oxygen if needed
- Perform prehospital stroke assessment
- Establish and record exact time patient was last seen normal
- If possible, bring a witness to the hospital; alternatively, record name and phone number (preferably cell phone number) of the witness
- Medical history:
 - Identify current medications taken by patient, especially any anticoagulants (aspirin, warfarin, etc)
 - Record recent illnesses, surgery, or trauma and any history of stroke, drug abuse, migraine, infection, and/or pregnancy



*Emergency medical personnel should first follow their institution's protocols and processes.

PREHOSPITAL STROKE ASSESSMENT TOOLS

Enable identification and prioritization of stroke patients^{1,2}

- Formal stroke assessment tools can increase paramedic sensitivity to stroke identification to $\geq 90\%$
- Frequently used screening tools include*
 - Cincinnati Prehospital Stroke Severity Scale
 - Los Angeles Prehospital Stroke Screen (LAPSS)



*State or local regulations may specify which scale to use.

References: 1. Crocco TJ, et al. *Prehosp Emerg Care*. 2007;11:313-317. 2. Jauch EC, et al. *Stroke*. 2013;44:870-947.

PREHOSPITAL STROKE EMERGENT LARGE VESSEL OCCLUSION (ELVO) SCALES¹

What scale does your system use?

Prehospital Stroke Scale	Sensitivity	Specificity
Cincinnati Prehospital Stroke Severity Scale (CPSSS)	83%	40%
3-item stroke scale (3I-SS)	67%	92%
Los Angeles Motor Scale (LAMS)	81%	89%
Legs, eyes, gaze, speech (LEGS)	69%	81%
Rapid Arterial Occlusion Evaluation Scale (RACE)	85%	68%
Severe hemiparesis	27%-48%	
Vision, aphasia, neglect (VAN)	100%	90%

Reference: 1. Teleb MS, et al. *J NeuroIntervent Surg.* 2017;9:122-126.

TYPES OF STROKE CENTERS^{1,2}



CERTIFIED COMPREHENSIVE STROKE CENTERS (CSCs)

For multifaceted 24/7 stroke care



CERTIFIED PRIMARY STROKE CENTERS (PSCs)

For rapid, uniform, evidence-based care for stroke patients



ACUTE STROKE-READY HOSPITALS (ASRHs)

For effective diagnosis and treatment of most stroke patients, without fully organized inpatient systems of care



THROMBECTOMY-CAPABLE STROKE CENTERS (TSC)

For performing endovascular thrombectomy (EVT) and caring for patients after the procedure

References: **1.** Centers for Disease Control and Prevention. *A summary of primary stroke center policy in the United States*. 2011. **2.** Jauch EC, et al. *Stroke*. 2013;44:870-947.

STROKE CENTER CAPABILITIES¹

What should you expect from your certified centers?

	Primary Stroke Centers (PSCs)	Comprehensive Stroke Centers (CSCs)
Treatment Capabilities	IV thrombolytics and medical management of stroke	IV thrombolytics; endovascular therapy
Stroke Unit	Stroke unit of designated beds for the acute care of stroke patients	Dedicated neuro intensive care beds for complex stroke patients available 24/7; on-site neurointensivist coverage 24/7
Guidelines	Recommendations from Brain Attack Coalition for Primary Stroke Centers, 2011	Recommendations from Brain Attack Coalition for Comprehensive Stroke Centers, 2005
Neurosurgical Services	Within 2 hours; OR is available 24/7 in PSCs providing neurosurgical services	24/7 availability; neurointerventionist; neuroradiologist; neurologist; neurosurgeon
EMS Collaboration	Access to protocols used by EMS	Access to protocols used by EMS, routing plans; records from transfer

EMS = emergency medical services; OR = operating room.

Reference: 1. Joint Commission website. The Joint Commission Stroke Certification Programs – Program Concept Comparison. https://www.jointcommission.org/assets/1/18/StrokeProgramGrid_abbrev_010518.pdf.

STROKE CENTER CAPABILITIES (CONT.)¹

What should you expect from your certified centers?

	Acute Stroke-Ready Hospitals (ASRHs)	Thrombectomy-Capable Stroke Center (TSC)
Treatment Capabilities	IV thrombolytics: Anticipate transfer of patients who have received IV thrombolytics	IV thrombolytics; mechanical thrombectomy, IA thrombolytics
Stroke Unit	No designated beds for acute care of stroke patients	Dedicated neuro intensive care beds for complex stroke patients available 24/7; on-site critical care coverage 24/7
Guidelines	Recommendations from Brain Attack Coalition for Acute Stroke Ready Hospitals, 2013	AHA/ASA Focused Update for the Early Management of Patients with Acute Ischemic Stroke Regarding Endovascular Treatment, 2015
Neurosurgical Services	Within 3 hours (provided through transferring the patient)	Within 2 hours; OR is available 24/7 in TSCs providing neurosurgical services
EMS Collaboration	Access to protocols used by EMS	Access to protocols used by EMS, routing plans; records from transfer

AHA = American Heart Association; ASA = American Stroke Association; EMS = emergency medical services; OR = operating room.

Reference: 1. Joint Commission website. The Joint Commission Stroke Certification Programs – Program Concept Comparison. https://www.jointcommission.org/assets/1/18/StrokeProgramGrid_abbrev_010518.pdf.

STROKE CENTERS: BYPASS REQUIREMENTS^{1,2}

2018 guidelines suggest when hospital bypass is appropriate*

Patients with a positive stroke screen and/or a strong suspicion of stroke should be transported rapidly to the closest healthcare facilities that can capably administer IV alteplase.

(Class 1, Level of Evidence B-NR).¹

– AHA/ASA 2018 Guidelines

- If large vessel occlusion (LVO) is suspected, patients should be routed to the closest certified center regardless of interventional capability, unless transport to a comprehensive center adds less than 15 minutes²



What is the bypass protocol in your territory?

*State or local stroke systems of care may have specific EMS routing protocols.

AHA = American Heart Association; ASA = American Stroke Association; CSC = comprehensive stroke center; PSC = primary stroke center.

References: **1.** Powers WJ, et al. *Stroke*. 2018;49(3):e46–e110. **2.** American Heart Association website. http://www.heart.org/idc/groups/ahaecc-public/@wcm/@gwtg/documents/downloadable/ucm_482025.pdf.

CARE EN ROUTE^{1,2,*}

- Provide supplemental oxygen to maintain oxygen saturation >94%²
- Monitor blood pressure (BP), but do not treat arterial hypertension.²
The benefit of prehospital BP intervention is not proven
- Check and record blood glucose to assess for hypoglycemia and manage appropriately²
- Hypoglycemia is frequently found in patients with stroke-like symptoms¹
 - Hypoglycemia can be corrected rapidly in most patients with 50% dextrose
 - Do not administer dextrose in nonhypoglycemic patients
- Establish cardiac monitoring and intravenous (IV) access, if possible²

*Emergency medical personnel should first follow their institution's protocols and processes.

EMS FEEDBACK LOOP¹

Results from a survey of regional EMS providers prompted the creation of 24-hour progress reports from stroke team members to EMS in that region, leading to¹:

- Improved stroke patient transport rates from 47% to 68%
- Increased EMS provider satisfaction

Feedback can be in the form of:

- Individual patient reports to EMS teams
- Trend reports of patients over time

Consider asking your stroke centers for these trends over time:

- Type of dispatched call, ambulance notification, on-scene arrival, and departure times
- Documented prenotification to ED by EMS and last seen normal by EMS
- Documented prehospital neurological exam, blood pressure, and finger stick
- Trip sheet in electronic medical record
- Diagnosis, interventions, course of stay discharge

ED = emergency department.

Reference: 1. Hamm TL, et al. *Stroke*. 2010;41:e205–e206.

SUMMARY¹⁻⁴

EMS responsibilities¹⁻⁴

- ✓ Performance of stroke assessment measures and rapid transport to closest appropriate facility capable of treating stroke
- ✓ Management of CABs
- ✓ Acquisition of history of event, preferably with assistance of a witness
- ✓ Establish cardiac monitoring and IV access, if possible
- ✓ Provide rapid transport to closest appropriate stroke center
- ✓ Provide prehospital notification that a potential stroke patient is en route
- ✓ Present patient to the ED

Systems of care can improve patient outcomes¹⁻⁶

- ✓ Recommendations provide that suspected stroke patients be taken to CSCs, if possible
 - Prehospital notification is critical
 - Quality improvement initiatives should include EMS feedback

CAB = chest compression-airway-breathing; CSCs = comprehensive stroke centers; ED = emergency department.

References: **1.** Jauch EC, et al. *Stroke*. 2013;44:870-847. **2.** Crocco TJ, et al. *Prehosp Emerg Care*. 2007;11:313-317. **3.** Teleb MS, et al. *J NeuroIntervent Surg*. 2017;9:122-126. **4.** Field JM, et al. *Circulation*. 2010;122(suppl 3):S640-S656. **5.** Hamm TL, et al. *Stroke*. 2010;41:e205-e206. **6.** Powers WJ, et al. *Stroke*. 2018;49(3):e46-e110.



TEST YOURSELF!

Scenario: A 65-year-old woman collapses at a shopping mall

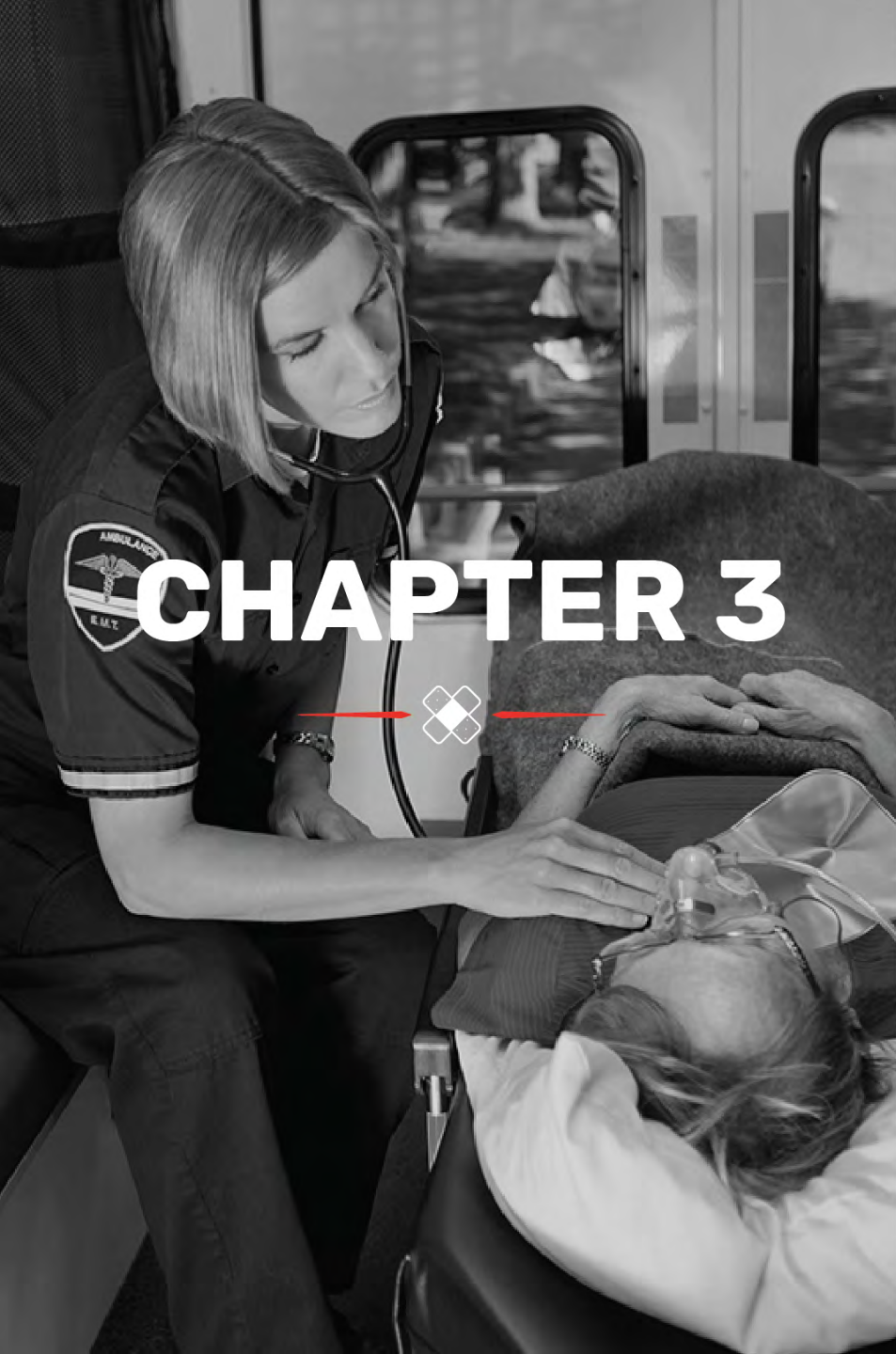
You determine the woman has suffered a stroke.



WHAT ARE THE STEPS YOU TAKE IN YOUR LIMITED TIME?

Your patient must be taken to the hospital.

**There is a comprehensive stroke center
9 miles away and an acute stroke-ready
hospital 4 miles away. Where do you take
your patient?**



CHAPTER 3



Consequences of Stroke: Disability

LEARNING OBJECTIVES FOR THIS CHAPTER

- Disability due to stroke deficit can have lasting effects on patients and their caregivers
- EMS professionals can play a significant role in educating about stroke recognition and the urgency of prompt treatment

STROKE IS ONE OF THE LEADING CAUSES OF **LONG-TERM DISABILITY** IN THE US^{1,2}

Even an isolated deficit can lead to disability and can have a lasting impact³

Disability is defined as a “yes” response to at least one of the following limitation categories²:

- Use of an assistive device (cane, crutches, walker, or wheelchair)
- Difficulty performing activities of daily living (ADLs), instrumental activities of daily living (IADLs), or specified functional activities
- One or more selected impairments
- Limitation in the ability to work around the house or at a job or business



EFFECTS OF DISABILITY: MANY PATIENTS REQUIRE ONGOING SUPPORT¹⁻³

The National Stroke Association estimates that there are about 7,000,000 stroke survivors over the age of 20 in the US¹

- Many ischemic stroke patients require ongoing support^{1,2}
- Some at-risk patients view severe loss of motor functions as worse than death⁴
- Higher levels of disability have been associated with earlier mortality²

In 2 separate studies:

At 6 months²

45%

of ischemic stroke patients were **functionally dependent***
(N = 7,710)

At 1 year³

50%[†]

of patients with a cerebral infarct had a **disability[‡]**
(N = 92)[§]

*Defined as Rankin Scale score 3-5 or survey question response on requiring assistance for activities for daily living.²

[†]Of 92 patients who responded to a survey of 200 patients with a confirmed cerebral infarction in the North East Melbourne Stroke Incidence Study (NEMESIS).³

[‡]Defined as less than 20/20 on the Barthel Index.³

[§]Data from North East Melbourne Stroke Incidence Study (NEMESIS). Due to different social, medical, and government support structures, there are limitations to the conclusions that can be applied for practice in the US.³

References: **1.** National Stroke Association website. http://www.stroke.org/sites/default/files/resources/NSA_%20FactSheet_Stroke_101_2014.pdf. **2.** Slot KB, et al. *BMJ*. 2008;336(7640):376-379. **3.** Dewey HM, et al. *Cerebrovasc Dis*. 2003;15:133-139. **4.** Solomon NA, Glick HA, Russo CJ, et al. *Stroke*. 1994;25:1721-1725.

EFFECTS OF DISABILITY: LONG-TERM IMPACT OF STROKE¹⁻³

Potential disabilities in patients with ischemic stroke ≥ 65 years of age^{1,*}



PSYCHOLOGICAL IMPACT¹

- Depressive symptoms: 35%



PHYSICAL IMPACT¹

- Aphasia (impaired communication): 19%
- Hemiparesis (paralysis of one side of the body): 50%
- Inability to walk without some assistance: 30%



One in five strokes occurs in individuals under 55 years of age, and that proportion is increasing.^{2,3}

*In a survey of patients older than 65 taken 6 months after ischemic stroke.

References: **1.** Go AS, et al. *Circulation*. 2013;127:e6–e245. **2.** Kissela BM, et al. *Neurology*. 2012;79:1781–1789. **3.** Mozaffarian D, et al. *Circulation*. 2016;133:e38–360.

EMS MAKES A DIFFERENCE¹⁻⁴

Benefits associated with 911 use vs private transport¹⁻⁴

- EMS use is strongly associated with decreased time to initial physical examination
- EMS professionals are able to manage symptoms en route should they deteriorate
- EMS professionals are more aware as to which hospital is most appropriate

EMS-based educational programs have led to^{4,5}:

- Growth in general stroke awareness
- An increase in public knowledge of stroke signs and symptoms
- A positive effect on stroke knowledge and behavior



Public education tools can be found at
www.strokeawareness.com/hcp.

SUMMARY^{1,2}

Stroke is a leading cause of disability¹

- ✓ Stroke deficits can lead to disability and can have long-term impacts on both patient and caregiver

Stroke and the urgent need for treatment²

- ✓ Less than half of 911 calls for stroke are made within the first hour of symptom onset



TEST YOURSELF!

**Scenario: A 65-year-old woman collapses
at a shopping mall**



YOU COMPLETE THE EMS CALL

- Patient is in the emergency department (ED)
- ED has been briefed
- Paperwork for the call has been completed and filed
- You are preparing for your next EMS call

**How do you close the feedback loop
for this patient?**



EMS **CALL TO ACTION**

- Know your regionally chosen prehospital stroke scales and routing protocols
- Know the stroke capabilities of your hospitals and ask for feedback
- Spread awareness: educate the community on signs and symptoms of stroke



APPENDIX



BRAIN AREAS AND RELATED FUNCTIONS¹⁻⁵

Clot location impacts symptoms based on associated neuroanatomy³

Frontal lobe^{1,2}

- Control of mood, emotions, and thought
- Conveys emotion in speech, facial expressions, and gestures

Parietal lobe^{1,2}

- Sensory perception

Occipital lobe¹

- Occipitoparietal cortices mediate verbal and nonverbal material for immediate visual memory
- Occipitotemporal regions are used in object and facial recognition

Insula¹

- Language processing and function

Temporal lobe^{1,2}

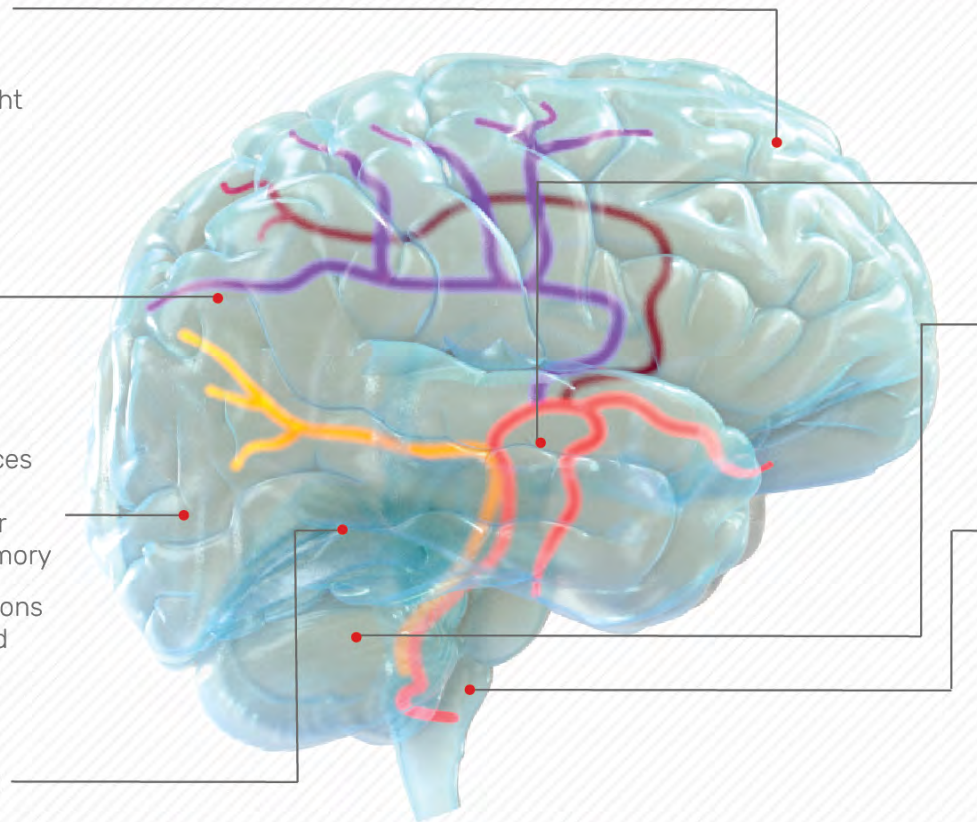
- Emotional modulation of memories
- Fear conditioning
- May store long-term autobiographical memory

Cerebellum¹

- Refines force and timing of movement
- Contributes to coordinated stepping

Brain stem^{1,2,4,5}

- Balance and locomotion
 - Initiation and speed of locomotion
 - Postural tone
 - Modulation of muscle-generated force



● Anterior cerebral artery (ACA)

● Posterior cerebral artery (PCA)

● Vertebralbasilar cerebral system

● Middle cerebral artery (MCA)

CINCINNATI PREHOSPITAL STROKE SEVERITY SCALE (CPSSS)¹



Facial droop (have patient smile)

Normal: Both sides of face move equally

Abnormal: One side of face does not move as well



Arm drift (have patient hold arms out for 10 seconds)

Normal: Both arms move equally or not at all

Abnormal: One arm drifts compared with the other or does not move at all



Speech (have patient speak a simple sentence)

Normal: Patient uses correct words with no slurring

Abnormal: Slurred or inappropriate words or mute

LOS ANGELES PREHOSPITAL STROKE SCREEN (LAPSS) AND LOS ANGELES MOTOR SCALE (LAMS)^{1,2}

LAPSS: Screening criteria¹

- Age >45 years
- History of seizures or epilepsy absent
- Symptom duration <24 hours
- At baseline, patient is not wheelchair-bound or bedridden
- Blood glucose between 60 mg/dL and 400 mg/dL

LAMS²:

<u>Facial droop:</u>	Absent – 0 Present – 1
<u>Arm drift:</u>	Absent – 0 Drifts down – 1 Falls rapidly – 2
<u>Grip strength:</u>	Normal – 0 Weak grip – 1 No grip – 2

- For regional systems of care in which EMS routes patients directly to the most appropriate facility, a LAMS score of ≥ 4 may be used to route selected patients to comprehensive stroke centers



REFERENCES



REFERENCES

About stroke. American Stroke Association website. <https://www.strokeassociation.org/en/about-stroke>. Accessed February 22, 2019.

About the severity-based stroke triage algorithm for EMS. American Heart Association website. http://www.heart.org/idc/groups/ahaecc-public/@wcm/@gwtg/documents/downloadable/ucm_492025.pdf. Accessed February 1, 2019.

Acker JE, Pancioli AM, Crocco TJ, et al; American Heart Association; American Stroke Association Expert Panel on Emergency Medical Services Systems, Stroke Council. Implementation strategies for emergency medical services within stroke systems of care: a policy statement from the American Heart Association/American Stroke Association Expert Panel on Emergency Medical Services Systems and the Stroke Council. *Stroke*. 2007;38(11):3097-3115.

Andrew NE, Kilkenny MF, Naylor R, Purvis T, Cadilhac DA. The relationship between caregiver impacts and the unmet needs of survivors of stroke. *Patient Prefer Adherence*. 2015;9:1065-1073.

Benjamin EJ, Muntner P, Alonso A, et al; American Heart Association Council on Epidemiology and Prevention Statistics Committee; Stroke Statistics Subcommittee. Heart disease and stroke statistics—2019 update: a report from the American Heart Association [published online ahead of print January 31, 2019]. *Circulation*. doi:10.1161/CIR.0000000000000659.

Brainstem function. MedlinePlus website. <https://medlineplus.gov/ency/imagepages/18007.htm>. Updated April 30, 2018. Accessed February 19, 2019.

Brault MW, Hootman J, Helmick CG, et al. Prevalence and most common causes of disability among adults—United States, 2005. *MMWR Morb Mortal Wkly Rep*. 2009;58(16):421-426.

Browning RG, Olson DW, Stueven HA, Mateer JR. 50% dextrose: antidote or toxin? *Ann Emerg Med*. 1990;19(6):683-687.

Centers for Disease Control and Prevention. *A summary of primary stroke center policy in the United States*. Atlanta, GA: Centers for Disease Control and Prevention, US Dept of Health and Human Services; 2011.

Certification for thrombectomy-capable stroke centers. The Joint Commission website. https://www.jointcommission.org/certification/certification_for_thrombectomycapable_stroke_centers.aspx. Accessed February 19, 2019.

REFERENCES (CONT.)

Crocco TJ, Grotta JC, Jauch EC, et al. EMS management of acute stroke--prehospital triage (resource document to NAEMSP position statement). *Prehosp Emerg Care*. 2007;11(3):313-317.

Dewey HM, Sturm J, Donnan GA, et al; North East Melbourne Stroke Incidence Study. Incidence and outcome of subtypes of ischaemic stroke: initial results from the North East Melbourne Stroke Incidence Study (NEMESIS). *Cerebrovasc Dis*. 2003;15(1-2):133-139.

Donnan GA, Davis SM. Neuroimaging, the ischaemic penumbra, and selection of patients for acute stroke therapy. *Lancet Neurol*. 2002;1(7):417-425.

Facts about advanced certification for comprehensive stroke centers. The Joint Commission website. https://www.jointcommission.org/assets/1/18/comprehensive_stroke_center_certification.pdf. Published September 2012. Accessed February 19, 2019.

Facts about primary stroke center certification. The Joint Commission website. https://www.jointcommission.org/assets/1/18/primary_stroke_center_certification.pdf. Published November 2009. Accessed February 19, 2019.

Field JM, Hazinski MF, Sayre MR, et al. Part 1: executive summary: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122(18)(suppl 3):S640-S656.

George MG, Tong X, Bowman BA. Prevalence of cardiovascular risk factors and strokes in younger adults. *JAMA Neurol*. 2017;74(6):695-703.

Go AS, Mozaffarian D, Roger VL, et al; American Heart Association Statistics Committee; Stroke Statistics Subcommittee. Heart disease and stroke statistics--2013 update: a report from the American Heart Association. *Circulation*. 2013;127(1):e6-e245.

Goetz CG, ed. *Textbook of Clinical Neurology*. 3rd ed. Philadelphia, PA: Saunders; 2007.

González RG. Imaging-guided acute ischemic stroke therapy: from "time is brain" to "physiology is brain". *AJNR Am J Neuroradiol*. 2006;27(4):728-735.

Hamm TL, Helland B, Keough D. Emergency services feedback: closing the loop increasing knowledge. In: Abstracts From the 2010 International Stroke Conference: Oral Presentations; February 23-26, 2010; San Antonio, TX. Abstract 17.

REFERENCES (CONT.)

Jauch EC, Saver JL, Adams HP Jr, et al; American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2013;44(3):870-947.

The Joint Commission stroke certification programs – program concept comparison. The Joint Commission website. https://www.jointcommission.org/assets/1/18/StrokeProgramGrid_abbrev_010518.pdf. Published January 2018. Accessed March 19, 2019.

Khatri P, Conaway MR, Johnston KC; Acute Stroke Accurate Prediction Study (ASAP) Investigators. Ninety-day outcome rates of a prospective cohort of consecutive patients with mild ischemic stroke. *Stroke*. 2012;43(2):560-562.

Kidwell CS, Starkman S, Eckstein M, Weems K, Saver JL. Identifying stroke in the field. Prospective validation of the Los Angeles prehospital stroke screen (LAPSS). *Stroke*. 2000;31(1):71-76.

Kissela BM, Khoury JC, Alwell K, et al. Age at stroke: temporal trends in stroke incidence in a large, biracial population. *Neurology*. 2012;79(17):1781-1787.

Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Prehospital Stroke Scale: reproducibility and validity. *Ann Emerg Med*. 1999;33(4):373-378.

Know the signs and symptoms of a stroke. Centers for Disease Control and Prevention website. https://www.cdc.gov/dhbsp/data_statistics/fact_sheets/fs_strokesigns.htm. Updated June 16, 2016. Accessed February 15, 2019.

Llinas RH. Overview of the approach to the stroke patient. In: Wityk RJ, Llinas RH, eds. *Stroke*. Philadelphia, PA: American College of Physicians; 2007:1-20.

Martin-Schild S, Albright KC, Tanksley J, et al. Zero on the NIHSS does not equal the absence of stroke. *Ann Emerg Med*. 2011;57(1):42-45.

Mozaffarian D, Benjamin EJ, Go AS, et al; American Heart Association Statistics Committee; Stroke Statistics Subcommittee. Heart disease and stroke statistics–2016 update: a report from the American Heart Association. *Circulation*. 2016;133(4):e38-e360.

REFERENCES (CONT.)

Nazliel B, Starkman S, Liebeskind DS, et al. A brief prehospital stroke severity scale identifies ischemic stroke patients harboring persisting large arterial occlusions. *Stroke*. 2008;39(8):2264-2267.

Powers WJ, Rabinstein AA, Ackerson T, et al. 2018 guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2018;49(3):e46-e110.

Slot KB, Berge E, Dorman P, Lewis S, Dennis M, Sandercock P; Oxfordshire Community Stroke Project, International Stroke Trial (UK); Lothian Stroke Register. Impact of functional status at six months on long term survival in patients with ischaemic stroke: prospective cohort studies. *BMJ*. 2008;336(7640):376-379.

Smith WS, Lev MH, English JD, et al. Significance of large vessel intracranial occlusion causing acute ischemic stroke and TIA. *Stroke*. 2009;40(12):3834-3840.

Snell RS. *Clinical Neuroanatomy*. 7th ed. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins; 2010.

Solomon NA, Glick HA, Russo CJ, Lee J, Schulman KA. Patient preferences for stroke outcomes. *Stroke*. 1994;25(9):1721-1725.

Stroke 101: fast facts on stroke. National Stroke Association website. https://www.stroke.org/wp-content/uploads/2018/12/NSAM-2017_Stroke-101_v3_AQ_pdfversion.pdf. Published 2017. Accessed February 19, 2019.

Summers D, Leonard A, Wentworth D, et al; American Heart Association Council on Cardiovascular Nursing; the Stroke Council. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. *Stroke*. 2009;40(8):2911-2944.

Tadros A, Crocco T, Davis SM, et al. Emergency medical services-based community stroke education: pilot results from a novel approach. *Stroke*. 2009;40(6):2134-2142.

Teleb MS, Ver Hage A, Carter J, Jayaraman MV, McTaggart RA. Stroke vision, aphasia, neglect (VAN) assessment—a novel emergent large vessel occlusion screening tool: pilot study and comparison with current clinical severity indices. *J Neurointerv Surg*. 2017;9(2):122-126.

REFERENCES (CONT.)

Thomas SH, Schwamm LH, Lev MH. Case records of the Massachusetts General Hospital. Case 16-2006. A 72-year-old woman admitted to the emergency department because of a sudden change in mental status. *N Engl J Med*. 2006;354(21):2263-2271.

White H, Boden-Albala B, Wang C, et al. Ischemic stroke subtype incidence among whites, blacks, and Hispanics: the Northern Manhattan Study. *Circulation*. 2005;111(10):1327-1331.

Xu J, Murphy SL, Kochanek KD, Arias E. Mortality in the United States, 2015. *NCHS Data Brief*. 2016;(267):1-8.

Yang Q, Tong X, Schieb L, et al. Vital signs: recent trends in stroke death rates – United States, 2000–2015. *MMWR Morb Mortal Wkly Rep*. 2017;66(35):933-939.
