



EMS FOR STROKE THE FIRST LINE OF DEFENSE

Genentech
A Member of the Roche Group

 American College of
Emergency Physicians®
ADVANCING EMERGENCY CARE 

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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



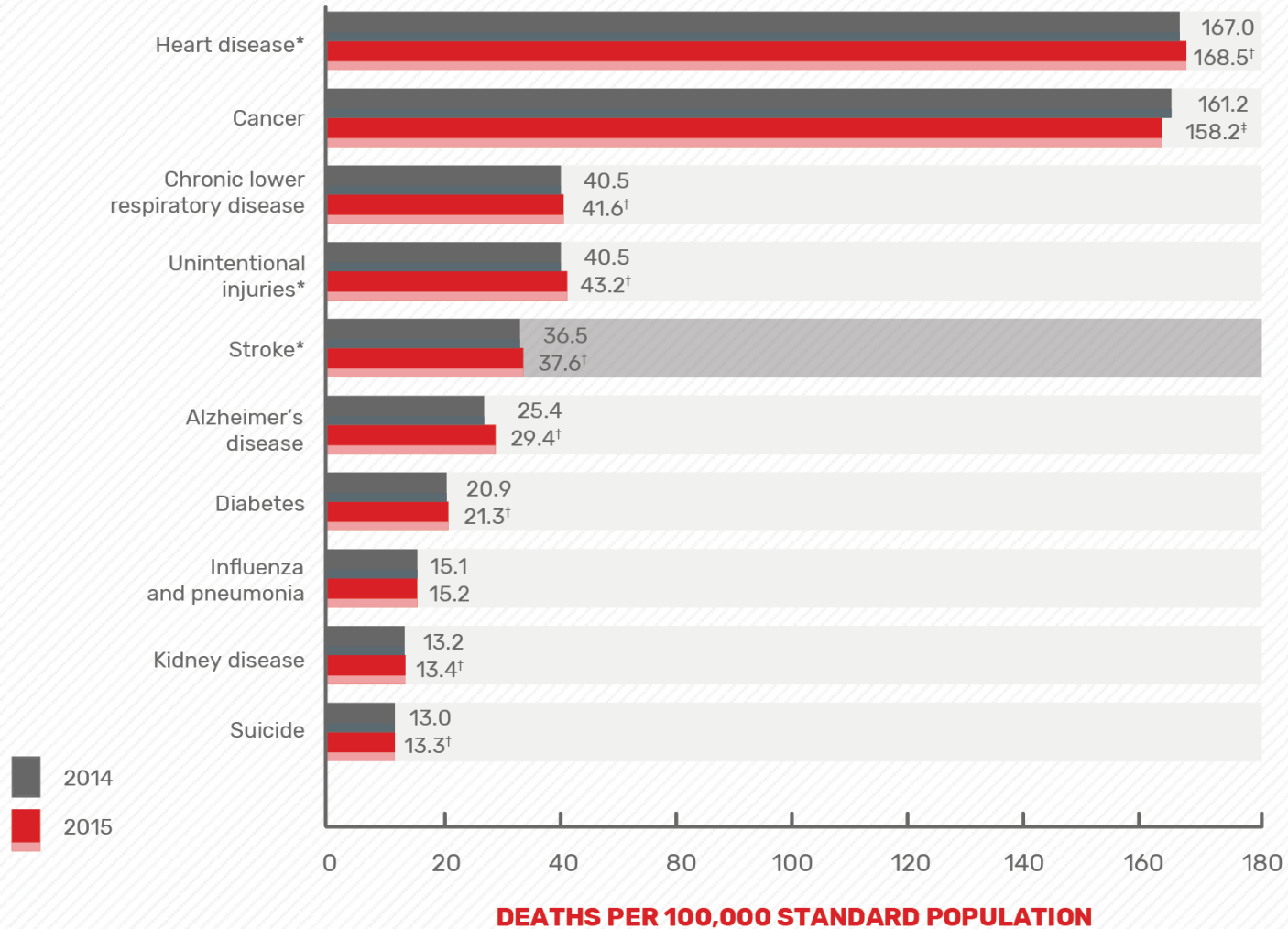
Leading cause of serious, long-term disability¹



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.

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

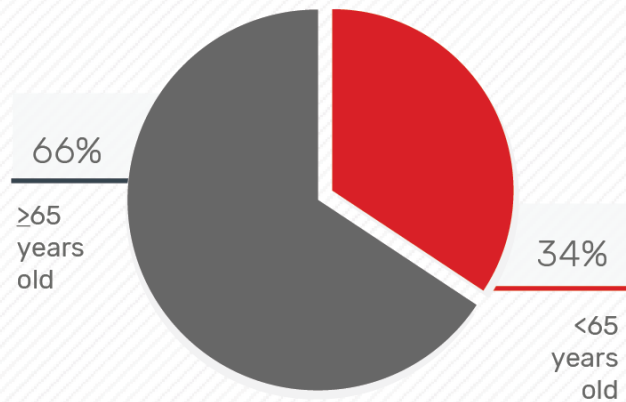
[§]Data from North East Melbourne Stroke Incidence Study (NEMESIS). Due to different social, medical, and government support structures, there are limitations to the conclusions that can be applied for practice in the US.³

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.

STROKE PREVALENCE BY AGE¹⁻³

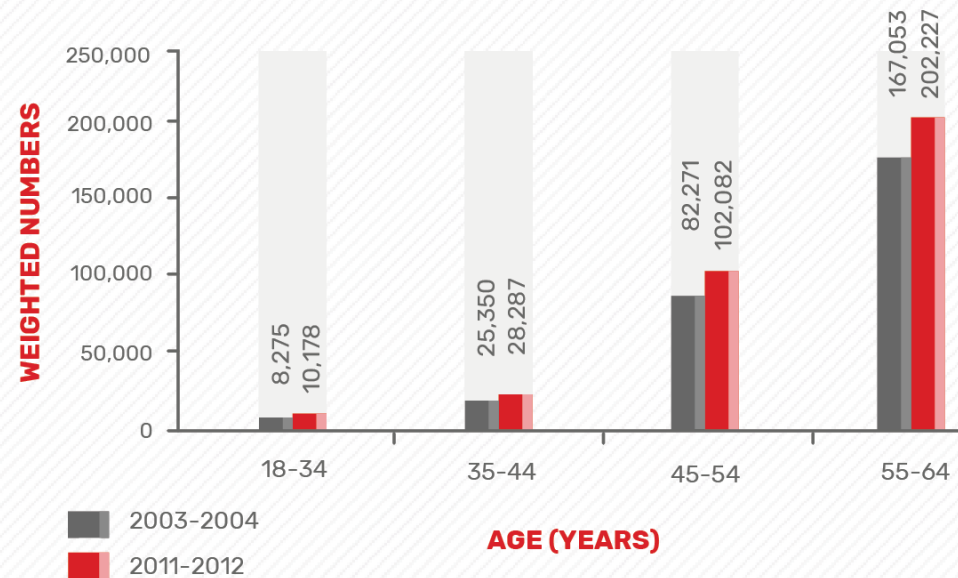
The incidence of stroke in younger people is increasing¹

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.

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.** George MG, et al. *JAMA Neurol.* 2017;74(6):695-703.

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)

● Vertebrobasilar cerebral system

● Middle cerebral artery (MCA)

References: 1. Goetz CG. *Textbook of Clinical Neurology*. 2007. 2. Llinas R. *Stroke*. 2007. 3. Martin-Schild S. *Ann Emerg Med*. 2001;42-45. 4. MedlinePlus website. <https://medlineplus.gov/ency/imagepages/18007.htm>. 5. Snell RS. *Clinical Neuroanatomy*. 2010.

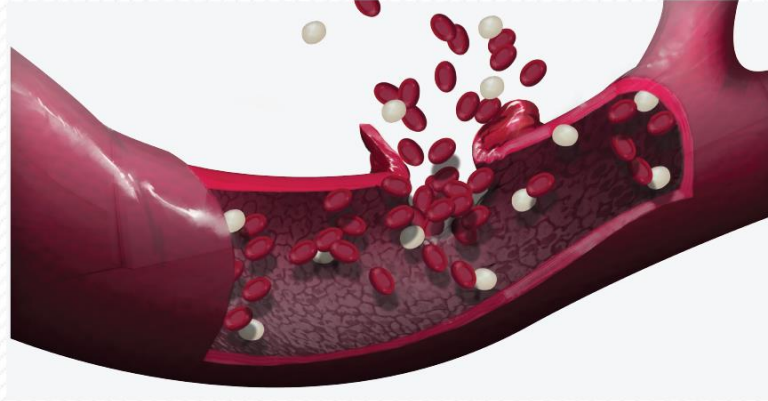
TYPES OF STROKE¹⁻⁴



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.

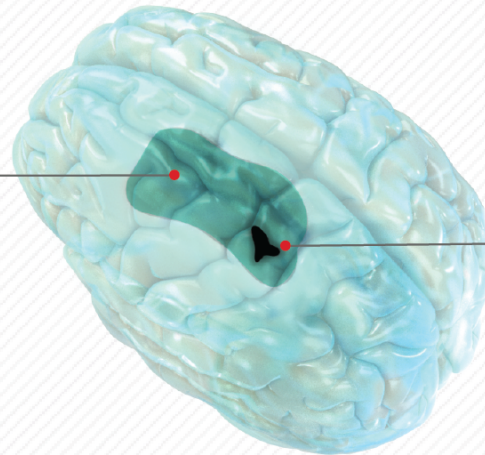
GOAL FOR ISCHEMIC STROKE: SAVE THE PENUMBRA

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?



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?

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.

References: 1. Field JM, et al. *Circulation*. 2010;122(suppl 3):S640-S656. 2. Jauch EC, et al. *Stroke*. 2013;44:870-947.

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.

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.

References: **1.** Browning RG, et al. *Ann Emerg Med.* 1990;19:683-687. **2.** Jauch EC, et al. *Stroke.* 2013;44:870-947.

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.

WI Coverdell EMS Partner Report Card
Q1-Q4 2019

	EMS Agency			
	SAMPLE	2019 EMS Agency Data	Q2 2020 Coverdell EMS Partners	Q2 2020 All Wisconsin EMS
Measures including all stroke runs				
Number of stroke patients identified via primary or secondary impression	69	40	3535	11155
EMS on-scene time recorded ¹	87%	70%	85%	86%
Stroke screening (e.g., CPSS) performed and documented as a vital sign	94%	49%	45%	58%
Neuro exam, stroke screening, or Glasgow Coma Scale performed and documented as a vital sign	99%	88%	84%	91%
Percent of runs transported to a designated stroke center	0%	67%	70%	67%
Measures excluding transfers/transports				
Number of stroke runs excluding transfers/transports	60	51	2430	8434
EMS left scene within 15 minutes of arriving to patient (of those with an on-scene time)	72%	54%	53%	55%
Situation last known well (LKW) time entered	75%	71%	18%	31%
Situation LKW and patient arrived at destination times were both entered	72%	70%	17%	28%
Percent of stroke patients arrived at hospital within 3.5 hours of time LKW ²	60%	43%	67%	68%
Blood glucose obtained and documented as a vital sign	65%	49%	79%	77%
Records complete with blood glucose, stroke scale (neuro, stroke scale list, or Glasgow Coma Scale), and on-scene time	60%	47%	58%	62%



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?

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





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 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.

RECOGNIZING STROKE IS A CHALLENGE¹

Help raise awareness

- People still do not recognize stroke symptoms
- Less than half of 911 calls for stroke are made within the first hour of symptom onset

The collage features several educational materials:

- Top Left:** A poster with a couple. Text: "WHEN IT COMES TO STROKE IT'S OK TO OVER-REACT". A testimonial: "We were out with friends when my husband suddenly had trouble walking. I suspected stroke, so I CALLED 911 IMMEDIATELY. It helped save his life." Bottom: "If you suspect STROKE, CALL 911 immediately" and "HOW MANY OF THE 10 STROKE SYMPTOMS DO YOU KNOW? Learn them inside".
- Top Middle:** A red header: "WHEN IT COMES TO STROKE, BE FAST CALL 911". Subtext: "Any one of these sudden SIGNS could mean a STROKE".
- Top Right:** A poster with a woman's face. Text: "WHEN IT COMES TO STROKE IT'S OK TO OVER-REACT". Subtext: "If you suspect STROKE, CALL 911 immediately".
- Center:** A checklist of 10 symptoms with icons: Balance (Watch for sudden loss of balance), Eyes (Check for vision loss), Face (Look for an uneven smile), Arm (Check if one arm is weak), Speech (Listen for slurred speech), Time (Call 911 right away).
- Bottom Middle:** A red footer: "Learn all 10 SYMPTOMS OF STROKE @ overreact2stroke.com". Logos for Genentech, American College of Emergency Physicians, and EMS STRONG.
- Bottom Right:** A poster with a woman's face. Text: "WHEN IT COMES TO STROKE IT'S OK TO OVER-REACT BE FAST CALL 911". Subtext: "Any one of these sudden SIGNS could mean a STROKE".

Reference: 1. Jauch EC, et al. *Stroke*. 2013;44:870-947.

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