rn.com

AMN Healthcare Education Services

When Minutes Count: Recognizing Stroke
This course has been awarded
two (2.0) contact hours.

This course expires on April 30, 2020.

First Published: October 6, 2010
Updated: December 31, 2013

Acknowledgements
RN.com acknowledges the valuable contributions of…

Conflict of Interest and Commercial Support

RN.com strives to present content in a fair and unbiased manner at all times, and has a full and fair disclosure policy that requires course faculty to declare any real or apparent commercial affiliation related to the content of this presentation. Note: Conflict of Interest is defined by ANCC as a situation in which an individual has an opportunity to affect educational content about products or services of a commercial interest with which he/she has a financial relationship.

The author of this course does not have any conflict of interest to declare.

The planners of the educational activity have no conflicts of interest to disclose.

There is no commercial support being used for this course.

Purpose and Objectives

Stroke prevention is a leading public health issue. This two contact hour CE course identifies ways in which healthcare professionals can recognize the early warning signs of stroke and prevent the occurrence of stroke through education.

This course reviews primary and secondary stroke prevention tools that healthcare professionals can use to modify risk factors for stroke.

After successful completion of this course, you will be able to:

1. Recognize the early warning signs of ischemic and hemorrhagic stroke

2. Identify objectives of the Healthy People 2020 campaign in reducing stroke and cardiovascular disease

3. Name four modifiable and four non-modifiable risk factors for stroke

4. Describe assessment strategies of patients for identifying neurological changes

5. Identify and discuss stroke prevention guidelines and strategies

6. Review clinical performance measures as a secondary prevention tool

Introduction

A stroke refers to a sudden impairment of brain function as a result of an interruption of circulation to an area of the brain following either occlusion or hemorrhage of an artery supplying that area. This is sometimes termed a "brain attack" or cerebrovascular accident (Centers for Disease Control and Prevention [CDC], 2016b).

Cerebrovascular disease is usually present for many years before a stroke occurs, although the symptoms of a stroke may occur suddenly.

Healthcare professionals can play a major role in educating society about the risk factors for stroke and lifestyle modifications that can be made to decrease the risk of stroke.

By creating greater public and professional awareness and recognition of stroke risk factors and warning signs, prompt medical attention can be given, thus improving patient outcomes and care and ultimately reducing the personal and societal impacts of stroke (CDC, 2014).

Note! This course provides a high-level overview of stroke prevention and recognition, but does not review drug management therapies in-depth. Please see other stroke management courses on RN.com for pharmacological therapies.

Statistics
Stroke is a leading cause of death and disability in the United States and across the globe. In the United States, stroke is the fifth leading cause of death, but it is the second leading cause of death worldwide.   Approximately 795,000 people in the U.S. suffer a stroke each year, with 610,000 of these are new strokes.   About 133,000 die each year in the U.S from a stroke.   Here are some other specific statistics for the U.S.:

- About one out of every 20 deaths in the U.S. is from a stroke
- Stroke does occur in children and young adults
- Someone has a stroke once every 40 seconds
- Someone dies from a stroke about every four minutes

(American Heart Association {AHA}, 2017).

Stroke is the leading cause of long-term disability in the U.S.   The effects of this on society are enormous. Stroke has many costs, including the cost of health care services, medications, and lost productivity.   It is estimated that by 2030 there will be a $1044 billion global cost for cardiovascular disease, including stroke.   The personal and family costs are immeasurable (AHA, 2017).

Accelerated aging can occur with stroke, at an approximate rate of 3.6 years lost per hour.   Patients who receive treatment within three hours of initial stroke symptoms have less disability at three months, compared to those who received delayed care.   Without appropriate action, the impact of stroke on our society will be even more devastating.   The majority of strokes are preventable, but if they occur remember TIME IS BRAIN (American Heart Association/American Stroke Association [AHA/ASA], 2013).

<div align="center">

Did You Know?
There is good news!   There was a decrease in the stroke death rate in the U.S., down 28.7%, from 2004 to 2014 (AHA, 2017)

</div>

Test Yourself
Which of the following is an accurate statistic about stroke in the United States?
- A. Stroke is the leading cause of death
- B. About 133,000 people suffer a stroke each year
- **C. Someone has a stroke every 40 seconds**

Stroke Recognition
Healthcare professionals can have a major impact on the outcome of a stroke.

By understanding the risk factors for cerebrovascular disease and recognizing the early warning signs of an impending stroke, you can greatly improve patient outcomes and prevent secondary attacks.

A short review of the anatomy and physiology of the brain will be provided.   A brief presentation of the etiology and presentation of TIA (transient ischemic attack), acute ischemic stroke, and acute hemorrhagic stroke will be also be covered, to assist you in educating the public in recognizing the warning signs of an impending stroke. Early stroke intervention and management will significantly reduce the severity and impact of the stroke. Neurological assessments are also vital to identify any changes in your patient.

Primary and secondary prevention strategies will be reviewed, and stroke prevention guidelines explored. Clinical performance measures are interventions which can prevent recurrence of stroke and reduce the severity of associated morbidities.

Stroke and the Brain
When a stroke occurs, the effects on the body will depend on the location in the brain of the stroke, as well as the severity.   If a stroke happens on the left side of the brain, the right side of the body will be affected.   The opposite is also true.   Impairments of senses, movement, sensation, and other neurological deficits are a result of the area of the brain that is impacted (American Heart Association/American Stroke Association [AHA/ASA], 2012).

Review of the Brain
This brief review of the brain includes main areas that may be impacted by stroke.   The brain in is one of the body's largest organs in an adult. It weighs about three pounds and is divided into four major parts: the cerebrum, diencephalon, brain stem, and cerebellum (Martin, 2012).

Cerebrum
The cerebrum is the largest portion of the brain, covering the diencephalon. There are two hemispheres- the right and the left.   Each cerebral hemisphere is subdivided into lobes.   These are the frontal, temporal, parietal, and occipital lobes (Scanlon & Sanders, 2015).

Frontal Lobe
The frontal lobe is located in front of the central sulcus, and involves reasoning, planning, parts of speech and movement (motor cortex), emotions, and problem solving.

The frontal lobe is also involved in spontaneity, memory, language, initiation, judgment, impulse control, and social and sexual behavior. In most people, the left frontal lobe is involved in controlling language related movement, whereas the right frontal lobe plays a role in non-verbal abilities.

Frontal lobe damage can affect emotional control and personality.   This type of damage also seems to have an impact on flexibility and ability to problem solve, sexual behaviors, personality changes, motor control, facial expression, and Broca's aphasia, or difficulty in speaking (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the frontal lobe:
- Personality
- Behavior
- Emotions

- Intellectual function
- Ability to write words
- Speech motor (Broca's area)

(Rughani, 2015; Scanlon & Sanders, 2015)

Parietal Lobe
The parietal lobe is located behind the central sulcus. It is involved with perception of stimuli related to touch, pressure, temperature, and pain.

The parietal lobes can be divided into two functional regions, involving sensation and perception. The overall role of the parietal lobe is to integrate sensory information to form a single perception (also known as cognition).

Parietal lobe damage can cause right-left confusion (person unable to distinguish left from right), agraphia (difficulty with writing), and acalculia (trouble with mathematics). It can also produce aphasia (language difficulty), and agnosia (inability to perceive objects normally) (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the parietal lobe:
- Primary center for sensation
- Ability to recognize body parts
- Left versus right

(Rughani, 2015; Scanlon & Sanders, 2015)

Temporal Lobe
The temporal lobe is located below the lateral fissure. It is concerned with sensory perception and recognition of auditory stimuli (hearing) and memory (hippocampus) (Rughani, 2015; Scanlon & Sanders, 2015).

Temporal lobe damage may result in impaired memory, difficulty recognizing words or speaking, and recall of non-verbal stimuli such as music or drawings.   Individuals with temporal lobes damage may also have difficulty placing words or pictures into categories. The temporal lobes are highly associated with memory skills and language (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the temporal lobe:
- Primary auditory reception center
- Language comprehension (Wernicke's area)

(Rughani, 2015; Scanlon & Sanders, 2015)

Occipital Lobe
The occipital lobe is located at the back of the brain, behind the parietal lobe and temporal lobe. It is concerned with many aspects of vision (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the occipital lobe typically results in visual changes, even producing visual hallucinations (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the occipital lobe:
- Primary visual reception center
- Understanding of written material

(Rughani, 2015; Scanlon & Sanders, 2015)

Limbic System

The limbic system, also known as the border, is composed of certain components of the cerebrum and the diencephalon. The components of this system include the limbic lobe, the hippocampus, the amygdaloid nucleus, the mammillary bodies of the hypothalamus, and the anterior nucleus of the thalamus. Basically, the limbic system encircles the brainstem and influences the emotional aspects of behavior that are essential to our survival. It also plays a role in memory, although the exact mechanism is not understood fully. The limbic system is also thought to play some part in how we sense pleasure, pain, anger, rage, fear, sadness and sexual feelings. Because of its role in these core emotions, it is also known as the visceral or emotional brain (Scanlon & Sanders, 2015).

Diencephalon

The diencephalon is situated between the brain stem and the cerebrum. It contains the thalamus and hypothalamus (Scanlon & Sanders, 2015).

Thalamus

The thalamus constitutes about eighty percent of the diencephalon, and is composed of two masses of grey matter.   The thalamus serves as a communication station for all sensory impulses that reach the cerebral cortex from the spinal cord, brain stem, cerebellum, and parts of the cerebrum. The thalamus also functions as an understanding center for some sensory impulses such as pain, temperature, light, touch, and pressure (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the thalamus may cause drowsiness, impaired attention span, impairment movement, or development of epilepsy.   A common occurrence with thalamus damage is central pain syndrome, which is intense neuropathic pain of the affected limb (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the thalamus:
- Main relay station for the nervous system (touch, temperature, flow of information)
- Pain threshold

(Rughani, 2015; Scanlon & Sanders, 2015).

Hypothalamus

The primary functions of the hypothalamus are to integrate and control the autonomic nervous system, reception, and integration of sensory impulses from the viscera. It coordinates the endocrine response of many hormones within the endocrine system.

The hypothalamus produces and releases hormones that stimulate the pituitary gland, including the growth hormone releasing hormone (GRH), thyrotropic releasing hormone (TRH), and corticotropin releasing hormone (CRH).

Once in the pituitary, they act to produce or release other hormones from the pituitary gland. A negative feedback loop inhibits the hypothalamus to stop stimulating hormone production.   The hypothalamus is also responsible for the "mind over body" phenomenon. When strong emotions are produced by the cerebral cortex, nerve impulses travel down through the hypothalamus to the body. Likewise, continued psychological stress traveling upward through the hypothalamus may produce long-term, very real systemic illnesses. The hypothalamus also plays a role in feelings such as rage and aggression, and regulates body temperature, hunger, thirst, sleep and wake cycles (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the hypothalamus can cause hormone imbalances and related effects, temperature fluctuations, sleep disruption, and changes in appetite (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the hypothalamus:
- Center for:
    - Temperature control
    - Sleep
    - Pituitary regulation
    - Heart rate
    - Blood pressure
    - Emotional regulation
    - Autonomic nervous system activity

(Rughani, 2015; Scanlon & Sanders, 2015).

Cerebellum
The cerebellum is located at the back of the brain.   It underlies the occipital and temporal lobes.   It is a small structure, but contains the majority of neurons in the brain.   The cerebellum modifies the motor commands that are sent through descending pathways.   The cerebellum is important for maintaining balance and posture, coordinating voluntary movements, cognitive functions, and motor learning (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the cerebellum can cause hypotonia, slurred speech, tremors, ataxic gait, tendency to fall, and nystagmus.   This type of damage may also impair inability to judge distances and impaired coordination (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the cerebellum:
- Coordinating motion of the various muscles involved in voluntary movements
- Motor learning
- Maintenance of balance and posture

(Rughani, 2015; Scanlon & Sanders, 2015)

Brain Stem
The brain stem consists of the medulla oblongata, pons, and mid-brain, or mesencephalon (Rughani, 2015; Scanlon & Sanders, 2015).

Medulla
The medulla oblongata, or medulla, is at the base of the brain stem, and is essentially a continuation of the upper part of the spinal cord.   It contains all ascending and descending nerve tracts between the brain and spinal cord. The medulla is also the origin of several cranial nerves. They are cranial nerves VIII, IX, X, XI, and XII (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the medulla can cause dysphagia, tongue deviation, voice changes, vertigo, and ataxia. Weakness on the opposite site of the body can also occur (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of the functions of the medulla:
- Continuation of the spinal cord in the brain
- Controls quality of respirations and heart rate, swallowing and hiccoughing, and gag and cough reflexes

(Rughani, 2015; Scanlon & Sanders, 2015)

Pons
The pons is the bridge that connects the spinal cord with the brain and certain parts of the brain with each other. These connections occur via fibers that run in two major directions. The transverse fibers connect with the cerebellum. The longitudinal fibers connect the spinal cord or medulla with the upper parts of the brain stem. Cranial nerves VI and VII are also supported by the pons (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the pons can impair facial and eye movements. Weakness on the opposite site of the body can also occur (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of the functions of the pons:
- Connects medulla oblongata and midbrain, ventral to the cerebellum
- Support cranial nerves

(Rughani, 2015; Scanlon & Sanders, 2015)

Mid-Brain
The mid-brain, or mesencephalon, extends from the pons to the lower portion of the diencephalons. The cerebral aqueduct travels through the mid-brain and connects the third and fourth ventricles. Within the mid-brain, there are nerve fibers that convey nerve impulses from the cerebral cortex to the pons and spinal cord. The mid-brain also has some reflex centers that control eye, head, and neck movements. The mid-brain is also the origin of cranial nerves II and IV (Rughani, 2015; Scanlon & Sanders, 2015).

Damage to the midbrain can cause impaired eye movements, and inability to focus attention. Damage to both sides of the midbrain can cause serious inability to move, and may even cause coma (Rughani, 2015; Scanlon & Sanders, 2015).

Overview of functions of the midbrain:
- The midbrain or mesencephalon, extends from the pons to the lower portion of the diencephalons
- Support cranial nerves
- Reflex centers for eye, head, and neck movements

(Rughani, 2015; Scanlon & Sanders, 2015)

Test Yourself
Which brain structure is involved with auditory reception?
- **A. Temporal lobe**
- B. Occipital lobe
- C. Thalamus

The correct answer is A. The temporal lobe is involved with auditory reception.

For more in-depth information on anatomy and physiology of the brain and central nervous system, see RN.com's Assessment Series:
Neurological Anatomy and Physiology

Types of Stroke
There are three main types of stroke:

- TIA (transient ischemic attack)
- Acute ischemic stroke
- Acute hemorrhagic stroke

A brief review of the cause and clinical presentation of each type of stroke will be reviewed, as well as the early warning signs for each type of stroke.

Transient Ischemic Attack (TIA)
A transient ischemic attack (TIA) is a transient stroke that lasts only a few minutes, but is an important predictor of stroke.   It is caused by a temporary cut in blood supply to the brain, due to the partial blockage of an artery by a blood clot or debris. TIAs have the same symptoms as a stroke, but they are temporary and do not usually cause long-term brain damage. It is important to understand that the distinction between TIA and ischemic stroke has become less important in recent years because prevention approaches are the same, and they share pathophysiological mechanisms (American Heart Association/American Stroke Association [AHA/ASA], 2014a).

A TIA, or mini-stroke, is a warning of an impending stroke. A person who has had a TIA is at greater risk of having a stroke or heart attack. A TIA patient has a 20% risk for stroke within the same year (Furie & Ay, 2015).

TIAs are often warning signs that a person is at risk for a more serious and debilitating stroke. About one-third of those who have a TIA will have an acute stroke sometime in the future.

Since there is no way to tell whether symptoms are from a TIA or an acute stroke, patients should assume that all stroke-like symptoms signal an emergency and should not wait to see if they go away. A prompt evaluation (within 60 minutes) is necessary to identify the cause of the TIA and determine appropriate therapy (NINDS, 2016).

A mini stroke or series of mini strokes can occur in tiny arteries that do not affect a large enough area to cause noticeable symptoms, yet lead to gradual deterioration.

TIAs are also known as silent brain infarctions, as they may be difficult to detect, particularly with elderly patients.   There are also many conditions which mimic a TIA.   TIAs may lead to a condition called multiple infarct dementia associated that is with clumsiness, weakness, emotional instability, and mental impairment (Nadarajan, Perry, Johnson, & Werring, 2014; NINDS, 2016).

**Many strokes can be prevented by heeding the warning signs of TIAs and treating underlying risk factors
(NINDS, 2016).**

Early Warning Signs: TIA
The symptoms of a TIA, which usually occur suddenly, are similar to those of stroke but do not last as long. Most symptoms of a TIA disappear within an hour, although rarely they may persist for up to 24 hours.
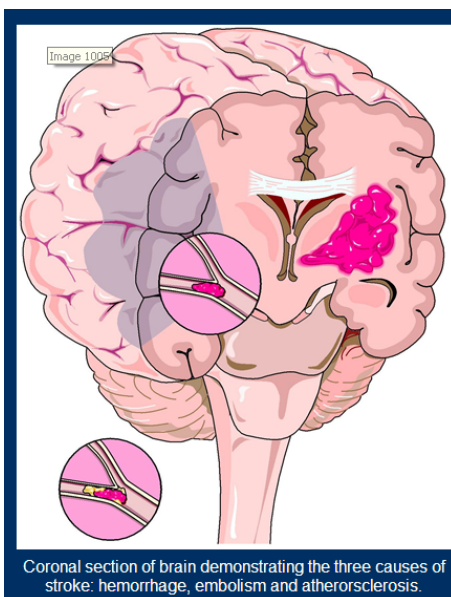
Symptoms of a TIA may include:

- A numb or weak feeling in the face, arm or leg
- Trouble speaking or understanding
- Unexplained dizziness
- Blurred, double, or poor vision in one or both eyes

- Loss of balance or an unexplained fall
- Difficulty swallowing
- Headache (usually severe or of abrupt onset) or unexplained change in the pattern of headaches
- Confusion
- Unconsciousness

The presentation and severity of the symptoms depends on the area of the brain affected and the cause.

The warning signs or symptoms of stroke may occur alone or in combination. They may last a few seconds or up to 24 hours, and then disappear. On average, most TIAs last several minutes. They may also be repeated TIA episodes within the day. These signs should not be ignored, as they represent a problem with blood flow, which could trigger a stroke (Furie & Ay, 2015; National Stroke Association [NSA], 2017b).

Coronal section of brain demonstrating the three causes of stroke: hemorrhage, embolism and atherorsclerosis.

Test Yourself
Early warning signs of a TIA may only last a few seconds or up to 24 hours.
    A. True
    B. False
The correct answer is: True. The warning signs or symptoms of stroke may occur alone or in combination. They may last a few seconds or up to 24 hours, and then disappear. These signs should not be ignored, as they represent a problem with blood flow, which could trigger a stroke.

Acute Ischemic Stroke
Ischemic stroke is distinguished by the sudden loss of blood circulation to an area of the brain, which results in a corresponding loss of neurologic function. Acute ischemic stroke is the most common type of stroke. This type of stroke occurs when there is a blockage in a blood vessel which results in a lack of blood flow to the affected area. Usually this type of stroke results from atherosclerosis, which

can cause the blood to clot. There are two types of clots:

- A clot that stays in place in the brain is called a cerebral thrombus.
- A clot that breaks loose and moves through the blood to the brain is called a cerebral embolism.
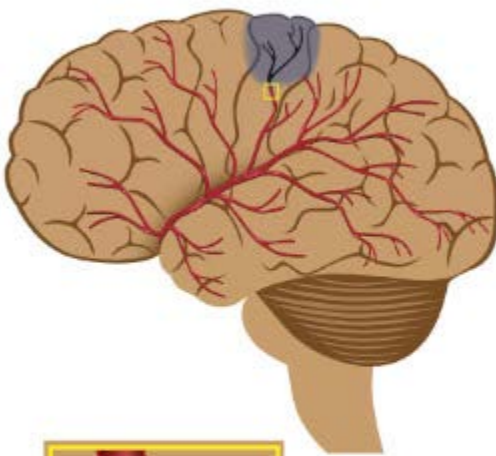
Other causes of ischemic stroke include:

- Abnormal heart valve.
- Inflammation of the inside lining of the heart chambers and heart valves (endocarditis).
- Mechanical heart valve.

A clot can form on a heart valve, break off, and travel to the brain. For this reason, those with mechanical or abnormal heart valves often must take blood thinners (CDC, 2014; Jauch, 2016) .
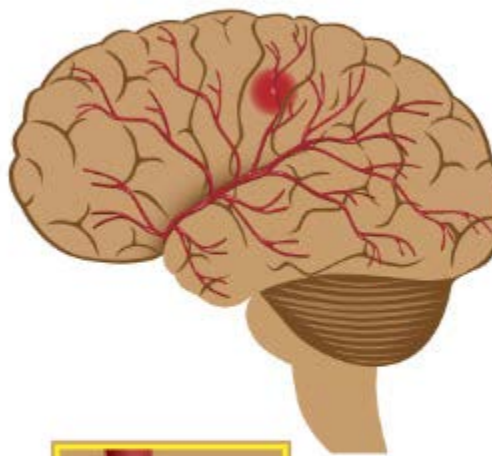
Brain Stroke

Ischemic Stroke

Hemorrhagic Stroke

Blockage of blood vessels; lack of blood flow to affected area

Rupture of blood vessels; leakage of blood

© Can Stock Photo Inc. / alila

Early Warning Signs: Ischemic Stroke
Early warning signs of ischemic stroke include:

- Sudden unilateral numbness, weakness or paralysis of face, arm or leg -especially on one side of the body
- Sudden confusion
- Sudden speech abnormality

- Sudden vision disturbances or gaze abnormality (may be unilateral or bilateral)

- Sudden trouble walking

- Sudden dizziness (especially if with other listed symptoms)

- Sudden loss of balance/coordination

- Sudden altered level of consciousness with neurological deficits

Although these symptoms can each occur alone, they are more likely to occur in combination with ischemic stroke.
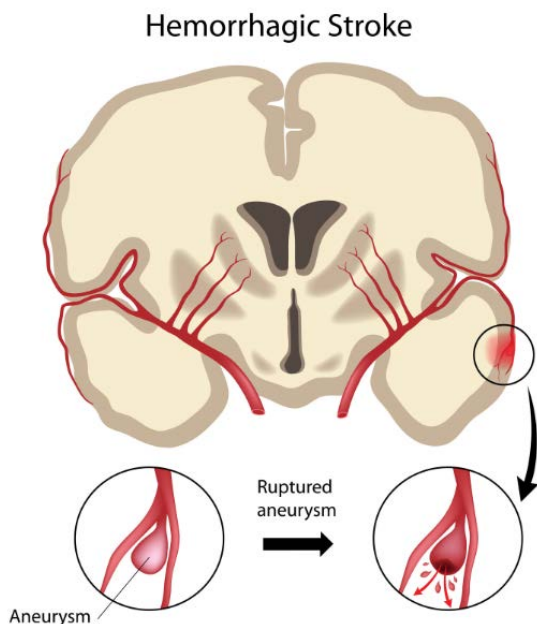(CDC, 2014; Jauch, 2016)

Acute Hemorrhagic Stroke
Acute hemorrhagic stroke occurs when a blood vessel ruptures inside the brain. The brain is very sensitive to bleeding and damage can occur very rapidly, either because of the presence of the blood itself, or because the fluid increases pressure on the brain and harms it by pressing it against the skull. Acute hemorrhagic strokes are less common than acute ischemic strokes, but more fatal. In hemorrhagic stroke, bleeding happens directly into the brain parenchyma.

Bleeding irritates the brain tissue, causing swelling. The surrounding tissues of the brain resist the expansion of the bleeding, which is finally contained by forming a mass (hematoma). Both swelling and hematoma will compress and displace normal brain tissue.

Most often, hemorrhagic stroke is caused by hypertension alone, which causes leakage from damaged intracerebral arteries. However, it could be caused by an aneurysm. An aneurysm is a weak spot in an artery wall, which balloons out because of the pressure of the blood circulating inside the affected artery. Eventually, it can burst and cause serious harm. The larger the aneurysm is, the more likely it is to burst. It is unclear why people develop aneurysms, but genetics may play a role, since aneurysms run in families (CDC, 2014; Jauch, 2016).

Hemorrhagic Stroke

Aneurysm

Ruptured aneurysm

© Can Stock Photo Inc. / alila

Normally the blood-brain barrier keeps brain cells from being bathed in blood. When a blood vessel ruptures, flooding upsets the delicate chemical balance the brain needs to function normally. Blood contaminates cerebral spinal fluid (CSF) when there is bleeding into the subarachnoid space on the brain's surface (this explains why a lumbar puncture maybe performed to rule out the presence of blood in the CSF).

Early Warning Signs: Hemorrhagic Stroke

Signs and symptoms of intracerebral and subarachnoid hemorrhaging include the same as ischemic stroke, as well as:

- Sudden and severe headache with no known cause

- Nausea and vomiting with no known cause

For additional information on the management of stroke, please review RN.com's course:

Acute Ischemic Stroke Management.

Test Yourself

Which of the following is true regarding hemorrhagic stroke?
     A. The incidence is higher than ischemic stroke
     B. Symptoms of hemorrhage stroke are the same as ischemic stroke
     C. Hemorrhagic strokes are more fatal than ischemic stroke
The answer is C.   Hemorrhagic strokes are more fatal than ischemic stroke

Hemorrhagic Transformation

Hemorrhagic transformation, also known as conversion, is when an infarction from an ischemic stroke converts into an area of hemorrhage. Possible reasons for hemorrhagic transformation include reperfusion of tissue injured by ischemia or from disruption of the blood-brain barrier.   The reperfusion may be a result of either restoration of blood flow of an occluded vessel or from collateral blood supply to the ischemic area.   When the blood-brain barrier is disrupted, red blood cells leaking out from the weakened capillary bed, causing petechial hemorrhage or a clinically identifiable intraparenchymal hematoma.

Hemorrhagic transformation of an ischemic infarct, when it occurs, is usually seen within the first week after an ischemic stroke, but can occur within 2-14 days.   It is more commonly seen after cardioembolic strokes or with a larger infarct size.   Hemorrhagic transformation is also a risk following administration of tissue plasminogen activator (tPA) as a treatment of ischemic stroke (Liebeskind, 2017).

B.E.F.A.S.T.

The National Stroke Association (NSA) had developed an "Act. F.A.S.T." campaign to quickly and easily identify early signs and symptoms of an evolving stroke.   However, F.A.S.T. covers only 20% of strokes.   Posterior strokes exist and happen.   For further assessment, B.E.F.A.S.T. is used.

If you suspect an individual may be having a stroke, act- do this simple B.E.F.A.S.T. test:

B.E.F.A.S.T.	
BALANCE	Is there a sudden loss of balance or coordination?

EYES	Is there sudden blurred or double vision or sudden, persistent vision trouble?
FACE	Ask the person to smile. Does one side of the face droop?
ARMS	Ask the person to raise both arms. Does one arm drift downward?
SPEECH	Ask the person to repeat a simple sentence. Is their speech slurred or strange? Are the words slurred? Can he/she repeat the sentence correctly?
TIME	If the person shows any of these symptoms, time is important. Note the time when symptoms first began. Call 911 or get to the hospital fast. Brain cells are dying.

(Glober et al., 2016; National Stroke Association, 2017a)

Did you Know?
Did you know that 1.9 million neurons die per minute?   For every 15 minutes that we are faster with diagnosis and treatment, more stroke patients have better outcomes, including less mortality and morbidity (Klingman, 2016)

Test Yourself
B.E.F.A.S.T stands for:
   A. **B**ilateral strength, **E**ven grips, **F**acial droop assessment, **A**irway management, **S**ubjective assessment, and **T**est reflexes.
   B. **B**alance assessment, **E**ye assessment, **F**acial droop assessment, **A**sk patient to raise both arms, **S**peech assessment, and **T**imely transfer to hospital.
   C. **B**elieve patient complaints, **E**xtension and flexion, **F**ind a comfortable position to assess the patient in, **A**sk the date and time, **S**ee if the patient can read / write, and **T**imely documentation.
The correct answer is: B. The correct answer is: Balance assessment, Eye assessment Facial droop assessment, Ask patient to raise both arms, Speech assessment and Timely transfer to hospital.

Neurological Assessment
Using B.E.F.A.S.T. can detect changes in a rapid manner which may indicate a stroke is occurring. It is also important for nurses to assess patients thoroughly for neurological changes in patient care settings.   Frequently, changes in a head to toe assessment can show subtle changes which may be missed otherwise.   Ongoing assessments for patients with any neurological conditions or symptoms is crucial.   Key components include:
   • Mental status information
        o Level of consciousness
        o Orientation assessment
   • Pupils
        o Right/left pupil description
        o Right/left pupil reaction
        o Right/left pupil size

- Neurological symptoms (if any)
  - Characteristics of communication
  - Characteristics of speech
  - Aspiration risk
  - Facial symmetry
- Glasgow Coma Scale (GCS); a copy of the scale can be found at https://www.cdc.gov/masstrauma/resources/gcs.pdf
  - Eye opening response
  - Best verbal response
  - Best motor response
  - GCS score (calculated)
  - Response to stimuli
- Cranial nerves assessment
- Neuromuscular/extremities
  - Right/left/upper/lower extremity strength
  - Pronator drift Right/left /upper/lower extremity sensation
  - Ataxia (loss of voluntary control of muscle movements)
- Perform the National Institutes of Health Stroke Scale (NIHSS); a copy of the scale can be found at http://www.strokecenter.org/wp-content/uploads/2011/08/NIH_Stroke_Scale.pdf
  - Level of consciousness (LOC)
  - LOC questions
  - LOC commands
  - Best gaze
  - Visual fields
  - Facial palsy
  - Motor arm
  - Motor leg
  - Limb ataxia
  - Sensory
  - Best language
  - Dysarthria
  - Extinction and inattention

(AHA, 2014; Maryniak, 2014)

For more information on neurological assessment, check out RN.com's course *Focused Neurological Assessment*

Test Yourself
One component included in the National Institutes of Health Stroke Scale (NIHSS) is:
- **A. Visual fields**
- B. Cranial nerves
- C. Response to stimuli

The correct answer is A.   Visual fields is included with the NIHSS.

The Eight Ds of Stroke Care
Rapid assessment and intervention is essential for early detection of stroke, which is a life-altering events.   The Stroke Chain of Survival, defined by the eight "Ds" is an efficient way to cover all appropriate care required for stroke.

- **Detection:**   Detection of stroke can save time. It involves recognizing the signs and symptoms of an acute stroke.   This early detection provides more early interventions, which decreases morbidity and mortality, and improves patient outcomes.
- **Dispatch**:   Upon recognition of stroke symptoms, dispatch to EMS and activating the stroke system is critical.
- **Delivery:**   This involves the immediate transport of the patient to a hospital, preferably a stroke center.   A pre-arrival notification by EMS can prepare the receiving facility.
- **Door:**   This is the arrival of the patient to the emergency department (to the door).   Door to assessment, evaluation, and preparation are all included.   The emergency department team and neurology are all vital for the recognition and interventions processes.
- **Data**:   Data is collected based on the neurological exam and tests, such as a computerized tomography (CT) examination, to make an informed decision for treatment.   A CT exam is recommended within 25 minutes of arrival.   An accurate diagnosis is required to rule out conditions which may mimic a stroke, such as a brain tumor, drug overdose or hypoglycemia.
- **Decision**:   Decisions for treatment are made based on the type of stroke, risk factors, onset of symptoms, and severity of stroke.   The patient and family must be included in the decision after risks and benefits of treatments are presented.
- **Drug:**   Drug administration must be timely. If the patient is a candidate for using fibrinolytic therapy, there is a narrow window of opportunity.   The decision to administer tissue plasminogen activator (tPA) is now expected to be at less than 45 minutes, although according to guidelines, it can be administered within three hours of onset of symptoms.
- **Disposition:**   The disposition of the patient does not end at treatment or transfer to or from an intensive care unit.   The disposition is also the continuum where stroke victims should be assessed and monitored for further complications, prevention of another stroke, and quality of life.   Stroke patients require frequent monitoring of neurological status, blood glucose levels, and vital signs.

(ACLS Certification Institute, 2017)

Focus on Prevention

Most strokes are not fatal and often result in chronic neurological disability, including vascular dementia, subtle brain injury and cognitive decline. In addition, recurrent stroke is frequent; about 25 percent of people who recover from their first stroke will have another stroke within five years (AHA, 2017).

Thus, it is imperative that health care professionals employ both primary and secondary stroke prevention measures to decrease the incidence of stroke, and the neurological burden of clinical stroke.

Primary Prevention

Prevention of a first (primary) stroke emphasizes different strategies from those used to prevent recurrence (secondary stroke prevention).

Primary prevention uses screening for hypertension, heart disease, diabetes, obesity, elevated cholesterol, atrial fibrillation and carotid artery stenosis.

Primary stroke prevention focuses on the early identification of disease processes that have been identified as a precursor to a stroke, and includes the management of these risk factors through lifestyle changes, medication and possibly surgical intervention (AHA, 2017).

Test Yourself
Primary stroke prevention includes screening for:
  A. Atrial fibrillation
  B. Carotid stenosis
  C. Elevated cholesterol
  D. All of the above
The correct answer is: D. All of the above.

Secondary Stroke Prevention
Secondary stroke prevention is for those who have already suffered a stroke or TIA, and those individuals with established coronary artery disease.

Survivors of a transient ischemic attack (TIA) or stroke have an increased risk of another stroke, which is a major source of increased mortality and morbidity.

Secondary stroke prevention focuses on the prevention of additional attacks, and relies heavily on pharmaceuticals to control disease processes.

Healthy People 2020 Objectives
The CDC and the National Heart, Lung, and Blood Institute (HLBI) are working together on the nation's Healthy People 2020 objectives to combat heart disease and stroke.

Twenty-five objectives have been set for 2020, including sub-objectives.   The objectives are:

- Increase overall cardiovascular health in the U.S. population
- Reduce coronary heart disease deaths
- Reduce stroke deaths
- Increase the proportion of adults who have had their blood pressure measured within the preceding two years and can state whether their blood pressure was normal or high
- Reduce the proportion of persons in the population with hypertension
- Increase the proportion of adults who have had their blood cholesterol checked within the preceding five years
- Reduce the proportion of adults with high total blood cholesterol levels
- Reduce the mean total blood cholesterol levels among adults
- Increase the proportion of adults with prehypertension who meet the recommended guidelines
- Increase the proportion of adults with hypertension who meet the recommended guidelines
- Increase the proportion of adults with hypertension who are taking the prescribed medications to lower their blood pressure
- Increase the proportion of adults with hypertension whose blood pressure is under control
- Increase the proportion of adults with elevated LDL cholesterol who have been advised by a health care provider regarding cholesterol-lowering management, including lifestyle changes and, if indicated, medication
- Increase the proportion of adults with elevated LDL-cholesterol who adhere to the prescribed LDL-cholesterol lowering management lifestyle changes and, if indicated, medication
- Increase aspirin use as recommended among adults with no history of cardiovascular disease

- Increase the proportion of adults aged 20 years and older who are aware of the symptoms of and how to respond to a heart attack
- Increase the proportion of adults aged 20 years and older who are aware of the symptoms of and how to respond to a stroke
- Increase the proportion of out-of-hospital cardiac arrests in which appropriate bystander and emergency medical services (EMS) were administered
- Increase the proportion of eligible patients with heart attacks or strokes who receive timely artery-opening therapy as specified by current guidelines
- Increase the proportion of adults with coronary heart disease or stroke who have their low-density lipoprotein (LDL) cholesterol level at or below recommended levels
- Increase the proportion of adults with a history of cardiovascular disease who are using aspirin or antiplatelet therapy to prevent recurrent cardiovascular events
- Increase the proportion of adult heart attack survivors who are referred to a cardiac rehabilitation program at discharge
- Increase the proportion of adult stroke survivors who are assessed for and/or referred to rehabilitation services
- Reduce hospitalizations of older adults with heart failure as the principal diagnosis
- Increase the proportion of patients with hypertension in clinical health systems whose blood pressure is under control

(Healthypeople.gov, 2017).

Reducing Risk
Research has shown that groups of individuals acting together have a significant impact on reducing the risk and occurrence of stroke. Healthcare professionals have a unique opportunity to prevent stroke through education.

According to the NSA (2015), 80% of strokes can be prevented, and patient education and awareness is key. It is estimated that 50% of all strokes occur in asymptomatic patients. By educating the public on risk factors and early warning signs of impending stroke, the incidence of strokes could be significantly reduced.

In the U.S., organizations such as the National Stroke Association (NSA), the Centers for Disease Control and Prevention (CDC), and state departments of health have made strides in essential stroke education and programming efforts.

The goals of these organizations are to:
- Increase professional and public awareness of stroke
- Reduced incidence rates through prevention efforts
- Reduced individual and societal impact of stroke
- Increase capacity of cardiovascular health programs to better address prevention of stroke at the community level

(CDC, 2014; NSA, 2015)

Calculating the Risk of Stroke
The risk of stroke is based on multiple risk factors.   It is difficult to have one tool that incorporates all of the factors, based on the weight and considerations of each factor.   The association of

cardiovascular disease and stroke is high, so it is reasonable to use tools related to cardiovascular disease (American Heart Association, 2014).

A risk calculator which calculates the risk of atherosclerotic cardiovascular disease (ASVCD) is available through the American Heart Association at http://static.heart.org/riskcalc/app/index.html#!/baseline-risk

Modifiable and Non-Modifiable Risk Factors for Stroke

Risk factors for stroke can be divided into two groups:

- **Modifiable risk factors:** Include those risk factors that can be modified or controlled by healthy lifestyle modifications. These include obesity, smoking, alcohol abuse, and inactivity (AHA/ASA, 2014b; NSA, 2015).

- **Non-modifiable risk factors:** Are risk factors that are beyond the control of the individual. Age, gender, race, pre-existing disease, low birth weight, and familial history are all uncontrollable risk factors. African-American men over the age of 55, with diabetes and a family history of stroke are at greatest risk for developing a stroke. Medical stroke risk factors include previous stroke, previous episode of transient ischemic attack, diabetes, high cholesterol and/or triglycerides, hypertension, heart disease, atrial fibrillation, and carotid artery disease (AHA/ASA, 2014b; NSA, 2015).

It is possible to dramatically reduce modifiable risks through healthier lifestyle choices and medications (such as antihypertensives).

Test Yourself
Which of the following risk factors for cardiovascular disease and stroke are non-modifiable?
    A. Obesity, smoking, gender
    B. Age, race and familial history
    C. Pre-existing disease, alcohol abuse and inactivity
The correct answer is: B.
Modifiable Risk Factors: Include those risk factors that can be modified or controlled by healthy lifestyle modifications. These include obesity, smoking, alcohol abuse and inactivity.
Non-modifiable Risk Factors: Are risk factors that are beyond the control of the individual. Age, gender, race, pre-existing disease and familial history are all uncontrollable risk factors.

Primary and Secondary Stroke Prevention Guidelines
Stroke prevention guidelines have been developed by organizations including the National Stroke Association (NSA) and the American Heart Association/American Stroke Association (AHA/ASA) that all healthcare professionals should be familiar with. These guidelines reflect current medical practices and standards and form an integral part of primary and secondary stroke prevention.

These stroke prevention guidelines advise patients to:

- Be familiar with their blood pressure readings and check it at least once a year.

- Determine if they suffer from atrial fibrillation, which encourages the formation of blood clots resulting in a stroke
- Stop smoking
- Drink in moderation
- Determine if they have high cholesterol.
- Determine if they have diabetes, and take measures to control the disease if present.
- Exercise daily.
- Consume a low-salt diet.
- Seek medical attention for circulation problems that could increase the risk of stroke.
- Be familiar with the symptoms of stroke.

(AHA/ASA 2014b; NSA 2015)

Hypertension

High blood pressure is the most common risk factor for stroke, and is often referred to as "the silent killer" as it is usually asymptomatic. High blood pressure puts unnecessary stress on blood vessel walls, causing them to thicken and deteriorate, which can eventually lead to a stroke and cardiovascular disease.

For people over age 18, optimal blood pressure is less than 120/80 mmHg. Blood pressure can vary occasionally with exercise or stress, but a blood pressure reading consistently higher than 120/80 is considered pre-hypertension.

BP reduction is recommended for both prevention of recurrent stroke and prevention of other vascular events in persons who have had an ischemic stroke or TIA. An absolute target BP level must be individualized, but benefit has been associated with an average reduction of approximately 10/5 mmHg, and normal BP levels have been defined as <120/80 mmHg.

Stage one hypertension is a measurement of 140/90 mmHg or higher. Maintaining a blood pressure below 140/90 may reduce the risk of further complications. Interventions for a prehypertension (systemic between 120-139 mmHg and diastolic between 80-89 mmHg) are also recommended (AHA/ASA, 2014b; NSA, 2015).

Other factors associated with hypertension include excess weight, excessive alcohol consumption, diabetes, lack of exercise and a high-salt diet.

Hypertension Factors

The following factors are associated with hypertension:

- A family history of high blood pressure.
- Age: The incidence of hypertension rises in men after age 35 and in women after age 45.
- Gender: Men are more likely to have hypertension than women.
- Race: African-Americans are at higher risk for high blood pressure, and are more impacted by stroke than any other racial group in the U.S.

(AHA/ASA, 2014b; NSA, 2015).

About 75 million American adults (32%) have high blood pressure—that's 1 in every 3 adults (CDC, 2016a).

Atrial Fibrillation (AF)

Atrial fibrillation (AF) is a type of irregular or "racing" heartbeat that increases the risk of thrombi formation and stroke. Atrial fibrillation increases a person's risk for stroke by four to five times on average.   Strokes are also more fatal in patients who have AF (AHA/ASA, 2014b).

Many strokes related to AF can be prevented, and treatment of AF is usually very effective when it is diagnosed early.   While it can occur at any age, AF is more common in the elderly. About 5% of people 65 years old have AF and it is more common in those with high blood pressure, heart disease, or lung disease.

Early symptoms of AF include a rapid pulse and fluttering, racing or pounding sensations in the chest. Other symptoms may include dizziness, fainting or lightheadedness during an episode (AHA/ASA, 2014b; Reiffel, 2014).

High risk patients should check their pulse at least once a month, to identify irregular rhythms.

Most AF-related strokes could be prevented with anti-coagulation treatments, yet up to two-thirds of AF patients who had strokes were not prescribed anti-coagulants or blood thinners. Anticoagulation can significantly reduce the risk of a first stroke. There are several reasons why current drugs are not being prescribed including interactions with diet and other drugs, the necessity for frequent blood tests and monitoring and concerns about increased risk of bleeding. But, there are new drugs on the horizon that may have fewer complications and will eliminate the monitoring issues associated with current treatments (AHA/ASA, 2014a, 2014b).

Healthy Lifestyles

A healthy lifestyle is the cornerstone of both stroke prevention and rehabilitation.

Healthy lifestyles include:
- Weight management
- Healthy diet
- Exercise
- Avoiding alcohol
- Smoking cessation
- Monitoring and treating high cholesterol
- Controlling diabetes

Weight Management

Losing weight if necessary and maintaining a healthy body weight. Body Mass Index (BMI) is a number calculated from a person's weight and height. BMI provides a reliable indicator of body fat and is used to screen for weight categories that may lead to health problems. A BMI between 18.5 - 24.9 is within a healthy weight range (CDC, 2015).

Copy and paste the following URL to your browser to access the CDC's Adult BMI Calculator.
http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html

Healthy Diet
A well-balanced diet including all food groups and limiting the amount of sodium is recommended. A low-fat diet is encouraged to lower cholesterol. Saturated fats should be avoided.
(CDC, 2014; NSA, 2015)

Regular Aerobic Exercise
The CDC (2014) recommends at least 2 hours and 30 minutes (150 minutes) of moderate-intensity aerobic activity every week and muscle-strengthening activities on 2 or more days a week that work all major muscle groups. Regular aerobic exercise helps reduce the risk for coronary heart disease, control blood pressure and diabetes, manage weight gain, and relieve stress.

Avoiding Alcohol
Recent studies have shown that although heavy drinking is detrimental, drinking a glass of wine or beer each day may lower the risk for stroke, provided that there is no other medical reason to avoid alcohol.

However, alcohol is a drug, and can interact with other medications.   Healthy lifestyles also include avoiding alcohol or drinking in moderation. For most people, limited drinking, no more than two drinks per day, does not significantly affect the risk of stroke (CDC, 2014; NSA, 2015).

Smoking Cessation
Smoking increases the risk of stroke nearly two-fold. The more cigarettes smoked, the greater the risk. Smoking raises blood pressure and encourages the formation of atheroschlerotic plaque buildup in arteries.

Smoking reduces the amount of oxygen in the blood, causing the heart to work harder and allowing blood clots to form more easily. Smoking also increases the amount of build-up in the arteries, which may block the flow of blood to the brain, causing a stroke.

The following are tips to promote smoking cessation:

- Encourage patients to set a quit date and mark their calendars at home and at work.
- Advise patients to ask their family, friends and co-workers for support in quitting smoking.
- Recommend that patients talk to their healthcare providers about nicotine replacement therapy or medication to control the urge to smoke.
- Dispose of all cigarettes, ashtrays, lighters and matches before the Quit Date.
- Encourage patients to reward themselves for doing well, and buy something special with the money saved on cigarettes.

(CDC, 2014; NSA, 2015)

Hypercholesterolemia

Hypercholesterolemia increases the risk for heart disease, a stroke risk factor. Plaque build-up in the arteries from high levels of cholesterol can also can block blood flow to the brain and cause a stroke.

Cholesterol is delivered to and from cells by lipoproteins. The two lipoproteins that have a direct effect on cholesterol levels are low-density lipoproteins (LDL) and high-density lipoproteins (HDL).

LDL cholesterol: Due to its artery-clogging properties, LDL cholesterol is referred to as "bad" cholesterol. LDL carries cholesterol into the blood stream and to the tissues where it is stored. LDL cholesterol causes plaque build-up, which over time, causes narrowing or blockage of arteries.

HDL cholesterol: HDL carries cholesterol away from the tissues to the liver, where it is filtered out of the body. High levels of HDL, also called "good" cholesterol, seem to protect against stroke and heart attack. A low HDL level may signify a greater risk factor for stroke or heart disease.
(National Institutes of Health [NIH], 2017; NSA, 2015)

Factors Affecting Hypercholesterolemia
Factors affecting blood cholesterol levels include:

- Foods high in saturated fat

- Excess body weight

- Lack of exercise

- Family history

- Age (most people experience an increase until the age of 65)

- Gender (women under age 50 tend to have lower cholesterol and those in menopause have higher levels)

It is recommended that all adults age 20 and older should have their cholesterol checked at least once every five years. Cholesterol should be checked more frequently in men older than 45 and women older than 55, and with individuals who have a family history of hypercholesterolemia.
(NIH, 2017; NSA, 2015)

Hypercholesterolemia Guidelines
In November 2013, guidelines from the American College of Cardiology (ACC), the American Heart Association (AHA) and the National Heart, Lung, and Blood Institute (NHLBI) were released, that contain substantial changes from the Adult Treatment Panel (ATP) 3 recommendations. These guidelines were updated in 2014 and focus on defining groups for whom LDL lowering is proven to be most beneficial.

The guidelines identify four major groups of patients for whom cholesterol-lowering statins have the greatest chance of preventing stroke and heart attacks:
- Patients with cardiovascular disease

- Patients with LDL cholesterol levels of 190 mg/dL or higher

- Patients with Type 2 diabetes who are between 40 and 75 years of age

- Patients with an estimated 10-year risk of cardiovascular disease of 7.5 percent or higher, who are also between 40 and 75 years of age (the report provides formulas for calculating 10-year risk).

By more accurately identifying higher risk individuals for statin therapy, the guideline focuses statin therapy on those most likely to benefit from therapy.

A new risk assessment tool to determine which patients would most likely benefit from statin therapy, is the Pooled Cohort Equations, which estimates 10-year atherosclerotic cardiovascular disease (ASCVD) risk in both white and black men and women.

(Lambert, 2014)

Controlling Diabetes
Although diabetes cannot be cured, it can be controlled. Type 2 diabetes can often be prevented by exercising and avoiding weight gain. A self-care program that includes strict compliance with medications, self-monitoring of blood glucose levels, following a sensible food plan, and regular exercise can keep diabetes under control and reduce the risk for heart disease and stroke.

Diabetes increases the risk of stroke and heart disease. According to the American Diabetes Association (ADA) 2014), diabetics are 1.5 times more likely to have a stroke than people who do not have diabetes.

The risk of developing a stroke is even greater in diabetics under the following conditions:

- Presence of hypertension

- Abnormal blood cholesterol levels

- Smoking

- History of stroke or a transient ischemic attack (TIA)

- Family history of stroke or TIAs

Stroke risk can be lowered in diabetic patients by:

- Consistent and frequent blood glucose monitoring and correction

- Meal planning to maintain a healthy weight and reduce hypercholesterolemia

- Smoking cessation support groups

- Increasing physical activity levels

- Regular medical check-ups and re-evaluation of medication schedules

(ADA, 2014)

Healthy lifestyle programs form part of primary and secondary stroke prevention.

Test Yourself
As part of healthy lifestyle recommendations for reducing the risk of cardiovascular disease and stroke, the exercise recommendations from the CDC include:
    A. At least 60 minutes of aerobic activity per day.
    B. At least 80 minutes of aerobic activity per month.
    C. At least 150 minutes of aerobic activity per week.
The correct answer is: C. The CDC (2014) recommends at least 2 hours and 30 minutes (150

minutes) of moderate-intensity aerobic activity every week and muscle-strengthening activities on two or more days a week that work all major muscle groups.

Additional Stroke Prevention Therapies
Stroke research has focused on both preventative measures as well as management strategies (primary and secondary stroke prevention and management).

Today, new stroke prevention therapies may help reduce vascular inflammation and thrombi formation, lower triglycerides and act as protective mechanisms. New technology can also identify early risk factors for stroke.

Beyond traditional therapies, aspirin therapy, stroke biomarkers, Single Nucleotide Polymorphisms (SNPs) and genetic testing are all tools that can be employed in the prevention and early recognition of stroke risk factors.   There has been controversy with the use of vitamin E and fish oil (omega three fatty acid) supplementation.

Stroke prevention therapies can be used for both primary stroke prevention (preventing an initial stroke) and secondary stroke prevention (preventing a second or third stroke).

Up to 80% of all strokes can be prevented by reducing risk factors (NSA, 2015).

Aspirin Therapy
Aspirin (acetylsalicylic acid) is the most widely studied anti-platelet therapy, and many studies support the use of aspirin as an effective anti-platelet agent for the prevention of heart attack, stroke and death from cardiovascular disease.

More than 50 million U.S. adults take aspirin regularly for long-term prevention of cardiovascular disease yet, controversy remains regarding the most appropriate long-term daily dose.

Currently available clinical data does not support the routine, long-term use of aspirin dosages greater than 75 to 81 mg/day in the setting of cardiovascular disease prevention.   Higher dosages, which may be commonly prescribed, have not conclusively shown to be more effective in preventing events, and are associated with increased risks of bleeding, gastrointestinal hemorrhage and possible increased risk of renal failure.   In addition, aspirin should not be taken during a stroke, as the stroke may be hemorrhagic in origin.

Baby aspirin (81 mg) is usually recommended rather than adult aspirin (usually 325 mg) to reduce the risk of transient ischemic attacks or death in patients at risk.   The use of aspirin is inconclusive in patients who are diabetic.   In low doses, aspirin appears to interfere with clotting by keeping a platelet-aggregating substance from forming.
(AHA/ASA, 2014b)

Clinical trials have shown that daily warfarin is best for people with AF who are over age 65 or who have additional vascular risk factors (AHA/ASA, 2014b).

Stroke Biomarkers
In recent years, risk factors for stroke have emerged that can be called biomarkers. These are changes in the body that indicate an ongoing disease process or a risk of disease. Examples of biomarkers for stroke could be a change in blood chemistry or gene expression.

Biomarkers do not necessarily play causative roles in the disease.

Researchers also have discovered several biomarkers of advanced atherosclerosis that could be used to identify people in danger of stroke. For example, elevated levels of two proteins in the blood, C-reactive protein and phospholipase A2, are associated with atherosclerosis and increased risk of stroke.

Irregularities in the appearance of atherosclerotic plaques, observed by high-resolution ultrasound, are also tied to higher stroke risk.

By identifying stroke biomarkers, lifestyle modification programs can be implemented to decrease risk factors for primary or secondary stroke.
(Laborde, et al., 2012)

Genetic Testing
Genetic testing might also be useful for predicting how different people will respond to different stroke therapies.

For example, because people metabolize warfarin at different rates, it is difficult to determine optimal dosing of the drug, which could cause severe bleeding if given in excess.

Traditionally, physicians have had to estimate the initial dose based on a formula that includes the individual's age, blood pressure, and other factors, and then adjust the dose through trial and error.

It is now known that certain variants in two genes, CYP2C9 and VKORC1, cause increased sensitivity to warfarin. Taking these variations into account and plugging them into the traditional formula appear to predict an optimal warfarin dosage with greater accuracy (Dean, 2016).

Stroke Performance Measures
There are stroke performance measures which act as guidelines for the accurate diagnosis, management of stroke care and the prevention of secondary strokes. These are applicable to patients with diagnoses of ischemic stroke, hemorrhagic stroke, and TIA. The stroke performance measures identify interventions that can be employed after a stroke to reduce the severity of the stroke and prevent a secondary stroke.

There are measures used by the Joint Commission (TJC) and the Centers for Medicare and Medicaid Services (CMS) which are part of accreditation requirements.   These include:

- Venous thromboembolism prophylaxis
- Discharged on antithrombotic therapy
- Anticoagulation therapy for atrial fibrillation/flutter

- Thrombolytic therapy administered
- Antithrombotic therapy by end of hospital day 2
- Discharged on statin medication
- Stroke education
- Assessed for rehabilitation

The American Heart Association/American Stroke Association have also endorsed additional measures which are used with stroke registries and Get with the Guidelines.   These include:
- Dysphagia screening
- Tobacco use counseling

These stroke performance measures form an integral part of secondary stroke prevention. (AHA, 2014)

Stroke Performance Measures

This table identifies which performance measures are suitable for a patient, based upon the admission diagnosis.

The Stroke Performance Measures

Performance Measure One: **VTE (venous thromboembolism) Prophylaxis**

Stroke patients are at increased risk of developing venous thromboembolism (VTE). VTE prophylaxis should be administered within the first 48 hours of onset of symptoms. For acutely ill stroke patients who are confined to bed, thrombo-prophylaxis with low-molecular-weight heparin (LMWH), low-dose unfractionated heparin (LDUH), or fondaparinux is recommended if there are no contraindications. Aspirin alone is not recommended as an agent to prevent VTE. Mechanical prophylaxis with sequential compression devices (SCDs) alone is also not recommended.

Excluded populations include any patients who are less than 18 years of age, patients who are discharged prior to end of hospital day 2, and patients who are receiving comfort measures only on day of or day after admission (AHA, 2014).

Performance Measure Two: **Discharge on Antithrombotic Therapy**

Antithrombotic therapy should be prescribed at discharge following acute ischemic stroke to reduce stroke mortality and morbidity, if no contraindications exist. For patients with a stroke due to a cardioembolic source (e.g., atrial fibrillation, mechanical heart valve), warfarin is recommended unless contraindicated. Warfarin is not generally recommended for secondary stroke prevention in patients presumed to have a non-cardioembolic stroke.

Note! Anticoagulants that are used to prevent deep vein thrombosis are usually insufficient in dosage to serve as antithrombotic therapy, to prevent recurrent ischemic stroke or TIA.

Excluded populations include any patients who are less than 18 years of age, patients who are discharged or transferred to another hospital or hospice, and patients who are receiving comfort measures only (AHA, 2014)

Performance Measure Three: Anticoagulation for AF

Patients with an ischemic stroke with atrial fibrillation/flutter should be discharged on anticoagulation therapy. This is an effective strategy in preventing recurrent stroke in patients who have a history of atrial fibrillation, TIA or prior stroke.

Non-valvular atrial fibrillation (NVAF) is a common arrhythmia and an important risk factor for stroke. Much emphasis has been placed on identifying methods for preventing recurrent ischemic stroke as well as preventing first stroke. Prevention strategies focus on the modifiable risk factors such as hypertension, smoking, and atrial fibrillation. The administration of anticoagulation therapy, unless there are contraindications, is an established effective strategy in preventing recurrent stroke in high stroke risk-atrial fibrillation patients with TIA or prior stroke.

Excluded populations include any patients who are less than 18 years of age, patients who are discharged or transferred to another hospital or hospice, and patients who are receiving comfort measures only (AHA, 2014)

Performance Measure Four: t-PA Administration

Administration of thrombolytic therapy in acute ischemic stroke patients who arrive at the hospital within two hours of stroke onset, and for whom IV t-PA was initiated at this hospital within three hours of stroke onset, have had improved outcomes.

Note! Although controversy still exists among some specialists, the major society practice guidelines developed in the United States all recommend the use of IV t-PA for eligible patients (AHA, 2014).

Excluded populations include patients less than 18 years of age, patients admitted for the performance of elective carotid intervention or patients who presented in the emergency department more than two hours after the event, or for whom the time of the event is unknown (AHA, 2014)

Performance Measure Five: Antithrombotic Therapy by End of Hospital Day 2

Antithrombotic therapy should be initiated within 48 hours of symptom onset in acute ischemic stroke patients to reduce stroke mortality and morbidity as long as no contraindications exist.

Excluded populations include patients less than 18 years of age, patients who received IV or IA thrombolytic therapy within the first 24 hours, patients discharged before the end of hospital day 2, and patients receiving comfort measures only by end of hospital day 2 (AHA, 2014).

Performance Measure Six: Discharge on Cholesterol Reducing Medication

An elevated serum lipid level has been a well-documented risk factor for coronary artery disease (CAD). Recently, there has been an increased focus on examining the relationship between elevated lipid levels and the incidence of stroke. Stroke patients with LDL>100 mg/dL, or on a cholesterol-reducer prior to admission, should be discharged on cholesterol reducing drugs.

All patients with ischemic stroke should have lipid profile measurement performed within 48 hours of admission and treatment should be initiated in patients who have a LDL level > 100 mg/dL, or continued in patients who were previously on lipid-lowering therapy and have an LDL< 100 mg/dL.

Ischemic stroke patients with LDL > 100 mg/dL, or who were on cholesterol reducing therapy prior to hospitalization should be discharged on statin medication.

Statins are associated with a dramatic reduction in the rate of recurrent ischemic stroke and major coronary events. The treatment is well tolerated and cost-effective.

Excluded populations include patients discharged/transferred to another short term general hospital for inpatient care, patients who left against medical advice, patients discharged to hospice and patients receiving comfort measures only (AHA, 2014).

Performance Measure Seven: Dysphagia Screening

Dysphagia is a potentially serious complication of stroke. The importance of assessing a patient's ability to swallow, before approving the oral intake of fluids, food or medication, has been noted in multiple practice guidelines.

Patients with ischemic or hemorrhagic stroke should undergo screening for dysphagia with an evidence-based bedside testing protocol before being given any food, fluids, or medication by mouth. Patients who have abnormal results should be referred for a complete examination by a speech and language pathologist.

Recent evidence suggests that pneumonia rates in this population may be reduced when a systematic program of diagnosis and treatment of dysphagia is included in an ischemic stroke management plan.

Excluded populations include patients less than 18 years of age and patients who are NPO throughout the hospital stay.   Although endorsed as best practice and required for stroke registries and Get with the Guidelines, this measure is not a CMS requirement (AHA, 2014).

Performance Measure Eight: **Stroke Education**

Patient education programs increase healthy behaviors, improve health status, and/or decreased healthcare costs of their participants.

Patient education should include information about the event (e.g., cause, treatment, and risk factors), the role of various medications or strategies, as well as desirable lifestyle modifications to reduce risk or improve outcomes. Family/caregivers will also need guidance in planning effective care strategies appropriate to the patient's prognosis and potential for rehabilitation.

Education should address the following topics:

- Personal risk factors for stroke
- Warning signs for stroke
- Activation of emergency medical system
- Need for follow-up after discharge

- Medications prescribed at discharge

Patient education programs have been shown to increase healthy behavior, improve health status, and decrease health care costs. Patient education should include information about the event (e.g., cause, treatment, and risk factors), the role of various medications or strategies, as well as desirable lifestyle modifications to reduce risk or improve outcomes.

Family/caregivers will also need guidance in planning effective and realistic care strategies appropriate to the patient's prognosis and potential for rehabilitation.

Excluded populations include patients less than 18 years of age, patients discharged/transferred to another short-term hospital for inpatient care, patients discharged against medical advice or discharged to hospice, patients receiving comfort measures only and patients for whom discharge destination cannot be determined or unknown (AHA, 2014).

Performance Measure Nine: **Smoking Cessation**

Cigarette smoking is the single most alterable risk factor contributing to premature morbidity and mortality. Smoking nearly doubles the risk of ischemic stroke. Patients who smoke should be counseled to stop smoking to decrease the risk of stroke.

Research indicates that patients who receive even brief smoking cessation advice from their physicians are more likely to quit than those receiving no counseling at all. Addressing smoking habits and initiating smoking cessation may promote the patient's medical recovery.

For the purposes of this measure, a smoker is defined as someone who has smoked cigarettes anytime during the year prior to hospital arrival.

Excluded populations include patients less than 18 years of age, patients who are discharged/transferred to another short term general hospital for inpatient care, patients who left against medical advice, patients discharged to hospice and patients receiving comfort measures only. Although this is endorsed as best practice, this is not a CMS requirement for a stroke measure (AHA, 2014).

Performance Measure Ten: **Stroke Rehabilitation**

This should begin as soon as the diagnosis of stroke is established and life-threatening problems are under control. Among the high priorities for stroke are to mobilize the patient and encourage resumption of self-care activities as soon as possible.

Effective rehabilitation interventions initiated early following stroke can enhance the recovery process and minimize functional disability. The primary goal of rehabilitation is to prevent complications, minimize impairments, and maximize function.

Excluded populations include patients less than 18 years of age, patients who are discharged/transferred to another short term general hospital for inpatient care, patients who left against medical advice, patients discharged to hospice and patients receiving comfort measures only (AHA, 2014).

Test Yourself

Which of the following statements is true regarding VTE prophylaxis of acutely ill stroke patients?
    A. Aspirin is the recommended therapy
    B. Use of sequential compression devices alone is appropriate
    C. Medical thrombo-prophylaxis therapies, such as heparin, should be used
The answer is C. For acutely ill stroke patients who are confined to bed, thrombo-prophylaxis with low-molecular-weight heparin (LMWH), low-dose unfractionated heparin (LDUH), or fondaparinux is recommended if there are no contraindications.

Conclusion
Research has shown that primary stroke prevention *does* actually prevent strokes.   By creating greater public and professional awareness of stroke risk factors and warning signs, prompt medical attention can be given, and patient outcomes can be improved.

Stroke prevention also includes raising awareness of strokes in the community. Awareness and education will result in people becoming more adept at recognizing the common symptoms of stroke and seeking medical attention promptly. This is important knowledge that could help save lives by reducing delays in treatment.

Secondary stroke prevention is important in limiting the recurrence of strokes, and minimizing the impact of the primary stroke.

It is important to educate the public about the symptoms of stroke and the importance of getting to the hospital quickly, as the outcome of a stroke is directly dependent upon early intervention and management.

Resources
The National Institutes of Health through the National Institute of Neurological Disorders and Stroke (NINDS): http://stroke.nih.gov/

The National Stroke Association (NSA):   www.stroke.org

Appendix One: The NIH Scale
http://www.nihstrokescale.org/

References
ACLS Certification Institute.   (2017). The 8 D's of stroke care.   Retrieved from https://acls.com/free-resources/stroke/the-8-ds-of-stroke-care

American Heart Association/American Stroke Association (AHA/ASA).   (2012). Effects of stroke. Retrieved from http://www.strokeassociation.org/STROKEORG/AboutStroke/EffectsofStroke/Effects-of-Stroke_UCM_308534_SubHomePage.jsp

American Heart Association/American Stroke Association (AHA/ASA).   (2013). Focus on quality: Stroke essentials: EMS and stroke.   Retrieved from http://www.heart.org/idc/groups/heart-public/@wcm/@swa/documents/image/ucm_465464.pdf

American Heart Association/American Stroke Association (AHA/ASA). (2014a). Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack. Retrieved from http://stroke.ahajournals.org/content/early/2014/04/30/STR.0000000000000024

American Heart Association/American Stroke Association (AHA/ASA) (2014b). Guidelines for the primary prevention of stroke. Retrieved from http://stroke.ahajournals.org/content/early/2014/10/28/STR.0000000000000046

American Heart Association (2014). Clinical performance measures for adults hospitalized with acute ischemic stroke. Retrieved from http://stroke.ahajournals.org/content/45/11/3472

American Heart Association (AHA) (2017). Heart disease and stroke statistics 2017 at a glance. Retrieved from http://www.heart.org/idc/groups/ahamah-public/@wcm/@sop/@smd/documents/downloadable/ucm_491265.pdf

American Diabetes Association (ADA). (2014). Stroke. Retrieved from http://www.diabetes.org/living-with-diabetes/complications/stroke.html

Centers for Disease Control and Prevention (CDC). (2014). Stroke. Retrieved from https://www.cdc.gov/stroke/

Centers for Disease Control and Prevention (CDC). (2015). Assessing your weight. Retrieved from https://www.cdc.gov/healthyweight/assessing/index.html

Centers for Disease Control and Prevention (CDC). (2016a). High blood pressure fact sheet. Retrieved from https://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_bloodpressure.htm

Centers for Disease Control and Prevention (CDC) (2016b). Stroke fact sheet. Retrieved from https://www.cdc.gov/dhdsp/data_statistics/fact_sheets/fs_stroke.htm

Dean, L. (2016). Warfarin therapy and the genotypes CYP2C9 and VKORC1. Retrieved from https://www.ncbi.nlm.nih.gov/books/NBK84174/

Furie, K.L. & Ay, H. (2014). Patient information: Transient ischemic attack (Beyond the basics). *Up to Date*. Retrieved from http://www.uptodate.com/contents/transient-ischemic-attack-beyond-the-basics

Glober, N., Sporer, K., Guluma, K., Serra, J., Barger, J…. & Salvucci, A. (2016). Acute stroke: Current evidence-based recommendations for prehospital care. Western Journal of Emergency Medicine, 17(2). Retrieved from http://westjem.com/health-policy-analysis/acute-stroke-current-evidence-based-recommendations-for-prehospital-care.html

HealthyPeople.gov. (2017). 2020 Topics & objectives: Heart disease & stroke. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/heart-disease-and-stroke

Jauch, E. (2016). Ischemic stroke. Retrieved from http://emedicine.medscape.com/article/1916852-overview#a1

Klingman, J. (2016). *Improving door to needle and EST times*. WSA Stroke Bootcamp, Anaheim, Ca.

Laborde, C., Mourino-Alvarez, L., Akerstrom, F., Padial, L., Vivanco, F., & Felix Gil-Dones, M. (2012). Potential blood biomarkers for stroke. *Expert Review of Proteomics, 9*(4), 437-449.

Lambert, M. (ed). (2014). ACC/AHA release updated guideline on the treatment of blood cholesterol to reduce ASCVD risk. *American Family Physician, 90*(4), 260-265.

Liebeskind, D. (2017). Hemorrhagic stroke. Retrieved from http://emedicine.medscape.com/article/1916662-overview#a6

Martin, J. (2012). *Neuroanatomy text and atlas* (4th ed.). New York: McGraw Hill.

Maryniak, K. (2014). *Focused neurological assessment.* RN.com. Retrieved from https://lms.rn.com/getpdf.php/2060.pdf

Nadarajan, N., Perry, R., Johnson, J., & Werring, D. (2014). Transient ischaemic attacks: mimics and chameleons. *Practical Neurology, 14*(1), 23–31.

National Institutes of Health (NIH) (2017). Hypercholesterolemia. Retrieved from https://ghr.nlm.nih.gov/condition/hypercholesterolemia

National Institute of Neurological Disorders and Stroke (NINDS). (2016). Transient ischemic attack information page. Retrieved from https://www.ninds.nih.gov/disorders/all-disorders/transient-ischemic-attack-information-page

National Stroke Association (2015). Reduce your risk of stroke starting now. Retrieved from http://www.stroke.org/sites/default/files/resources/prevention-brochure-2015.pdf

National Stroke Association (2017a). Act FAST. Retrieved from http://www.stroke.org/understand-stroke/recognizing-stroke/act-fast

National Stroke Association. (2017b). What is a TIA? Retrieved from http://www.stroke.org/understand-stroke/what-stroke/what-tia

Reiffel, J.A. (2014). Atrial fibrillation and stroke: Epidemiology. *American Journal of Medicine, 127*(4), e15-6.

Rughani, A. (2015). Brain anatomy. Retrieved from http://emedicine.medscape.com/article/1898830-overview

Scanlon, V. & Sanders, T. (2015). *Essentials of anatomy and physiology* (7th ed.). Philadelphia: F.A. Davis Co.

At the time this course was constructed all URL's in the reference list were current and accessible. RN.com. is committed to providing healthcare professionals with the most up to date information available.

Disclaimer

This publication is intended solely for the educational use of healthcare professionals taking this course, for credit, from RN.com, in accordance with RN.com terms of use. It is designed to assist healthcare professionals, including nurses, in addressing many issues associated with healthcare. The guidance provided in this publication is general in nature, and is not designed to address any specific situation. As always, in assessing and responding to specific patient care situations, healthcare professionals must use their judgment, as well as follow the policies of their organization and any applicable law. This publication in no way absolves facilities of their responsibility for the appropriate orientation of healthcare professionals. Healthcare organizations using this publication as a part of their own orientation processes should review the contents of this publication to ensure accuracy and compliance before using this publication. Healthcare providers, hospitals and facilities that use this publication agree to defend and indemnify, and shall hold RN.com, including its parent(s), subsidiaries, affiliates, officers/directors, and employees from liability resulting from the use of this publication. The contents of this publication may not be reproduced without written permission from RN.com.

Participants are advised that the accredited status of RN.com does not imply endorsement by the provider or ANCC of any products/therapeutics mentioned in this course. The information in the course is for educational purposes only. There is no "off label" usage of drugs or products discussed in this course.

You may find that both generic and trade names are used in courses produced by RN.com. The use of trade names does not indicate any preference of one trade named agent or company over another. Trade names are provided to enhance recognition of agents described in the course.

Note: All dosages given are for adults unless otherwise stated. The information on medications contained in this course is not meant to be prescriptive or all-encompassing. You are encouraged to consult with physicians and pharmacists about all medication issues for your patients.