CHAPTER 19 & SECTION OF CHAPTER 24

Vital Signs

LEARNING OBJECTIVES LESSON 19.1: TEMPERATURE

(SLIDE 1 OF 2)

1. Define a vital sign.
2. Explain the reasons for taking vital signs.
3. Explain how body temperature is maintained.
4. List examples of how heat is produced in the body.
5. List examples of how heat is lost from the body.

LEARNING OBJECTIVES LESSON 19.1: TEMPERATURE

(SLIDE 2 OF 2)

6. State the normal body temperature range and the average body temperature.
7. List and explain factors that can cause variation in the body temperature.
8. List and describe the three stages of a fever.
9. List the sites for taking body temperature, and explain why these sites are used.

INTRODUCTION TO VITAL SIGNS

(SLIDE 1 OF 5)

- Vital signs: Objective guideposts that provide data to determine a person's state of health
  - Temperature
  - Pulse
  - Respiration
  - Blood pressure
  - Pulse oximetry
    - May be ordered routinely as part of patient workup
    - May be ordered only when patient complains of respiratory problems (e.g., shortness of breath)

INTRODUCTION TO VITAL SIGNS

(SLIDE 2 OF 5)

- Normal ranges are finely adjusted
  - Any deviation from normal may indicate disease
- Variations in vital signs may take place during the course of an illness
- MAs should be alert to significant change in vital signs and report it to the physician
  - May indicate a change in patient's condition

INTRODUCTION TO VITAL SIGNS

(SLIDE 3 OF 5)

- Vital signs are usually checked during each office visit to establish
  - Patient's state of health
  - Baseline measurements against which future measurements can be compared

INTRODUCTION TO VITAL SIGNS

(SLIDE 4 OF 5)

- Guidelines for measuring vital signs
  - Be familiar with normal ranges for vital signs
    - Vary based on different age groups
  - Make sure equipment is in proper working condition
    - Ensures accurate readings

INTRODUCTION TO VITAL SIGNS

(SLIDE 5 OF 5)

- Guidelines for measuring vital signs
  - Eliminate or minimize factors that affect vital signs
    - Examples: Exercise, food and beverage consumption, emotional states
  - Use an organized approach when measuring vital signs
    - If all the vital signs are ordered, usually start with temperature, followed by pulse, respiration, BP, and pulse oximetry

REGULATION OF BODY TEMPERATURE

(SLIDE 1 OF 2)

- Maintained by hypothalamus
  - Functions as body's thermostat
  - Only allows temperature to vary 1° F to 2° F throughout day
- Temperature maintained through a balance of
  - Heat produced in the body
  - Heat lost from the body
- Constant temperature range must be maintained for body to function properly

REGULATION OF BODY TEMPERATURE

(SLIDE 2 OF 2)

- When minor changes in temperature occur
  - Hypothalamus senses this
    - Makes adjustments so temperature stays within the normal range
      - Example: Playing tennis on a hot day—body's heat-cooling mechanism is activated; perspiration occurs to remove excess heat

HEAT PRODUCTION

- Heat produced through:
  - Voluntary and involuntary muscle contractions
    - Voluntary: Person can control (e.g., movement)
    - Involuntary: Person cannot control (e.g., digestion, beating of heart, shivering)
  - Cell metabolism
    - Heat produced when nutrients are broken down in the cells
  - Fever
  - Strong emotional states

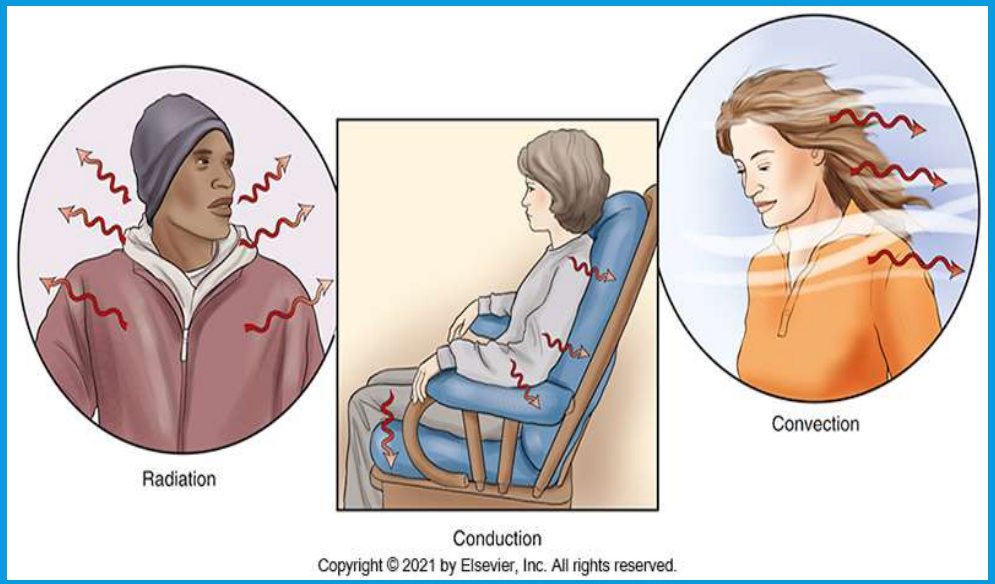
HEAT LOSS
(SLIDE 1 OF 2)

- Heat is lost through:
  - Urine and feces
  - Moisture droplets from lungs
  - Perspiration: Excretion of moisture through the pores of the skin
    - When moisture evaporates, heat is released; cools body

HEAT LOSS

(SLIDE 2 OF 2)

- Heat is lost through:
  - Radiation: Transfer of heat in the form of waves
    - Body heat radiates to cooler surroundings
  - Conduction: Transfer of heat from one object to another by direct contact
    - Heat transferred to a cooler object it touches
  - Convection: Transfer of heat through air currents
    - Cool air currents cause body to lose heat



BODY TEMPERATURE RANGE

- Purpose of measuring body temperature
  - Establish patient's baseline temperature
  - Monitor an abnormally high or low temperature
- Normal temperature range
  - 97° F to 99° F (36.1° C to 37.2° C)
- Average body temperature
  - 98.6° F (37° C)
- Usually recorded using the Fahrenheit system

ALTERATIONS IN BODY TEMPERATURES

- Fever (pyrexia): Above 100.4° F (38° C)
  - Heat being produced is greater than heat being lost
- Low-grade fever: 99° F to 100.4° F (37.2° C to 38° C)
- Hyperpyrexia: Above 105.8° F (41° C)
  - Serious condition
  - Generally fatal above 109.4° F (43° C)
- Hypothermia: below 97° F (36.1° C)
  - Classified as subnormal
  - Heat being lost is greater than heat being produced
  - Person usually cannot survive with a temperature below 93.2° F (34° C)

VARIATIONS IN BODY TEMPERATURE

(SLIDE 1 OF 3)

- Normal fluctuations occur throughout the day
- Factors that affect body temperature
  - Age
    - Infants and young children: Higher temperature than adults—heat-regulating (thermoregulatory) system not yet fully established
    - Elderly: Lower temperature—loss of subcutaneous fat; lack of exercise; loss of thermoregulatory control

VARIATIONS IN BODY TEMPERATURE

(SLIDE 2 OF 3)

- Factors that affect body temperature
  - Diurnal variations: During sleep, body metabolism and muscle contractions slowdown
    - Causes temperature to be lowest in morning
  - Emotional states: Strong emotions increase temperature (crying, extreme anger)
    - Infants/young children often cry during examinations
  - Environment
    - Cold weather: Decreases temperature
    - Hot weather: Increases temperature

VARIATIONS IN BODY TEMPERATURE

(SLIDE 3 OF 3)

- Factors that affect body temperature
  - Exercise: Causes increase in voluntary muscle contractions
    - Elevates body temperature
  - Patient's normal body temperature: Some patients normally run low or high temperatures
  - Pregnancy: Cell metabolism increases
    - Elevates body temperature

FEVER
(SLIDE 1 OF 2)

- Common symptom of illness (particularly inflammation and infection)
- Febrile: Person who has a fever (above 100.4° F)
- Afebrile: Person who does not have a fever

FEVER
(SLIDE 2 OF 2)

- Pyrogen: Any substance that produces fever (e.g., pathogens)
  - Resets hypothalamus; causes temperature to increase above normal
- Most fevers are self-limiting; temperature returns to normal after disease process is completed

STAGES OF A FEVER
(SLIDE 1 OF 4)

- Onset: When temperature begins to rise
  - May be slow or sudden
  - Patient often experiences:
    - Coldness
    - Chills
    - Increase in pulse and respiratory rate

STAGES OF A FEVER

(SLIDE 2 OF 4)

- During the course of a fever
  - Temperature rises and falls in one of three patterns:
    - Continuous: Body temperature fluctuates minimally—always remains elevated
    - Intermittent: Body temperature alternately rises and falls—at times returns to normal or even becomes subnormal
    - Remittent: Wide range of temperature fluctuations occurs, all are above normal

STAGES OF A FEVER

(SLIDE 3 OF 4)

- During the course of a fever
  - Increased pulse and respiratory rate
  - Feels warm to touch
  - May also experience:
    - Flushed appearance
    - Increased thirst
    - Loss of appetite
    - Headache
    - Malaise—vague sense of body discomfort, weakness, and fatigue; often marks the onset of a disease; continues through the course of the illness

STAGES OF A FEVER

(SLIDE 4 OF 4)

- Subsiding stage: Temperature returns to normal
  - Can return gradually or suddenly (crisis)
  - Patient perspires and may become dehydrated

ASSESSMENT SITES
(SLIDE 1 OF 3)

- Mouth
- Axilla
- Rectum
- Ear
- Forehead

ASSESSMENT SITES
(SLIDE 2 OF 3)

- Site should have an abundant blood supply
  - So that temperature of the entire body is obtained
- Site must be as closed as possible (mouth, axilla, rectum, ear)
  - Prevents air from interfering with the reading

ASSESSMENT SITES
(SLIDE 3 OF 3)

- Site chosen depends on:
  - Patient's age, condition, and state of consciousness
  - Type of thermometer available
  - Medical office policy

ORAL TEMPERATURE

- Convenient and one of most common routes
- When MA records temperature
  - In general, physician assumes it is taken through the oral route unless otherwise noted
- Rich blood supply under the tongue on either side of the frenulum linguae
  - Site for placement of thermometer
- Patient must keep mouth closed to provide a closed space

AXILLARY TEMPERATURE

- Recommended for toddlers and preschoolers
- Also recommended for
  - Mouth-breathing patients
  - Patients with oral inflammation or oral surgery
- Measures 1° F lower than the oral route
- Make a notation to indicate the axillary route was used

RECTAL TEMPERATURE
(SLIDE 1 OF 2)

- Extremely accurate temperature measurement
  - Few factors can alter reading
- Rectum is highly vascular
- Provides the most closed cavity
- Measures 1° F higher than the oral route
- Make a notation in patient's chart to indicate the rectal route was used

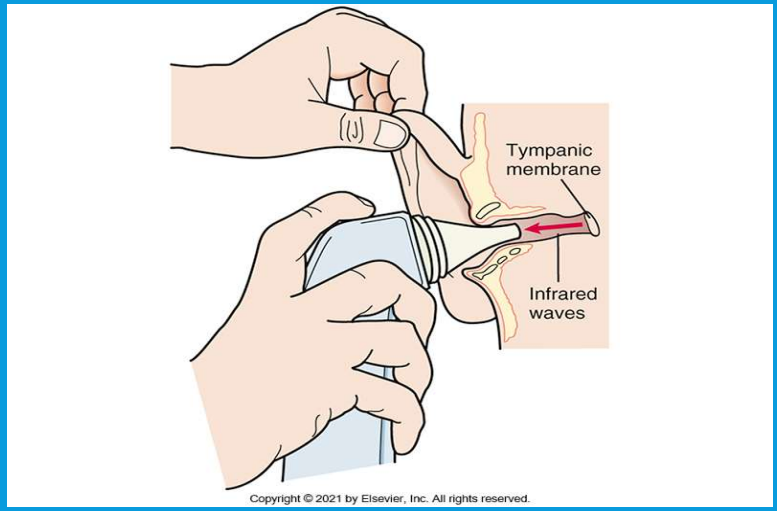
RECTAL TEMPERATURE

(SLIDE 2 OF 2)

- Recommended for:
  - Infants and young children
    - First 6 weeks of life
    - Generally until at least 6 months of age
  - Unconscious patients
  - Mouth-breathing patients
  - When greater accuracy is desired
- Danger of rectal trauma*
  - Lay baby or child on his or her back, lift his or her thighs
  - Use disposable probe covers
  - Apply water soluble lubricant
  - **Gently insert the probe approximately ½ an inch and no more than 1 inch**
  - **Do not force insertion**

AURAL TEMPERATURE

- Used with tympanic membrane thermometer
- Ear: Closed cavity that is easily accessible
- More comfortable for patient
- Easier to measure temperature in:
  - Children younger than 6 years
  - Uncooperative patients
  - Patients unable to have their temperature taken orally



FOREHEAD TEMPERATURE
(SLIDE 1 OF 3)

- Temporal artery: Major artery of head
  - Runs laterally across forehead and down the side of the neck
- In forehead area, located 2 mm below the skin surface
- Ideal site to measure temperature
  - Temporal artery is close to skin surface
  - Easily accessible
  - Constant steady flow of blood

FOREHEAD TEMPERATURE

(SLIDE 2 OF 3)

- Used to measure body temperature in individuals of all ages
  - Newborns
  - Infants
  - Children
  - Adults
  - Elderly

FOREHEAD TEMPERATURE

(SLIDE 3 OF 3)

- Results about the same as a rectal temperature measurement
  - Approximately 1° F higher than oral temperature
- Approximately 2° F higher than axillary temperature

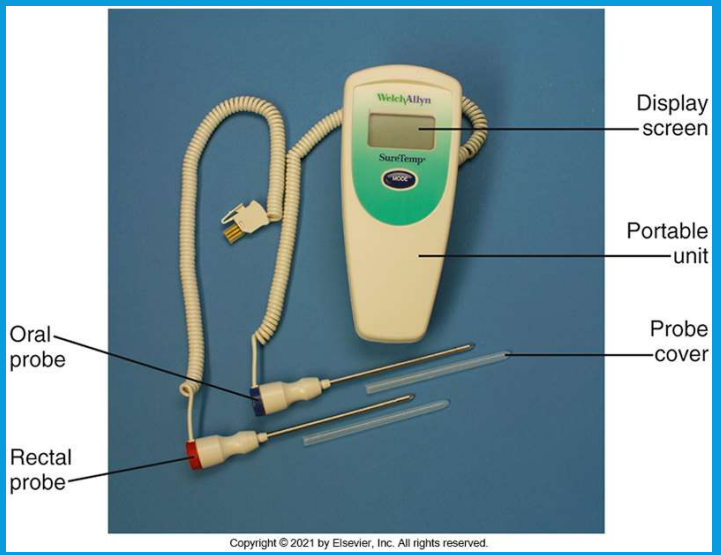
TYPES OF THERMOMETERS

- Four types
  - Electronic
  - Tympanic membrane
  - Temporal artery
  - Chemical
- Mercury glass thermometers are no longer used in medical office
  - Break easily and release mercury
  - Mercury can damage the nervous system
  - If released into the environment, harmful to wildlife
  - Many cities have banned sale or use of mercury

ELECTRONIC THERMOMETER

(SLIDE 1 OF 3)

- Often used in medical office
- Measures oral, axillary, and rectal temperature
- Measures temperature in 4 to 20 seconds
- Results digitally displayed on a screen
- Consists of interchangeable probes attached to a battery-operated portable unit
  - Blue probe: Oral and axillary temperature
  - Red probe: Rectal temperature



ELECTRONIC THERMOMETER

(SLIDE 2 OF 3)

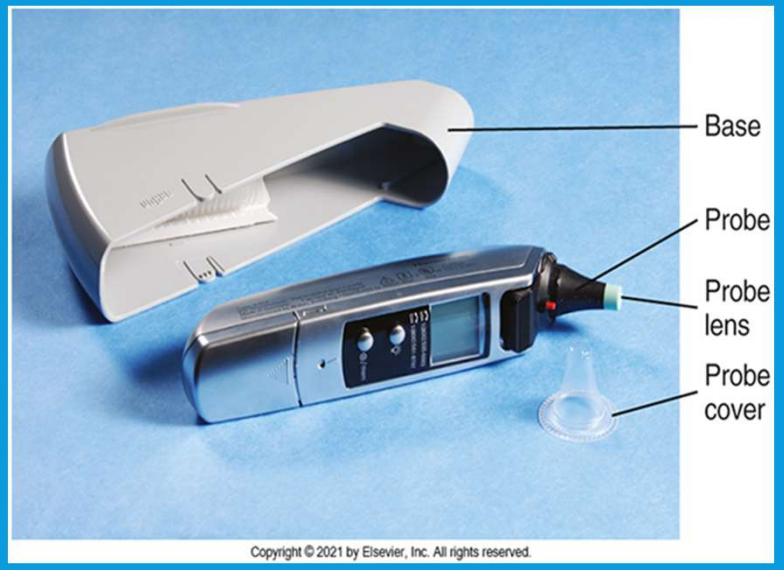
- Disposable plastic cover placed over the probe
  - Prevents transmission of microorganisms between patients
- Probe is inserted into site and is left in place until audible tone is heard
- Temperature is displayed on the screen

ELECTRONIC THERMOMETER
(SLIDE 3 OF 3)

- Probe cover should be ejected into regular waste container
- Clean casing, probe, and attached cords after each used
  - Use disinfectant cleaner

TYMPANIC MEMBRANE THERMOMETER (SLIDE 1 OF 3)

- Used at aural site
- Detects thermal energy radiated from tympanic membrane
  - Calculates body temperature from this information
- Battery-operated handheld device with a sensor probe
  - Disposable plastic cover placed over the probe



TYMPANIC MEMBRANE THERMOMETER (SLIDE 2 OF 3)

- Placed in outer third of external ear canal
- Activation button depressed momentarily
- Results displayed on a digital screen
- Probe cover is ejected into regular waste container

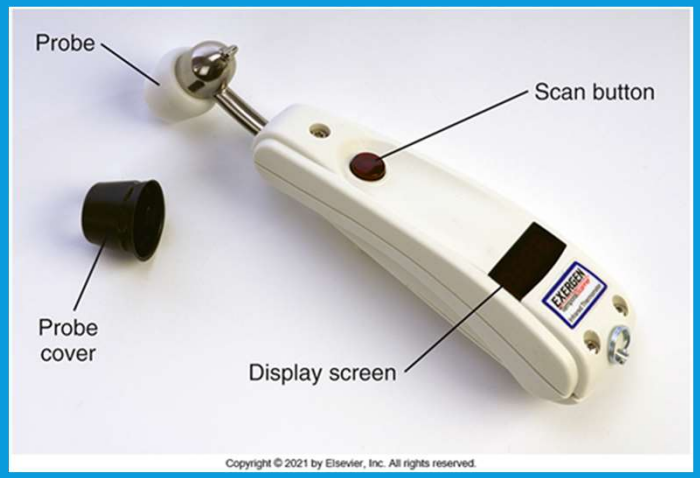
TYMPANIC MEMBRANE THERMOMETER (SLIDE 3 OF 3)

- Adults and children older than 3 years; pull auricle upward and backward
- Children younger than 3 years; pull ear pinna downward and backward

TEMPORAL ARTERY THERMOMETER

(SLIDE 1 OF 2)

- Newest method for measuring body temperature
- Electronic device with probe attached to a portable unit
- Procedure
  - Scan button is continually depressed
  - Probe is slowly moved across forehead
  - Probe sensor scans the forehead for heat given off by temporal artery



TEMPORAL ARTERY THERMOMETER

(SLIDE 2 OF 2)

- Probe sensor captures highest temperature: Peak temperature—temperature given off by the temporal artery (body temperature)
- Probe sensor also measures ambient temperature: Surrounding air temperature; thermometer automatically corrects for any effect from ambient temperature
- Displays an accurate body temperature reading

EARLOBE TEMPERATURE MEASUREMENT (SLIDE 1 OF 3)

- Sweating of the forehead; causes inaccurate temperature reading
  - Causes skin of forehead to cool; results in falsely low temperature reading
- Occurs when:
  - A fever breaks
  - Skin is clammy
    - Sweating may not be readily visible

EARLOBE TEMPERATURE MEASUREMENT (SLIDE 2 OF 3)

- To avoid problem
  - Temperature of neck area behind earlobe is measured (after scanning forehead)
    - Less affected by sweating than forehead
  - During sweating, arteries behind the earlobe dilate
    - Results in a constant, steady flow of blood
    - Provides an accurate measurement of body temperature when patient is sweating

EARLOBE TEMPERATURE MEASUREMENT (SLIDE 3 OF 3)

- To avoid problem
  - If patient's forehead has cooled from sweating
    - Temperature behind earlobe automatically registers as peak temperature
    - Overrides forehead temperature
  - Area behind earlobe does not normally provide an accurate body temperature measurement
    - Supersedes the forehead measurement when patient is sweating

CARE AND MAINTENANCE
(SLIDE 1 OF 2)

- Store in clean, dry area
- Protect from:
  - Extremes in temperature
  - Direct sunlight
  - Dust
- Clean casing periodically
  - Damp cloth moistened with disinfectant
  - Never splash water on or immerse the unit in water
    - Could damage the thermometer

CARE AND MAINTENANCE
(SLIDE 2 OF 2)

- Probe lens must be clean and shiny
  - Dirty lens; falsely low reading
  - To clean lens:
    - Wipe with antiseptic wipe
    - Immediately wipe dry with cotton-tipped applicator stick

TEMPORAL ARTERY THERMOMETER

(SLIDE 1 OF 2)

- Temporal artery thermometer guidelines
  - Operating environmental temperature: 60° F to 104° F (15.5° C to 40° C)
  - Do not take temperature over scar tissue, open sores, or abrasions
  - Make sure the side of the head to be measured is exposed to the environment

TEMPORAL ARTERY THERMOMETER

(SLIDE 2 OF 2)

- Temporal artery thermometer guidelines
  - A falsely low temporal artery reading can result from
    - A dirty probe lens
    - Sweating of the forehead—earlobe measurement becomes overriding temperature reading
    - Scanning the forehead too quickly
    - Not keeping the button depressed while scanning the forehead and area behind the earlobe

LEARNING OBJECTIVES
LESSON 19.2: PULSE

10. Explain the mechanism of pulse.
11. List and explain the factors that affect the pulse rate.
12. Identify a specific use for each of the eight pulse sites.
13. State the normal range of pulse rate for each age group.
14. Explain the difference between pulse rhythm and pulse volume.

MECHANISM OF THE PULSE

(SLIDE 1 OF 2)

- When the left ventricle of the heart contracts, blood is forced into the aorta
  - Aorta: Major trunk of the arterial system
    - Aorta is already filled with blood
    - Must expand to accept blood from left ventricle
    - Creates a pulsating wave that travels from the aorta through the walls of the arterial system - wave is known as the pulse; can be felt as a light tap

MECHANISM OF THE PULSE
(SLIDE 2 OF 2)

- Pulse rate is measured by counting the number of "taps" or beats per minute
- Heart rate is determined by taking the pulse rate

FACTORS AFFECTING PULSE RATE
(SLIDE 1 OF 4)

- Age
  - As age increases, the pulse rate decreases
  - Children have a faster pulse rate than adults
- Gender
  - Women tend to have faster pulse rates than men
- Physical activity
  - Increases pulse rate temporarily

FACTORS AFFECTING PULSE RATE

(SLIDE 2 OF 4)

- Emotional states increase pulse rate temporarily
  - Anxiety
  - Fear
  - Excitement
  - Anger

FACTORS AFFECTING PULSE RATE

(SLIDE 3 OF 4)

- Metabolism
  - Increased body metabolism increases pulse rate
  - Example; during pregnancy
- Fever
  - Increases pulse rate

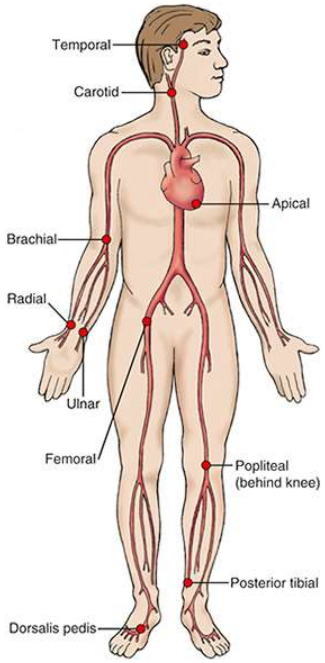
FACTORS AFFECTING PULSE RATE
(SLIDE 4 OF 4)

- Medications
  - May increase or decrease pulse
  - Examples
    - Digitalis: Decreases pulse
    - Epinephrine: Increases pulse

PULSE SITES

(SLIDE 1 OF 12)

- Pulse felt most strongly when superficial artery is held against a firm tissue (bone)
- Radial (radial artery)
  - Most common site
  - Located in a groove on the inner aspect of the wrist just below the thumb
  - Easily accessible



PULSE SITES

(SLIDE 2 OF 12)

- Radial (radial artery)
  - Used by individuals monitoring their own heart rate
    - Athletes
    - Patients taking heart medications
    - Individuals starting exercise program

PULSE SITES

(SLIDE 3 OF 12)

- Apical (apex of the heart)
  - Stronger beat
    - More easily heard than other pulse sites
  - Should be taken if:
    - Having difficulty feeling radial pulse
    - Pulse is abnormally slow or rapid
  - Often used for infants and children 3 years and younger
    - Other sites are difficult to palpate

PULSE SITES

(SLIDE 4 OF 12)

- Apical (apex of the heart)
  - Measured using a stethoscope
    - Chest piece placed over apex of the heart
    - Location: Fifth intercostal space at left midclavicular line

PULSE SITES

(SLIDE 5 OF 12)

- Brachial (brachial artery)
  - Located in antecubital space
    - Location: Space at the front of the elbow
    - During blood pressure measurement, the stethoscope is placed over the antecubital space and the brachial pulse is used to determine the BP reading.
  - Used to:
    - Take BP
    - Measure pulse in infants
    - Assess circulation to lower arm

PULSE SITES

(SLIDE 6 OF 12)

- Ulnar
  - Location: Little finger on the side of the wrist
  - Used to assess circulation to hand

PULSE SITES

(SLIDE 7 OF 12)

- Temporal
  - Location: Front of ear just below eye level
  - Used when radial pulse is inaccessible

PULSE SITES

(SLIDE 8 OF 12)

- Carotid
  - Location: Anterior side of neck
    - Slightly to one side of midline
  - Best site to find a pulse quickly
  - Used to:
    - Measure pulse in children and adults during cardiac arrest
    - Monitor pulse during exercise

PULSE SITES

(SLIDE 9 OF 12)

- Femoral
  - Location: Middle of the groin
  - Used to:
    - Measure pulse in infants, children, and adults during cardiac arrest
    - Assess circulation to lower leg

PULSE SITES

(SLIDE 10 OF 12)

- Popliteal
  - Location: Back of the knee
  - Used to:
    - Measure BP when the brachial artery is not accessible
    - Assess circulation to the lower leg

PULSE SITES

(SLIDE 11 OF 12)

- Posterior tibial
  - Location: Inner space of ankle, posterior to ankle bone
  - Used to assess circulation to the foot

PULSE SITES

(SLIDE 12 OF 12)

- Dorsalis pedis
  - Location: Upper surface of foot between the first and second metatarsal bones
  - Used to assess circulation to the foot

ASSESSMENT OF PULSE
(SLIDE 1 OF 2)

- Purpose of measuring pulse
  - Establish patient's baseline pulse rate
  - Assess pulse following special procedures, medications, or disease processes that affect the heart
- Assessment of pulse includes:
  - Pulse rate
  - Rhythm
  - Volume

ASSESSMENT OF PULSE
(SLIDE 2 OF 2)

- Palpation is used to locate the pulse (except for the apical site)
  - Apply moderate pressure with the pads of the three middle fingers
  - Use of excessive pressure, can obstruct pulse
  - Too little pressure, may not be able to detect pulse
  - Do not use thumb, it has a pulse of its own
    - Would result in measurement of MA's pulse

PULSE RATE

(SLIDE 1 OF 4)

- Number of heartbeats in 1 minute
  - Measured in beats per minute
- Normal adult range: 60 to 100 beats/min
  - Average falling between 70 and 80 beats/min

PULSE RATE

(SLIDE 2 OF 4)

- Tachycardia: An abnormally fast heart rate of more than 100 beats/min
  - Occurs during:
    - Hemorrhaging
    - Heart disease
  - Normally occurs during vigorous exercise and strong emotional states

PULSE RATE

(SLIDE 3 OF 4)

- Bradycardia: An abnormally slow heart rate of less than 60 beats/min
  - Normally occurs:
    - During sleep
    - In trained athlete
- If patient exhibits tachycardia or bradycardia during radial pulse measurement
  - Measure patient's apical pulse

PULSE RATE

(SLIDE 4 OF 4)

Age Group	Pulse Range (Beats/Min)	Average Pulse (Beats/Min)
Infant (birth to 1 year)	120-160	140
Toddler (1-3 years)	90-140	115
Preschool child (3-6 years)	80-110	95
School age (6-12 years)	75-105	90
Adolescent (12-18 years)	60-100	80
Adult (after 18th year)	60-100	80
Adult (after 60th year)	67-80	74
Well trained athletes	40-60	50

PULSE RHYTHM AND VOLUME
(SLIDE 1 OF 4)

- Pulse rhythm: Time interval between heartbeats
  - Normal rhythm: Same interval between beats
  - Dysrhythmia: Unequal or irregular intervals between beats
    - Also termed arrhythmia
    - Physician may order: Apical-radial pulse; electrocardiogram; Holter monitoring
- Record abnormalities in rhythm or volume
- Normal pulse, record as regular and strong

PULSE RHYTHM AND VOLUME

(SLIDE 2 OF 4)

- Apical-radial pulse
  - Performed to determine if a pulse deficit is present
  - Taking an apical-radial pulse
    - Measuring the apical pulse at the same time as the radial pulse for one full minute
  - Pulse deficit: Radial pulse rate is less than the apical pulse rate
    - One MA measures an apical pulse rate of 88 beats/min
    - Another MA simultaneously measures a radial pulse rate of 76 beats/min
    - Results in a pulse deficit of 12 beats

PULSE RHYTHM AND VOLUME

(SLIDE 3 OF 4)

- Apical-radial pulse
  - Pulse deficit: Radial pulse rate is less than the apical pulse rate
    - Means that not all of the heartbeats are reaching the peripheral arteries
    - Caused by an inefficient contraction of the heart—not strong enough to transmit a pulse wave to the peripheral pulse site
    - Frequently occurs with atrial fibrillation (dysrhythmia)

PULSE RHYTHM AND VOLUME

(SLIDE 4 OF 4)

- Pulse volume: Strength of the heartbeat
  - Amount of blood pumped into the aorta by each contraction
    - Should remain constant
    - Normal pulse feels strong and full
  - Thready pulse, blood volume decreases
    - Pulse feels weak
  - Bounding pulse, blood volume increases
    - Pulse feels extremely strong and full

LEARNING OBJECTIVES LESSON 19.3: RESPIRATION AND PULSE OXIMETRY

(SLIDE 1 OF 3)

15. Explain the purpose of respiration.
16. State what occurs during inhalation and exhalation.
17. State the normal respiratory rate for each age group.
18. List and explain the factors that affect the respiratory rate

LEARNING OBJECTIVES LESSON 19.3: RESPIRATION AND PULSE OXIMETRY

(SLIDE 2 OF 3)

19. Explain the difference between rhythm and depth of respiration.
20. Describe the character of each of the following abnormal breath sounds: crackles, rhonchi, wheezes, and pleural friction rub.
21. Explain the purpose of pulse oximetry.

LEARNING OBJECTIVES LESSON 19.3: RESPIRATION AND PULSE OXIMETRY

(SLIDE 3 OF 3)

22. State the normal oxygen saturation level of a healthy individual.
23. List and describe the functions of the controls, indicators, and displays on a pulse oximeter.
24. Describe the difference between a reusable and a disposable oximeter probe.
25. List and describe factors that may interfere with an accurate pulse oximetry reading.

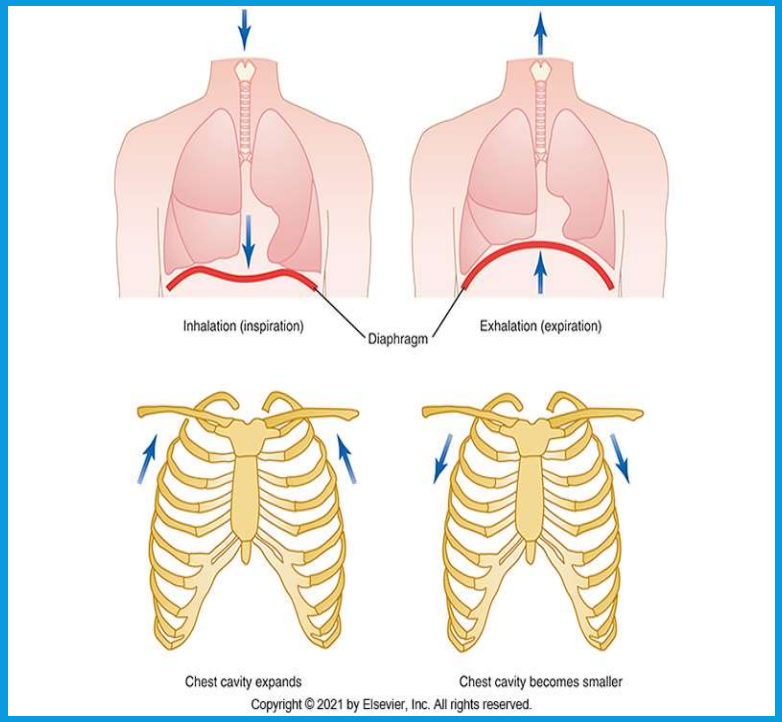
MECHANISM OF RESPIRATION

(SLIDE 1 OF 3)

- Purpose of respiration
  - Exchange of oxygen (O_2) and carbon dioxide (CO_2) between the atmosphere and blood
- One complete respiration: One inhalation and one exhalation

MECHANISM OF RESPIRATION
(SLIDE 2 OF 3)

- Divided into two phases
  - Inhalation
    - Diaphragm descends
    - Lungs expand
    - Causes air containing O_2 to move into lungs
  - Exhalation
    - Diaphragm ascends
    - Lungs return to original state
    - Causes air containing CO_2 to be expelled



MECHANISM OF RESPIRATION

(SLIDE 3 OF 3)

- Classified as:
  - External respiration: Exchange of O_2 and CO_2 between alveoli and blood
    - Alveoli: Thin-walled air sacs of the lungs in which the exchange of O_2 and CO_2 takes place
    - Blood located in small capillaries—comes in contact with alveoli; picks up oxygen; carries it to the cells of the body
  - Internal respiration: Exchange of O_2 and CO_2 between body cells and blood
    - O_2 is given off to the cells
    - CO_2 is picked up—transmitted as a waste product to lungs

CONTROL OF RESPIRATION
(SLIDE 1 OF 2)

- Involuntary respiration
  - Controlled by medulla oblongata
  - Buildup of CO_2 sends message to medulla
    - Triggers respiration to occur automatically

CONTROL OF RESPIRATION
(SLIDE 2 OF 2)

- Voluntary respiration
  - Person can control (e.g., singing, talking)
  - Breath can only be held a certain length of time
    - Medulla stimulated, causes respiration to occur involuntarily

ASSESSMENT OF RESPIRATION

- Measure respiration without patient's knowledge
  - Patient can control respiration
- Ideal time, after pulse is taken

RESPIRATORY RATE

(SLIDE 1 OF 4)

- Normal adult range: 12 to 20 respirations per minute
- Ratio of one respiration for every four pulse beats
  - Example
    - If respiratory rate is 18/min, pulse rate would be 72 beats/min (4 × 18 = 72)

RESPIRATORY RATE

(SLIDE 2 OF 4)

- Tachypnea: Abnormal increase of more than 20/min
- Bradypnea: Abnormal decrease of less than 12 /min
- Factors that affect respiratory rate
  - Age
    - As age increases, the respiratory rate decreases
    - Respiratory rate of a child, faster than adult

RESPIRATORY RATE

(SLIDE 3 OF 4)

- Factors that affect respiratory rate
  - Physical activity: Increases rate temporarily
  - Emotional state: Increases rate temporarily
  - Fever: Increases rate
    - As body tries to rid itself of excess heat
  - Medications: Increase or decrease rate (depends on type of medication)

RESPIRATORY RATE

(SLIDE 4 OF 4)

Age Group	Average Respiratory Range (breaths/min)	Respiratory Average (breaths/min)
Infant (birth-1 year)	30-40	35
Toddler (1-3 years)	23-25	30
Preschool child (3-6 years)	20-30	25
School-age child (6-12 years)	18-26	22
Adolescent (12-18 years)	12-20	16
Adult (after 18th year)	12-20	16

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 1 OF 6)

- Rhythm
  - Should be even and regular
  - Pauses between inhalation and exhalation should be equal

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 2 OF 6)

- Depth of respiration
  - Amount of air inhaled or exhaled
  - Described as:
    - Normal: Depth is the same
    - Deep: Large volume of air is inhaled and exhaled
    - Shallow: Exchange of small volume of air
  - Determined by observing the amount of movement of chest

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 3 OF 6)

- Eupnea: Normal respiration
  - Rate: 12 to 20 respirations/min
  - Rhythm: Even and regular
  - Depth: Normal

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 4 OF 6)

- Hyperpnea: Abnormal increase in rate and depth
  - Patient exhibits very deep, rapid, and labored breathing
  - Occurs normally in exercise
  - Occurs abnormally in fever and pain
  - Also occurs with any condition in which the supply of oxygen is inadequate
    - Heart disease
    - Lung disease

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 5 OF 6)

- Hyperventilation: Abnormally fast and deep breathing
  - Usually associated with acute anxiety (e.g., hysteria, panic attacks)
  - Individual is "overbreathing"
  - Causes dizziness and weakness

RHYTHM AND DEPTH OF RESPIRATION

(SLIDE 6 OF 6)

- Hypopnea: Abnormal decrease in rate and depth
  - Depth: Approximately half of normal respirations
  - Often occurs with sleep disorders

COLOR OF THE PATIENT

(SLIDE 1 OF 3)

- Observe color while taking respirations
- Hypoxia: A reduction in the oxygen supply to the tissues
  - Results in cyanosis

COLOR OF THE PATIENT
(SLIDE 2 OF 3)

- Cyanosis: Bluish coloration of skin and mucous membranes
  - First observed in nailbeds and lips
    - Blood vessels lie close to the skin in these areas
  - Occurs in patients with:
    - Advanced emphysema
    - Cardiac arrest

COLOR OF THE PATIENT
(SLIDE 3 OF 3)

- Apnea: Temporary absence of respirations
  - May occur during sleep
    - Known as sleep apnea
  - Serious if breathing ceases for more than 4 to 6 minutes
    - Patient could suffer brain damage and death

RESPIRATORY ABNORMALITIES
(SLIDE 1 OF 2)

- Dyspnea: Difficulty breathing or shortness of breath
  - Normal during vigorous exercise
  - Abnormal in patients with:
    - Emphysema
    - Asthma

RESPIRATORY ABNORMALITIES
(SLIDE 2 OF 2)

- Orthopnea: Condition in which breathing is easier when an individual is in a sitting or standing position
  - Occurs with disorders of the heart and lungs
    - Asthma
    - Emphysema
    - Pneumonia
    - Congestive heart failure

BREATH SOUNDS

- Caused by air moving through the respiratory tract
- Normal breath sounds: Quiet and barely audible
- Adventitious sounds: Abnormal breath sounds
  - Indicate presence of respiratory disorder

PULSE OXIMETRY

(SLIDE 1 OF 3)

- Painless and noninvasive procedure
- Used to measure oxygen saturation of hemoglobin in arterial blood
  - Hemoglobin
    - Complex compound found in red blood cells
    - Function: Transport oxygen

PULSE OXIMETRY

(SLIDE 2 OF 3)

- Pulse oximetry provides information about cardiorespiratory status
  - Amount of oxygen being delivered to tissues

PULSE OXIMETRY

(SLIDE 3 OF 3)

- Pulse oximeter
  - Computerized device
  - Measures oxygen saturation
  - Consists of a cliplike probe connected to a monitor
  - Also measures pulse rate in beats/min
    - Beep is emitted with each pulse beat

MECHANISM OF ACTION
(SLIDE 1 OF 5)

- Probe attached to peripheral pulsating capillary bed (fingertip)
- Light-emitting diode (LED)
  - Transmits infrared light and red light through tissues to a photodetector (light detector)

MECHANISM OF ACTION
(SLIDE 2 OF 5)

- Bright red hemoglobin
  - High oxygen content (oxygen rich)
  - Absorbs infrared light from LED
- Dark red hemoglobin
  - Low in oxygen (oxygen poor)
- Absorbs red light from LED

MECHANISM OF ACTION
(SLIDE 3 OF 5)

- Computer of oximeter
  - Calculates light transmitted from oxygen-rich and oxygen-poor hemoglobin
    - From this ratio, oxygen saturation of hemoglobin is determined-measurement converted to a percentage; displayed on screen of the monitor

MECHANISM OF ACTION
(SLIDE 4 OF 5)

- SpO_2: Saturation of peripheral oxygen
  - Pulse oximeter measures oxygen saturation of peripheral capillaries
  - Abbreviation used when a pulse oximeter is used to measure the oxygen saturation level

MECHANISM OF ACTION
(SLIDE 5 OF 5)

- SaO_2: Saturation of arterial oxygen
  - Arterial blood gas (ABG) analysis
    - More complete, but invasive measurement of oxygen saturation
    - Requires drawing a blood specimen from an artery
  - Abbreviation SaO_2 used when ABG analysis is used to measure the oxygen saturation level

INTERPRETATION OF RESULTS
(SLIDE 1 OF 4)

- Pulse oximetry reading: Represents percentage of Hgb saturated with oxygen
  - Each molecule of Hgb can carry four oxygen molecules
    - 100 molecules of Hgb fully saturated with oxygen; carrying 400 molecules of oxygen
      - Oxygen saturation reading: 100%
    - 100 molecules of Hgb carrying 360 molecules of oxygen
      - Oxygen saturation reading: 90%
  - The more hemoglobin saturated with oxygen, the higher the oxygen saturation

INTERPRETATION OF RESULTS

(SLIDE 2 OF 4)

- Oxygen saturation of healthy individuals: 95% to 99%
  - Air is only 21% saturated with oxygen
    - Unusual for hemoglobin to be 100% saturated with oxygen
    - Patients on supplemental oxygen may have a reading of 100%

INTERPRETATION OF RESULTS
(SLIDE 3 OF 4)

- Oxygen saturation of healthy individuals: 95% to 99%
  - Oxygen saturation less than 95%: Inadequate amount of oxygen reaching the tissues
    - Some patients with chronic pulmonary disease are able to tolerate lower saturation levels
  - Oxygen saturation between 85% and 90%: Respiratory failure resulting in tissue damage
  - Oxygen saturation of 75%: Cyanosis appears
  - Oxygen saturation below 70%: Life threatening

INTERPRETATION OF RESULTS
(SLIDE 4 OF 4)

- Hypoxemia: Decrease in the oxygen saturation of the blood (less than 95%)
  - Can lead to hypoxia
- Hypoxia: A reduction in the oxygen supply to tissues
  - If not treated, tissue damage and death
  - Symptoms; headache, mental confusion, nausea, dizziness, shortness of breath, and tachycardia
  - Tissues most sensitive to hypoxia; brain, heart, pulmonary vessels, and liver

PURPOSE OF PULSE OXIMETRY

(SLIDE 1 OF 4)

- Performed on patients complaining of respiratory problems (e.g., dyspnea)
- Decreased SpO_2 reading (along with further testing and clinical signs and symptoms)
  - Assists physician in diagnosis and treatment
  - May include drug therapy and oxygen therapy

PURPOSE OF PULSE OXIMETRY

(SLIDE 2 OF 4)

- Decreased SpO_2 value (hypoxemia) caused by:
  - Acute pulmonary disease (pneumonia)
  - Chronic pulmonary disease (emphysema, asthma, bronchitis)
  - Cardiac problems (congestive heart failure, coronary artery disease)

PURPOSE OF PULSE OXIMETRY

(SLIDE 3 OF 4)

- Used to assess:
  - Effectiveness of oxygen therapy
  - Patient tolerance to activity
  - Effectiveness of treatment such as bronchodilators
  - Patient tolerance to analgesia and sedation

PURPOSE OF PULSE OXIMETRY

(SLIDE 4 OF 4)

- Most often used for 'spot-check' measurement of oxygen saturation (single measurement)
- Occasionally used for short-term continuous monitoring
  - Patient experiencing an asthmatic attack
  - Sedated patient during minor office surgery

COMPONENTS OF THE PULSE OXIMETER

- Handheld pulse oximeter
  - Used by most offices
  - Portable and lightweight
  - Usually battery operated
- Stand-alone oximeter
  - Used in a hospital setting
  - Continuous bedside monitoring of oxygen saturation
- Pulse oximeter also measures pulse rate

MONITOR
(SLIDE 1 OF 7)

- Contains controls, indicators, and displays
  - On/Off control: Turns oximeter on and off
  - SpO_2% display: Digital display of oxygen saturation
    - Expressed as a percent
    - Updated with each pulse beat

MONITOR
(SLIDE 2 OF 7)

- Contains controls, indicators, and displays
  - Pulse rate display: Indicates pulse rate in beats/min
    - Updated with each pulse beat
    - Oximeter emits a constant-pitch audible beep with each pulse beat

MONITOR
(SLIDE 3 OF 7)

- Contains controls, indicators, and displays
  - Pulse strength bar graph indicator: Display of pulse strength
    - Consists of a segmented display of bars
    - Stronger the pulse, the more segments light up
  - Pulse search indicator: Lights when oximeter is searching for pulse
  - Adjustable volume control: Adjusts the beep that sounds with each pulse beat
    - Settings; high, low, and off

MONITOR
(SLIDE 4 OF 7)

- Contains controls, indicators, and displays
  - Low battery indicator: Warns that battery is getting low
    - Lights up and sounds an alarm when 30 minutes of battery use remain
  - Alarm messages: Audible beeps that indicate a problem or condition that may affect the reading
    - Must not be ignored
    - Must be corrected before continuing

MONITOR
(SLIDE 5 OF 7)

- Power-on self test (POST)
  - Automatically occurs when oximeter is turned on
  - Takes approximately 3 to 5 seconds
  - Oximeter checks its internal systems to make sure it is functioning properly
  - If problem is detected, alarm sounds and monitor displays an error code
    - Refer to troubleshooting section of user manual for interpretation of code and action to take

MONITOR
(SLIDE 6 OF 7)

- Oximeter begins searching for a pulse
  - Pulse search indicator lights up
  - Takes several seconds to:
    - Locate a pulse
    - Calculate and display SpO_2 reading

MONITOR
(SLIDE 7 OF 7)

- Oximeter is unable to detect pulse or pulse is too weak to provide necessary data needed to calculate oxygen saturation
  - Alarm sounds
  - Oximeter may automatically shut off
  - Reposition probe or move probe to another finger
    - Perform procedure again

PROBE
(SLIDE 1 OF 6)

- Reusable or disposable
  - Most offices use reusable clip-on probes
    - Convenient to use
    - Easy to apply
    - More susceptible to inaccurate readings from patient movement
    - Must be cleaned and disinfected after use

PROBE
(SLIDE 2 OF 6)

- Reusable or disposable
  - Disposable probes
    - Expensive to use
    - Used for long-term monitoring of oxygen saturation in the hospital
    - Made of adhesive bandage-like material
    - Discarded after use

PROBE
(SLIDE 3 OF 6)

- Handle reusable probe carefully
  - Hitting probe against hard object or dropping it may damage it
  - Use probe designed for oximeter being used
    - Mixing probes from different manufacturers can result in an inaccurate reading

PROBE
(SLIDE 4 OF 6)

- Probe must be attached to a peripheral site
  - Highly vascular
  - Skin is thin
    - Most common site: Fingertip
    - Other sites: Toe and earlobe

PROBE
(SLIDE 5 OF 6)

- Cable connects probe to monitor
  - Probe may be permanently attached to cable
  - Or may be a separate device
    - Requires connection to the cable

PROBE
(SLIDE 6 OF 6)

- Cable connects probe to monitor
  - Never lift or carry the monitor by the cable which could:
    - Damage the cable connections
    - Cause cable to disconnect from monitor causing monitor to fall on floor or fall on patient

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 1 OF 9)

- Incorrect positioning of probe
  - Light is transmitted from LED to photodetector
    - Must be aligned directly opposite to each other—automatically occurs when probe is applied

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 2 OF 9)

- Incorrect positioning of probe
  - Alignment of probe may be impossible with
    - Patient with very small fingers (e.g., thin patient or child)
    - Patients with very large fingers (e.g., obese patient)—use another site (e.g., earlobe); pediatric probes can be used with thin patients or children

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 3 OF 9)

- Fingernail polish or artificial nails
  - Opaque coating on fingernail may result in falsely low reading
    - Interferes with light transmission through finger
    - The darker the coating, more likely the SPO_2 reading is affected—blue, black, and green nail polishes cause the most problems
    - Remove nail polish with acetone or fingernail polish remover

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 4 OF 9)

- Fingernail polish or artificial nails
  - Patient has artificial fingernails
    - Use another site (e.g., earlobe or toe)
  - Oil, dirt, and grime on fingertip can interfere with proper light transmission
    - Cleanse site with soap and water and allow to dry
  - Avoid areas with bruises, burns, stains, or tattoos
  - Darkly pigmented skin and jaundice
    - Do not affect reading

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 5 OF 9)

- Poor peripheral blood flow
  - Pulse oximeter works best when there is a good strong pulse in finger to which the probe is applied
  - Poor blood flow may cause pulse to be so weak that oximeter cannot obtain a reading
  - Conditions resulting in poor blood flow
    - Peripheral vascular disease
    - Vasoconstrictor medications
    - Severe hypotension
    - Hypothermia

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 6 OF 9)

- Poor peripheral blood flow
  - Use earlobe, less affected by decreased blood flow
  - Patients with cold fingers (but not hypothermic)
    - May have enough constriction that it interferes with obtaining a reading
    - Ask patient to warm finger by rubbing hands together
  - Never attach probe to finger of arm to which automatic BP cuff is applied
    - Blood flow to finger cut off when cuff inflates, results in loss of pulse signal

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 7 OF 9)

- Ambient (surrounding) light
  - Examples: Bright fluorescent light, direct sunlight, overhead examination light
  - May result in inaccurate reading
  - Ambient light may be picked up by photodetector and alter the reading

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 8 OF 9)

- Ambient (surrounding) light
  - Corrected by:
    - Turning off light
    - Moving probe away from light source
    - Covering probe with opaque material (washcloth)

FACTORS AFFECTING PULSE OXIMETRY

(SLIDE 9 OF 9)

- Patient movement
  - Common cause of inaccurate reading
  - Motion affects ability of light to travel from LED to photodetector
  - Prevents probe from picking up the pulse signal
  - Instruct patient to remain still during procedure
  - Occasionally patient movement cannot be eliminated (tremors of hands)
    - Measure at a site less affected by motion (e.g., toe or earlobe)

PULSE OXIMETER CARE AND MAINTENANCE
(SLIDE 1 OF 2)

- Monitor and cable
  - Clean periodically with damp cloth of warm water and disinfectant cleaner
    - Make sure cloth is not too wet
    - To prevent solution from running into monitor—could damage internal components

PULSE OXIMETER CARE AND MAINTENANCE

(SLIDE 2 OF 2)

- Probe
  - Clean periodically with soft cloth moistened in water and disinfectant cleaner
    - Disinfect by wiping thoroughly with an antiseptic wipe and allow to dry
    - Remove dirt and grime—could interfere with light transmission
    - Never soak or immerse in liquid solution—would damage probe
  - Probe is heat-sensitive, cannot be autoclaved
  - Store pulse oximeter at room temperature in a dry environment

LEARNING OBJECTIVES LESSON 19.4: BLOOD PRESSURE

(SLIDE 1 OF 2)

26. Define blood pressure.
27. State the normal range of blood pressure for an adult.
28. List and describe factors that affect the blood pressure.
29. Identify the different parts of a stethoscope and a sphygmomanometer.

LEARNING OBJECTIVES
LESSON 19.4: BLOOD PRESSURE
(SLIDE 2 OF 2)

30. Identify the Korotkoff sounds.
31. State the advantages and disadvantages of an automatic blood pressure monitor.
32. Explain how to prevent errors in blood pressure measurement.

MECHANISM OF BLOOD PRESSURE

(SLIDE 1 OF 2)

- Blood pressure: Measurement of force exerted by the blood on the walls of the arteries
- Systole: Phase in the cardiac cycle in which the ventricles contract
  - Blood is pushed out of the heart and into the aorta and pulmonary artery, exerting pressure on their walls
- Systolic pressure: Point of highest pressure on arterial walls
  - Recorded during systole

MECHANISM OF BLOOD PRESSURE

(SLIDE 2 OF 2)

- Diastole: Phase in cardiac cycle in which the heart relaxes between contractions
- Diastolic pressure: Point of lesser pressure on arterial walls
  - Recorded during diastole
  - Pressure is lower because the heart is relaxed

INTERPRETATION OF BLOOD PRESSURE (BP) (SLIDE 1 OF 4)

- Measurement expressed as a fraction
  - Numerator: Systolic pressure
  - Denominator: Diastolic pressure
- Measured in millimeters of mercury (mm Hg)
- New guidelines from National Heart, Lung, and Blood Institute
  - Normal BP: Less than 120/80 mm Hg
  - Prehypertension
    - Sustained systolic: 120 to 139 mm Hg or
    - Sustained diastolic: 80 to 89 mm Hg

INTERPRETATION OF BLOOD PRESSURE (BP) (SLIDE 2 OF 4)

- BP should be taken at every office visit
  - Several readings taken on different occasions
    - Provide a good index of baseline BP
  - Rise or fall of 20 to 30 mm Hg in baseline BP is significant
    - Even if it is still in normal range

INTERPRETATION OF BLOOD PRESSURE (BP) (SLIDE 3 OF 4)

- Hypertension: High blood pressure
  - Hypertension stage I
    - Sustained systolic: 140 to 159 mm Hg or
    - Sustained diastolic: 90 to 99 mm Hg
  - Hypertension stage 2
    - Sustained systolic: 160 or higher mm Hg or
    - Sustained diastolic: 100 mm Hg or higher
  - Caused by excessive pressure on the arterial walls
  - Most common condition that causes an abnormal BP reading

INTERPRETATION OF BLOOD PRESSURE

(SLIDE 4 OF 4)

- Hypotension: Low blood pressure
  - Reduced pressure on arterial walls
  - BP reading below 95/60 mm Hg
- Pulse pressure: Difference between systolic and diastolic pressures
  - Determined by subtracting smaller number from larger number
    - Example: If BP is 110/70 mm Hg, pulse pressure is 40 (110 to 70 mm Hg)
  - Normal range: 30 to 50

FACTORS AFFECTING BLOOD PRESSURE

(SLIDE 1 OF 4)

- Age: As age increases, so does blood pressure
- Gender: After puberty women have a lower BP than men of the same age
  - After menopause: BP is higher in women
- Diurnal variations: BP is lower in the morning and higher in the afternoon
  - During sleep
    - Decreased metabolism
    - Decreased physical activity
  - As metabolism and activity increase during the day
    - Blood pressure rises

FACTORS AFFECTING BLOOD PRESSURE

(SLIDE 2 OF 4)

- Emotional states: Increase BP
  - Calm patient before taking BP
- Exercise: Temporarily increases BP
  - If a patient has been involved in physical activity
    - Allow patient to rest 20 to 30 minutes before taking BP

FACTORS AFFECTING BLOOD PRESSURE

(SLIDE 3 OF 4)

- Body position: BP varies based on position
  - Diastolic pressure in sitting position, higher than in lying position
  - Make a notation if the position is other than sitting
    - L: lying
    - St: standing

FACTORS AFFECTING BLOOD PRESSURE

(SLIDE 4 OF 4)

- Medications: May increase or decrease BP (depending on type of medication)
  - Important to record prescription and over-the-counter medications in patient's chart
- Also increases BP
  - Recent meal
  - Caffeine
  - Smoking
  - Bladder distention
  - Pain

ASSESSMENT OF MANUAL BLOOD PRESSURE

- Equipment needed
  - Stethoscope
  - Sphygmomanometer

STETHOSCOPE

- Instrument for amplifying and hearing sounds produced by the body
- Consists of four parts
  - Earpieces
  - Sidepieces (binaurals)
  - Plastic or rubber tubing
  - Chest piece

STETHOSCOPE CHEST PIECE

- Types
  - Diaphragm: Large flat disc
    - Most useful for hearing high-pitched sounds—lung sounds; bowel sounds
  - Bell: Bowl-shaped appearance
    - Most useful for hearing low-pitched sounds—heart sounds; vascular system sounds
  - If chest piece consists of both, must rotate desired piece into position before use—otherwise cannot hear sounds

MANUAL SPHYGMOMANOMETER

- Sphygmomanometer: Instrument for measuring arterial blood pressure
- Consists of:
  - Manometer: Scale for registering the pressure of air in the bladder
  - Inner inflatable bladder surrounded by a covering (cuff)
  - Pressure bulb with a control valve to inflate and deflate the inner bladder

ANEROID SPHYGMOMANOMETER
(SLIDE 1 OF 2)

- Gauge with a round scale calibrated in millimeters
  - Needle points to calibrations
  - Needle must be at zero before taking BP

ANEROID SPHYGMOMANOMETER
(SLIDE 2 OF 2)

- MA should be no farther than 3 feet from the scale of the manometer
  - To ensure an accurate reading
- Position manometer for direct viewing
- Recalibrate manometer every year to ensure accuracy

CUFF SIZES
(SLIDE 1 OF 5)

- Variety of sizes
  - Measured in centimeters (cm)
- Size of cuff: Refers to inner bladder rather than outer covering

CUFF SIZES

(SLIDE 2 OF 5)

- Inner bladder of cuff should:
  - Encircle 80% of arm circumference (but not more than 100%)
  - Be wide enough to cover two-thirds of the distance from the axilla to antecubital space
    - Cuff must fit properly to ensure an accurate reading

CUFF SIZES
(SLIDE 3 OF 5)

- Child cuff often used for adult with thin arms
- Adult cuff used for average-sized adult arm
- Thigh cuff used for thigh or adults with large arms

CUFF SIZES

(SLIDE 4 OF 5)

- If cuff is too small, reading is falsely high
- If cuff is too large, reading is falsely low
- Center of inflatable bag should be directly over brachial artery
  - To allow complete compression of the brachial artery
- Velcro is used to secure the cuff

CUFF SIZES

(SLIDE 5 OF 5)

- Obese patients with an arm circumference of more than 50 cm (20 inches)
  - May not be possible to fit adult thigh cuff around arm
  - Blood pressure can be measured using forearm and radial artery
    - Position appropriate-sized cuff midway between elbow and wrist—center of bladder positioned over radial pulse; place the diaphragm over radial pulse; measure blood pressure using the same technique as with the brachial artery

KOROTKOFF SOUNDS
(SLIDE 1 OF 2)

- Used to determine systolic and diastolic BP readings
  - When bladder of the cuff is inflated:
    - Brachial artery is compressed
    - No audible sounds heard

KOROTKOFF SOUNDS
(SLIDE 2 OF 2)

- Used to determine systolic and diastolic BP readings
  - As cuff is deflated, sounds become audible
    - When blood flows freely, sounds can no longer be heard

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 1 OF 7)

- Used in some medical offices to measure BP
- Used in home monitoring by patients with high BP

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 2 OF 7)

- Important to use a device that has undergone a clinical validation process
- Uses an electronic sensor
  - Measures oscillations from the wall of the brachial artery as cuff deflates
    - Oscillation: Back and forth movement that occurs in the brachial artery as pulse wave travels through it

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 3 OF 7)

- Uses an electronic sensor
  - Point of maximum oscillation corresponds to mean arterial pressure
    - Mean arterial pressure: Overall index of BP
  - Computer in device uses this information to calculate systolic and diastolic BP
  - Results are displayed on a screen
  - Takes approximately 30 seconds

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 4 OF 7)

- Advantages
  - Automatically determines how much the cuff should be inflated
    - To reach a pressure that is 30 mm Hg above systolic pressure
  - Cuff does not have to be manually inflated and deflated
    - Performed automatically by the device
  - Brachial artery does not need to be located
    - Bladder of cuff does not need to be centered over brachial artery

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 5 OF 7)

- Advantages
  - Stethoscope and user listening skills not required
    - Electronic sensor measures oscillations from wall of brachial artery to obtain reading
  - Less susceptible to external environmental noise than manual devices
  - BP measurement is easy to read
    - Readings are shown on a digital display screen
  - Allows for multiple BP measurements
  - Most come with internal memory
    - Stores multiple BP measurement

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 6 OF 7)

- Disadvantages
  - Certain factors can cause the device to fail to obtain a reading
    - Patient movement
    - Muscle tremors
    - Preeclampsia
    - Dysrhythmias
    - Very weak pulse—if present, use an alternative method of BP measurement

ASSESSMENT OF BLOOD PRESSURE: AUTOMATIC METHOD

(SLIDE 7 OF 7)

- Disadvantages
  - Because device relies on brachial artery oscillations to obtain a reading:
    - Stiff arteries (e.g., older patients) can interfere with an accurate reading
  - Expensive

PREVENTION OF ERRORS IN BLOOD PRESSURE MEASUREMENT

(SLIDE 1 OF 2)

- Instruct patient not to consume caffeine, use tobacco, or exercise for 30 minutes before blood pressure measurement
- Patient should be comfortably seated
- Always use proper cuff size
- Never take blood pressure over clothing
- Position the patient properly
- Avoid extraneous sounds from cuff
- Compress brachial artery completely

PREVENTION OF ERRORS IN BLOOD PRESSURE MEASUREMENT

(SLIDE 2 OF 2)

- Apply equal pressure over brachial artery
- Instruct patient to relax as much as possible and not to talk during procedure
- Position earpieces so you can hear sounds clearly
- Avoid extraneous sounds from tubing
- Position chest piece properly
- Rapidly inflate cuff
- Release pressure at moderate steady rate
- Avoid venous congestion
- Measure/document blood pressure in both arms during initial blood pressure assessment of a new patient

AVERAGE OPTIMAL BLOOD PRESSURE FOR AGE

(SLIDE 1 OF 1)

Age	Blood Pressure (mm Hg)
Newborn	40
1 month	85/54
1 year	95/65
6 years	105/65
10-13 years	110/65
14-17 years	120/75
Adult	Less than 120/80

PEDIATRIC VITAL SIGNS

- MAHEC does follows current recommendations which include the following vital signs at indicated ages:

Age	Vitals
2 months-2 years	Weight Height Head Circumference
3 years	Weight Height Head Circumference BP
4-18 years	Weight Height BP HR

DEVELOPING A RAPPORT

- If trust and confidence are gained, child is more likely to cooperate during examination or procedure
- Requires special techniques based on age of child
- Toddlers and preschool children
  - Respond well to making a game of the procedure
- School-aged children
  - Explain purpose of an instrument
  - Allow child to hold instrument (if possible)
  - Allow child to help during the procedure

CARRYING THE INFANT

- Lift and carry infant in a manner that is:
  - Safe
  - Comfortable

GROWTH MEASUREMENTS

- One of the best methods to evaluate progress of the child
- Measured at each office visit and plotted on growth chart
  - Weight
  - Height (length)
  - Head circumference (up to 3 years)

WEIGHT

- Determine nutritional needs
- Calculate proper medical dosage
- Infants: Measured in recumbent position
  - Scale should be zeroed and diaper must be off
  - Can determine if a newborn infant is nutritionally deficient enough to receive a diagnosis, often Failure to Thrive, that ***could require hospitalization***
  - Accuracy is a necessity
- Older children: Measured in standing position

LENGTH AND HEIGHT

- Length
  - Measured in children younger than 24 months
  - Measured from vertex of head to heel in supine position
  - Two people are needed to determine length accurately; having the parent help at the head is often best
  - Head must stay at the top snuggly and securely and legs should be extended fully for accurate measurement
  - ***A newborn infant length is also used to determine if nutrition is deficient and can lead to hospitalization***
- Older children: Measured in standing position

HEAD CIRCUMFERENCE

- Head circumference (HC)
  - Infancy: Period of rapid brain growth
    - Important to measure HC in children under age 3 years—plot on a growth chart
- Head circumference (HC)
  - Newborn HC range: 32 to 38 cm (12.5 to 15 inches)
  - A 4-inch (10-cm) increase in HC occurs in first year of life
- Important screening measure for:
  - Macroencephaly
  - Microencephaly

PEDIATRIC BLOOD PRESSURE (BP) MEASUREMENT

- American Academy of Pediatrics recommends:
  - Children 3 years of age and older measure BP annually
- Purpose
  - Identify children at risk for developing hypertension as adults
  - Identify children with kidney disease or heart disease
    - When treated, BP usually returns to normal
- Overweight children usually have higher BP than normal-weight children
  - To reduce BP
  - Weight loss through a prescribed diet and physical activity

Questions?