A couple in their 50s is shopping in a mall, where a health fair is set up. You are a nurse participating at a booth offering blood pressure readings. After much coaxing, the woman persuades her husband to have his blood pressure taken. You obtain a reading of 168/94 mm Hg. The wife reacts strongly, saying, “I told you that your lack of exercise and overeating would catch up with you one day. How am I going to manage being a widow at such an early age?” The husband responds by saying, “Don’t worry about me. I’m just as healthy as ever, and I plan to live until I’m 99 years old. I’m sure there’s something wrong with that machine.” Both of them turn to you. The wife says, “Tell him it’s not the machine and that he isn’t taking care of himself!”

Once you have completed this chapter and have incorporated vital signs into your knowledge base, review the above scenario and reflect on the following areas of Critical Thinking:

1. Identify possible interpretations of an isolated blood pressure reading of 168/94 mm Hg. List factors that may have affected the reading’s accuracy.
2. Analyze the man’s reaction to this situation. Indicate the teaching points about blood pressure that may be appropriate at this time.
3. Outline potential ways to deal therapeutically with the wife’s anxiety, describing possible verbal and nonverbal interactions.

Upon completion of this chapter, the student will be able to do the following:

1. Describe the procedures used to assess the vital signs: temperature, pulse, respirations, and blood pressure.
2. Describe factors that can influence each vital sign.
3. Identify equipment routinely used to assess vital signs.
4. Identify rationales for each route of temperature assessment.
5. Identify the location of commonly assessed pulse sites.
6. Describe how to assess orthostatic hypotension.
7. Recognize normal vital sign values among various age groups.
vital signs—body temperature (T), pulse (P), respirations (R), and blood pressure (BP)—indicate the function of some of the body’s homeostatic mechanisms. Measurement and interpretation of the vital signs are important components of assessment that can yield information about underlying health status. Client teaching concerning the vital signs is a key aspect of health promotion.

Typical or normal ranges of values for vital signs have been established for clients of various age groups (Table 26-1). During initial measurement of a client’s vital signs, the values are compared with these normal ranges to determine any variation that might indicate illness. When several sets of vital signs have been obtained, this information forms a baseline for comparison of subsequent measurements. Isolated vital sign values are less helpful; a series of values should be taken and evaluated to establish trends for the client. Vital sign trends that deviate from normal are much more significant than isolated abnormal values.

The tasks involved in measuring vital signs are simple and easy to learn, but interpreting the measurements and incorporating them into ongoing care and assessment require knowledge, problem-solving skills, critical thinking, and experience. Although measuring vital signs are usually part of routine care, they provide valuable information and their evaluation should not be taken lightly.

The frequency with which to assess vital signs should be individualized for each client. Healthy people may have vital signs checked only during annual physical examinations. Clients seen in ambulatory settings, wellness clinics, or psychiatric institutions may require infrequent vital sign checks. Most inpatient settings have a policy regarding the frequency of vital sign assessment, minimally every 8 hours for stable clients. Physicians order additional vital sign checks at specific intervals based on the client’s condition (e.g., postoperatively or after an invasive diagnostic procedure). The nurse caring for the client may decide to monitor vital signs more frequently if the client’s condition changes.

### BODY TEMPERATURE

Humans are warm-blooded creatures, which means they maintain a consistent internal body temperature independent of the outside environment. The body’s surface or skin temperature can vary widely with environmental conditions and physical activity. Despite these fluctuations, the temperature inside the body, the core temperature, remains relatively constant, unless the client develops a febrile illness. The body’s cells, tissues, and organs require this constant internal temperature and function optimally within a relatively narrow temperature range.

Normal body temperature when measured orally usually ranges between 36.5°C and 37.5°C (97.6°F and 99.6°F). This state of normal body temperature in a client is termed afebrile. When temperature exceeds 37.5°C, this is termed pyrexia. Body temperature can fluctuate with exercise, changes in hormone levels, changes in metabolic rate, and extremes of external temperature. In general, rectal temperatures may be 1°C higher than oral temperatures and axillary temperatures 1°C lower than oral temperatures (Sund-Levander, Grodzinsky, Loyd, & Wahren, 2004). Tympanic temperatures fall approximately midway between normal oral and rectal temperature measurements. Refer to Table 26-2, which lists normal adult temperatures at different body sites.

### Regulation of Body Temperature

Body temperature regulation requires the coordination of many body systems. For the core temperature to remain steady, heat production must equal heat loss. The hypothalamus, located in the pituitary gland in the brain, is the body’s built-in thermostat. It can sense small changes in body temperature and stimulates the necessary responses in the nervous system, circulatory system, skin, and sweat glands to maintain homeostasis (state of dynamic equilibrium).

### Heat Production

The body continually produces heat as a byproduct of chemical reactions that occur in body cells. This collective process is known as metabolism. The process of thermoregulation keeps core temperature fairly constant regardless of where the heat is being produced. The basal metabolic rate (BMR) is the amount of energy the body uses, and thus the amount of heat produced, during absolute rest in an awake state. Physical exercise, increased production of thyroid hormones, and stimulation of the sympathetic nervous system can increase heat production.

#### Table 26-1

<table>
<thead>
<tr>
<th>Normal Vital Sign Ranges Across the Lifespan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse</strong></td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td><strong>Newborn (&gt;96 h)</strong></td>
</tr>
<tr>
<td><strong>Infant (&gt;1 mo)</strong></td>
</tr>
<tr>
<td><strong>Preschooler</strong></td>
</tr>
<tr>
<td><strong>School-age</strong></td>
</tr>
<tr>
<td><strong>Adolescent</strong></td>
</tr>
<tr>
<td><strong>Adult</strong></td>
</tr>
<tr>
<td><strong>Older adult (&gt;70 yr)</strong></td>
</tr>
</tbody>
</table>
Heat Loss

Just as the body is continually producing heat, it is also continuously losing heat. Heat is lost through four processes: radiation, conduction, convection, and evaporation.

Exposure to a cold environment increases radiant heat loss. All objects with temperatures above absolute zero constantly lose heat through infrared heat rays. Covering the body with closely woven, dark fabric can reduce radiant heat loss.

Conduction is the transfer of heat from one object to another. The body loses a considerable amount of heat to the air through conduction. It can also lose heat to water during swimming or tepid baths. Convection is the loss of heat through air currents such as from a breeze or a fan. Evaporation causes heat loss as water is transformed to a gas. Examples of evaporation include diaphoresis (sweating) during strenuous exercise or when one is febrile.

Factors Affecting Body Temperature

Understanding the factors that can affect body temperature can help nurses accurately assess the significance of body temperature variations.

Age

Newborns have unstable body temperatures because their thermoregulatory mechanisms are immature. It is not uncommon for elderly persons to have body temperatures less than 36.4°C (97.6°F) because normal temperature drops as a person ages (Copstead & Banasik, 2000). Remember this fact when evaluating low-grade temperatures in the elderly or identifying those at risk for hypothermia.

Environment

Ordinarily, changes in environmental temperatures do not affect core body temperature, but core body temperature can be altered by exposure to hot or cold extremes. The degree of change relates to the temperature, humidity, and length of exposure. The body’s thermoregulatory mechanisms are also influential (e.g., infants and older adults often have diminished control mechanisms). Death may occur if a person’s core body temperature drops to 25°C (77°F) or rises to 45°C (113°F).

Time of Day

Body temperature normally fluctuates throughout the day. Temperature is usually lowest around 3 AM and highest between 5 and 7 PM (Beaudry, VandenBosch, & Anderson, 1996). A person’s body temperature can vary by as much as 2°C (3.6°F) from early morning to late afternoon. Thermostylist attribute this variation to changes in muscle activity and digestive processes, which are usually lowest in the early morning during sleep. Even greater variation in body temperature at various times of the day is found in infants and children.

Although researchers have established no absolute relationship between circadian rhythm and body temperature, 95% of clients have their maximum temperature elevation around 6 PM. A study by Beaudry et al. (1996) suggests once-a-day fever screening of afebrile clients at 6 PM. This would ease burdens on staff time and limit the disruption of sleeping clients during the night.

Exercise

Body temperature increases with exercise because exercise increases the breakdown of carbohydrates and fats to provide energy. Strenuous exercise, such as running a marathon, can temporarily raise the temperature to as high as 40°C (104°F).

Stress

Emotional or physical stress can elevate body temperature. When stress stimulates the sympathetic nervous system, circulating levels of epinephrine and norepinephrine increase. As a result, the metabolic rate increases, which, in turn, increases heat production. Stressed or anxious clients may have an elevated temperature with no underlying pathology.

Hormones

Women usually have greater variations in their temperature than do men. Progesterone, a female hormone secreted at ovulation, increases body temperature 0.3° to 0.6°C (0.5° to 1°F) above baseline. By measuring their temperature daily, women can determine when they ovulate, which is the basis for the rhythm method of birth control (see Chapter 51). After menopause, mean temperature norms are the same for men and women (Sund-Levander et al., 2002) Thyroxine, epinephrine, and norepinephrine also elevate body temperature by increasing heat production.

Factors Affecting Body Temperature Measurement

Consider external factors that can lead to false temperature readings. Small, insignificant alterations in oral temperature readings can occur after smoking or when oxygen is administered by mask or cannula. Hot or cold drinks may cause slight variations in oral temperature readings; the most marked variation is found after clients have been drinking ice water. Wait 15 minutes after clients have ingested ice water to take their oral temperatures.

Assessing Body Temperature

Temperature measurement establishes a baseline for comparison as a disease progresses or therapies are instituted. The reliability of a temperature value depends on selecting the most appropriate site, choosing the correct equipment, and using the correct procedure.
Sites

Use judgment when selecting the route to measure temperature. The five sites used are the mouth, ear, rectum, forehead (temporal artery), and axilla. In most clinical situations, any of these sites is satisfactory if the nurse uses proper technique and accounts for normal variations for the different sites. Additional sites are the esophagus and pulmonary artery, both of which are considered core temperatures. Normal temperature varies within a person, among people, and among sites. See Table 26-2.

**ORAL.** The most common site for temperature measurement is the mouth. Advantages of the oral route include easy access and client comfort. Drinking hot or cold liquids can affect temperature measurement; wait 15 to 30 minutes to allow the client’s mouth temperature to return to baseline before placing the thermometer. Oral temperature assessment may not be prudent or safe for infants, young children, unconscious or irrational clients, or clients with seizure disorders.

**RECTAL.** Rectal temperature measurement, once thought to be the most accurate and commonly used clinically, has now been replaced by tympanic technology that is less invasive for the client. Clients often do not tolerate rectal temperatures well because of discomfort and embarrassment. If this route is used, take care to avoid placing the thermometer into fecal material, which may elevate the temperature reading falsely.

The rectal route is contraindicated in clients with diarrhea, those who have undergone rectal surgery, those with rectal diseases, and those with cancer who are neutropenic. In selected clients (e.g., quadriplegics), rectal temperature measurements may cause vagal stimulation, which can result in bradycardia and syncope.

**EAR.** Since the development of the tympanic membrane thermometer, the ear has been added to the list of sites where temperature can be measured easily and safely. Measuring temperature at this site has many advantages. The tympanic membrane receives its blood supply from the same vasculature that supplies the hypothalamus; thus, tympanic temperature readings reflect core body temperature. Cerumen in the ear canal, crying, or otitis media will not alter temperature readings significantly (Jevon & Jevon, 2001). Smoking, drinking, and eating, which slightly alter oral temperature measurement, do not affect tympanic temperature measurement. The ear is readily accessible and permits rapid temperature readings in very young, confused, or unconscious clients. Because the ear canal harbors fewer pathogens than the oral or rectal cavities, infection control is a minor concern with the tympanic site.

There is some concern that this site may be less accurate than rectal or oral temperature readings. Poor measurement technique is often responsible for errors in measurement, usually false low readings (Mackechnie & Simpson, 2006). To obtain an accurate reading, hold the pinna and gently pull the ear slightly upward and backward to straighten the ear canal (pull pinna down and straight back for a child under 3 years old), fit the probe snugly in the client’s ear canal, and angle it toward the jaw line (Pullen, 2003).

**TEMPORAL ARTERY (FOREHEAD).** Recently developed devices allow fast, safe measurement of temperature at the site of the temporal artery. The limited research available using these devices indicates they may be more accurate than tympanic thermometers, and comparable to oral thermometers in accuracy. They are easy to use and well tolerated by infants and young children. Measurements do not appear to be affected by perspiration and are consistent when taken on either the right or left side of the forehead (Roy, Powell, & Gerson, 2003).

**AXILLARY.** The axillary route is considered the least accurate and least reliable site because several factors can influence the measurement obtained. For example, if the client has bathed recently, the reading may reflect the temperature of the water used. Friction used to dry the skin may influence the temperature. The axillary route is recommended for infants and children and is the route of choice in clients who cannot tolerate measurement by other routes.

**Equipment**

Equipment used for temperature measurement includes electronic thermometers, tympanic membrane thermometers, temporal artery thermometers, disposable paper thermometers, and temperature-sensitive strips. Once used commonly, glass mercury thermometers are no longer being used due to the dangers of exposure to mercury.

**Electronic Thermometers.** Healthcare facilities use the electronic thermometer extensively. Many types are on the market, but all have similar characteristics. The thermometer consists of a battery-powered display unit and a temperature-sensitive probe connected to the display unit by a thin cord (Fig. 26-1). A disposable plastic sheath covers the probe to prevent the transmission of infection. Electronic thermometers provide readings in less than 60 seconds. When used orally, they are most accurate if placed in the sublingual pocket. The thermometer displays results based on the Celsius or Fahrenheit scale; some thermometers can display readings from both scales. The electronic thermometer is ideally suited for use with children because the sheath is unbreakable and the time necessary for accurate measurement is relatively short. A separate probe can be used for rectal temperature measurement.

**Tympanic Membrane Thermometer.** The tympanic membrane thermometer is a portable, hand-held device resembling an otoscope that recharges using a battery pack (Fig. 26-2). It records temperature through a sensor probe placed in the ear canal to detect infrared radiation from the eardrum. Some studies have revealed discrepancies between these readings and core body temperature (Craig, Lancaster, Taylor, Williamson, & Smyth, 2002; Farnell, Maxwell, Tan, Rhodes, & Philips, 2005), resulting in both false-positive and false-negative readings obtained using this device. These discrepancies can be minimized by using the same ear and device for measurement each time and
by ensuring that the user is well trained. Because discrepancies are usually small, the convenience, safety, and efficiency of tympanic temperature measurement outweigh its disadvantages.

The tympanic membrane thermometer is appropriate for infants older than 2 months or very young children who may have difficulty remaining still for extended periods. Because recordings are obtained within 2 seconds, the tympanic membrane thermometer often is preferred in emergency departments or other areas where assessments must be made quickly. Tympanic thermometers should not be used on people with ear drainage or scarred tympanic membranes (Jevon & Jevon, 2001).

**TEMPORAL ARTERY THERMOMETER.** The temporal artery thermometer is a hand-held device that scans the forehead and measures temperature over the temporal artery (Fig. 26-3). The temporal artery thermometer corrects for radiant heat loss from the forehead by measuring the ambient temperature at the same time the skin temperature over the temporal artery is measured. The thermometer then adjusts the temperature measurement to discount radiant heat loss. Measurement of temperature over the temporal artery does not require contact with mucous membranes, but the head must be uncovered since bandages or clothing will trap heat. Also moisture on the skin can affect the accuracy of measurement (Larson et al., 2007).

**DISPOSABLE PAPER (CHEMICAL) THERMOMETERS.** Single-use paper thermometers (Fig. 26-4) are thin strips of chemically treated paper with raised dots that change color to reflect the temperature. Disposable thermometers are very convenient when infection control is a concern because they are discarded following...
a single use. These thermometers are available with readings in Celsius or Fahrenheit and are reported to be accurate (Molton, Blacktop, & Hall, 2001). For oral temperature measurement, they are placed deeply in the sublingual pocket and left in place for 60 seconds. When used for axillary temperatures, the strips are placed vertically against the trunk of the body and held in place by the upper arm for 3 full minutes.

**Temperature-Sensitive Strips.** Temperature-sensitive strips can be used to obtain a general indication of body surface temperature. They are usually placed on the forehead or abdomen; the skin under the strip must be dry. After a specified length of time, the strip changes color. On one brand, a green “N” indicates a normal temperature, a brown “N” indicates a transition phase, and a blue-green “F” indicates an elevated temperature. The transition phase reflects the onset of a high temperature in the area where the strip was placed. The strip is removed and discarded after the color change has been noted. This method is particularly useful in the home. Because children younger than 2 years still have immature thermoregulatory systems, any variation from normal should be confirmed.

**Glass Mercury Thermometer.** Although some homes still have glass thermometers, healthcare environments no longer use these devices because of the risks of mercury exposure to people and the environment should the thermometer break. Mercury exposure can cause respiratory irritation, gastrointestinal irritation, and renal damage. Prolonged exposure causes neurological impairment. Instruct clients regarding the risk mercury exposure poses and the hazard of cleaning up mercury should the thermometer break. Instruct them to purchase new safe equipment. Mercury thermometers are no longer sold in retail stores.

**Scales**

Temperature can be measured on the Celsius or Fahrenheit scale (Fig. 26-5). The scale used varies among agencies. Nurses do not routinely have to convert from one scale to the other; however, if conversion is necessary, use the simple formulas provided in Figure 26-5.

**Methods**

Nurses often delegate temperature taking to unlicensed assistive personnel. Nurses use critical thinking to interpret temperature measurements, document the results, and report abnormal values. Whenever possible, measure and record temperature measurements at the same site, using the same device, so that fluctuations may be interpreted accurately. See Procedure 26-1 for specific details on how to obtain a temperature measurement using different routes and equipment.

**Pulse**

Contraction of the ventricles of the heart ejects blood into the arteries. The force of the blood entering the aorta from the left ventricle causes stretching or distention of the elastic aortic wall.
As the aorta first expands and then contracts, a pulse wave is created that travels along the blood vessels. The pulse wave or pulsation can be felt as a throb or tap where the arteries lie close to the skin surface.

**Characteristics**

Characteristics of the pulse include rate or frequency, rhythm, and quality. Rate or frequency refers to the number of pulsations per minute. Rhythm refers to the regularity with which pulsation occurs. Quality refers to the strength of the palpated pulsation.

Specialized cells that make up the heart’s conduction system establish the rate and rhythm of the pulse. An electrical impulse in the sinoatrial (SA) node of the right atrium initially stimulates contraction of the ventricles. In adults, the SA node initiates the impulse 60 to 100 times per minute. The electrical impulse then spreads quickly through the conduction system to the remainder of the heart so that the heart muscle contracts in a synchronous fashion. Irregularities of heart rhythm usually indicate a failure in the conduction system or the generation of an impulse from a site other than the SA node.

Several factors determine the quality of the arterial pulse, including the force with which blood is ejected from the ventricles, the amount of blood ejected with each heartbeat (stroke volume), and the compliance or elasticity of the arteries.

**Factors Affecting Pulse Rate**

Understanding the factors that affect pulse rate helps with accurate assessment of the significance of pulse rate variations.

**Age**

The average pulse rate of an infant ranges from 100 to 160 beats per minute. The heart rhythm in infants and children often varies markedly with respiration, increasing during inspiration and decreasing with expiration. The normal range of the pulse in an adult is 60 to 100 beats per minute. Table 26-1 shows the normal pulse ranges for various age groups.

**Autonomic Nervous System**

Stimulation of the parasympathetic nervous system (dominant activation during resting states) results in a decrease in the pulse rate. Normally, parasympathetic nervous system input slows the pulse rate below 100 beats per minute. Conversely, stimulation of the sympathetic nervous system results in an increased pulse rate. Sympathetic nervous system activation occurs in response to a variety of stimuli, including pain, anxiety, exercise, fever, ingestion of caffeinated beverages, and changes in intravascular volume.

**Medications**

Certain cardiac medications, such as digoxin, decrease pulse rate. Medications that decrease intravascular volume, such as diuretics, may cause a reflex increase in pulse rate. Other medications mimic or block the effects of the autonomic nervous system. For example, atropine inhibits parasympathetic input, causing an increased pulse rate. Other medications, such as propranolol, block sympathetic nervous system action, resulting in a decreased heart rate.

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**Assessing the Pulse**

Baseline pulse rate and rhythm are established during the initial nursing assessment and are used for comparison with future measurements.

**Sites**

The pulse can be assessed in any location where an artery lies close to the skin surface and can be compressed against a firm underlying structure such as muscle or bone. The most commonly assessed pulses are the temporal, carotid, apical, brachial, radial, femoral, popliteal, pedal, and posterior tibial (Fig. 26-6).

**Temporal.** The temporal artery courses across the temporal bone of the skull. The pulsation of the temporal artery is most easily palpated just in front of the upper part of the ear.

**Carotid.** The sternomastoid muscles, which stand out when the jaw is clenched forcefully, run from below the ear to the clavicle and sternum. Beneath the sternomastoid muscles lie the...
carotid arteries. The carotid artery is most easily palpated at the lower half of the neck, along the medial border of the sternomastoid muscle. Palpating the carotid artery in the upper part of the neck may result in stimulation of the carotid sinus, which causes a reflex drop in pulse rate. The carotid pulse best represents the quality of pulsation in the aorta because of its proximity to the central circulation.

**SAFETY ALERT**
Always palpate the carotid artery in the lower half of the neck to avoid stimulating the carotid sinus. Never palpate bilateral carotid pulses simultaneously because this can seriously impair cerebral blood flow.

**Apical.** The contraction or beating of the heart ventricles also can be palpated with the hand or auscultated with a stethoscope placed over the area of the left ventricle. Normally, this area is at the level of the fifth intercostal space at about the midclavicular line.

**Brachial.** The brachial artery lies between the groove of the biceps and triceps muscles in the inner aspect of the upper arm. The brachial pulse is palpated most easily with the client’s arm extended at the elbow and supported by the examiner to prevent muscle contraction, which may obscure the pulse.

**Radial.** The radial artery is the site most commonly assessed in the clinical setting. The radial pulse is palpated on the thumb side of the inner aspect of the wrist.

**Femoral.** The femoral pulse is palpated in the anterior, medial aspect of the thigh, just below the inguinal ligament, about halfway between the anterior superior iliac spine and the symphysis pubis. Deep palpation may be required to detect the femoral pulse beneath the subcutaneous tissue.

**Popliteal.** The popliteal pulse is palpable behind the knee in the lateral aspect of the popliteal fossa (the hollow area at the back of the knee joint). The pulse is best assessed with the knee flexed and the leg relaxed. The client may be supine or prone.

**Pedal.** The pedal pulse or dorsalis pedis pulse can be felt on the dorsal aspect of the foot (the area of the foot that is on top in a standing position). The pulse is palpated lateral to the tendon that runs from the great toe toward the ankle. The dorsalis pedis pulse may be congenitally absent in some clients.

**Posterior Tibial.** The posterior tibial pulse is located behind the malleolus (the rounded protuberance of bone) of the inner ankle. The pulse is palpated by curving the fingertips over the bone.

**Equipment**
A stethoscope and a Doppler ultrasound device may be used to measure pulse rate.

**Stethoscope.** Auscultation of the apical pulse requires a stethoscope. The stethoscope should have snugly fitting ear pieces and thick-walled tubing about 12 inches (30 cm) long for optimal sound transmission. The stethoscope should be equipped with a bell and a diaphragm.

**Doppler.** Peripheral pulses that cannot be detected by palpation may be assessed with an ultrasonic Doppler device. A conductive gel is first applied to the skin to reduce resistance to sound transmission. The transmitter of the device is then placed over the artery to be assessed (Fig. 26-7). High-frequency waves directed at the artery from the transmitter are disturbed by the pulsating flow of blood and are reflected back to the ultrasound device. The sound disturbances (Doppler shifts) are amplified and heard through ear pieces or a speaker attached to the device.

A Doppler assessment of the pulse is generally used to determine the adequacy of blood flow to an area for which occlusive vascular disease threatens the blood supply or for postoperative assessment where peripheral circulation can be occluded. The Doppler also may be useful when obesity or edema obscures the pulse, or in situations of cardiopulmonary collapse where peripheral vasoconstriction makes pulses difficult to palpate.

**Methods**
Palpation and auscultation are methods used to assess pulse rate.

**Palpation.** The pulse is palpated using the first and second or second and third fingers of one hand. Use light pressure initially to locate the area of strongest pulsation. More forceful palpation may be applied to count the rate, determine the rhythm, and assess the quality of pulsation. Count the number of pulses for 30 or 60 seconds and multiply as necessary to yield pulses per minute. The time interval used to assess the pulse depends on the client’s condition and the agency’s norms. Clients with irregular or abnormally slow or fast pulse rates are best assessed for 1 full minute. Clients with regular rhythms and normal rates may be assessed for a shorter time. Intervals of 15 seconds may be used for clients with regular rhythms when reassessing the pulse frequently, as during recovery from anesthesia.

Regardless of the time interval selected, count the initial pulsation as zero. Do not count pulses at or after completion of the time interval. Counting the first pulse as one or counting pulses after the period of assessment results in overestimation of the pulse. The error is multiplied when intervals of less than 60 seconds are used to assess the rate. Counting even one extra pulsation in a 15-second pulse assessment results in overestimation of the pulse rate by four. Procedure 26-2 provides detailed instructions on taking a pulse.

**Auscultation.** Auscultation of the apical pulse provides the most accurate assessment of the pulse rate and is the preferred
site when the peripheral pulses are difficult to assess or the pulse rhythm is irregular. Assess the apical pulse by placing the diaphragm of the stethoscope over the apex of the heart, which is located at the fifth intercostal space at the midclavicular line. The sounds heard are due to vibrations caused by the opening and closing of the cardiac valves. Each heartbeat consists of two sounds. The first, $S_1$, is caused by closure of the mitral and tricuspid valves that separate the atria from the ventricles. The second sound, $S_2$, is caused by the closure of the pulmonic and aortic valves. The sounds are often described as a muffled “lub-dub.” Together, they constitute one heartbeat. To determine the apical pulse, count the heartbeats for 1 full minute.

Assess the pulse for rate, rhythm, and quality. Pulse rate and rhythm are routinely assessed; pulse quality is assessed less often or in exceptional circumstances when abnormalities may be anticipated. Any pulse out of the range of normal (rate or rhythm) is considered dysrhythmic.

**Rate.** In adults, the normal rate is 60 to 100 pulsations per minute. Adult pulse rates above 100 beats per minute are called tachycardia. Sympathetic nervous system activation may result in tachycardic rates. Tachycardic rates also may occur when the impulse for cardiac contraction comes from an abnormal site in the heart that stimulates the heart to beat faster.

An abnormally slow pulse rate is called bradycardia. In adults, a pulse rate below 60 beats per minute is considered bradycardic. Bradycardia may be the normal resting heart rate in a trained athlete. Disease of the SA node may result in bradycardia because of poor impulse formation. In addition, enhanced parasympathetic nervous system activity (e.g., stimulation of the carotid sinus) may cause bradycardia.

**Rhythm.** Normally, cardiac contractions occur at evenly spaced intervals, resulting in a regular rhythm. Infants and children often have increased pulse rates during inspiration and decreased rates during expiration.

Heart disease, medications, or electrolyte imbalances may alter the heart’s normal rhythmic beating, causing an irregular pulse. An irregular pulse rhythm that still displays a consistent pattern is called regularly irregular. An example is pulsus bigemini, in which a normal heartbeat initiated in the SA node is followed by a heartbeat initiated in a different part of the heart. The second beat is early and often weaker than the first, resulting in a regularly irregular pulse.

If the pulse has no pattern, it is called irregularly irregular. Irregularly irregular pulses may be a component of many conditions, including atrial fibrillation. In atrial fibrillation, the atria do not contract in a synchronous fashion, and the primary impulse for the heartbeat does not come from the SA node. Consequently, the time interval between successive ventricular contractions varies, and an irregularly irregular pulse is detected.

When you note an abnormal pulse rhythm, consider using the auscultatory method to obtain an apical pulse rate. Also, determine if irregularity of the pulse is a new finding for the client.

**Assessing Pulse Characteristics**

**Quality.** Pulse quality generally refers to the strength of pulsation and may be rated on a numeric scale (Table 26-3). Since there are multiple scales for grading pulses, it is best to describe what you feel. The normal quality of the pulse is described as full or strong and can be palpated easily. Weak pulses are obliterated easily by the examiner’s fingers and may be described as thready. A bounding pulse is stronger than normal and difficult to obliterate. Pulse quality reflects the stroke volume, the compliance or elasticity of the arteries, and the adequacy of blood delivery. When stroke volume is decreased, as in severe hemorrhage, the pulse is often thready and may be difficult to palpate in the peripheral arteries. The pulse is usually palpated more easily in the central areas, such as the carotid or femoral arteries. With aging, the arteries lose elasticity, and the pulse becomes bounding. The combination of rapid pulse rate and increased stroke volume with exercise results in a pulse that the client can feel and is sometimes called a pounding heart.

Palpate peripheral pulses bilaterally (except for carotids) to compare quality. Equality of pulsation provides information about local blood flow. For example, partial occlusion of a right femoral artery would result in weaker femoral, popliteal, pedal, and posterior tibial pulses on the right compared to the left. Bilateral pulse comparison is used to monitor for complications after procedures that are invasive to the arteries, such as arteriography. After an arteriogram, during which a large artery is punctured and injected with radiographic dye, the normal clotting to seal the artery may cause total arterial occlusion. Weakened or absent pulses distal to the puncture site would signal an occlusion.

**Pulse Deficits.** In some situations, stroke volume may vary from beat to beat during cardiac contraction, resulting in a pulse wave so weak that it cannot be perceived by palpation at a peripheral site. It is important to recognize this situation because it provides information about the heart’s ability to perfuse the body adequately. When some of the ventricular contractions do not perfuse, a difference exists between the apical and peripheral pulses—a pulse deficit. When a pulse deficit is present, the radial pulse rate is always lower than the apical pulse rate. Document and report to the physician any new finding of a pulse deficit so that evaluation and follow-up can occur.

<table>
<thead>
<tr>
<th>TABLE 26-3</th>
<th>SCALE TO RATE PULSE QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No pulse detected</td>
</tr>
<tr>
<td>1+</td>
<td>Thready, weak pulse; easily obliterated with pressure; pulse may come and go</td>
</tr>
<tr>
<td>2+</td>
<td>Pulse difficult to palpate; may be obliterated with pressure</td>
</tr>
<tr>
<td>3+</td>
<td>Normal pulse</td>
</tr>
<tr>
<td>4+</td>
<td>Bounding, hyperactive pulse; easily palpated and cannot be obliterated</td>
</tr>
</tbody>
</table>
Respiration is a term used to summarize two different but related processes: external respiration and internal respiration. External respiration is the process of taking oxygen into and eliminating carbon dioxide from the body. Internal respiration refers to the use of oxygen, the production of carbon dioxide, and the exchange of these gases between the cells and the blood.

The process of inspiration is active. Inspiratory muscles contract, resulting in increased intrathoracic volume as the lungs expand. The pressure in the airway becomes negative and air flows inward. At the end of inspiration, natural lung recoil occurs, the airway pressure becomes slightly positive, and the air flows out as the muscles relax. Expiration is basically a passive process.

Normal breathing is automatic and involuntary. At rest, the normal adult respiratory rate is 12 to 20 breaths per minute. Normal tidal volume (the amount of air moving in and out with each breath) is 500 mL or 6 to 8 L/min (Martini, 2006). In people with healthy respiratory systems, the normal stimulus to breathe is hypercarbia, an increased carbon dioxide level. Chemoreceptors throughout the body sense changes in carbon dioxide levels and stimulate the respiratory center, which increases or decreases respiratory rate and depth accordingly. Chapter 35 provides an in-depth explanation of respiratory control.

### Factors Affecting Respirations

Several factors can affect respiratory rate, rhythm, and depth. Familiarity with these factors allows the nurse to determine the significance of alterations.

#### Age

Normal growth from infancy to adulthood results in an increased lung capacity. As lung capacity increases, lower respiratory rates are sufficient to exchange air. As the adult ages, lung elasticity decreases. With this decrease in elasticity, respiratory rate increases to allow for adequate air exchange.

#### Medications

Narcotics decrease respiratory rate and depth. Sympathomimetic drugs (e.g., albuterol) can be used to dilate bronchioles, increasing the person’s ability to move air into and out of the lungs.

#### Stress

Stress or strong emotions can change a person’s respiratory pattern because such conditions stimulate the sympathetic nervous system. Stressors, including pain, anxiety, infection, and fever, increase the rate and depth of respirations.

#### Exercise

When people exercise, their tissues consume and process more oxygen. Also, exercise produces extra carbon dioxide and heat that the body must eliminate. The body responds to these needs by increasing the rate and depth of respirations.

#### Altitude

The oxygen content of the air decreases as the altitude increases. To compensate for the decreased oxygen content, the rate and depth of respirations at higher elevations increase to improve the oxygen supply available to the body tissues.

#### Gender

Because men normally have a larger lung capacity than do women, men may have a lower respiratory rate.

### Assessing Respirations

Assess respirations during every vital sign evaluation. Establish a set of normal baseline measurements of rate, rhythm, depth, and quality for each client so comparisons can be made.

The respiratory assessment can provide valuable information and insight into a client’s condition. When assessing a client’s respiratory status, keep in mind the client’s normal pattern, the influence of any disease conditions, and the influence of any therapies that could affect the client’s respiratory status.

#### Rate

Respiratory rate changes with age. At rest, the normal respiratory rate for an infant is 30 to 60 breaths per minute, decreasing to 12 to 20 breaths per minute for an adult. Tachypnea is an abnormally fast respiratory rate (usually above 20 breaths per minute in the adult). Bradypnea is an abnormally slow respiratory rate (usually less than 12 breaths per minute in the adult). Apnea, the absence of respirations, is often described by the length of time in which no respirations occur (e.g., a 10-second period of apnea). Continuous apneas are synonymous with respiratory arrest and is not compatible with life.

#### Rhythm and Depth

Eupnea refers to normal respiratory rhythm and depth. Regularity refers to the pattern of inspiration and expiration. Inspiration is usually twice as long as inspiration. Assess depth by observing the movement of the chest wall. Also note the use of accessory muscles. Table 26-4 describes abnormal patterns, such as Biot’s respirations, Cheyne-Stokes respirations, Kussmaul respirations, and apneustic respirations.

#### Quality

Respirations are usually automatic, quiet, and effortless. When assessing respirations, be attentive to changes from the normal quality. Abnormalities in quality are usually characterized by effort or noise.

Dyspnée describes respirations that require excessive effort. Respirations can be painful and labored. Clients may report being unable to catch their breath. Dyspnée can occur at rest or with activity; dyspnée that occurs with activity is called exertional dyspnée. Healthy people who are not in good physical condition may experience exertional dyspnée.

Breathing also can be noisy. A number of terms are used to describe the different types of noisy respirations that can be heard without a stethoscope. Stridor is a harsh inspiratory sound that may be compared to crowing. It may indicate an upper airway obstruction. It is commonly heard in children with croup or after aspiration of a foreign object. Wheezing is a high-pitched musical sound. It is usually heard on expiration but may be heard on inspiration. It is associated with partial obstruction of the
ular contraction (cardiac systole) is the systolic blood pressure. During ventricular relaxation (cardiac diastole), blood pressure is due to elastic recoil of the vessels, and the measured pressure is the diastolic blood pressure. The mathematical difference between the measured systolic and diastolic blood pressures is the pulse pressure. For instance, a systolic pressure of 120 mm Hg and a diastolic pressure of 80 mm Hg result in a pulse pressure of 40 mm Hg.

Blood pressure is a function of the flow of blood produced by contraction of the heart and the resistance to blood flow through the vessels. The pressure, flow, and resistance relationship is described mathematically as pressure equals flow multiplied by resistance (\( P = F \times R \)).

**Methods**
Perform the respiratory assessment without clients being aware that you are doing so. If clients are conscious of the procedure, they may alter their breathing patterns or rate. Assess the respiratory rate after or before taking the radial pulse, while holding the client’s wrist. If respirations are very shallow and difficult to visually detect, count them while observing the sternal notch, where respiration is more apparent. If the client is sleeping, rest a hand gently on the client’s chest to detect its rise and fall. With an infant or young child, assess respirations before taking the temperature so the child is not crying, which alters the respiratory status. See Procedure 26-3 for details on assessing respirations.

**BLOOD PRESSURE**

**Blood pressure** is the force that blood exerts against the walls of the blood vessels. The pressure in the systemic arteries is most commonly measured in the clinical setting. Blood pressure is stated in millimeters of mercury (mm Hg).

**Physiologic Factors Determining Blood Pressure**
The contractions of the heart result in a pulsating flow of blood into the arteries. The pressure is highest when the ventricles of the heart contract and eject blood into the aorta and pulmonary arteries. The blood pressure measured during ventricular contraction (cardiac systole) is the systolic blood pressure. During ventricular relaxation (cardiac diastole), blood pressure is due to elastic recoil of the vessels, and the measured pressure is the diastolic blood pressure. The mathematical difference between the measured systolic and diastolic blood pressures is the pulse pressure. For instance, a systolic pressure of 120 mm Hg and a diastolic pressure of 80 mm Hg result in a pulse pressure of 40 mm Hg.

Blood pressure is a function of the flow of blood produced by contraction of the heart and the resistance to blood flow through the vessels. The pressure, flow, and resistance relationship is described mathematically as pressure equals flow multiplied by resistance (\( P = F \times R \)).

**Blood Flow**
Blood flow is essentially equal to cardiac output. Cardiac output is the product of stroke volume (the amount of blood each ventricle pumps with each heartbeat) and heart rate. A stroke volume of 70 mL and a heart rate of 72 beats per minute result in a cardiac output of 5040 mL/min, or about 5 L/min. Average cardiac output in a resting man is 5.5 L/min.

Poor cardiac pumping (as occurs with a failing heart) or reduced blood volume (as in severe hemorrhage) may reduce stroke volume, which in turn decreases cardiac output. Bradycardia also may cause decreased cardiac output. Conversely, a rapid heart rate and larger stroke volumes would be expected to increase cardiac output.

The magnitude of output change created by increases or decreases in one factor (either heart rate or stroke volume) is influenced by the other factor’s concurrent response. An increase in heart rate in response to a decrease in stroke volume to maintain a normal cardiac output is an example of a compensatory response.
Resistance
Friction among the cells and other blood components and between the blood and the vessel walls causes blood flow resistance. The friction within the blood components reflects the blood’s viscosity and is largely due to the number and shape of the blood cells. Normally, the number and type of blood constituents do not vary greatly, and viscosity is a constant factor.

Friction between the blood and the vessel walls varies with the dimensions of the vessel lumen. Contraction and relaxation of the smooth muscle in the vessel walls control the diameter of the blood vessel. The autonomic nervous system regulates this vascular tone. Constricted vessels offer greater resistance, thus increasing blood pressure; dilated vessels offer less resistance, thus decreasing blood pressure.

Factors Affecting Blood Pressure
Major factors affecting blood pressure include age, autonomic nervous system, circulating volume, medications, and normal fluctuations.

Age
Blood pressure gradually increases throughout childhood and correlates with height, weight, and age. These normal changes make it difficult to identify abnormal blood pressure levels for children at various developmental stages. The National Institutes of Health (NIH) states that children and adolescents with blood pressure levels of 120/80 mm Hg or above, but less than the 95th percentile, are considered to have prehypertension. Blood pressure consistently above the 95th percentile for age indicates a need for diagnostic evaluation (NIH, 2005).

In adults, systolic and diastolic blood pressure increase gradually as age advances. In part, this trend is due to increased systemic vascular resistance, reflecting arterial narrowing and decreased vessel elasticity due to atherosclerotic vessel disease. The increase in systolic blood pressure is proportionally greater than the increase in diastolic blood pressure; therefore, pulse pressure widens. Table 26-1 shows normal blood pressures for various age groups.

Autonomic Nervous System
The autonomic nervous system influences heart rate, cardiac contractility, systemic vascular resistance, and blood volume. Increased sympathetic nervous system activity results in increased heart rate, stronger contraction of heart muscle, changes in vascular smooth muscle tone, and increased blood volume due to retention of water and sodium. The cumulative effect is increased blood pressure. Therefore, factors that enhance sympathetic nervous system activity (such as pain, anxiety, fear, smoking, and exercise) result in elevated blood pressure readings.

Exceptions occur when sympathetic nervous activity cannot keep up with a stressor. An example is a client with severely diminished blood volume resulting from hemorrhage. The sympathetic nervous system is activated to maintain adequate blood pressure, but it may not be enough to compensate for the volume loss. Measured blood pressure may be quite low, although sympathetic nervous system activity is increased markedly.

Circulating Volume
A decrease in circulating volume, either from blood or fluid loss, results in lower blood pressure. Fluid volume deficit can occur with abnormal, unreplaced losses such as diarrhea or diaphoresis. Insufficient oral intake also can cause fluid volume deficit. Excess fluid, such as in congestive heart failure or renal failure, can cause elevated blood pressure readings.

Medications
Any medication that alters one or more of the previously described determining factors may cause a change in blood pressure. Examples are diuretics, which decrease blood volume; cardiac medications, which affect the heart’s rate or contractile force; narcotic analgesics, which reduce pain and sympathetic nervous system activity; and specific antihypertensive agents.

Normal Fluctuations
Blood pressure fluctuates from minute to minute in response to a variety of stimuli. Increased ambient temperature causes blood vessels near the skin surface to dilate, decreasing resistance and blood pressure. Blood pressure also fluctuates with the respiratory cycle, increasing during expiration and decreasing during inspiration.

In addition to these fluctuations, there is a discernible circadian pattern to blood pressure. Investigators have documented a consistent variation in blood pressure throughout the day.

Assessing Blood Pressure
Blood pressure may be measured directly with a catheter placed into an artery. Direct measurement provides a continuous reading of blood pressure and is used in critical care settings. However, blood pressure is usually measured by indirect methods, using an inflatable cuff to temporarily occlude arterial blood flow through one of the limbs. As the cuff is deflated and flow returns, the blood pressure is determined by palpation, auscultation, or oscillations. Table 26-5 summarizes potential sources of error in blood pressure measurement. Procedure 26-4 provides detailed instructions for measuring blood pressure.

Sites
Blood pressure can be measured in either the upper or lower extremity.

Upper Extremity. The blood pressure usually is measured in the arm. Wrap a cuff around the upper part of the limb and auscultate or palpate blood flow at the brachial artery. Blood pressure also may be determined by auscultation or palpation of the radial artery in the wrist with an appropriately sized cuff applied to the forearm. Blood pressure readings will differ when measured in the upper and lower arm, so it is important to note the site of blood pressure measurement (Schell et al., 2006). Avoid measuring blood pressure in any arm with a venous access device, especially an internal arteriovenous fistula, peripheral vascular access for hemodialysis, or a peripherally inserted central catheter (PICC) line. Also, if the client has had a mastectomy, blood pres-
sure monitoring on the same side can further impede circulation, contributing to lymphedema.

**LOWER EXTREMITY.** The blood pressure would be measured in the lower extremity if the client had arteries in the upper extremity that could not be palpated, if the upper extremity was covered by dressings or splints, if the client had a PICC line, or if the client had a mastectomy. Wrap the cuff around the thigh or above the ankle.

Thigh pressure measurement requires a larger, appropriately sized cuff. Place the client in a flat, supine position with the cuff centered midthigh over the popliteal artery. Auscultate or palpate blood flow at the popliteal fossa. When an appropriately sized cuff is used, blood pressure measurements should vary only slightly from readings measured in the upper extremity (unless the client has peripheral vascular disease) (Woods, SivarajanFroelicher, & Motzer, 2004). Using a cuff that is too small will result in falsely high readings.

To measure blood pressure in the ankle, place the client in a flat, supine position, and place a standard arm cuff just above the malleolus. Auscultate or palpate the posterior tibialis or dorsalis pedis pulse as you deflate the cuff.

For accurate data interpretation, note the site of blood pressure measurement.

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**TABLE 26-5**

<table>
<thead>
<tr>
<th>Error</th>
<th>Cause</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falsely low readings</td>
<td>Environmental noise</td>
<td>Turn down TV or radio; stop talking; avoid moving stethoscope or tubing. Use hearing-amplified stethoscope or hearing aid. Angle ear pieces forward to fit snugly into ear canal. Shorten tubing to 30–38 cm (12–15 in). Place meniscus at eye level. Palpate systolic pressure to avoid missing auscultatory gap. Measure arm circumference; bladder should be 80% to 100% of arm circumference. Reposition arm at level of heart, generally fourth intercostal space. Practice slow release of 2 mm Hg per second. Consistently try to record BP at end expiration.</td>
</tr>
<tr>
<td>Falsely high readings</td>
<td>Measuring BP when a client has just eaten, is in pain, is anxious, or has a full bladder Cold hands or stethoscope Viewing meniscus from below eye level Cuff too narrow Wrapping cuff unevenly or loosely Deflating cuff too slowly Venous congestion Unsupported arm Back unsupported, legs dangling Arm below heart level</td>
<td>Try to assess BP during basal state, or adjust interpretation accordingly. Warm hands and stethoscope before measuring BP. View meniscus from eye level. Measure arm circumference; bladder should be 80% to 100% of arm circumference. Rewrap cuff snugly. Practice steady deflation of cuff at 2 mm Hg per second. Wait 2 min before reinflating cuff to retrace BP; elevate arm to promote redistribution of blood. Support arm on table to prevent muscle contraction. Provide support for legs and back. Reposition arm at heart level, usually at the 4th intercostal space.</td>
</tr>
<tr>
<td>Inaccurate readings</td>
<td>Meniscus or needle not at zero Faulty valves or leaky tubing Examiner digit preference Forgetting measurement</td>
<td>Recalibrate or service equipment. Replace equipment. Do not round up or down. Record immediately in the room.</td>
</tr>
</tbody>
</table>

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**Equipment**

There are several different pieces of equipment that can be used to measure blood pressure: the sphygmomanometer, stethoscope, Doppler ultrasound, and electronic devices.

**SPHYGMOMANOMETER.** A sphygmomanometer consists of an inflatable bladder enclosed in a nondistensible cuff. The bladder is connected to an inflating mechanism such as a bulb or pump, a valve for deflation, and a manometer (Fig. 26-8). The manometer may be an aneroid or gravity-mercury type. The gravity-mercury type has always been standard, but it is now being phased out in many healthcare settings because of environmental concerns.

Aneroid manometers have a circular gauge marked in 2-mm increments. The pressure transmitted from the cuff causes movement of a metal bellows within the manometer, a movement indicated by a needle on the gauge. Aneroid manometers require yearly calibration with a properly functioning mercury manometer or other pressure standard. These routine checks of manometer function should be made throughout the range of pressure measurement to ensure the device’s accuracy. Aneroid manometers with a stop peg at the zero point or an external reset are not recommended because verifying the accuracy of the manometer is impossible.
Scenes for Thought

Mr. Richards is sitting up in bed with an IV in his left arm and ECG leads attached to his chest. Being careful to use his right arm, the nurse prepares to take his blood pressure.

Less Effective

Nurse: Hi, Mr. Richards. I’m here to take your blood pressure.
Mr. R.: Again? They just took it 20 minutes ago. (Looks irritated.)
Nurse: Sure, we have to do that on heart patients. Just let me get this cuff on, and I’ll be out of your way in a minute, okay?
Mr. R.: I guess so. Everyone else does. (Continues to look annoyed.)
Nurse: There, all done. I’ll be back to change your bed and get you up in the chair in a little bit.
Mr. R.: ‘Bye. (Sinks back onto the pillows.)

More Effective

Nurse: Hi, Mr. Richards. I’m Cheryl Bianco, and I’ll be taking care of you today. How’s it going?
Mr. R.: Okay, I guess. Are you going to take my blood pressure again? (Looks irritated.)
Nurse: Yes, I am. You look irritated about that. Are you? (Exploring her observation.)
Mr. R.: Well, yes. I mean, I’m not annoyed at you, but ever since I had the heart attack, people have been taking my pressure every 10 minutes, it seems, and I don’t like it. (Stopping to breathe.)
Nurse: It feels like the staff is focusing on your pressure. (Restating.)
Mr. R.: Are they worried? Am I going to have another heart attack? Should I be worried? I’m confused. (Looking upset.)
Nurse: It sounds like you’re looking for some information. Let’s talk about it. (Opportunity to provide information and allay his fears.)

Critical Thinking Challenge

• Analyze the significance of his blood pressure as Mr. Richards sees it.
• Detect his feelings regarding the blood pressure readings.
• Infer what his thinking might do to all of his vital signs if he is upset about frequent blood pressure readings.

Mercury manometers consist of a vertical glass tube marked in 2-mm increments. Cuff pressures are transmitted through the tubing into the manometer and force the mercury to rise in the glass tube. The surface tension of the mercury in the tube causes the top of the mercury column to be curved. The pressure reading is made from the top point of the curved surface (the meniscus) of the mercury. The manometer must be at eye level to ensure an accurate reading. Particulate matter or air bubbles in the glass tube distort readings. Enough mercury must be present in the reservoir to maintain the meniscus at zero with the cuff deflated. The air vent at the top of the glass tube must be clean and allow free passage of air, or the mercury will be unable to rise and fall smoothly in the tube.

The tubing and hand bulb in all sphygmomanometers must be free of cracks or holes, and connections must be airtight to prevent leaks that cause poor transmission of pressure and consequently inaccurate readings. To allow the operator to control the rate of deflation, the deflation valve must function smoothly.

Stethoscope. A stethoscope is necessary for the auscultatory method of blood pressure measurement. The stethoscope should have snugly fitting ear pieces and thick-walled tubing about 12 in (30 cm) long for optimal sound transmission. The stethoscope should be equipped with a bell and a diaphragm.

Doppler. The Doppler method is useful during low-flow states or when the blood pressure is difficult to auscultate by stethoscope. A standard cuff is used to occlude an artery while the ultrasound transducer is placed over the artery distal to the site of occlusion. Systolic blood pressure is the point at which continuous pulsatile flow is heard. Diastolic blood pressure may be difficult to identify reliably with the Doppler but is considered the point at which continuous flow is heard.
**Electronic Devices.** Automated devices are used frequently to monitor blood pressure during anesthesia, in the critical care area, postoperatively, or in ambulatory settings when frequent assessments are necessary. The electronic units determine blood pressure by analyzing the sounds of blood flow or measuring oscillations. Although absolute values detected with automatic cuffs may vary slightly, the values are usually within 5 mm Hg of values obtained through direct arterial measurement (Widener, Yang, Costello, & Allen, 1999). Occasionally values can differ by as much as 37 mm Hg. Therefore, treatment should not be based on an isolated automated blood pressure reading (Widener et al., 1999). Very irregular heart rates or excessive movement from shivering, transporting the client, or the use of a rapid-cycling ventilator can interfere with blood pressure readings. Systolic, diastolic, and mean arterial blood pressure and heart rate are displayed on the monitor (Fig. 26-9). The machine can be set to record these values automatically at a preset interval (e.g., every 15 minutes). The data obtained are stored in the machine and can be retrieved easily as needed. Although electronic devices are appropriate for monitoring blood pressure, diagnosis of hypertension requires measurement of blood pressure using auscultation with a sphygmomanometer (Jones, Appel, Sheps, Roccella, & Lenfant, 2003).

**Methods**

Ideally, measure baseline blood pressure with the client in a resting state, after he or she has been sitting quietly for 5 minutes or more. The client should be in a warm, quiet environment, with back supported and feet flat on the floor if sitting. At least 30 minutes should elapse between smoking, exercising, or eating and the blood pressure reading. Sometimes blood pressure must be measured when the client is anxious or in pain, but these readings may differ from those made if the client were in a basal state.

**Proper Cuff Size.** The American Heart Association has made specific recommendations about cuff size and application (Table 26-6). Using an inappropriately sized cuff or incorrect cuff placement may lead to an erroneous reading. Base cuff size on the circumference of the limb that you are using. The width of the cuff bladder should be at least 40% of the circumference of the midpoint of the limb. An average adult arm requires a bladder with a 12- to 14-cm width. The bladder length should be 80% to 100% of the limb circumference, or approximately twice the bladder width.

**Ethical / Legal Issue**

You are working on a busy day surgery center. You delegate to a nursing assistant every-5-minute vital sign assessments for a postoperative client. The nursing assistant is using an automated monitor to obtain blood pressure and pulse readings every 5 minutes. The vital signs she records on the client’s record appear stable.

When the client has been back from the operating room about 30 minutes, you notice her hand (distal to the automated cuff) is purple. You quickly release the cuff, but color does not return to the client’s hand.

**Critical Thinking Challenge**

- If the client sustains permanent injury due to the malfunction of the automated monitoring system, who might be considered negligent (the hospital, nursing assistant, the RN, the doctor, the manufacturing company)?
- What factors make this client especially vulnerable?
- What could be done to prevent similar situations from occurring?

**Table 26-6**

**Acceptable Bladder Dimensions (in CM) for Arms of Different Sizes**

<table>
<thead>
<tr>
<th>Cuff</th>
<th>Bladder Width (cm)</th>
<th>Bladder Length (cm)</th>
<th>Arm Circumference Range at Midpoint (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>3</td>
<td>6</td>
<td>≤6</td>
</tr>
<tr>
<td>Infant</td>
<td>5</td>
<td>15</td>
<td>6–15†</td>
</tr>
<tr>
<td>Child</td>
<td>8</td>
<td>21</td>
<td>16–21†</td>
</tr>
<tr>
<td>Small adult</td>
<td>10</td>
<td>24</td>
<td>22–26</td>
</tr>
<tr>
<td>Adult</td>
<td>13</td>
<td>30</td>
<td>27–34</td>
</tr>
<tr>
<td>Large adult</td>
<td>16</td>
<td>38</td>
<td>35–44</td>
</tr>
<tr>
<td>Adult thigh</td>
<td>20</td>
<td>42</td>
<td>45–52</td>
</tr>
</tbody>
</table>

* There is some overlapping of the recommended range for arm circumferences in order to limit the number of cuffs; it is recommended that the larger cuff be used when available.

† To approximate the bladder width:arm circumference ratio of 0.40 more closely in infants and children, additional cuffs are available.

Apply the cuff snugly around the limb, and center the bladder over the artery. Using a cuff that is too small or loosely applied results in spuriously high readings. Using a cuff that is too large results in spuriously low readings (Fig. 26-10).

**Proper Positioning.** Measure blood pressure with the arm at heart level. Elevating the arm above heart level results in a falsely low measurement; positioning the arm below heart level results in a falsely high reading. When the client is flat, the arm is approximately at heart level. If the client is sitting or standing, support the forearm horizontally at the level of the heart (generally considered the level of the fourth intercostal space, where the ribs join the sternum). Failure to support the arm causes the client to contract the arm muscles, elevating the blood pressure.

**Correlation With the Respiratory Cycle.** The intrathoracic pressure changes that occur during a normal respiratory cycle affect the heart and great vessels. Consequently, blood pressure is lower during inspiration than expiration. Exaggerated decreases in systolic blood pressure with inspiration (called pulspus paradoxus or paradoxical blood pressure) occur in diseases such as cardiac tamponade, constrictive pericarditis, emphysema, hypovolemic shock, and pulmonary embolus. Consistently measuring blood pressure at the end of expiration eliminates the variability of readings caused by respiratory changes.

**Proper Inflation and Deflation.** An inflated cuff slows the return of venous blood from the extremity back to the heart. Increased venous pressures are transmitted back to the arterial side of the circuit, which leads to a corresponding rise in arterial pressures. Slow, prolonged, or frequent cuff inflation promotes venous congestion. Inflate the cuff rapidly when taking a reading and deflate it completely after measurement. At least 2 minutes should elapse before sequential cuff inflation on any one limb. Elevating the arm above the head between cuff measurements speeds venous return to the heart.

**Auscultation.** When determining the blood pressure by the auscultatory method, use an inflatable cuff to temporarily occlude blood flow through a limb. As you deflate the cuff and blood flow returns, the Korotkoff sounds can be heard with a stethoscope placed over the artery. Five distinct phases are identifiable, as shown in Table 26-7. The onset of phase I Korotkoff sounds is the recorded systolic pressure. Diastolic pressure is indicated by the onset of phase V sounds in adults and phase IV sounds in children.

Because the Korotkoff sounds are low in frequency, the bell of the stethoscope is best used for auscultation, although most practitioners use the diaphragm because of its larger shape and ease of placement. If the sounds are inaudible with the diaphragm, try the stethoscope bell. Do not press the head of the stethoscope too firmly against the skin because doing so may partially occlude blood flow and alter the reading.

An auscultatory gap is the absence of Korotkoff sounds between phases I and II. Failure to identify an auscultatory gap may result in underestimation of the systolic blood pressure or overestimation of the diastolic pressure. Find the auscultatory gap by palpating the brachial or radial pulse while inflating the cuff. Inflate the cuff about 30 mm Hg above the number where palpable pulsation disappears. In addition to detecting an auscultatory gap, palpation gives an initial estimate of systolic blood pressure and eliminates the need to inflate the cuff to extremely high pressures in people with normal or low blood pressure. When you detect an auscultatory gap, record the systolic and diastolic pressures as usual, and note the magnitude and range of the auscultatory gap (e.g., 196/90; auscultatory gap from 184 to 150).

**Palpation.** When Korotkoff sounds are inaudible, blood pressure may be estimated by palpation. Apply the cuff and inflate as previously described and palpate the brachial or radial artery during cuff deflation. Systolic blood pressure is the point at which pulsation returns. Diastolic blood pressure is difficult to determine reliably with palpation but is indicated by a snap or whipping palpable vibrations. Palpated blood pressure is
usually recorded as a systolic reading over “P” for palpated (e.g., 110/P).

**Abnormalities**

Hypertension, hypotension, and orthostatic hypotension are three abnormalities of blood pressure.

**Hypertension.** Hypertension is the condition in which blood pressure is chronically elevated. Although in industrialized societies there is a trend toward increased blood pressure with advancing age, hypertension is a dangerous disease associated with an increased risk of morbidity and mortality due to cardiovascular complications, such as stroke or heart failure. Therefore, chronically elevated blood pressure is treated aggressively in adults of any age. For adults of any age, blood pressure between 120/80 and 139/89 mm Hg is considered **prehypertension.** Adults with blood pressure above 140/90 mm Hg should be evaluated for hypertension. Hypertension is diagnosed on the basis of serial elevated values, rather than a single measurement. Studies have shown that some clients demonstrate higher recorded blood pressure in the physician’s office than in the home setting. This is referred to as the “white coat effect.” Ambulatory blood pressure measurements refer to blood pressure values obtained away from the clinical setting while the person is engaged in normal activity. Ambulatory blood pressure measurements are helpful in diagnosing hypertension accurately and in planning treatment. The Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) endorses the use of ambulatory monitoring, especially for clients with “white coat hypertension” (Artinian, 2004; Frost & Hajjar, 2006). Chapter 36 covers hypertension in greater detail.

**Hypotension.** Hypotension is blood pressure below 100/60 mm Hg. Low blood pressure readings can be normal for some healthy, young adults and are no cause for concern. A sudden drop in blood pressure, significantly below the normal range for a person, causes hypotension. For example, a hypertensive client who usually has blood pressure readings of 180/94 mm Hg would be considered hypotensive if his or her blood pressure fell to 120/80 mm Hg. Once again, a significant change from baseline values is more important than any one specific measurement.

**Orthostatic Hypotension.** In adults, moving from a flat, horizontal position to a vertical position results in pooling of blood in the lower extremities. People with healthy, intact autonomic nervous systems reflexively compensate for the volume shift by increasing the rate and force of myocardial contraction and vasoconstriction, thus maintaining adequate blood pressure. Even with normal compensation, however, a position change usually results in a drop in systolic blood pressure and an increase in heart rate. Inadequate reflex compensation upon position change results in orthostatic hypotension. Symptoms of orthostatic hypotension are those related to decreased cerebral perfusion, such as dizziness, weakness, blurred vision, syncope, and marked changes in blood pressure and heart rate. Orthostatic blood pressure

### Table 26-7: Korotkoff Sounds

<table>
<thead>
<tr>
<th>Phase</th>
<th>Interpretation</th>
<th>Description</th>
<th>Recording</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I</td>
<td>Systolic</td>
<td>Initiated by the onset of faint, clear tapping sounds of gradually increasing intensity</td>
<td>Recorded as systolic pressure</td>
</tr>
<tr>
<td>Phase II</td>
<td>Diastolic 1st</td>
<td>Sound has a swishing quality</td>
<td></td>
</tr>
<tr>
<td>Phase III</td>
<td>Diastolic 1st</td>
<td>Marked by crisper, more intense sounds; clear intense tapping</td>
<td></td>
</tr>
<tr>
<td>Phase IV</td>
<td>Diastolic 2nd</td>
<td>Characterized by muffled, blowing sounds</td>
<td>Recorded as diastolic pressure in children</td>
</tr>
<tr>
<td>Phase V</td>
<td></td>
<td>Absence of sound</td>
<td>Recorded as diastolic pressure in adults</td>
</tr>
</tbody>
</table>

\[
BP = 120/90/80
\]
changes may indicate hypovolemia, a failure of the autonomic nervous system protective reflexes. Hypovolemia or impaired vasoconstriction is signaled by decreased blood pressure and increased heart rate. Autonomic nervous system dysfunction is indicated by decreased blood pressure without marked increases in heart rate. Orthostatic hypotension is a drop in systolic pressure of at least 25 mm Hg or a drop in diastolic pressure of at least 10 mm Hg when moving from lying to sitting or standing (Jevon, 2001).

Instruct clients with chronic orthostatic hypotension to change positions slowly, moving from a lying to a sitting to a standing posture and allowing several minutes to elapse before proceeding to the next position.

Measure orthostatic blood pressure in clients exhibiting symptoms of dizziness, blurred vision, or weakness when changing position; clients taking diuretic medications; and clients with a history of volume loss. The best data for determining and monitoring therapy will come from systematic, consistent technique in assessing blood pressure and heart rate response to position change. Procedure 26-5 gives a step-by-step description for assessing for orthostatic hypotension.

Clients experiencing severe orthostatic hypotension may be unable to tolerate a standing position long enough for you to obtain the blood pressure and heart rate.

Record the blood pressure and heart rate values and the position of the client when the values were obtained. Document any symptoms of diminished cerebral perfusion.

**SAFETY ALERT**

If the client becomes severely symptomatic while standing, he or she should be assisted back to bed without completing the measurements.

**SAFETY ALERT**

The person experiencing postural hypotension is at risk for falling. Therefore, checking postural vital signs is one way of screening to ensure client safety.

Nurses are responsible for ensuring accurate assessment and documentation of vital signs. Frequently, they delegate vital sign monitoring to unlicensed assistive personnel. It is essential to provide these health team members with clear guidelines so that abnormal readings can be reported promptly. After assessing trends, report abnormal findings to the physician. Vital signs...
often are documented in a graph format, with time as the horizontal axis and the measured value as the vertical axis. Data entered into an electronic medical record also may be viewed in a graph format that allows trends to be seen easily. Trends may reflect normal variations or a change in response to disease or therapy. For example, the normal trend is toward a decreased body temperature in the early morning. If the graph shows increasing values during the night and early morning, this trend may indicate fever and would require further investigation. Increasing pulse rate, with or without a drop in blood pressure or rise in temperature, may indicate infection.

**LIFESPAN CONSIDERATIONS**

Knowledge of developmental considerations is important for accurate measurement and interpretation of vital signs. Table 26-1 summarizes normal ranges for the vital signs across the lifespan.

**Newborn and Infant**

Temperature, pulse, and respirations fluctuate widely in newborns. Their thermoregulatory mechanisms are immature, and ambient temperature may affect body temperature of the newborn markedly. Pulse and respiration increase rapidly above resting values when a newborn is active, crying, or startled. The apical pulse is the most reliable method of assessing heart rate because peripheral pulses are faint and difficult to palpate and accurately count. Healthy newborns may exhibit periodic apnea. Blood pressure is not assessed routinely in the healthy newborn or infant because the information obtained is unreliable. Conditions in which children younger than 3 years should have blood pressure measured include prematurity, very low birth weight, congenital heart disease, recurrent bladder infections, and kidney disease.

Safety considerations are important when monitoring the vital signs of newborns and infants. Tympanic or axillary temperature monitoring is preferred because rectal temperature monitoring can cause mucosal tearing or perforation, and infants cannot safely hold oral thermometers in their mouths. However, regular-sized tympanic probes may be too large for the ear canals of premature infants or infants younger than 2 months. The inguinal site is an alternative safe site suggested for use in newborns, especially those in superheated environments (Cusson, Madonia, & Taekman, 1997). Infants move quickly, so protecting them from falling or injury during vital sign monitoring is essential.

**Toddler and Preschooler**

As a child enters the second year of life, vital signs fluctuate less. The pulse rate decreases to a normal range of 80 to 120 beats per minute, and respirations fall to 22 to 40 breaths per minute. Normal blood pressure ranges from a systolic pressure of 80 to 112 mm Hg over a diastolic pressure of 50 to 80 mm Hg. Blood pressure is monitored routinely after the age of 3 years, using an appropriately sized cuff.

Toddlers and preschoolers may become fearful of procedures involving vital sign measurement. At this age verbal explanation do little to allay fears. Permitting children to play with stethoscopes or to push the buttons on electronic thermometers may help calm their fears. Having parents or other caregivers hold and talk to frightened children can be comforting.

Safety concerns continue to be important. Monitor temperature using the tympanic, temporal artery, or axillary route until the child is 4 or 5 years old and can follow directions about holding the thermometer in the sublingual pocket.

**School-Age Child and Adolescent**

The broad range of normal values for children reflects the wide variability in their vital signs. In general, temperature, pulse, and respirations gradually decrease through childhood, but blood pressure increases and correlates with height and weight.

Children in this age group are familiar with vital sign assessment and seldom exhibit fear during monitoring. Health teaching about normal values and the reason for taking vital signs helps to educate them. A child may try to experiment by putting the thermometer under hot water or near a light source, so validate any unlikely temperature readings.

**Adult and Older Adult**

Vital signs are usually stable during young adulthood. As adults age, the effects of lifestyle and chronic diseases become evident in the vital signs. Chronic respiratory disease and exposure to pollutants, such as cigarette smoke, can influence respiratory rate and pattern. Cardiovascular diseases may cause changes in the heart rate and rhythm. The incidence of hypertension is increasing in the United States. An estimated 30% of adult Americans—many of whom go undiagnosed and untreated every year—have clinically significant high blood pressure (Fields et al., 2004). Conversely, orthostatic hypotension is common in older adults, although the actual incidence is unclear. It is uncertain whether orthostatic hypotension is a result of normal aging or is seen only in elderly people with existing disease states. Older adults also have lower normal ranges for body temperature.

Often adults ask nurses about the values obtained during monitoring. This discussion is an excellent opportunity for client education.

**KEY CONCEPTS**

- Temperature, pulse, respirations, and blood pressure are considered the vital signs because significant deviations from normal ranges are not compatible with life.
- Vital sign assessment is an important nursing function that permits the nurse to detect alterations from normal and to evaluate the client’s progress.
- Body temperature can be monitored in five sites: oral cavity, ear, rectum, temporal artery, and axilla.
- Factors that can affect body temperature include age, environmental conditions, time of day, exercise, stress, and hormone level.
- Equipment to monitor body temperature includes electronic thermometers, tympanic membrane thermometers,
temporal artery thermometers, chemically treated paper thermometers, and temperature-sensitive strips. Glass mercury thermometers are no longer used.

- As the heart contracts and ejects blood into the circulation, pulsations can be palpated at various arterial sites in the body.
- Evaluation of the pulse should include rate, rhythm, and quality.
- Factors such as age, autonomic nervous system stimulation, and medications can affect the pulse.
- An irregular pulse should be counted for 1 full minute, preferably at the apical site.
- A pulse deficit occurs when a cardiac contraction creates a pulse wave that is weak and not palpable at peripheral sites.
- Age, medications, stress, exercise, altitude, gender, body position, and the presence of a fever can influence respiratory rate, rhythm, and depth.
- Abnormal breathing rates include tachypnea (more than 20 breaths per minute), bradypnea (less than 12 breaths per minute), and apnea (interval of absent respirations).
- Abnormal breathing patterns include Biot’s respirations, Kussmaul respirations, and apneustic respirations.
- Blood pressure is a function of the flow of blood produced by the heart and the resistance to blood flow through the vessels.
- Systolic pressure occurs during ventricular contraction, and diastolic pressure occurs during ventricular relaxation. Pulse pressure is the difference between systolic and diastolic pressure.
- Factors that can affect blood pressure include age, autonomic nervous system input, circulating volume, medications, and circadian rhythms.
- Blood pressure is usually measured indirectly using a sphygmomanometer and a stethoscope.
- Auscultation of blood pressure reveals five different phases known as Korotkoff sounds. The first Korotkoff sound corresponds to systolic pressure and the fifth (fourth in children) to diastolic pressure.
- Selecting proper cuff size, keeping the arm at heart level, avoiding venous congestion, and detecting the presence of an auscultatory gap are important steps in obtaining accurate blood pressure readings.
- Orthostatic hypotension occurs when a person experiences a decrease in blood pressure when changing from a supine to an upright position.
- Normal variations in vital signs occur throughout the lifespan.

REFERENCES


BIBLIOGRAPHY


### Procedure 26-1

#### Assessing Body Temperature

**Purpose**
1. Obtain baseline temperature data for comparing future measurements.
2. Screen for alterations in temperature.
3. Evaluate temperature response to therapies.

**Assessment**
- Identify client’s baseline temperature.
- Assess for clinical signs and symptoms of temperature alteration.
- Assess for factors that influence body temperature measurement:
  - Ingestion of hot or cold foods or liquids in last 30 minutes (oral)
  - Smoking within last 30 minutes
  - Recent exercise
  - Age, hormones, drugs that cause variations in body temperature
- Determine site most appropriate for temperature measurement.

**Equipment**
- Digital or electronic thermometer
- Disposable plastic thermometer sheaths or probe covers
- Water-soluble lubricant and disposable gloves (for rectal temperature)
- Pen and vital sign documentation record

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**Assessing Oral Temperature with an Electronic Thermometer**

**Procedure**

1. Wash hands. Identify client and explain the procedure.
   **Rationale:** Reduces microbe transmission, ensures safety, and increases client compliance.

2. Remove electronic thermometer from the battery pack, and remove the temperature probe from the recording unit, noting a digital display of temperature on the screen (usually 34°C or 94°F).
   **Rationale:** The electronic thermometer is stored in a battery pack to ensure that it is always charged and ready for use. Extending the temperature probe prepares the machine to measure and record temperature. The digital display of temperature indicates that it is charged.

3. Place the disposable cover over the temperature probe and attach securely. Grasp the base of the probe. (Fig. 1)
   **Rationale:** Ensures snug fit of the probe cover and prevents the transmission of microorganisms.

4. Insert the probe below the client’s tongue and into the sublingual pocket of the mouth. Ask the client to close his or her lips around the probe. Hold the probe, supporting it in place. (Fig. 2)
   **Rationale:** Inserting the probe into the sublingual pocket obtains the most accurate temperature. The weight of the probe will displace it from the sublingual pocket if left unsupported.

5. Wait for a beep (usually 10 to 20 seconds), which indicates the estimated temperature. Watch to see if temperature continues to rise. When the temperature reading stops...
Procedure 26-1 Continued

Assessing Rectal Temperature With an Electronic Thermometer

Procedure

1. Wash hands. Don clean gloves. Identify client and explain procedure.
   **Rationale:** Prevents transmission of microorganisms and increases client compliance.

2. Close bedroom door or bed curtains. Assist client to Sims’ position with upper leg flexed. Expose only anal area.
   **Rationale:** Privacy reduces embarrassment from exposing buttocks. Lateral position exposes anal area for thermometer placement.

3. Remove rectal (red) electronic thermometer from battery pack and extend the temperature probe from the unit, noting a digital display of temperature on the screen.
   **Rationale:** Ensuring that rectal (red) probe only is used for monitoring rectal temperature prevents cross-contamination of oral probe with rectal bacteria.

4. Securely attach the disposable cover over the temperature probe.
   **Rationale:** Prevents transmission of microorganisms.

5. Apply water-soluble lubricant liberally to thermometer probe tip. (Fig. 5)
   **Rationale:** Lubricant facilitates insertion of thermometer without irritating or traumatizing the rectum.

6. Separate client’s buttocks with one gloved hand until the anal sphincter is visible.
   **Rationale:** Visual exposure of anus ensures accurate placement of probe.

7. Ask client to take a deep, slow breath. Insert thermometer into anus in direction of umbilicus, 1 inch for a child and 1.5 for an adult. Do not force. (Fig. 6)
   **Rationale:** Deep, slow breath allows client to relax external sphincter. Insertion depth allows adequate exposure of probe to blood vessels in rectal wall.

8. Return probe to the storage place within the unit and return the thermometer to the battery pack. Cleanse according to agency policy.
   **Rationale:** Proper storage prevents damage to the sensitive temperature probe and ensures that the unit will be recharged and ready for use. Adequate cleansing prevents transmission of microorganisms when thermometer is used for another client.

9. Record temperature on vital sign documentation record. Discuss findings with client if appropriate.
   **Rationale:** These actions ensure proper documentation and encourage client’s understanding of health status.

10. Return the probe from the client’s mouth. (Fig. 3)
    **Rationale:** The device reports an estimated temperature before achieving a final reading. The reading at the beep indicates estimated temperature. Usually the final temperature reading is very close to this estimated reading and often this is the temperature recorded if there are time pressures.

6. Hold the probe over a waste container and displace the probe cover by pressing the probe release button. (Fig. 4)
    **Rationale:** The contaminated probe cover can be removed without touching the nurse’s hands, thus preventing the transmission of microorganisms.

7. Return the probe to the storage place within the unit and return the thermometer to the battery pack. Cleanse according to agency policy.
    **Rationale:** Proper storage prevents damage to the sensitive temperature probe and ensures that the unit will be recharged and ready for use. Adequate cleansing prevents transmission of microorganisms when thermometer is used for another client.

8. Record temperature on vital sign documentation record. Discuss findings with client if appropriate.
    **Rationale:** These actions ensure proper documentation and encourage client’s understanding of health status.

Fig. 2 Hold probe in sublingual pocket.

Fig. 3 Note temperature displayed on the unit before removing the probe from client’s mouth.

Fig. 4 Release probe cover into waste receptacle.
Assessing Axillary Temperature with an Electronic Thermometer

Procedure

1. Follow steps 1 to 3 in Assessing Oral Temperature With Electronic Thermometer.
4. Close bedroom door or unit curtains; assist client to comfortable position, and remove clothing to expose axilla. (Fig. 8)
   *Rationale:* Clothing in the axilla area could interfere with accurate temperature measurement.

5. Place thermometer against middle of axilla; fold client’s arm down and place across chest, enclosing thermometer in axillary area. (Fig. 9)
   *Rationale:* This position maintains correct position of thermometer against blood vessels in axilla.

6. Wait for a beep that indicates the estimated temperature. Watch to see if temperature continues to rise. When it stops, note the temperature displayed on the unit and remove the probe from the client’s axilla.
   *Rationale:* Beep indicates estimated temperature. Usually the final temperature reading is very close to this estimated reading and often this is the temperature that is recorded if there are time pressures.

7. Follow steps 6 to 8 in Assessing Oral Temperature with Electronic Thermometer.

8. Hold the probe in place until machine emits a beep. Obtain reading. (Fig. 7)
   *Rationale:* Holding thermometer prevents rectal damage or perforation caused by client moving with thermometer in place.

9. Follow steps 6 to 8 in Assessing Oral Temperature With Electronic Thermometer.
Assessing Temperature Using a Tympanic Membrane Thermometer

Procedure

1. Wash hands. Identify client and explain procedure.  
   **Rationale:** Provides for safety and increases client compliance.

2. Remove tympanic thermometer from recharging base and check that the lens is clean. Attach tympanic probe cover to sensor unit. (Fig. 10)  
   **Rationale:** A clean lens is important to detect infrared radiation from the eardrum. Dirty lenses are a common cause of inaccurate measurements. Probe cover keeps unit clean and prevents the transfer of microorganisms.

3. Insert probe into ear canal, making sure the probe fits snugly. Avoid forcing the probe too deeply into the ear. Pulling the pinna back, up, and out in an adult will straighten the ear canal. (Fig. 11) Some manufacturers recommend moving the thermometer in a figure-eight pattern. Rotate the probe handle toward the jaw line.  
   **Rationale:** Straightening the ear canal permits better exposure of the tympanic membrane. Snug fit into the ear canal is also necessary for accurate temperature detection. Forceful deep insertion could result in injury to the eardrum. Angling the probe toward the jaw line ensures an accurate reading.

4. Activate the thermometer, and note the temperature readout, which is usually displayed within 2 seconds. (Fig. 12)  
   **Rationale:** Temperature assessment occurs very quickly with the tympanic membrane thermometer.

5. Eject sensor probe cover directly into waste container, cleanse according to agency policy, and return tympanic thermometer to base for recharging. Store away from temperature extremes.  
   **Rationale:** Preventing contamination of equipment by microorganisms is important. Recharging tympanic thermometer will prepare thermometer for later use. Proper storage will help ensure accurate functioning of the equipment.

6. Record temperature on vital sign documentation record. Discuss findings with client if appropriate.  
   **Rationale:** These actions ensure proper documentation and encourage client’s understanding of health status.

Assessing Temperature Using a Temporal Artery Thermometer

Procedure

1. Wash hands. Identify client and explain procedure.  
   **Rationale:** Provides for safety and increases client compliance.

2. Remove thermometer from storage base. If low battery indicator shows, replace battery.

3. Inspect the thermometer lens. If not shiny, clean by first wiping with alcohol, then rinsing with water-dampened swabs. Allow to air dry.  
   **Rationale:** Buildup of skin oils can cause inaccurate readings.

4. Attach disposable cover.  
   **Rationale:** Probe cover keeps unit clean and prevents the transfer of microorganisms.

5. Move hair to expose forehead and hairline. Measure only exposed side of forehead. If patient is lying on side,
measure “up” side only. If patient is perspiring heavily (diaphoretic), consider alternate method (e.g., oral).

**Rationale:** Anything covering the skin will insulate it and keep heat from dissipating, which may lead to a falsely high reading. Diaphoresis causes skin cooling, which may cause a falsely low reading.

6. Place probe flush against the center of the forehead and depress button. Slowly slide probe straight across forehead to hairline. Keeping button depressed, lift the probe from the forehead and touch it against the neck just behind the earlobe. (Figs. 13, 14, 15)

**Rationale:** Measurement of both forehead and behind the ear may compensate for skin cooling due to diaphoresis.

7. Release the button and read the recorded temperature within 15 seconds. If repeated measurements are necessary, wait at least 30 seconds. (Fig. 16)

**Rationale:** Skin cooling may occur with rapidly repeated measurements.

8. Eject probe cover directly into waste container, cleanse according to agency policy, and return temporal thermometer to storage base. Store away from temperature extremes.

**Rationale:** Preventing contamination of microorganisms from equipment is important. Proper storage will help ensure accurate functioning of the equipment.

9. Record temperature on vital sign documentation record, indicating “TA” for temporal artery site. Discuss findings with client if appropriate.

**Rationale:** These actions ensure proper documentation and encourage client’s understanding of health status.

**Documentation**

- Oral temp 37 C at 0800,
- No complaints of chills or diaphoresis,
- Afebrile for last 36 hours
**Lifespan Considerations**

**Newborns, Infants, and Children**
- Newborn thermoregulation is ineffective and immature. Environmental temperatures greatly affect the body temperatures of infants.
- A child who has a very high temperature reading (>38.5°C) should have the temperature re-checked at a different site.
- Tympanic or axillary temperature measurement is the preferred method for infants over 2 months and children younger than 6 years old because these areas are easily accessible. Younger children have limited attention spans and a more difficult time holding their lips closed long enough to obtain an accurate oral temperature reading. Also, with the tympanic or axillary route, there is no chance of rectal perforation if the infant or child moves suddenly. Remember that tympanic temperature readings can be affected by devices such as incubators, radiant warmers, or fans.
- When taking a tympanic membrane temperature measurement in children under 3 years old, pull the pinna down and straight back. (Fig. 17) In children older than 3 years, pull the pinna slightly upward and straight back as you would with an adult client. (Fig. 18)

**Older Adults**
- Older adults may have difficulty flexing their legs and assuming the left lateral position for rectal temperature measurement. Thermometer may be inserted with both legs straight.
- Normal body temperature drops to an average of 36°C in the older adult.

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**Home Care Modifications**

- Advise purchase of digital or battery-operated thermometer to replace any glass thermometers that are still being used in the home since they pose an environmental hazard. Tympanic thermometers are becoming less expensive and are a good choice for quick, accurate temperature measurement in the home.
- Clean probe after each use or use disposable probe covers to prevent transmission of infectious organisms between family members.
- If family members need to assess temperature of clients, they may need to know:
  - How frequently to monitor temperature
  - When to notify home care nurse or physician
  - Not to measure temperature orally in children younger than 6 years, or in any confused or unconscious person

**Collaboration and Delegation**

- Unlicensed assistive personnel routinely monitor clients’ temperatures. Remind UAPs to promptly report any temperature elevation above 38°C to the RN for follow-up.
- Instruct UAPs that they must report even low-grade fevers in certain clients (e.g., those who are immunocompromised).
- Usually physicians want to be notified of any temperature greater than 38.5°C (101°F).
### Obtaining a Pulse

#### Purpose
1. Obtain a baseline measurement of heart rate and rhythm.
2. Evaluate the heart’s response to various therapies and medications.
3. Peripheral pulse may be palpated to assess local blood flow to an extremity or to monitor perfusion to an extremity following surgery or diagnostic procedures (cardiac catheterization).

#### Assessment
- Review medical history to determine risk factors for alterations in pulse rate (heart disease, fluid or electrolyte imbalances, pain, hemorrhage).
- Assess for physical signs and symptoms of alteration in cardiac or vascular status (dyspnea, chest pain, palpitations, syncope, edema, cyanosis).
- Identify factors that influence pulse (age, medications, fever, exercise).
- Identify site most appropriate for pulse assessment.
- Review previous and baseline pulse assessments, if available.

#### Equipment
- Wristwatch with second hand
- Vital sign flowsheet or computer documentation record and pen
- Doppler and conducting gel (for difficult-to-palpate pulses)
- Stethoscope

### Obtaining a Radial Pulse

#### Procedure
1. Wash hands, identify the client, and explain the procedure.  
   **Rationale:** Provides safety and increases client compliance.
2. Position client comfortably with forearm across chest or at side with wrist extended.  
   **Rationale:** Relaxed position of lower arm with wrist extended allows easier artery palpation.
3. Place fingertips of your first two or three fingers along the groove at base of thumb, on client’s wrist. (Fig. 1)  
   **Rationale:** Fingertips are the most sensitive part of the hand for palpating pulses. Do not use the thumb to palpate: it has a strong pulse that you may confuse with the client’s.
4. Press against radial artery to obliterate pulse, then gradually release pressure until you feel pulsations; assess for regularity and strength.
5. If pulse is not easily palpable, use Doppler.
   a. Apply conducting gel to end of probe or to radial site.  
      **Rationale:** Doppler works by ultrasound, which transmits sound better with the airtight seal that gel provides.
   b. Press “on” button and place probe against skin on pulse site. Reposition slightly, using firm pressure, until you hear a pulsating sound.
6. If pulse is regular, count pulse for 30 seconds, and multiply by two. If pulse is irregular, count for 1 full minute. If irregular pulse is a new finding, assess apical radial rate. Count the initial pulse as zero.  
   **Rationale:** Prevents overestimation of pulse. If pulse is irregular, a longer counting period ensures a more accurate pulse rate determination. An apical radial rate is helpful to determine if irregular beats are strong enough to perfuse to peripheral pulse sites.

### Obtaining an Apical Pulse

#### Procedure
1. Wash hands, identify the client, and explain the procedure.  
   **Rationale:** Provides safety and increases client compliance.
2. Position client in supine or sitting position with sternum and left chest exposed. (Fig. 2)  
   **Rationale:** This position allows easy access for selection of auscultatory site. Rustling from clothing or bed linens will not distract nurse from hearing pulse.
3. Use an alcohol swab to clean the stethoscope and ear pieces before using.  
   **Rationale:** Maintains asepsis.
4. Warm diaphragm of stethoscope by holding it in the palm of your hand for 5 to 10 seconds.
Rationale: A cold metal or plastic diaphragm can startle the client when placed directly on the chest. This could alter pulse rate.

5. Locate apex of the client’s heart by palpating the space between the fifth and sixth rib (fifth intercostal space) and moving to the left midclavicular line. (Fig. 3)

6. Insert the ear pieces of stethoscope into your ears and place diaphragm over apex of client’s heart. (Fig. 4)  
Rationale: The heartbeat is usually heard loudest at the fifth intercostal space, near the midclavicular line.

7. Assess the heartbeat for regularity and dysrhythmias. 
Rationale: Frequent irregularities within 1 minute may indicate inadequate cardiac perfusion.

8. If rhythm is regular, count the heartbeat for 30 seconds, and multiply by two. (Fig. 5) Count for 1 full minute if the rhythm is irregular. Count the initial pulse as zero.  
Rationale: Prevents overestimation of pulse. Heart rate is more accurate when counted over a longer period if the rate is irregular.

9. Replace the client’s gown and assist the client to return to a comfortable position. (Fig. 6)  
Rationale: Provides for client comfort.

10. Share results of assessment with client, if appropriate.  
Rationale: Promote the client’s understanding of health and response to therapies.

11. Document pulse on vital sign record or computerized record. Specify in the documentation that you obtained an apical pulse (e.g., AP).  
Rationale: Maintains legal record and communicates with health team members.
LIFESPAN CONSIDERATIONS

Infants and Children
- Newborns and children younger than 2 years have weak radial pulses. Assess apical pulses for heart rate.
- The apex of the heart on an infant is at the third to fourth intercostal space, to the left of the midclavicular line.
- Crying greatly increases the pulse rate. Decrease the child’s crying by taking the pulse while the child sits in a parent’s or caregiver’s lap or by distracting the child with toys before disruptive procedures.

Older Adults
- If client is taking cardiac medications such as digitalis preparations or beta blockers, or if he or she has a history of cardiac dysrhythmias, obtain a more accurate assessment of heart rate and rhythm using the apical pulse site for a full minute.

HOME CARE MODIFICATIONS
- Pulse may need to be assessed at home if client is taking various cardiac medications. Teach the caregiver or client how to locate and count the pulse and to keep a diary of daily pulse rate to take to healthcare appointments.
- Digital pulse rate devices are available for home use.

COLLABORATION AND DELEGATION
- Unlicensed assistive personnel (UAP) often assess pulses. Validate their technique for accuracy. Provide specific information about clients (e.g., if apical pulse is required or if pulse is usually irregular). Indicate what assessment data (e.g., pulse <60 or >110; new irregularity) UAPs need to report promptly for follow-up.
- Report new alterations in rhythm or new episodes of unexplained tachycardia or bradycardia to physician/cardiologist for follow-up.

Assessing Respirations

Purpose
1. Assess respiratory status by evaluating rate and quality.
2. Evaluate the influence of medications and therapies on respiration.

Assessment
- Identify risk factors for altered respiratory status (chest trauma, respiratory disease, smoking history, respiratory depressant medications).
- Assess for physical signs and symptoms of altered respiratory status (cyanosis, clubbed fingers, reduced level of consciousness, pain during inspiration, dyspnea, coughing, retractions, nasal flaring, grunting, orthopnea, and so on).
- Review pertinent laboratory studies (arterial blood gases, oxygen saturation, complete blood count).
- Determine baseline respiratory rate.

Equipment
Watch with second hand
Vital signs documentation sheet or computer documentation record

Procedure
1. Wash hands and identify client.
   **Rationale:** Provides for client safety.
2. After or before assessment of pulse, keep your fingers resting on client’s wrist and observe or feel the rising and falling of chest with respiration. (Fig. 1) If client is asleep, you may gently place your hand on the client’s chest so you can feel chest movement. Do not explain procedure to client.
   **Rationale:** Explaining procedure may make client self-conscious about respirations and could cause him or her to alter respiratory pattern.
3. When you have observed one complete cycle of inspiration and expiration, and if respiration is regular, look at second hand of watch and count the number of complete cycles in 30 seconds and multiply by 2. (Fig. 2) In children younger than 2 years or in adults with an irregular rate, count for 1 full minute.
   **Rationale:** Children normally have irregular respiratory patterns. Ensures accuracy of assessment.
LIFESPAN CONSIDERATIONS

Infants and Children
• A crying child’s respiratory rate cannot be accurately assessed. Count respirations when the child is sleeping, if possible. If the child is crying, attempt to quiet him or her before assessing respirations. If the child cannot be soothed, write “crying” on the vital signs documentation sheet.

HOME CARE MODIFICATIONS
• High-risk infants may be placed on apnea monitors, so that parents can be quickly alerted if respirations dangerously slow or stop.

COLLABORATION AND DELEGATION
• Unlicensed assistive personnel (UAP) frequently monitor clients’ respirations. They must take care to accurately assess rate, especially for clients with shallow breathing patterns. They must report promptly any alterations of rhythm or rate <12 or >20.

Documentation

RR 16, shallow and regular, no use of accessory muscles.

Fig. 1 Keep fingers resting on client’s wrist and observe rise and fall of chest with respiration.

Fig. 2 Look at second hand of watch and count the number of complete cycles in 30 seconds; then multiply by two.

4. If respirations are shallow and difficult to count, observe at the sternal notch.  
   Rationale: Respirations are more visible at the sternal notch.

5. Note depth and rhythm of respiratory cycle.  
   Rationale: Respiratory characteristics give additional data about alterations in respiratory status.

6. Discuss findings with client and document respiratory rate, depth, rhythm, and character.  
   Rationale: Maintains legal record and communicates with healthcare team.
Obtaining Blood Pressure

**Purpose**
1. Evaluate the client’s hemodynamic status by obtaining information about cardiac output, blood volume, peripheral vascular resistance, and arterial wall elasticity.
2. Obtain baseline measurement of blood pressure.
3. Monitor the hemodynamic response to various therapies or disease conditions.
4. Screen for hypertension.

**Assessment**
- Assess blood pressure on initial client examination.
- Identify factors that may alter blood pressure (medications, exercise, age, emotional conditions, smoking, postural changes).
- Assess best site for obtaining blood pressure.
- Review previous blood pressure readings, if available.
- Consider any factors that limit site selection (e.g., mastectomy, dialysis access, PICC line).

**Equipment**
- Stethoscope
- Sphygmomanometer with bladder and cuff correct size for client and site
- Vital signs flow sheet or computerized record

**Procedure**

1. Wash hands; identify client; explain procedure to client; assist client to a comfortable position with forearm supported at heart level and palm up. (Fig. 1)
   **Rationale:** Variations in blood pressure can occur with client in different positions. Blood pressure increases when the arm is below heart level and decreases when above heart level. Diastolic blood pressure may increase 10% if arm is unsupported, secondary to isometric muscle contraction used to support arm.
2. Expose the upper arm completely.
   **Rationale:** Accurate placement of cuff and stethoscope requires complete exposure of upper arm.
3. Wrap deflated cuff snugly around upper arm with center of bladder over brachial artery. Lower border of cuff should be about 2 cm above antecubital space (nearer the antecubital space on an infant). (Fig. 2)
   **Rationale:** Placing bladder directly over brachial artery ensures proper compression of artery during cuff inflation. Loose or uneven application can result in falsely high readings.
4. Palpate brachial or radial artery with fingertips. Close valve on pressure bulb and inflate cuff until pulse disappears. Inflate cuff 30 mm Hg higher. Slowly release valve and note reading when pulse reappears.
   **Rationale:** Identify approximate systolic blood pressure reading to prevent underestimating systolic blood pressure should client have an auscultatory gap. Note: Some researchers state that this two-step method may result in significantly lower diastolic readings, requires more time, and may cause the client longer periods of stress (Jones, Simpson, & Ahmed, 2006). It is most important to use the two-step method during the initial screening to detect the presence of an auscultatory gap.
5. Fully deflate cuff, and wait 1 to 2 minutes.
   **Rationale:** A waiting period prevents falsely high readings by allowing blood trapped in the vein to be recirculated.
6. Place stethoscope ear piece in ears. Repalpate the brachial artery and place stethoscope bell or diaphragm over site. (Fig. 3 and 4)
Rationale: Blood pressure is a low-frequency sound and is best heard with the stethoscope bell, but the diaphragm is widely used because it is easily placed and more generally available.

7. Close bulb valve by turning clockwise. Inflate cuff to 30 mm Hg above reading where brachial pulse disappeared. (Fig. 5)
   **Rationale:** Ensures accurate assessment of systolic blood pressure.

8. Slowly release valve so pressure drops about 2 to 3 mm Hg per second. (Fig. 6)
   **Rationale:** Inaccurate measurements may occur if deflation rate is too fast or too slow.

9. Identify manometer reading when first clear Korotkoff sound is heard.
   **Rationale:** Indicates systolic pressure reading.

10. Continue to deflate, and note reading when sound muffles or dampens (fourth Korotkoff) and when it disappears (fifth Korotkoff).
    **Rationale:** American Heart Association recommends using the fifth Korotkoff sound as diastolic pressure in adults, fourth Korotkoff in children. In adults, if fourth and fifth Korotkoff are 10 mm Hg or greater apart, note all three readings.

11. Deflate cuff completely and remove from client’s arm. (Fig. 7)
12. Record blood pressure. Record systolic (e.g., 130) and diastolic (e.g., 80) in the form 130/80. If three pressures are to be recorded, use the form 130/80/40 (40 is the fifth Korotkoff). Abbreviate RA or LA to indicate right or left arm measurement.
    **Rationale:** Maintains legal record and communicates with health team members.
13. Assist client to comfortable position and discuss findings with client, if appropriate.
   
   **Rationale:** Encourages the client’s understanding of health status and promotes compliance with therapies.

**Documentation**

B/P 130/82 in right arm in sitting position at end expiration.

**LIFESPAN CONSIDERATIONS**

**Infants and Children**
- Selection of proper-sized cuff and bladder is important for obtaining accurate blood pressure measurements in children and adults. The bladder width should be at least 40% of the circumference of the limb.
- In infants, Korotkoff sounds may be too faint for accurate measurement. Accurate assessment of systolic pressure can be obtained using a Doppler ultrasonic device.
- When monitoring blood pressure in children, take respiration and pulse rate first because they are less invasive and less likely to cause anxiety.

**Older Adults**
- Adults with hypertension are prone to auscultatory gaps in blood pressure. Estimation of systolic pressure using the brachial artery palpation technique will prevent inaccurate readings secondary to auscultatory gap.
- Diastolic pressure often increases with age as a result of decreased compliance of the arteries.

**HOME CARE MODIFICATIONS**

- You may teach clients with hypertension to monitor their blood pressure at home. A variety of monitors for home use are available. They include digital printouts with time and date for accurate record keeping. Teach the client:
  - To avoid caffeinated beverages, smoking, and exercise for 30 minutes before measurement
  - To use the same arm and body position for each measurement
  - At what measurements the client should alert the nurse or physician

**COLLABORATION AND DELEGATION**

- Frequently, unlicensed assistive personnel (UAP) monitor clients’ blood pressures. Validate their techniques for accuracy and provide specific client information (e.g., how frequently to monitor, appropriate size of cuff, site limitations). If client has been experiencing hypertension or hypotension, verbalize what readings they need to promptly report for follow-up.
- Report any cases of significant hypertension or hypotension to the physician. Physicians frequently establish parameters of notification.

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**Procedure 26-5**

**Assessing for Orthostatic Hypotension**

**Purpose**

1. Assess the compensatory status of the cardiovascular and autonomic nervous systems to changes in body position.
3. Assess for the client’s safety in getting up and ambulating.

**Assessment**

- Identify clients at risk for postural drops in blood pressure:
  - Risk of volume depletion
  - Inadequate vasoconstrictor mechanisms secondary to prolonged bed rest
  - Autonomic insufficiency secondary to spinal cord injury or drugs (beta-adrenergic blockers, calcium channel blockers)
- Assess client for complaint of dizziness or lightheadedness during position changes.
- Review baseline blood pressure measurements, if available.

**Equipment**

- Stethoscope
- Sphygmomanometer
- Watch or clock with second hand
- Vital sign documentation form or computerized record
**Procedure 26-5**

1. Wash hands. Identify client and explain procedure.  
   **Rationale:** Ensures client safety and increases compliance.

2. Position client supine with head of bed flat for 10 minutes.  
   **Rationale:** Allow blood pooled in lower extremities to reenter circulation.

3. Check and record supine blood pressure and pulse. Keep blood pressure cuff attached. (Fig. 1)  
   **Rationale:** Provides baseline information with which to compare measurements after position changes. Assesses pulse rate to help differentiate the cause of postural hypotension. During position changes, if pulse rate rises as blood pressure falls, secondary to sympathetic stimulation, the cause may be volume depletion. If the pulse does not increase when the blood pressure falls, the cause may be related to the lack of sympathetic response.

4. Assist client to a sitting position with legs dangling over the edge of the bed. Wait 2 to 4 minutes and check blood pressure and pulse rate. (Fig. 2) **Note:** The waiting period is a convenient time to auscultate the client’s lung fields.  
   **Rationale:** Two to four minutes provides adequate time for the autonomic nervous system to reflexively compensate for volume shifts in the normal person.

5. Assist client to standing position. Wait 2 to 4 minutes and check blood pressure and pulse rate. Be alert to signs and symptoms of dizziness. (Fig. 3)  
   **Rationale:** If blood pressure drops significantly, the client may become light-headed and may need to be returned to bed before test completion.

6. Assist the client back to a comfortable position.

7. Record measurements and any symptoms that accompanied the postural change. Report a drop of 25 mm Hg in systolic pressure or a drop of 10 mm Hg in diastolic pressure.  
   **Rationale:** Maintains legal record and communicates with healthcare team.

8. Discuss findings with client, if appropriate.  
   **Rationale:** If there is a significant postural blood pressure drop, advise the client to sit on the edge of the bed for several minutes before walking to avoid dizziness and possible falls.
**COLLABORATION AND DELEGATION**

- Nurses frequently delegate postural blood pressure monitoring to unlicensed assistive personnel. Reinforce to them the order for taking blood pressures: supine first, then sitting, then standing. Caution them that safety is always the most important consideration. If the client becomes dizzy, the assessment must stop and the client should return to bed.

- If other health professionals report that the client complains of dizziness upon rising, validate by obtaining a postural blood pressure.

**Documentation**

- Lying: 142/80
- Sitting: 110/60, p 96
- c/o of dizziness, returned to bed and MD notified.
AUTHOR QUERIES:

AQ1 Please add to reference list OR delete from text.
AQ2 OK to delete BODY POSITION & FEVER here, since the topics are not in this chapter of this edition?
AQ3 Please cite in text or delete from references.