VITAL SIGNS

SCENARIO

Dr. Susan Xu is a member of a multiphysician primary care practice. Each physician in the practice has a medical assistant who works directly with him or her. Carlos Ricci, CMA (AAAMA), is Dr. Xu's assistant. Carlos graduated from a medical assistant program 3 years ago and enjoys the variety of patients seen in Dr. Xu's practice. One of Carlos' primary responsibilities is to accurately measure and record each patient's vital signs before the patient is seen by Dr. Xu.

While studying this chapter, think about the following questions:

- What factors might alter a patient's vital signs?
- What methods can Carlos use to gather and record a patient's temperature, pulse, respirations, blood pressure, height, weight, and body mass index (BMI)?
- What are the most recent guidelines for diagnosing and treating hypertension?

LEARNING OBJECTIVES

1. Define, spell, and pronounce the terms listed in the vocabulary.
2. Apply critical thinking skills in performing the patient assessment and patient care.
3. Cite the average body temperature, pulse rate, respiratory rate, and blood pressure for various age groups.
4. Describe emotional and physical factors that can cause the body temperature to rise or fall.
5. Obtain and record an accurate patient temperature using three different sites.
6. Convert temperature readings between the Fahrenheit and Celsius scales.
7. Describe pulse rate, rhythm, and volume.
8. Locate and record the pulse at multiple sites.
9. Demonstrate the best way to obtain an accurate respiratory count.
10. Specify physiologic factors that affect blood pressure.
11. Differentiate between essential and secondary hypertension.
13. Identify the different Korotkoff phases.
15. Accurately measure and document height and weight.
16. Convert kilograms to pounds and pounds to kilograms.
17. Identify patient education opportunities when measuring vital signs.
18. Determine the medical assistant's legal and ethical responsibilities in obtaining vital signs.
VOCABULARY

apnea (ap'-nee-uh) Absence or cessation of breathing.
arrhythmia An abnormality or irregularity in the heart rhythm.
bounding A term used to describe a pulse that feels full because of increased power of cardiac contraction or as a result of increased blood volume.
bradycardia (brad-i-kahr'-dee-uh) A slow heartbeat; a pulse below 60 beats per minute.
bradypnea (brad-ip-nee'-uh) Respirations that are regular in rhythm but slower than normal in rate.
cerumen (see-room'-men) A waxy secretion in the ear canal; commonly called ear wax.
chronic obstructive pulmonary disease (COPD) A progressive, irreversible lung condition that results in diminished lung capacity.
diurnal rhythm (die-ur'-ni) A pattern of activity or behavior that follows a day-night cycle.
dyspnea (disp-nee'-uh) Difficult or painful breathing.
essential hypertension Elevated blood pressure of unknown cause that develops for no apparent reason; sometimes called primary hypertension.
febrile (feb'-rihl) Pertaining to an elevated body temperature.
homeostasis Internal adaptation and change in response to environmental factors; multiple functions that attempt to keep the body’s functions in balance.
hyperventilation (huy-pur-vent-i-la-shun) An increase in the depth of breathing.
hypertension High blood pressure.
hyperventilation Abnormally prolonged and deep breathing, usually associated with acute anxiety or emotional tension.
hypotension Blood pressure that is below normal (systolic pressure below 90 mm Hg and diastolic pressure below 50 mm Hg).
intermittent pulse A pulse in which beats occasionally are skipped.
orthopnea (or-thop'-nee-uh) A condition in which an individual must sit or stand to breathe comfortably.

orthostatic (postural) hypotension A temporary fall in blood pressure when a person rapidly changes from a recumbent position to a standing position.
ottis externa Inflammation or infection of the external auditory canal (swimmer’s ear).
peripheral (pah'-ri-fuhl) A term that refers to an area outside of or away from an organ or structure.
pulse deficit A condition in which the radial pulse is less than the apical pulse; it may indicate a peripheral vascular abnormality.
pulse pressure The difference between the systolic and the diastolic blood pressures (30 to 50 mm Hg is considered normal).
pyrexia (pi-reks'-ee-uh) A febrile condition or fever.
rales Abnormal or crackling breath sounds during inspiration.
rhonchi (ron'-ki) Abnormal rumbling sounds on expiration, which indicate airway obstruction by thick secretions or spasms.
secondary hypertension An elevated blood pressure resulting from another condition, typically kidney disease.
sinus arrhythmia An irregular heartbeat that originates in the sinoatrial node (pacemaker).
spirometer An instrument that measures the volume of air inhaled and exhaled.
stertorius (shtur'-tuh-rus) A term that describes a strenuous respiratory effort marked by a snoring sound.
syncope (sing'-kuh-pee) Fainting; a brief lapse in consciousness.
tachycardia (tak-i-kahr'-dee-uh) A rapid but regular heart rate; one that exceeds 100 beats per minute.
tachypnea (tak-ip-nee'-uh) A condition marked by rapid, shallow respirations.
thready A term that describes a pulse that is scarcely perceptible.
 wheezing A high-pitched sound heard on expiration; it indicates obstruction or narrowing of respiratory passages.

Measurement of vital signs is an important aspect of almost every patient visit to the medical office. These signs are the human body's indicators of internal homeostasis and the patient’s general state of health. Because medical assistants are chiefly responsible for obtaining these measurements, it is imperative that they have confidence in the theoretic and practical applications of vital sign measurement. A medical assistant who understands the principles of and the reasons for these measurements becomes a valuable asset to any medical office.

Accuracy is essential. A change in one or more of the patient’s vital signs may indicate a change in general health. Variations may suggest the presence or disappearance of a disease process and therefore may lead to alteration of the treatment plan. Although the medical assistant obtains vital signs routinely, it is a task that requires consistent attention to accuracy and detail. These findings are crucial to a correct diagnosis, and vital signs should never be measured with indifference or casualness. In addition to accurate measurement, care must be taken when charting the findings on the patient’s medical record.

Vital signs are the patient’s temperature, pulse, respiration, and blood pressure. These four signs are abbreviated TPR and BP and may be referred to as cardinal signs. The medical assistant must understand the significance of the vital signs and measure and record them accurately. Anthropometric measurements are not considered vital signs but usually are obtained at the same time as the vital signs. These measurements include height, weight, body mass index (BMI), and other body measurements, such as fat composition and an infant’s head circumference.

FACTORS THAT MAY INFLUENCE VITAL SIGNS

Vital signs are influenced by many factors, both physical and emotional. A patient may have drunk a hot or cold beverage just
before the examination or may be angry or fearful about what the physician may find. For example, consider that a patient has been asked to return to have a repeat Papanicolaou (Pap) smear because the first one showed the presence of suspicious cells. The medical assistant measures the patient's blood pressure and finds it significantly elevated compared with previous readings. The patient may be anxious and apprehensive about the test results, and the elevated blood pressure readings reflect her anxiety.

What temperature reading might be expected in a patient who could not find a parking place and had to walk four blocks to the office, knowing he would be late for his appointment? If you said it would be elevated, you are right. Certainly, this patient's metabolism would increase because of the physical exercise, and as a result, his temperature would be elevated, along with his pulse, respirations, and blood pressure.

For one reason or another, many patients are apprehensive during an office visit. These emotions may alter vital signs, and the medical assistant must help the patient relax before taking any readings. Measurements sometimes must be obtained a second time, after the patient is calmer or more comfortable. For a better picture of the patient's vital signs, the medical assistant may be asked to record the vital signs twice at the beginning of the visit and just before the patient leaves the office.

### Temperature

#### Physiology

Body temperature is defined as the balance between the heat lost and the heat produced by the body. It is measured either in degrees Fahrenheit (°F) or degrees Celsius (°C). The process of chemical and physical change in the body that produces heat is called metabolism. Body temperature is a result of this process. The core body temperature is maintained within a normal range by the thermoregulatory center in the hypothalamus. The average body temperature varies from person to person and is different at different times throughout the day in each person. In a healthy adult, this diurnal rhythm varies from 97.6° to 99° F (36.4° to 37.3° C); the average daily temperature is 98.6° F (36.8° C). The body temperature is lowest in the morning and highest in the late afternoon. Factors that may affect body temperature include the following:

- **Age**: The body temperature of infants and young children fluctuates more rapidly in response to external environmental temperatures. Teething may cause a slight elevation in temperature but should not be the cause of a fever. Aging adults lose their ability to respond therapeutically to environmental temperature extremes, making them more susceptible to hypothermic or hyperthermic reactions.
- **Stress and physical activity**: Both exercise and emotional stress can increase the metabolic rate, causing an elevation in temperature.
- **Gender**: Hormone secretions result in fluctuations of the core body temperature in women throughout the menstrual cycle.
- **External factors**: Smoking, drinking hot fluids, and gum chewing can temporarily elevate an oral temperature.

In illness, an individual's metabolic activity is increased; this causes an increase in internal heat production, which in turn raises the body temperature. The increase in body temperature is thought to be the body's defensive reaction, because heat inhibits the growth of some bacteria and viruses.

When a fever is present, superficial blood vessels (those near the surface of the skin) constrict. The small papillary muscles at the base of hair follicles also constrict, creating goose bumps. Chills and shivering may follow, producing internal heat. As this process repeats itself, more heat is produced, and the body temperature becomes elevated or rises above the normal range. When more heat is lost than is produced, the opposite effect occurs, and body temperature drops below normal range.

#### Fever

Infection, either bacterial or viral, is the most common cause of fever in both children and adults.

Infants do not usually develop febrile illnesses during the first 3 months of life; if one is present, it usually is very serious. However, fever, or pyrexia, in young children is very common and accounts for an estimated 26% of office visits. Fevers are classified according to the 24-hour pattern they follow. The three most common patterns are:

- **Continuous fever**, which rises and falls only slightly during a 24-hour period. The temperature consistently remains above the patient's average normal temperature range and fluctuates less than 3 degrees.
- **Intermittent fever**, which comes and goes, alternating between elevated and normal levels.
- **Remittent fever**, which fluctuates considerably (i.e., more than 3 degrees) and never returns to the normal range.

Variation from the patient's average body temperature range may be the first warning of an illness or change in the patient's current condition. Patients with a fever usually have loss of appetite (anorexia), headache, thirst, flushed face, hot skin, and general malaise. Some patients experience an acute onset of chills and shivering followed by an increase in body temperature. A serious possible complication in young children with high fevers is a febrile seizure. Medication to reduce the fever, or antipyretic drugs (e.g., Tylenol), should be taken as instructed to prevent dangerous spikes in temperature. Age-related normal values for temperature readings are shown in Table 31-1.

#### Temperatures Considered Febrile

- Rectal, temporal, or aural (ear) temperature over 100.4° F (38° C)
- Oral temperature over 99.5° F (37.5° C)
- Axillary temperature over 98.6° F (37° C)
- Fever of unknown origin (FUO): A temperature over 100.9° F (38.3° C) that lasts 3 weeks in adults and 1 week in children without a known related diagnosis

#### Temperature Readings

A clinical thermometer is used to measure body temperature. It is calibrated either in the Fahrenheit or the Celsius scale. The Fahrenheit scale is most often used in the United States, but
TABLE 31-1 Age-Related Temperature Norms

<table>
<thead>
<tr>
<th>AGE</th>
<th>FAHRENHEIT (DEGREES)</th>
<th>CELSIUS (DEGREES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>98.2°</td>
<td>36.8° (axillary)</td>
</tr>
<tr>
<td>1 year</td>
<td>99.7°</td>
<td>37.6°</td>
</tr>
<tr>
<td>6 years to adult</td>
<td>98.6°</td>
<td>37° (oral)</td>
</tr>
<tr>
<td>Elderly over age 70</td>
<td>96.8°</td>
<td>36° (oral)</td>
</tr>
</tbody>
</table>

hospitals and many ambulatory care settings use the Celsius scale. The formulas for conversion from one system to the other are:

\[
{\circ}C = \left(\frac{{9}{F} - 32}{5}\right)
\]

\[
{\circ}F = \left(\frac{5}{9}\right)C + 32
\]

For example, if an infant's temperature is measured at 101° F, the Celsius conversion would be:

\[
{\circ}C = \left(\frac{9}{5}\right)(101° - 32)
= \frac{69}{5}
= 34.5° C
\]

If the ambulatory care setting where you work uses a Celsius thermometer, patients may ask you what the temperature is in Fahrenheit degrees, because that is the scale they understand. If the facility does not have a conversion chart available, you will need to convert the temperature mathematically. For example, if an infant's temperature is 39° C, what is the Fahrenheit reading?

\[
{\circ}F = \left(\frac{5}{9}\right)C + 32
= \left(\frac{9}{5}\right)(39°) + 32
= \frac{351}{5} + 32
= 70.2 + 32
= 102.2° F
\]

CRITICAL THINKING APPLICATION 31-1
Using the correct formula, convert the following temperatures from one system to the other.

99° F = ________ ° C  
102° F = ________ ° C  
38° C = ________ ° F  
39.5° C = ________ ° F

Several types of thermometers and several different methods can be used to take temperature readings. A digital thermometer is placed under the tongue, in the armpit, or rectally; a tympanic thermometer is inserted into the ear; and a temporal artery scanner is moved across the forehead. The average temperature values for adults at the three most common sites are shown in Table 31-2.

TABLE 31-2 Average Adult Temperatures

<table>
<thead>
<tr>
<th>SITE</th>
<th>FAHRENHEIT</th>
<th>CELSIUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>98.6°</td>
<td>37°</td>
</tr>
<tr>
<td>Axillary</td>
<td>97.6°</td>
<td>36.4°</td>
</tr>
<tr>
<td>Tympanic</td>
<td>98.6°</td>
<td>37°</td>
</tr>
</tbody>
</table>

Axillary temperatures are approximately 1° F (0.6° C) lower than accurate oral readings, because axillary readings are not taken in an enclosed body cavity. When taken correctly, the tympanic (ear) temperature is an accurate measure because it records the temperature of the blood closest to the hypothalamus. However, recent research on the newest device for obtaining temperatures, the temporal artery (TA) thermometer, indicates that this method is more accurate than tympanic measurements for identifying elevated temperatures in infants. Pediatricians, therefore, may prefer either rectal or TA temperatures in infants suspected of having a fever. The tympanic method still is considered a fast, accurate, and noninvasive way of recording temperatures for older children and adults.

When obtaining an oral temperature, you do not have to indicate the site when documenting the reading in the patient's chart. However, you should write (T) for tympanic, (A) for axillary, or (TA) for temporal artery readings after recording the temperature to clarify that an alternative site was used. The oral temperature cannot be measured accurately in young children because the technique requires patients to hold the thermometer under the tongue and keep the mouth closed. To take an infant's temperature rectally, lubricate the probe tip, hold the baby securely with the legs elevated, and insert the probe approximately ¼ inch; hold the probe carefully throughout the procedure to prevent rectal damage. Some pediatricians may prefer that infants' temperatures be taken with a tympanic thermometer, because it is more comfortable for the baby and eliminates the possible complication of a perforated rectum.

For patients over age 3 or for those unable to hold a thermometer properly in their mouth during the procedure, a tympanic or temporal thermometer can be used; if not, a less accurate axillary temperature can be obtained.

CRITICAL THINKING APPLICATION 31-2
The mother of a 3-year-old calls the office to report that her child had an axillary temperature of 101° F at 9 o'clock this morning. The schedule is very full today, so Carlos has to decide whether the child should be seen today or first thing tomorrow. When should Carlos schedule the appointment?

Types of Thermometers and Their Uses

Digital Thermometer

Digital thermometers are battery operated and are available in both Fahrenheit and Celsius scales. Disposable covers fit snugly over the probes and are easily and quickly removed by pushing...
in the colored end of the probe. The instrument sounds a beep when the process is completed (10 to 60 seconds), and the reading appears on an LED screen on the face of the instrument (Procedure 31-1). Because the only part of the instrument that comes in contact with the patient is the probe, and that is sheathed, the risk of cross-infection is greatly reduced (Figure 31-1). Another type of digital thermometer resembles the old mercury thermometers that the Occupational Safety and Health Administration (OSHA) no longer permits in healthcare facilities. These thermometers also have a digital screen on which the temperature is read and should always be covered by a disposable sheath.

The temperature should not be taken orally if the patient recently has had something hot or cold to eat or drink or has just smoked, because these factors may artificially alter the patient's temperature.

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**PROCEDURE 31-1**

**Obtain Vital Signs: Obtain an Oral Temperature Using a Digital Thermometer**

**GOAL:** To accurately determine and record a patient's temperature using a digital thermometer.

**EQUIPMENT and SUPPLIES**

- Digital thermometer
- Probe covers
- Biohazard waste container
- Disposable gloves as appropriate
- Patient record

**PROCEDURAL STEPS**

1. Sanitize your hands and
   **PURPOSE:** To ensure infection control.
2. Assemble the needed equipment and supplies.
3. Identify your patient and explain the procedure. Make sure the patient has not eaten, consumed any hot or cold fluids, smoked, or exercised during the 30 minutes before the temperature is measured.
   **PURPOSE:** Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation. The temperature will be inaccurate if hot or cold food or fluids have been ingested or the patient has exercised within 30 minutes.
4. Prepare the probe for use as described in the package directions (Figure 1). Make sure probe covers are always used.
   **PURPOSE:** To ensure infection control.
5. Place the probe under the patient's tongue (Figure 2) and instruct the patient to close the mouth tightly without biting down on the thermometer. Help the patient by holding the probe end.
   **PURPOSE:** Air seeping into the mouth interferes with an accurate body temperature reading.
6. When a beep is heard, remove the probe from the patient's mouth and immediately eject the probe cover into an appropriate biohazard waste container.
   **PURPOSE:** The probe cover is contaminated and must be discarded in a biohazard waste container.
7. Note the reading in the LED window of the processing unit.
8. Record the reading on the patient's medical record (e.g., T = 97.7°F).
   **PURPOSE:** Procedures that are not recorded are considered not done.
9. Sanitize your hands and disinfect the equipment as indicated.
   **PURPOSE:** To observe infection control measures and Standard Precautions.
Tympanic Thermometer

The tympanic membrane of the ear also can be used for quick, accurate, and safe assessment of a patient's temperature. It shares the blood supply that reaches the hypothalamus, which is the brain's temperature regulator. The ear canal is a protected cavity, so the aural temperature is not affected by factors such as an open mouth, hot or cold drinks, or even a stuffy nose that would prevent a patient from keeping the mouth closed during the procedure. In addition, the covered probe is designed to bounce an infrared signal off the end of the canal without touching it, so the risk of spreading communicable diseases during temperature measurement is greatly reduced.

The tympanic measurement system consists of a handheld processor unit equipped with a tympanic probe, which is covered with a disposable speculum for use (Figure 31-2).

When the probe is placed into the ear canal, it gently seals the external opening of the canal, and the infrared energy emitted by the tympanic membrane is gathered. This signal is digitized by the processor unit and shown on the display screen. Accurate readings are obtained in less than 2 seconds (Procedure 31-2). The speed of the tympanic thermometer and the comfort it affords the patient have greatly influenced its popularity. However, this unit should not be used (1) if the patient has bilateral otitis externa, because the procedure would be uncomfortable for the patient, and (2) if impacted cerumen is present in both ears, because the reading may be inaccurate.

Temporal Artery Scanner

The temporal artery scanner uses an infrared beam to assess the temperature of the blood flowing through the temporal artery of the lateral forehead, where the artery lies about 1 mm below the skin (Figure 31-3). Because the artery is so close to the skin, it provides good surface heat conduction, allowing the thermometer to obtain a fast, accurate, and noninvasive measurement of the body temperature.

To perform the procedure, place the probe in the center of the forehead, halfway between the eyebrows and the hairline. Bangs should be pushed back off the forehead (this method cannot be used if bandages cover the area). Depress the button on the scanner and gently stroke the probe across the forehead toward the hairline. As the scanner moves across the forehead, repeated temperature measurements are taken and the highest measurement is recorded; keeping the button depressed, lift the scanner from the temporal area and lightly place the probe behind the ear lobe. Release the button and remove the probe. Recording an accurate temperature takes about 3 seconds (Procedure 31-3).
PROCEDURE 31-2

Obtain Vital Signs: Obtain an Aural Temperature Using the Tympanic Thermometer

GOAL: To accurately determine and record a patient’s temperature using a tympanic thermometer.

EQUIPMENT and SUPPLIES
- Tympanic thermometer
- Disposable probe covers
- Biohazard waste container
- Disposable gloves as appropriate
- Patient record

PROCEDURAL STEPS

1. Sanitize your hands.
   PURPOSE: To ensure infection control.
2. Gather the necessary equipment and supplies.
3. Identify your patient and explain the procedure.
   PURPOSE: Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.
4. Place a disposable cover on the probe (Figure 1).
   PURPOSE: To ensure a clean surface and prevent cross-contamination.
5. Follow the package directions to start the thermometer.
6. Insert the probe into the ear canal far enough to seal the opening. Do not apply pressure (Figure 2). For children under age 3, gently pull the ear lobe down and back; for patients over age 3, gently pull the top of the ear up and back.
   PURPOSE: The external ear must be pulled gently to open the external auditory canal and expose the tympanic membrane for an accurate reading.
7. Press the button on the probe as directed. The temperature will appear on the display screen in 1 to 2 seconds.
8. Remove the probe, note the reading (Figure 3), and discard the probe cover into a biohazard container without touching it.
   PURPOSE: The probe cover is contaminated and must be discarded in a biohazard waste container.
9. Sanitize your hands and disinfect the equipment if indicated.
   PURPOSE: To ensure infection control.
10. Record the temperature results (e.g., T = 98.6°F [°F]) on the patient’s medical record.
   PURPOSE: Procedures that are not recorded are considered not done.

FIGURE 1

FIGURE 2 (From 3onuww-West K. Clinical procedures for medical assistants, ed 7, St Louis, 2008, Saunders.)

FIGURE 3
PROCEDURE 31-3

Obtain Vital Signs: Obtain a Temporal Artery Temperature

**GOAL:** To accurately determine and record a patient’s temperature using a temporal artery scanner.

**EQUIPMENT and SUPPLIES**

- Temporal artery thermometer
- Patient record
- Alcohol swab

**PROCEDURAL STEPS**

1. Sanitize your hands.  
   **PURPOSE:** To ensure infection control.
2. Gather the necessary equipment and supplies.  
3. Introduce yourself, identify your patient, and explain the procedure.  
   **PURPOSE:** Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.
4. Remove the protective cap on the probe. The probe can be cleaned by lightly wiping the surface with an alcohol swab.
5. Push the patient’s hair up off of the forehead to expose the site. Gently place the probe on the patient’s forehead, halfway between the eyebrows and the hairline.  
   **PURPOSE:** This places the probe directly over the temporal artery.
6. Depress and hold the SCAN button and lightly glide the probe sideways across the patient’s forehead to the hairline just above the ear (Figure 1). As you move the sensor across the forehead, you will hear a beep, and a red light will flash.  
   **PURPOSE:** This verifies that the scanner is recording temperatures as it moves across the surface of the temporal artery.
7. Keep the button depressed, lift the thermometer, and place the probe on the upper neck behind the ear lobe (Figure 2). The thermometer may continue to beep, indicating that the temperature is rising.  
   **PURPOSE:** To continue scanning of the temporal artery until the highest temperature is recorded on the thermometer.
8. When scanning is complete, release the button and lift the probe. Note the temperature recorded on the digital display. The scanner automatically turns off 15 to 30 seconds after release of the button.
9. Disinfect the thermometer if indicated and replace the protective cap.  
   **PURPOSE:** To ensure infection control.
10. Sanitize your hands.
11. Record the temperature results (e.g., $T = 101.6^\circ F$ [TA]) on the patient’s medical record.
   **PURPOSE:** Procedures that are not recorded are considered not done.

**Axillary Thermometer**

Studies indicate that axillary temperatures are very accurate when performed correctly. Axillary temperatures take more time to register the correct body temperature, but the method is safe, simple, and easy to perform (Procedure 31-4). Axillary temperatures are taken with a digital thermometer, which is placed into the axillary fold. If the digital thermometer has more than one probe, the oral (blue) probe with a disposable probe cover should be used. Because tympanic and temporal thermometers are relatively expensive, the axillary method may be a viable way for parents of young children to get accurate temperature readings at home.

**Disposable Thermometer**

Disposable thermometers (those that are used only once) are frequently used on small children in the home. The reading is obtained by a heat-sensitive material that changes color according to the elevation of body temperature. Two types of disposable thermometers frequently are used by parents of young children. One type is placed under the child’s tongue (Procedure 31-4); the other is placed on the forehead. Although both types are fairly reliable, the temperature-sensing materials have expiration dates, which often are overlooked, and specific storage requirements may apply. Disposable thermometers are considered to be good screening devices but not as accurate as other methods.
PROCEDURE 31-4

Obtain Vital Signs: Obtain an Axillary Temperature

GOAL: To accurately determine and record a patient's temperature using the axillary method.

EQUIPMENT and SUPPLIES

- Digital unit
- Thermometer sheath or probe cover
- Supply of tissues
- Biohazard waste container
- Disposable gloves as appropriate
- Patient gown as needed
- Patient record

PROCEDURAL STEPS

1. Sanitize your hands.
   PURPOSE: To ensure infection control.
2. Gather the needed equipment and supplies.
3. Introduce yourself, identify your patient, and explain the procedure.
   PURPOSE: Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.
4. Prepare the thermometer or digital unit in same manner as for oral use.
5. Remove the patient's clothing and gown the patient as needed to access the axillary region.
6. Pat the patient's axillary area dry with tissues if needed.
7. Cover the thermometer or probe and place the tip into the center of the armpit, pointing the stem toward the upper chest, making sure the thermometer is touching only skin, not clothing.
   PURPOSE: To obtain the most accurate axillary reading; contact with clothing alters the reading.
8. Instruct the patient to hold the arm snugly across the chest or abdomen until the thermometer beeps.
   PURPOSE: To prevent air from leaking in and interfering with the temperature reading.
9. Remove the thermometer, note the digital reading, and dispose of the cover in the biohazard waste container.
10. Disinfect the thermometer if indicated.
11. Sanitize your hands.
12. Record the axillary temperature on the patient's medical record (e.g., T = 97.6°F [A]).
   PURPOSE: Procedures that are not recorded are considered not done.

4/2/XX 9:30 AM  T = 98.2°F (A) — — — — — — C. Ricci, CMA (AAMA)

FIGURE 31-4 TempoDot disposable oral strip thermometer. (Courtesy TempoDot, Somerville, NJ.)

Cleaning Thermometers

Digital Thermometers

The digital unit or individual digital thermometers should be routinely cleaned with disinfectant. When ejecting the probe shield or removing the sheath, be careful not to contaminate the probe or the processing unit. If a chance exists that a patient's body fluids touched the unit, wipe it with disinfectant before returning it to the storage area.

Tympanic Thermometers

The same guidelines for a digital unit are followed in the cleaning of a tympanic thermometer. When using the device on a small child, be conscious of what the child touches. If the processing unit is touched, be sure to wipe it with disinfectant after use. However, be careful not to get the tip of the probe surface wet, and always use probe covers, because disinfectant can ruin the probe surface.

CRITICAL THINKING APPLICATION 31-3

How should the medical assistant adopt temperature-taking techniques in the following scenarios?

- A patient who talks continuously with the thermometer in his mouth
- A 7-year-old patient with bilateral otitis externa
- A 3-month-old patient when a temporal artery thermometer is available
- A 46-year-old patient with a severe asthma attack
- A 72-year-old patient with bilateral impacted cerumen
- A 28-year-old patient who has just smoked a cigarette

Disposable Thermometers

Always discard a disposable thermometer in the appropriate waste container immediately after use to prevent contamination and the spread of pathogens to other patients. If you are instructing a parent in the use of a disposable thermometer at home, be sure to emphasize that it should be discarded immediately in a childproof container.
Pulse

A patient’s pulse rate reflects the palpable beat of the arteries throughout the body as they expand in response to the contraction of the heart. With every beat, the heart pumps an amount of blood, known as the stroke volume, into the aorta. Arteries branch off the aorta as it travels down through the center of the abdomen, transferring the pulse beat throughout the body. To measure the pulse, an artery is used that is close to the body surface and can be pushed against a bone. Palpating a peripheral pulse gives the rate and rhythm of the heartbeat and local information about the condition of the artery used.

Pulse Sites

A pulse rate may be counted anywhere where an artery is near the surface of the body and the vessel can be pressed against a bone. The most common sites used to feel this rhythmic throbbing are the temporal, carotid, apical, brachial, radial, femoral, popliteal, and dorsalis pedis arteries (Figure 31-5).

The temporal pulse is located in the temple area of the skull, parallel and lateral to the eyes (Figure 31-6). It is seldom used as a pulse site but may be used as a pressure point to help control bleeding from a head injury.

The carotid artery is located between the larynx and the sternocleidomastoid muscle in the front and to the side of the neck (Figure 31-7). It most frequently is used in emergencies and to check the pulse during cardiopulmonary resuscitation (CPR). It can be felt by pushing the muscle to the side and pressing against the larynx.

The apical heart rate, or the heartbeat at the apex of the heart, is heard with a stethoscope. It often is used for infants and young children or in adults if the radial pulse is difficult to feel or is irregular. An apical count may be requested if the patient is taking cardiac drugs or has either bradycardia or tachycardia. To determine the presence of a pulse deficit, the physician may listen to the apical beat while the medical assistant counts the pulse at another site. The apex of the heart is located in the left fifth intercostal space on the midclavicular line; that is, between the fifth and sixth ribs on a line with the midpoint of the left clavicle. The stethoscope is placed just below the left nipple between the fifth and sixth ribs. The pulse should be counted for 1 full minute and documented with (AP) beside the recorded count (Procedure 31-5).

The brachial pulse is felt at the inner (antecubital) aspect of the elbow. This is the artery felt and heard when the blood pressure is measured (Figure 31-8). It also can be felt in the groove between the biceps and triceps muscles on the inner surface of the middle upper arm. This is the pulse that is checked on infants and young children receiving CPR.
PROCEDURAL STEPS

1. Sanitize your hands and clean the stethoscope earpieces and diaphragm with alcohol swabs.
   **PURPOSE:** To ensure infection control and to follow Standard Precautions.
2. Introduce yourself, identify your patient, and explain the procedure.
   **PURPOSE:** Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.
3. If necessary, assist the patient in donning the gown, providing the patient with a gown that opens in the front.
   **PURPOSE:** To expose the chest and provide privacy and warmth.
4. Assist the patient into the sitting or supine position.
   **PURPOSE:** To allow easier access to the apical site at the apex of the heart.
5. Hold the stethoscope’s diaphragm against the palm of your hand for a few seconds.
   **PURPOSE:** To warm the diaphragm, promoting patient comfort.
6. Place the stethoscope just below the left nipple in the intercostal space between the fifth and sixth ribs over the apex of the heart (Figures 1 and 2).
   **PURPOSE:** This is the point of maximum contractile strength, where the heartbeat can be heard best.
7. Listen carefully for the heartbeat.
8. Count the pulse for 1 full minute. Note any irregularities in rhythm and volume.
   **PURPOSE:** The apical pulse is always measured for 1 full minute to obtain the most accurate reading.
9. Help the patient sit up and dress.
10. Sanitize your hands.
11. Record the pulse in the patient’s chart (e.g., AP = 96) and record any arrhythmias.

---

**FIGURE 1**

**FIGURE 2**

---

The **radial artery** is the most frequently used site for counting the pulse rate. It is best found on the thumb side of the wrist, 1 inch below the base of the thumb (Figure 31-9).

The **femoral pulse** is located at the site where the femoral artery passes through the groin. The examiner must press deeply below the inguinal ligament to palpate this pulse.

The **popliteal pulse** is found at the back of the leg behind the knee. Palpation of this pulse requires the patient to be in a recumbent position with the knee slightly flexed. The popliteal artery is deep and difficult to feel. It is palpated and also monitored with a stethoscope when a leg blood pressure reading is necessary. The physician checks the blood flow through the popliteal artery if a circulatory system problem, such as a blood clot, is suspected in the lower leg.

The **dorsalis pedis** (pedal) artery is felt across the arch of the foot, just slightly lateral to the midline, beside the extensor tendon of the great toe. This pulse may be congenitally absent in some patients. Because a good pulse rate at this site is an indicator of normal lower limb circulation and arterial sufficiency, the physician checks the pedal pulses in patients with peripheral vascular problems (e.g., patients with diabetes mellitus).
heartbeats (pulsations) that occur in 1 minute. Because the body must balance heat loss by increasing circulation (a faster heart rate), the pulse rate is proportional to the size of the heart. The smaller the body, the greater the heat loss and the faster the heart must pump to compensate. Therefore, infants and children normally have a faster pulse than adults; as the aging process progresses, the pulse rate declines.

Pulse rates normally vary as a result of a person’s age, body size, gender, and health status. The rate is affected by an individual’s activities, psychological state, and certain medications. It usually is faster in women (70 to 80 beats per minute) than in men (60 to 70 beats per minute). Children tend to have more rapid pulse rates than adults. The rate is more rapid when sitting than when lying down, and it increases when an individual stands, walks, or runs. During sleep or rest, the pulse rate may drop as low as 45 to 50 beats per minute. Well-conditioned athletes tend to have pulse rates of 50 to 60 beats per minute, because consistent aerobic exercise strengthens the heart muscle (the myocardium) so that each heart contraction ejects an increased volume of blood into the arterial system. Table 31-3 lists the normal pulse ranges for various age groups of patients.

## Characteristics of a Pulse

When measuring a pulse, you must note three important characteristics: the rate, rhythm, and volume. These characteristics depend on the size and elasticity of the artery and the strength and regularity of the heart’s contractions. A patient’s pulse may reveal valuable information about the cardiovascular system.

### Rate

The pulse rate is a measure of the number of heartbeats felt from the movement of blood through an artery. When the heart contracts, pressure throughout the arteries increases, and the arteries expand. When the heart relaxes, arterial pressure decreases, and the arteries relax. Each contraction and relaxation of the heart muscle is a heartbeat, and each resulting expansion and relaxation of the arteries is the pulse rate. Normally the heartbeat (rate) and pulse rate are the same. The rate of the pulse is the number of

### Rhythm

The pulse rhythm is the time between each pulse beat. A normal rhythm pattern has an even tempo, which indicates that the intervals between the beats are of equal duration. An abnormal rhythm, or arrhythmia, is described according to the rhythm pattern detected. An intermittent pulse may occur in healthy individuals during exercise or after drinking a beverage containing caffeine. A common irregularity found in children and young adults is sinus arrhythmia, in which the heart rate varies with the respiratory cycle, speeding up at the peak of inspiration and slowing to normal with expiration. If beats are frequently skipped or if the beats are markedly irregular, the physician should be advised, because this may indicate heart disease. If an irregular rhythm is detected, the apical pulse should be measured for a full minute to ensure accuracy, and the rate should be recorded for the physician’s review. A note also should be made that the patient’s pulse was irregular.

### Volume

The volume (pulse amplitude) reflects the strength of the heart when it contracts. Volume can be assessed by feeling the strength of the pulse as the blood flows through the vessel. The force of each pulse beat is described as bounding, or full; strong, or

<table>
<thead>
<tr>
<th>AGE</th>
<th>RANGE</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>120-160</td>
<td>140</td>
</tr>
<tr>
<td>1-2 years</td>
<td>60-140</td>
<td>120</td>
</tr>
<tr>
<td>3-6 years</td>
<td>75-120</td>
<td>100</td>
</tr>
<tr>
<td>7-11 years</td>
<td>75-110</td>
<td>95</td>
</tr>
<tr>
<td>Adolescence to adulthood</td>
<td>60-100</td>
<td>80</td>
</tr>
</tbody>
</table>
normal; or thready, or weak. The force of the heartbeat and the condition of the arterial wall, whether hard or soft, influence the volume. The pulse may vary only in intensity and otherwise be perfectly regular. This condition also can indicate heart disease. The pulse force is recorded using a three-point scale.

**THREE-POINT SCALE FOR MEASURING PULSE VOLUME**

<table>
<thead>
<tr>
<th>3+ Full, bounding pulse</th>
<th>Pulsation is very strong and does not disappear with moderate pressure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2+ Normal pulse</td>
<td>Pulsation is easily felt but disappears with moderate pressure.</td>
</tr>
<tr>
<td>1+ Weak, thready pulse</td>
<td>Pulsation is not easily felt and disappears with slight pressure.</td>
</tr>
</tbody>
</table>

**Determining the Pulse Rate**

**Radial, Brachial, and Apical Pulse Rates**

The patient should be in a comfortable position, with the arm to be used at the same level as or lower than the heart (Procedure 31-6). The limb should be well supported and relaxed. The patient may be lying down or sitting. As with all pulse readings, the pads of the first three fingers are placed over the artery. The thumb should never be used to determine the pulse rate, because the thumb has its own pulse, and the medical assistant’s pulse rate may be confused with the patient’s rate. Push the radial artery against the bone until the strongest pulsation is felt. The pulse should be counted for 1 full minute. The 15- or 30-second interval may be used once the medical assistant becomes proficient in performing the skill.

Variations from the normal quality should be noted, such as an arrhythmia or a pulse that is thready or bounding. Some pulses are more difficult to feel than others, and finding the correct pressure to be used for each patient and site requires repeated practice and experience.

Both you and the patient should be in a relaxed position. The sensitivity in your counting fingers is greatly reduced if you are in an awkward position. Too much pressure obliterates the patient’s pulse, and too little pressure prevents detection of irregularities or of all the beats. Record the number of beats in 1 minute. Assess the pulse, including the rate, rhythm, and volume. If the pulse rate is counted at any site other than the radial artery, the rate should be recorded along with a notation of the site used.

**CRITICAL THINKING APPLICATION 31-4**

Mrs. Amez has a documented thready pulse. What site should Carlos use to measure the pulse?

---

**PROCEDURE 31-6**

**Obtain Vital Signs: Assess the Patient’s Radial Pulse**

**GOAL:** To accurately determine and record a patient’s radial pulse rate, rhythm, and volume.

**EQUIPMENT and SUPPLIES**

- Watch with a second hand
- Patient record

**PROCEDURAL STEPS**

1. Sanitize your hands.
   **PURPOSE:** To ensure infection control.
2. Introduce yourself, identify your patient, and explain the procedure.
   **PURPOSE:** Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.
3. Place the patient’s arm in a relaxed position, palm downward, at or below the level of the heart.
   **PURPOSE:** The patient’s radial artery is more easily palpated when the patient is relaxed and in this position.
4. Gently grasp the palm side of the patient’s wrist with your first three fingertips approximately 1 inch below the base of the thumb (Figure 1).
   **PURPOSE:** This position puts your fingertips directly over the radial artery.
   Press firmly (but do not press too hard, or you will occlude the artery and feel nothing).
5. Count the beats for 1 full minute using a watch with a second hand.
   **PURPOSE:** Counting for 1 full minute allows you to obtain an accurate count, including any irregularities in rhythm and volume.
6. Sanitize your hands.
   **PURPOSE:** To ensure infection control.
7. Record the count and any irregularities on the patient’s medical record (e.g., P = 72). The pulse usually is recorded immediately after the temperature.
   **PURPOSE:** Procedures that are not recorded are considered not done.
Femoral, Popliteal, and Pedal Pulses

Pulses in the lower extremities may be difficult to find and equally difficult to hear. A Doppler unit, which is an ultrasound unit that magnifies the pulsation, may be used to locate and count these pulses accurately (Figure 31-10). This unit is battery operated and can be attached to a stethoscope so that only you hear the beat, or it can be set so that both you and your patient can hear the pulsations.

Respiration

Physiology

The purpose of respiration is to provide for the exchange of oxygen and carbon dioxide among the atmosphere, the blood, and the body cells. Oxygen is taken into the body to be used for life-sustaining body processes, and carbon dioxide is released as a waste product.

One complete inspiration and expiration is called a respiration. During the inspiratory phase, the diaphragm contracts and drops down, causing the lungs to expand and fill with air. During the expiratory phase, the diaphragm returns to its normal, elevated position, causing the lungs to expel the waste air back into the atmosphere.

Respiration is both internal and external. External respiration is the exchange of oxygen and carbon dioxide in the lungs. Internal respiration occurs at the cellular level; when oxygen in the bloodstream is transferred into the cells for energy, and carbon dioxide is released as a waste product and transported back to the lungs for exhalation.

When a buildup of carbon dioxide occurs in the blood, a message is sent to the respiratory center in the medulla oblongata, located in the brain between the top of the spine and the brainstem. The respiratory control center sends a message that triggers respiration. Respiration, therefore, is controlled by the involuntary nervous system; this means that we breathe automatically. Because a person can control respiration to a certain extent, it also is a voluntary body function. However, breathing ultimately is under the control of the medulla oblongata, which is why we can hold our breath only for a given length of time. Once the blood’s carbon dioxide level rises to the point where cells become oxygen starved, a stimulus is sent and breathing begins involuntarily.

Characteristics of Respirations

Normally a person’s breathing is relaxed, automatic, and silent. When assessing a patient’s respirations, you must note three important characteristics: rate, rhythm, and depth.

- **Rate**: The rate of respiration is the number of respirations per minute and is described as normal, rapid, or slow. Figure 31-11 shows sample rate patterns recorded with a spirometer. Dyspnea occurs in patients with pneumonia, asthma, or chronic obstructive pulmonary disease (COPD). It also occurs after physical exertion or at very high altitudes. Other alterations in breathing are bradypnea, apnea, tachypnea, and hyperpnea. Hyperpnea usually is accompanied by hyperventilation and often is found when the patient is extremely anxious or in pain. Orthopnea frequently occurs in patients with congestive heart failure (CHF) and COPD. Wheezing signals difficulty breathing in patients with asthma. Typically a ratio of four pulse beats to one respiration is seen. As a rule, both the pulse and respiratory rates respond to exercise or emotional upsets. Table 31-4 lists normal respiratory ranges for patients in various age groups.

- **Rhythm**: The term rhythm refers to the breathing pattern. A regular breathing pattern is normal in adults; however, the breathing pattern for infants varies. Automatic interruptions, such as sighing, are also considered normal.

- **Depth**: The depth of respiration is the amount of air inhaled and exhaled. When a patient is at rest, normal respirations

FIGURE 31-10 Doppler ultrasound unit measuring the pedal pulse. (From deWit S: Fundamental concepts and skills for nursing, ed 3, St Louis, 2009, Saunders.)

FIGURE 31-11 Respiratory rate patterns, called spiagrams, are recorded using a spirometer.
have a consistent depth, which can be noted as you watch the rise and fall of the chest. Rapid, shallow breathing at rest occurs with some diseases, such as asthma and emphysema.

Normally no noticeable breath sounds occur during the breathing process; the exception is snoring. Noticeable breath sounds are a sign of certain diseases, such as pneumonia, asthma, and pulmonary edema. The physician indicates descriptive characteristics of breath sounds by using specific terminology (e.g., rales, rhonchi, and stertorous breathing).

When an individual cannot inspire enough oxygen to supply all the body's cells with oxygenated blood; the normal skin coloring, particularly around the mouth and the nail beds, turns a bluish, dusky color. This coloration, which indicates the increased level of carbon dioxide in the blood, is called cyanosis. The patient also may have other signs and symptoms, such as vertigo, chest pain (angina), and numbness in the fingers and toes.

### TABLE 31-4 Approximate Age-Related Respiration Ranges

<table>
<thead>
<tr>
<th>AGE</th>
<th>RANGE</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>30-50</td>
<td>40</td>
</tr>
<tr>
<td>1-3 years</td>
<td>20-30</td>
<td>25</td>
</tr>
<tr>
<td>4-6 years</td>
<td>18-26</td>
<td>22</td>
</tr>
<tr>
<td>7-11 years</td>
<td>16-22</td>
<td>19</td>
</tr>
<tr>
<td>Adolescence to adulthood</td>
<td>12-20</td>
<td>16</td>
</tr>
</tbody>
</table>

### CRITICAL THINKING APPLICATION 31-5
Tina Anderson, a 36-year-old patient who is obese, is wearing a heavy knitted sweater, and Carlos needs to obtain a respiratory count. What could he do to obtain an accurate measurement of Tina's respiratory rate?

### PROCEDURE 31-7

**GOAL:** To accurately determine and record a patient's respirations. Remember that the respiratory count may be altered if the patient is aware that you are counting his or her breaths. Respirations typically are counted immediately after the pulse has been taken while the fingers are still at the radial site.

**EQUIPMENT and SUPPLIES**
- Watch with a second hand
- Patient record

**PROCEDURAL STEPS**

1. Sanitize your hands.
   **PURPOSE:** To ensure infection control.
2. Introduce yourself and identify the patient.
   **PURPOSE:** Identification of the patient prevents errors.
3. The patient's arm is in the same position used to count the pulse. If you have difficulty noticing the patient's breathing, place the arm across the chest to detect movement.
   **PURPOSE:** This position allows you to feel or see the rise and fall of the chest wall.
4. Note the rise and fall of the patient's chest.
   **PURPOSE:** Inspiration and expiration make up one complete breathing cycle or respiration.
5. Count the respirations for 30 seconds, using a watch with a second hand, and multiply by 2.
   **PURPOSE:** Counting for 30 seconds allows you to obtain an accurate count and determine any irregularities in rhythm or depth or unusual breathing patterns. If respirations are abnormal in any way, count for 1 full minute.
7. Sanitize your hands.
   **PURPOSE:** To ensure infection control.
8. Record the respirations on the patient's medical record after the pulse recording (e.g., R = 18).
   **PURPOSE:** Procedures that are not recorded are considered not done.
**BLOOD PRESSURE**

The blood pressure reading reflects the pressure of the blood against the walls of the arteries. Each time the ventricles contract, blood is pushed out of the heart and into the aorta, exerting pressure on the walls of the arteries. There are actually two blood pressure readings: the **systolic** pressure is the highest pressure level that occurs when the heart is contracting and the first pulse beat is heard; the **diastolic** pressure is the lowest pressure level when the heart is relaxed and the last sound is heard. Systole (heart contraction) and diastole (heart relaxation) together make up the cardiac cycle. The difference between the systolic and diastolic pressures is the **pulse pressure**.

The blood pressure is read in millimeters of mercury, abbreviated mm Hg. However, you need not include the abbreviation when documenting the reading on the patient’s medical record. The blood pressure is recorded as a fraction, with the systolic reading the numerator (top) and the diastolic reading the denominator (bottom) (e.g., 130/80). Table 31-5 lists the normal blood pressure ranges for patients of various age groups.

### Factors That Affect Blood Pressure

The physiologic factors that determine blood pressure include blood volume, peripheral resistance created by blood viscosity (the thickness of the blood), vessel elasticity, and the condition of the heart muscle and arterial walls.

**Volume** is the amount of blood in the arteries. An increased blood volume raises the blood pressure, and a decreased blood volume lowers the blood pressure. Therefore, with extensive bleeding or hemorrhage, the blood volume drops, and so does the blood pressure.

The **peripheral resistance** of blood vessels refers to the relationship of the lumen (the diameter of the vessel) to the amount of blood flowing through it. The smaller the lumen, the greater the resistance to blood flow. Blood pressure is higher with a small or reduced-size lumen and lower with a large lumen. Vessels affected by fatty cholesterol deposits called **atherosclerotic plaques** become narrower over time, resulting in smaller vessel lumens and therefore a higher blood pressure.

**Vessel elasticity** is an artery’s ability to expand and contract to supply the body with a steady flow of blood. With age, lifestyle factors, or the presence of arteriosclerosis, vessel elasticity may decrease, causing the arterial walls to become firm and resistant; as a result, the blood pressure increases.

The condition of the myocardium is a primary determinant of the volume of blood flowing through the body. A strong, forceful contraction empties the heart and tends to keep the blood pressure within normal limits. If the myocardium becomes weak, pressure in the vessels begins to increase in an attempt to maintain an adequate level of circulating blood to meet the oxygen and nutrient needs of the body.

### Evaluating the Blood Pressure

When a patient’s blood pressure is being tracked, frequent readings should be taken at about the same time of day and by the same person. Secondary hypertension is caused by another underlying pathologic condition, such as renal disease, complications of pregnancy, endocrine imbalances, obesity, arteriosclerosis, atherosclerosis, and brain injuries. Temporary hypertension may occur with stress, pain, exercise, and exhaustion. Many patients experience “white coat hypertension,” that is, their blood pressure becomes elevated in the medical environment, although it is normal away from the healthcare facility. An adult is diagnosed with **essential hypertension** (primary hypertension) if the systolic pressure is 140 mm Hg or higher and/or the diastolic pressure is 90 mm Hg or higher. Essential hypertension is the most common type of hypertension. It has no single identified cause but is associated with obesity, a high blood level of sodium, elevated cholesterol levels, and family history.

In 2003 the American Heart Association (AHA) published new guidelines for the diagnosis and management of hypertension. A new category of blood pressure, prehypertension, was identified, and normal blood pressure levels were lowered to less than 120/80. Table 31-6 identifies the categories of normal, prehypertensive, and hypertensive blood pressures.

The goal of the new recommendations is to reduce the number of people who die each year from hypertension-related illnesses such as coronary artery disease, which leads to heart attacks, heart failure, kidney disease, and strokes. Hypertension can occur in children or adults, but individuals of African-American descent, middle-aged and elderly people, patients with diabetes mellitus, and those with kidney disease are at greatest risk. Hypertension has been called the silent killer, because it fre-
| TABLE 31-6 Hypertension Categories  |
|-----------------|-----------------|-----------------|
| BLOOD PRESSURE  | NORMAL          | PREHYPERTENSION | HYPERTENSION   |
| Systolic (mm Hg) | Less than 120   | 120-139         | 140 or higher  |
| Diastolic (mm Hg)| Less than 80    | 80-89           | 90 or higher   |

Hypotension is an abnormally low blood pressure, which may be caused by emotional or traumatic shock; hemorrhage; central nervous system disorders; and chronic wasting diseases. Persistent readings of 90/60 mm Hg or lower usually are considered hypotensive. Orthostatic (postural) hypotension can cause patients to experience vertigo or syncope. Some medications can cause orthostatic hypotension.

### Measuring Blood Pressure

The instrument used to measure blood pressure is called the *sphygmomanometer*. The term *manometer* refers to an instrument used to measure the pressure of a liquid or a gas. *Sphygmomon* means pulse. Therefore *sphygmomanometer* means an instrument used for measuring blood pressure in the arteries. The instrument consists of an inflatable cuff, an inflation bulb with a control valve, and a pressure gauge. The blood pressure mechanism consists of an aneroid dial attached to an inflatable cuff (Figure 31-13, A) or a blood pressure floor model (Figure 31-13, B).

Sphygmomanometers are delicately calibrated instruments and must be handled carefully. They should be recalibrated regularly and checked for accuracy, either by you or by a medical supply dealer. The needle on the aneroid dial sphygmomanometer should rest within the small square or circle at the bottom of the dial. The dial can be calibrated by connecting it to a calibrated manometer. Pump both manometers to 250 mm Hg and record readings on both machines at least four different times as the pressure is released. A correctly calibrated mechanism shows no more than a 3 mm Hg difference between the two readings at any time during the deflation period. If the sphygmomanometer is not correctly calibrated, the patient’s blood pressure reading will be inaccurate.

The sphygmomanometer must be used with a stethoscope. The objective of the procedure is to use the inflatable cuff to obliterate (cause to disappear) circulation through an artery. The stethoscope is placed over the artery just below the cuff, and the cuff is slowly deflated to allow the blood to flow again. As blood flow resumes, cardiac cycle sounds are heard through the stethoscope, and gauge readings are taken when the first (systolic) and the last (diastolic) sounds are heard (Procedure 31-8).

Blood pressure cuffs and stethoscopes are available in drug and retail stores for patients to use to measure their own blood pressure at home. These units can be aneroid, electronic, or computerized sphygmomanometers (Figure 31-14). If you have patients who are monitoring their pressures at home, be sure that they understand the mechanics of obtaining a reading accurately. It is best to have the patient bring his or her equipment to the office and demonstrate its use. While the patient is showing you the home equipment, you will have an ideal time to check technique and calibration and answer any questions the patient may have about the use of the equipment. This is also a good opportunity to reinforce treatment plans, such as medication, diet, and exercise. It is helpful for a patient who is monitoring blood pressure readings at home to keep a log and review it with the physician during visits to help detect blood pressure variations during normal daily activities.

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**CRITICAL THINKING APPLICATION 31-6**

Mr. Samuel Long, a 43-year-old patient, recently was diagnosed with essential hypertension. What should Carlos discuss with Mr. Long to emphasize the dangers of his disease and to educate him about possible lifestyle modifications he needs to make to improve his health? Are any community resources available that might help Mr. Long and his family effectively manage his disease?
FIGURE 31-13  A. Aneroid dial system with an inflatable cuff. B. Aneroid floor model with a large slotted base.

FIGURE 31-14  Personal blood pressure systems. A. Digital arm cuff. B. Digital wrist cuff.
PROCEDURE 31-8

Obtain Vital Signs: Determine a Patient’s Blood Pressure

GOAL: To perform a blood pressure measurement that is correct in technique, accurate, and comfortable for the patient.

EQUIPMENT and SUPPLIES

- Sphygmomanometer
- Stethoscope
- Antiseptic wipes/alcohol swabs
- Patient record

PROCEDURAL STEPS

1. Sanitize your hands.
   PURPOSE: To ensure infection control.

2. Assemble the equipment and supplies needed. Clean the earpieces and diaphragm of the stethoscope with alcohol swabs.
   PURPOSE: To follow Standard Precautions.

3. Introduce yourself, identify the patient, and explain the procedure.
   PURPOSE: Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.

4. Select the appropriate arm for application of the cuff (no mastectomy on that side, without injury or disease). If the patient has had a bilateral mastectomy, the blood pressure should be taken using a large thigh cuff with the stethoscope over the popliteal artery.
   PURPOSE: The pressure of the cuff temporarily interferes with circulation to the limb.

5. Seat the patient in a comfortable position with the legs uncrossed and the arm resting, palm up, at heart level on the lap or a table.
   PURPOSE: To expose the brachial artery; also, to promote patient relaxation and ensure a true reading. Crossed legs may increase the blood pressure, and positioning of the arm above the heart level may cause an inaccurate reading.

6. Roll up the sleeve to about 5 inches above the elbow or have the patient remove the arm from the sleeve.
   PURPOSE: Tight clothing prevents an accurate reading.

7. Determine the correct cuff size.
   PURPOSE: An incorrect cuff size prevents accurate measurement of blood pressure. The cuff should fit comfortably around the patient’s arm, and the bladder should be located over the brachial artery between the lines designated on the cuff. Pediatric, normal adult, and large adult cuff sizes should be available.

8. Palpate the brachial artery at the antecubital space in both arms. If one arm has a stronger pulse, use that arm. If the pulses are equal, select the right arm.
   PURPOSE: A stronger pulse is easier to measure; the right arm is the universal arm of choice.
   CAUTION: If a female patient has had a mastectomy, the blood pressure should never be taken on the affected side. Compressing the arm may cause complications. If she has had a bilateral mastectomy, another site, such as the popliteal artery, must be used, which requires use of a thigh cuff.

9. Center the cuff bladder over the brachial artery with the connecting tube away from the patient’s body and the tube to the bulb close to the body (Figure 1).
   PURPOSE: Pressure must be applied directly over the artery for an accurate reading. The cuff and its tubing should not touch the stethoscope. Noise from the tubing can interfere with a correct reading.

10. Place the lower edge of the cuff about 1 inch above the palpable brachial pulse, normally located in the natural crease of the inner elbow, and wrap it snugly and smoothly.
    PURPOSE: To help ensure an accurate reading. The cuff should be high enough on the arm that the stethoscope does not touch it, so that cuff sounds do not interfere with listening to the blood pressure sounds. A loose cuff results in an inaccurate reading.

11. Position the gauge of the sphygmomanometer so that it is easily seen.
    PURPOSE: An aneroid gauge should show the needle within the zero mark.

12. Palpate the brachial pulse, tighten the screw valve on the air pump, and inflate the cuff until the pulse can no longer be felt. Make a note at the point on the gauge where the pulse could no longer be felt. Mentally add 30 mm Hg to the reading. Deflate the cuff and wait 15 seconds (Figure 2).
    PURPOSE: The point where the brachial pulse is no longer felt provides an estimate of the systolic pressure. Pumping the cuff above that level ensures that phase I of the Korotkoff sounds will be heard.

13. Insert the earpieces of the stethoscope turned forward into the ear canals.
    PURPOSE: With the earpieces in this position, the openings follow the anatomic line of the ear canal and the blood pressure will be accurately heard.

14. Place the stethoscope’s diaphragm over the palpated brachial artery for an adult patient or the bell for a pediatric patient. Press firmly enough to obtain a seal but not so tightly that the artery is constricted.
PROCEDURE 31-8—cont'd

FIGURE 2

PURPOSE: Forming a seal around the head of the stethoscope aids listening for blood pressure sounds.

15. Close the valve and squeeze the bulb to inflate the cuff, rapidly but smoothly, to 30 mm above the palpated pulse level, which was previously determined (Figure 3).

16. Open the valve slightly and deflate the cuff at a constant rate of 2 to 3 mm Hg per heartbeat.

PURPOSE: Careful, slow release allows you to listen to all the sounds.

17. Listen throughout the entire deflation; note the point on the gauge at which you hear the first sound (systolic) and the last sound (diastolic) until the sounds have stopped for at least 10 mm Hg. Read the pressure to the closest even number.

18. Do not reinflate the cuff once the air has been released. Wait 30 to 60 seconds to repeat the procedure if needed.

PURPOSE: Not allowing the blood to refill in the brachial artery results in inaccurate readings.

19. Remove the stethoscope from your ears and record the systolic and diastolic readings as BP systolic/diastolic (e.g., BP 120/80).

FIGURE 3

NOTE: It is recommended that the blood pressure be checked and recorded in each arm during the initial assessment of the patient and then bilaterally periodically after that for patients with hypertension.

20. Remove the cuff from the patient’s arm and return it to its proper storage area. Clean the earpieces of the stethoscope with alcohol and return it to storage.

21. Sanitize your hands.

PURPOSE: To ensure infection control.

ADDITIONAL: The physician may direct the medical assistant to record the blood pressure with the patient in two different positions to determine whether orthostatic hypotension is a factor. To perform this skill:

1. Measure and record the patient’s blood pressure (as detailed earlier) while the patient is either supine or sitting.

2. Leave the cuff in place.

3. Have the patient stand and immediately measure the blood pressure again.

4. Record the second blood pressure, as well as any patient symptoms, such as complaints of (c/o) vertigo or lightheadedness.

5/19/XX 11 AM BP = 120/80 © arm — — — — — C. Ricci, CMA (AAMA)

COMMON CAUSES OF ERRORS IN BLOOD PRESSURE READINGS

- The limb used for measurement is not at the level of the heart.
- The rubber bladder in the cuff is not completely deflated before a reading is started or repeated.
- The pressure in the cuff is released too rapidly.
- The patient is nervous, uncomfortable, or anxious, which may cause a reading higher than the patient’s actual blood pressure.
- The patient drank coffee or smoked cigarettes within 30 minutes of the blood pressure measurement.
- The cuff is applied improperly.
- The cuff is too large, too small, too loose, or too tight.
- The cuff is not placed around the arm smoothly.

- The bladder is not centered over the artery, or it bulges out from the cover.
- The practitioner fails to wait 1 to 2 minutes between measurements.
- Instruments are defective:
  - Air leaks in the valve
  - Air leaks in the bladder
  - Aneroid needle not calibrated to zero

Korotkoff Sounds

Two basic heart sounds are produced by the functioning of the heart during the cardiac cycle. The first sound, produced at systole (contraction), is dull, firm, and prolonged and is heard as a lubb sound. The second sound, produced at diastole (relax-
ation), is shorter and sharper and is heard as a *dupp* sound. Therefore, *lubb-dupp* is the sound of one heartbeat.

Korotkoff sounds are the sounds heard during the auscultation of the blood pressure. These sounds are produced by the vibrations of the arterial wall when the blood surges back into the vessel after it has been compressed by the blood pressure cuff. The sounds were first discovered and classified into five distinct phases by Russian neurologist Nikolai Sergeyevich Korotkoff.

**Phase I**
Phase I is the first sound heard as the cuff deflates. The blood is resurging into the patient's artery and can be heard quite clearly as a sharp, tapping sound. Note the gauge reading when this first sound is heard. Record this as the systolic blood pressure.

**Phase II**
As the cuff deflates, even more blood flows through the artery. The movement of the blood makes a swishing sound. If you do not follow proper procedure in inflating the cuff, you may not hear these sounds because of their soft quality. Occasionally blood pressure sounds completely disappear during this phase. The loss of the sounds and their reappearance later is called the *auscultatory gap*. The silence may continue as the needle falls another 30 mm Hg. Auscultatory gaps occur particularly in hypertension and certain types of heart disease, so if you notice such a gap, make sure to report it to the physician.

**Phase III**
In phase III, a great deal of blood is pushing down into the artery. The distinct, sharp tapping sounds return and continue rhythmically. If you do not inflate the cuff enough, you will miss the first two phases completely and you will incorrectly interpret the beginning of phase III as the systolic blood pressure (phase I).

**Phase IV**
At this point, the blood is flowing easily. The sound changes to a soft tapping, which becomes muffled and begins to grow fainter. Occasionally these sounds continue to zero. This may occur in children, in patients of any age after exercise or with a fever, or in a pregnant patient with anemia. The AHA recommends that the beginning of phase IV be recorded as the diastolic reading for a child. Some physicians call the change at phase IV the *fading sound* and want it recorded between the systolic and the diastolic recordings (e.g., 120/84/70, with the 84 representing the gauge reading when the sounds of phase III have ended and those of phase IV are beginning). Other physicians consider phase IV the true diastolic pressure.

**Phase V**
All sounds disappear in this phase. Note the gauge reading when the last sound is heard. Record this as the diastolic pressure.

**Palpatory Method**
The systolic pressure may be checked by feeling the radial pulse rather than hearing it with the stethoscope. Place the cuff in the usual position and palpate the radial pulse, noting the rate and rhythm. Inflate the cuff until the pulse disappears and then add 30 mm Hg more of inflation to get above the systolic pressure. Do not remove your fingers from the pulse or change the pressure of your fingers. Then slowly release the pressure in the cuff and wait for the pulse to be felt again. Note the reading on the gauge, and record the first pulse felt as the systolic pressure. For example, if you first felt the radial pulse at 52 mm Hg, the palpated blood pressure is recorded as 52/P, with P indicating that the systolic reading was palpated. The diastolic and the Korotkoff phases cannot be determined by this method. This method can be very useful in times of a medical emergency, such as shock, when the patient's blood pressure cannot be auscultated.

**CRITICAL THINKING APPLICATION 31-7**
Vital signs are documented in this order: temperature (T), pulse (P), and respirations (R). Blood pressure is recorded after the TPR. Correctly document the following vital signs:

1. Oral temperature of 101.2°; apical pulse of 90; respirations, 22; and orthostatic blood pressure, 138/88 supine and 110/70 standing
2. Tympanic temperature of 36.8°; radial pulse of 66; respirations, 18; and bilateral blood pressure of 128/76 in the left arm and 132/80 in the right arm
3. Temporal temperature of 102.4°; apical pulse, 102; respirations, 27
4. Axillary temperature of 97.7°; carotid pulse of 58; respirations, 24; and palpated blood pressure, 62

**OSHA GUIDELINES FOR MEASURING VITAL SIGNS**
Guidelines established by the Occupational Safety and Health Administration (OSHA) for the measurement of vital signs include the following:

- Wash hands before and after each procedure.
- Always use protective disposable sheaths on all forms of thermometers.
- Immediately disinfect any equipment that has become contaminated during the procedure.
- Wear gloves if the potential exists for contacting any open areas or body fluids.
- When caring for a patient with a known respiratory infectious disorder, such as tuberculosis, use protective clothing, including a face shield or mask as indicated.
- Dispose of all contaminated material, including thermometer covers, gloves, and disinfectant swabs, in the proper biohazard waste containers.

**ANTHROPOMETRIC MEASUREMENT**
Anthropometry is the science that deals with the measurement of the size, weight, and proportions of the human body. These measurements often are included in the initial recording of vital
signs and before the physician performs a physical examination or a well-baby check. Because they are indicators of the patient's state of health and well-being, height and weight measurements and the associated BMI are discussed as aspects of the vital signs. Other measurements are discussed when pertinent in the specialty chapters.

## Measuring Weight and Height

A patient's weight and height can be helpful in diagnosis, and the medical assistant must determine these readings with accuracy and empathy (Procedure 31-9). In many medical settings, weight and height are measured routinely as the patient is escorted to the examination room. If this is the patient's first visit, the anthropometric measurements are written in the history database and used as reference information during future visits as needed. Many physicians now use the BMI to determine the risk for certain diseases, so the medical assistant may have to use accurately measured height and weight to determine the patient's BMI, as discussed in Chapter 30.

Certain medical specialties and specific medical problems may require continuous monitoring of weight. Hormone disorders (e.g., diabetes), growth patterns (seen in children), and eating disorders (e.g., obesity and bulimia) require accurate weight checks as part of every medical visit. In addition, maternity patients must have their weight monitored to make sure they are gaining weight but also as a precaution against too much weight gain, which may indicate fluid retention. Patients with cardiovascular disorders who tend to retain fluid should have their weight checked each time they are seen in the office. Some scales are calibrated in kilograms, and others in pounds. When a weight must be converted from one to the other, use the formulas shown later in the chapter.

Accurate height or length measurements are important when caring for children (see the chapter on pediatrics). The physi-

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### PROCEDURE 31-9

**Obtain Vital Signs: Measure a Patient's Weight and Height**

**GOAL:** To accurately weigh and measure a patient as part of the physical assessment procedure.

**NOTE:** Make sure the scale is located in an area away from traffic to maintain the patient's privacy.

**EQUIPMENT and SUPPLIES**

- Balance scale with a measuring bar
- Paper towel
- Patient towel
- Patient record

**PROCEDURAL STEPS**

1. Sanitize your hands.  
   **PURPOSE:** To ensure infection control.

2. Introduce yourself, identify your patient, and explain the procedure.  
   **PURPOSE:** Identification of the patient prevents errors, and explanations are a means of gaining implied consent and patient cooperation.

3. If the patient is to remove his or her shoes for weighing, place a paper towel on the scale platform. The patient may be given disposable slippers to wear.

4. Check to see that the balance bar pointer floats in the middle of the balance frame when all weights are at zero.  
   **PURPOSE:** A floating pointer indicates that the scale is properly adjusted and in balance.

5. Help the patient onto the scale. Make sure a female patient is not holding a purse and that a male or female patient has removed any heavy objects from pockets.

6. Move the large weight into the groove closest to the patient's estimated weight. The grooves are calibrated in 50lb increments. If you choose a groove that is more than the patient's weight, the pointer will immediately tilt to the bottom of the balance frame. You then must move it back one groove (Figure 1).

7. While the patient is standing still, slide the small upper weight to the right along the pound markers until the pointer balances in the middle of the balance frame.

   **PURPOSE:** The pointer floats between the bottom and the top of the frame when both lower and upper weights together balance the scale with the patient's weight.

8. Leave the weights in place.

9. Ask the patient to stand up straight and to look straight ahead. On some scales, the patient may need to turn with the back to the scale.
10. Adjust the height bar so that it just touches the top of the patient's head (Figure 2).
11. Leave the elevation bar set but fold down the horizontal bar. **PURPOSE:** To maintain the height recording while protecting the patient from possible injury.
12. Assist the patient off the scale. Make sure all items that were removed for weighing are given back to the patient.
13. Read the weight scale. Add the numbers at the markers of the large and the small weights and record the total to the nearest 1/4 lb on the patient's medical record (e.g., Wt: 136 3/4).
14. Read the marker at the movable point of the ruler and record the measurement to the nearest 1/4 inch on the patient's medical record (e.g., Ht: 64 3/4).
15. Use the patient's weight and height to record the BMI if this is office procedure.
16. Return the weights and the measuring bar to zero.
17. Sanitize your hands.
18. Record the results on the patient's medical record.

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**WEIGHT CONVERSION FORMULAS**

To Convert Kilograms to Pounds

1 kg = 2.2 lb
Multiply the number of kilograms by 2.2.

**Example**

A patient weighs 68 kg: 68 x 2.2 = 149.6 lb

To Convert Pounds to Kilograms

1 lb = 0.45 kg
Multiply the number of pounds by 0.45, or divide the number of pounds by 2.2 kg.

**Example**

A patient weighs 120 lb: 120 x 0.45 = 54 kg, or 120 ÷ 2.2 = 54.5 kg.

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**CRITICAL THINKING APPLICATION 31-8**

- A patient weighs 8 lb; how many pounds does he weigh?
- A patient weighs 148 lb; how many kilograms does she weigh?

**CRITICAL THINKING APPLICATION 31-9**

Mrs. Johnson is being seen for the first time by Dr. Xu. In what order should Carlos take her vital signs and her anthropometric measurements? Should the blood pressure be measured in both arms, with the patient both sitting and standing? If so, what is the rationale?
to take home, and use community resources when indicated to help the patient with weight-related issues (see Chapter 30 for further details).

### RESPONSIBILITIES OF THE MEDICAL ASSISTANT IN OBTAINING VITAL SIGNS

- Monitoring vital signs is a key responsibility of the medical assistant.
- It is crucial to measure and describe all facets of each vital sign correctly.
- The information must be accurately and clearly documented.
- The medical assistant should take advantage of all opportunities to answer questions and help the patient understand the significance of healthy vital signs.
- Patient privacy must be maintained throughout all procedures.
- Family members or caregivers should be included in patient care and education as indicated.
- Community resources should be used to promote holistic patient care.
- The medical assistant should be sensitive to cultural and socioeconomic factors that may affect the patient’s compliance with the physician’s recommendations, such as diet, exercise, weight control, and the use of medication.

### Closing Comments

#### Patient Education

All patients should know how to use a thermometer safely and accurately, as well as the preferred site based on age and other patient factors. Because many types of temperature-reading equipment are available, ask the patient what type of equipment he or she uses at home to obtain temperature readings. Inexpensive digital models have greatly simplified home temperature taking.

To teach a patient how to assess the pulse rate, familiarize the patient with counting the beats and how to determine the rate, rhythm, and regularity of the beat. Use diagrams to teach pulse points and have the patient measure your pulse to assess the patient’s accuracy and to provide any needed assistance.

If a patient is to keep track of respirations, a family member or helper must do this for the patient. The patient and all caregivers also should be taught self-assessment of impending complications, as well as preventive breathing exercises.

Monitoring blood pressure at home has become very common. Suggest that the patient bring his or her equipment to the office and practice with it. In this way, you can make sure the patient is using the equipment correctly and is recording the results accurately in a record book.

Weight management can be a trying and emotional experience for a patient. Understanding how weight is affected by the time of day, by a particular activity, or by the type of scale used can help the patient maintain a positive attitude. Have an assortment of weight management literature available for the patient.

#### Legal and Ethical Issues

The medical assistant must remember that as the physician’s agent, he or she plays an important role in preventing legal claims against the physician and the medical office. The medical assistant must always function within the legal boundaries of the profession. When obtaining vital signs, carefully select your response to a patient who asks about the results. Remember, medical assistants are not qualified to diagnose a patient problem; that is, never evaluate or give an opinion of what the results may mean. For example, if a patient asks, “Is my blood pressure better?” you might reply, “The reading is 160/90 today.” You have not said that it is worse, the same, or better but have informed the patient of the current blood pressure reading.

Always be accurate in transcribing results into the patient’s medical record. If the results are incorrectly recorded, the patient may be incorrectly diagnosed or treated. This can result in legal action that may implicate you. A careless attitude toward the assessment of vital signs and documentation can lead to possible legal entanglement. Every procedure in this chapter is accompanied by a reminder to record the test results. If no entry has been made, the assumption is that the procedure was not done. Develop sensitivity toward proper conduct and performance so that you can protect yourself and your physician-employer.
SUMMARY OF SCENARIO

Carlos recognizes the significance of measuring and recording each patient's vital signs and anthropometric measurements. Dr. Xu relies on Carlos to provide this information accurately. Carlos has never let these procedures become routine or done them without focusing on the task, because the patient's vital signs are an important reflection of the person's health status.

Carlos knows that a number of factors can alter a patient's vital signs, including the external environment, smoking, drinking hot beverages, exercise, and anxiety and pain. Carlos evaluates patient factors such as age, gender, level of compliance, and the presence of disease to determine the best method of accurately measuring vital signs. In addition, Carlos is sensitive to the need for safeguarding patient privacy. When he was first hired by Dr. Xu, he was concerned about privacy and confidentiality when he discovered that the patient scale was in the hall next to the waiting room. After he discussed this with the office manager, the scale was moved to an examination room so that patients could be weighed in privacy.

Carlos attended a workshop last year on the revised AHA guidelines for the diagnosis and treatment of hypertension, and he is prepared to explain those recommendations to patients. He recognizes his role in motivating patients diagnosed with prehypertension to stick with recommended lifestyle changes and follow the physician's treatment protocol. Carlos continues to care for patients while providing valuable assistance to Dr. Xu in her busy primary care practice.
The goal of the new recommendations is to reduce the number of people who die each year from hypertension-related illnesses. Treatment includes a combination of weight management, sodium reduction, lifestyle changes, and the use of two or more antihypertensive and diuretic medications.

13. Identify the different Korotkoff phases.

The Korotkoff phases are the categories of sounds heard during blood pressure measurement. These sounds are produced by the vibrations of the arterial wall when the blood surges back into the vessel after it has been compressed by the blood pressure cuff. Phase I is the first sound heard as the cuff deflates and is the systolic reading; phase II is the swishing sound made by the movement of the blood through the artery, but you may have an auscultatory gap in which sounds completely disappear; phase III involves distinct, sharp tapping sounds made as the blood rushes through the artery; in phase IV the sound changes to a soft tapping, which becomes muffled and begins to grow fainter; and in phase V sound completely disappears. The last sound heard is the diastolic reading.


A sphygmomanometer is used with a stethoscope to hear the systolic over diastolic sounds. (Procedure 31-8 outlines the method for performing this skill.)

15. Accurately measure and document height and weight.

A patient’s height and weight are anthropometric measurements that are recorded during the initial patient visit and periodically after that, depending on the patient’s needs and the physician’s preference. The scale should be kept in a private location. Variations in weight may indicate physical or emotional disorders, including diabetes, CHF, hormone abnormalities, depression, and eating disorders. Procedure 31-9 describes the techniques involved. Determine the patient’s BMI as indicated. (Chapter 30 discusses the BMI in more detail.)

16. Convert kilograms to pounds and pounds to kilograms.

To convert kilograms (kg) to pounds (lb), multiply the number of kilograms by 2.2. To convert pounds to kilograms, divide the number of pounds by 2.2 kg or multiply the number of pounds by 0.45 kg.

17. Identify patient education opportunities when measuring vital signs.

Patient education about vital signs includes confirming the patient’s ability to monitor vital signs at home as needed, providing assistance in working home equipment systems, and confirming understanding of the need to comply with the physician’s recommendations.

18. Determine the medical assistant’s legal and ethical responsibilities in obtaining vital signs.

Legal and ethical implications for the medical assistant include following the physician’s guidelines with patient disclosure, monitoring and recording vital signs accurately, and being consistently alert to inaccurate readings or potential carelessness.

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**CONNECTIONS**

Study Guide Connection: Go to the Chapter 31 Study Guide. Read and complete the activities.

Evolve Connection: Go to the Chapter 31 link at evolve.elsevier.com/rrn to complete the Chapter Review and Chapter Quiz. Pursue other resources listed for this chapter to increase your knowledge of Vital Signs.