DIVERSIFIED HEALTH OCCUPATIONS

Seventh Edition

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Library of Congress Control Number: 2007941692

ISBN-13: 978-1-4180-3021-6

ISBN-10: 1-4180-3021-X

Delmar Cengage Learning
5 Maxwell Drive
Clifton Park, NY 12065-2919
USA

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Printed in Canada
1 2 3 4 5 6 7 12 11 10 09 08

CHAPTER 15 Vital Signs

Observe Standard Precautions

Instructor's Check—Call Instructor at This Point

Safety—Proceed with Caution

OBRA Requirement—Based on Federal Law

Math Skill

Legal Responsibility

Science Skill

Career Information

Communications Skill

Technology

Chapter Objectives

After completing this chapter, you should be able to:

- List the four main vital signs
- Convert Fahrenheit to Celsius, or vice versa
- Read a clinical thermometer to the nearest two-tenths of a degree
- Measure and record oral temperature accurately
- Measure and record rectal temperature accurately
- Measure and record axillary temperature accurately
- Measure and record tympanic (aural) temperature accurately
- Measure and record temporal temperature accurately
- Measure and record radial pulse to an accuracy within ± 2 beats per minute
- Count and record respirations to an accuracy within ± 1 respiration per minute
- Measure and record apical pulse to an accuracy within ± 2 beats per minute
- Measure and record blood pressure to an accuracy within ± 2 mm of actual reading
- State the normal range for oral, axillary, and rectal temperature; pulse; respirations; and systolic and diastolic pressure
- Define, pronounce, and spell all key terms

KEY TERMS

apical pulse *(ape'-ih-kal)*
apnea *(ap'-nee"-ah)*
arrhythmia *(ah-rith'-me-ah)*
aural temperature
axillary temperature
blood pressure
bradycardia *(bray'-dee-car'-dee-ah)*
bradypnea *(brad"-ip-nee'-ah)*
character
Cheyne–Stokes *(chain' stokes")*
clinical thermometers
cyanosis
diastolic *(die"-ah-stall'-ik)*
dyspnea *(dis(p)'-nee"-ah)*
electronic thermometers
fever
homeostasis *(home"-ee-oh-stay'-sis)*
hypertension
hyperthermia *(high-pur-therm'-ee-ah)*
hypotension
hypothermia *(high-po-therm'-ee-ah)*
oral temperature
orthopnea *(or"-thop-nee'-ah)*
pulse
pulse deficit
pulse pressure
pyrexia
rale *(rawl)*
rate
rectal temperature
respirations
rhythm
sphygmomanometer *(sfig"-moh-ma-nam'-eh-ter)*
stethoscope *(steth'-uh-scope)*
systolic *(sis"-tall'-ik)*
tachycardia *(tack"-eh-car'-dee-ah)*
tachypnea *(tack"-ip-nee'-ah)*
temperature
temporal scanning thermometer
temporal temperature
tympanic thermometers
vital signs
volume
wheezing

15:1 INFORMATION

Measuring and Recording Vital Signs

Vital signs are important indicators of health states of the body. This unit discusses all of the vital signs in detail. The basic information that follows serves as an introduction for this topic.

Vital signs are defined as various determinations that provide information about the basic body conditions of the patient. The four main vital signs are temperature, pulse, respirations, and blood pressure. Many health care professionals are now regarding the degree of pain as the fifth vital sign. Patients are asked to rate their level of pain on a scale of 1 to 10, with 1 being minimal pain and 10 being severe pain. Other important vital signs that provide information about the patient's condition include the color of the skin, the size of the pupils in the eyes and their reaction to light, the level of consciousness, and the patient's response to stimuli. As a health care worker, it will be your responsibility to measure and record the vital signs of patients. However, it is not in your realm of duties to reveal this information to the patient. The physician will decide if the patient should be given this information. It is essential that vital signs be accurate. They are often the first indication of a disease or abnormality in the patient.

Temperature is a measurement of the balance between heat lost and heat produced by the body. Temperature can be measured in the mouth (oral), rectum (rectal), armpit (axillary), ear (aural), or by the temporal artery in the forehead (temporal). A low or high reading can indicate disease. Most temperatures are measured in degrees on a thermometer that has a Fahrenheit scale. However, some health care facilities are now measuring temperature in degrees on a Celsius (centigrade) scale. A comparison of the two scales is shown in figure 15-1 and in Appendix B. At times, it may be necessary to convert Fahrenheit temperatures to Celsius, or Celsius to Fahrenheit. The formulas for the conversion are as follows:

- To convert Fahrenheit (F) temperatures to Celsius (C) temperatures, subtract 32 from the Fahrenheit temperature and then multiply the result by 5/9, or 0.5556. For exam-

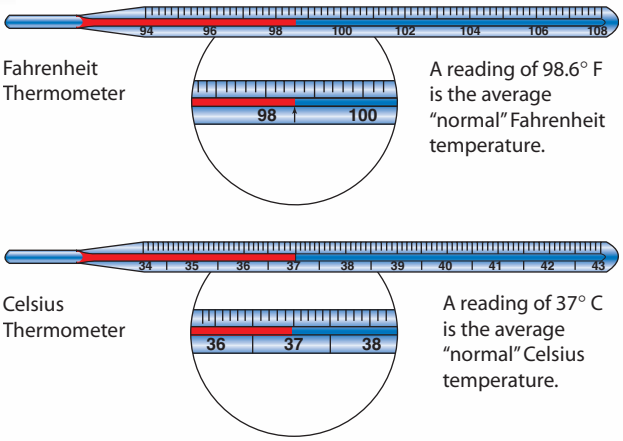

FIGURE 15-1 Normal oral body temperature on Fahrenheit and Celsius thermometers.

ple, to convert a Fahrenheit temperature of 212 to Celsius, subtract 32 from 212 to get 180. Then multiply 180 by 5/9, or 0.5556, to get the Celsius temperature of 100.0.

- To convert Celsius (C) temperatures to Fahrenheit (F) temperatures, multiply the Celsius temperature by 9/5, or 1.8, and then add 32 to the total. For example, to convert a Celsius temperature of 37 to Fahrenheit, multiply 37 by 9/5, or 1.8, to get 66.6. Then add 32 to 66.6 to get the Fahrenheit temperature of 98.6.

Pulse is the pressure of the blood felt against the wall of an artery as the heart contracts and relaxes, or beats. The rate, rhythm, and volume are recorded. **Rate** refers to the number of beats per minute, **rhythm** refers to regularity, and **volume** refers to strength. The pulse is usually taken over the radial artery, although it may be felt over any superficial artery that has a bone behind it. Any abnormality can indicate disease.

Respirations reflect the breathing rate of the patient. In addition to the respiration count, the rhythm (regularity) and character (type) of respirations are noted. Abnormal respirations usually indicate that a health problem or disease is present.

Blood pressure is the force exerted by the blood against the arterial walls when the heart contracts or relaxes. Two readings (systolic and diastolic) are noted to show the greatest pressure and the least pressure. Both are very important. Abnormal blood pressure is often the first indication of disease.

Another vital sign is the **apical pulse.** This pulse is taken with a stethoscope at the apex of the heart. The actual heartbeat is heard and counted. At times, because of illness, hardening of the arteries, a weak or very rapid radial pulse, or doctor's orders, you will be required to take an apical pulse. Also, because infants and small children have a very rapid radial pulse that is difficult to count, apical pulses are usually taken.

If you note any abnormality or change in any vital sign, it is your responsibility to report this immediately to your supervisor. If you have difficulty obtaining a correct reading, ask another individual to check the patient. Never guess or report an inaccurate reading.

STUDENT: *Go to the workbook and complete the assignment sheet for 15:1, Measuring and Recording Vital Signs.*

15:2 INFORMATION

Measuring and Recording Temperature

Body temperature is one of the main vital signs. This section provides the basic guidelines for taking and recording temperature.

Temperature is defined as "the balance between heat lost and heat produced by the body." Heat is lost through perspiration, respiration, and excretion (urine and feces). Heat is produced by the metabolism of food, and by muscle and gland activity. A constant state of fluid balance, known as **homeostasis,** is the ideal health state in the human body. The rates of chemical reactions in the body are regulated by body temperature. Therefore, if body temperature is too high or too low, the body's fluid balance is affected.

VARIATIONS IN BODY TEMPERATURE

The normal range for body temperature is 97–100° Fahrenheit, or 36.1–37.8° Celsius (sometimes called centigrade). However, variations in body temperature can occur. Some reasons for variations include:

- *Individual Differences*: some people have accelerated body processes and usually have higher temperatures; others have slower body processes and usually have lower temperatures

- *Time of Day*: body temperature is usually lower in the morning, after the body has rested and higher in the evening, after muscular activity and daily food intake have taken place
- *Body Sites*: parts of the body where temperatures are taken lead to variations; temperature variations by body site are shown in table 15-1.

Oral temperatures are taken in the mouth. The clinical thermometer is left in place for 3–5 minutes. This is usually the most common, convenient, and comfortable method of obtaining a temperature. Eating, drinking hot or cold liquids, and/or smoking can alter the temperature in the mouth. It is important to make sure the patient has *not* had anything to eat or drink, or has *not* smoked for at least 15 minutes prior to taking the patient's oral temperature. If the patient has done any of these things, explain why you cannot take the temperature and that you will return to do so.

Rectal temperatures are taken in the rectum. The clinical thermometer is left in place for 3–5 minutes. This is an internal measurement and is the most accurate of all methods. Rectal temperatures are frequently taken on infants and small children.

Axillary temperatures are taken in the armpit, under the upper arm. The arm is held close to the body, and the thermometer is inserted between the two folds of skin. A *groin* temperature is taken between the two folds of skin formed by the inner part of the thigh and the lower abdomen. Both axillary and groin are external temperatures and, thus, less accurate. The clinical thermometer is held in place for 10 minutes.

Aural temperatures are taken with a special tympanic thermometer that is placed in the ear or auditory canal. The thermometer detects and measures the thermal, infrared energy radiating from blood vessels in the tympanic membrane, or eardrum. Because this provides a measurement of body core temperature, there is no normal range. Instead, the temperature is calculated by the thermometer into an equivalent of one of four usual settings: equal mode, oral equivalent, rectal equivalent, or core equivalent. The equal mode provides no offset (adjustment) and is recommended for newborns, for whom axillary temperature is often taken. The oral equivalent is calculated with an offset; this mode is used for adults and children over 3 years of age, for whom oral readings are commonly used. The rectal mode is calculated with an offset and is used mainly for infants up to 3 years of age, for whom rectal temperatures are commonly taken. When the rectal mode is used on adults, the temperature may read higher than average. The core equivalent is calculated with an offset and measures core body temperatures such as those found in the bladder or pulmonary artery. The core equivalent mode should only be used where adult "core" temperatures are commonly used and should not be used for routine vital sign measurements. Most aural thermometers record temperature in less than 2 seconds; so this is a fast and convenient method for obtaining temperature. However, a drawback to using tympanic thermometers is that inaccurate results will be obtained if the thermometer is not inserted into the ear correctly or if an ear infection or wax buildup is present.

Temporal temperatures are a newer way to take temperature. A special temporal scanning thermometer is passed in a straight line across the forehead, midway between the eyebrows and upper hairline. The thermometer measures the temperature in the temporal artery to provide an accurate measurement of blood temperature. A normal temporal temperature is similar to a rectal temperature, because it measures the temperature inside the body or bloodstream. Research has shown that temporal thermometers are more accurate than other methods of taking temperature. Errors occur with clinical thermometers

TABLE 15-1 Temperature Variations by Body Site

	ORAL	RECTAL AND/OR TEMPORAL	AXILLARY AND/OR GROIN
Average Temperature	98.6°F (37°C)	99.6°F (37.6°C)	97.6°F (36.4°C)
Normal Range of Temperature	97.6–99.6°F (36.5–37.5°C)	98.6–100.6°F (37–38.1°C)	96.6–98.6°F (36–37°C)

because they are not inserted correctly, they are misread, or they are not left in place for the required period. Eating, drinking, smoking, and other actions alter or change an oral temperature. Perspiration or sweating alters or changes an axillary or groin temperature. These actions have no effect on a temporal temperature. Because a temporal scanning thermometer is easy to use and produces accurate results, it will become a common way to record body temperature.

- *Causes of increased body temperature*: illness, infection, exercise, excitement, and high temperatures in the environment
- *Causes of decreased body temperature*: starvation or fasting, sleep, decreased muscle activity, mouth breathing, exposure to cold temperatures in the environment, and certain diseases

Very low or very high body temperatures are indicative of abnormal conditions. **Hypothermia** is a low body temperature, below 95°F (35°C) measured rectally. It can be caused by prolonged exposure to cold. Death usually occurs if body temperature drops below 93°F (33.9°C) for a period of time. A **fever** is an elevated body temperature, usually above 101°F (38.3°C) measured rectally. **Pyrexia** is another term for fever. The term *febrile* means a fever is present; *afebrile* means no fever is present or the temperature is within the normal range. Fevers are usually caused by infection or injury. **Hyperthermia** occurs when the body temperature exceeds 104°F (40°C) measured rectally. It can be caused by prolonged exposure to hot temperatures, brain damage, and serious infections. Immediate actions must be taken to lower body temperature, because temperatures above 106°F (41.1°C) can quickly lead to convulsions, brain damage, and death.

TYPES OF THERMOMETERS

Clinical thermometers may be used to record temperatures. A clinical thermometer consists of a slender glass tube containing mercury or alcohol with red dye, which expands when exposed to heat. There are different types of clinical thermometers (figure 15-2). The glass oral thermometer has a long, slender bulb or a blue tip. A security oral thermometer has a shorter, rounder bulb and is usually marked with a blue tip. A rectal thermometer has a short, stubby, rounded bulb and may be marked with a red tip. In addition, some clinical thermometers have the word "oral" or "rectal" written on their stems. Disposable plastic sheaths may be used to cover the thermometer when it is used on a patient.

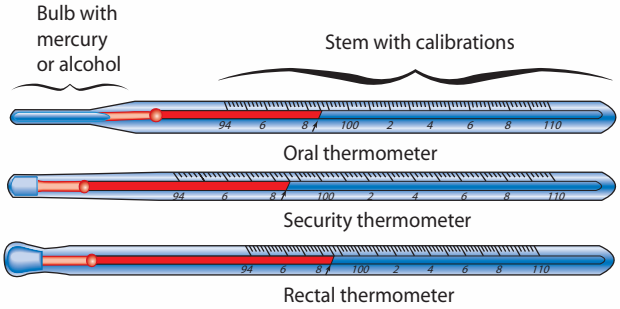

FIGURE 15-2 Types of clinical thermometers.

To avoid the chance of mercury contamination, the Occupational Health and Safety Administration (OSHA), the Environment Protection Agency (EPA), and the American Medical Association (AMA) recommend the use of alcohol-filled thermometers or digital thermometers. If a clinical thermometer containing mercury breaks, the mercury can evaporate and create a toxic vapor that can harm both humans and the environment. Mercury poisoning attacks the central nervous system in humans. Children, especially those under the age of six, are very susceptible. Mercury can contaminate water supplies and build up in the tissues of fish and animals. Therefore, proper cleanup of a broken clinical thermometer is essential. *Never* use a vacuum cleaner or broom to clean up mercury because this will break up the beads of mercury and allow them to vaporize more quickly. *Never* pour mercury down a drain or discard it in a toilet because this causes contamination of the water supply. If a clinical thermometer breaks, close doors to other indoor areas and open the windows in the room with the mercury spill to vent any vapors outside. Put on gloves and use two cards or stiff paper to push the droplets of mercury and broken glass into a plastic container with a tight-fitting lid. If necessary, use an eyedropper to pick up the balls of mercury. Shine a flashlight in the area of the spill because the light will reflect off the shiny mercury beads and make them easier to see. Wipe the entire area with a damp sponge. Then place all cleanup material, including the paper, eyedropper, gloves, and sponge, in the plastic container and label it "Mer-

cury for Recycling." Seal the lid tightly and take the container to a mercury recycling center. Most waste disposal companies will accept mercury for recycling. To discard unbroken mercury thermometers, place the intact thermometer in a plastic container with a tight-fitting lid, label it, and take it to a mercury recycling center.

Electronic thermometers are used in many facilities. This type of thermometer registers the temperature on a viewer in a few seconds (figure 15-3). Electronic thermometers can be used to take oral, rectal, axillary, and/or groin temperatures. Most facilities have electronic thermometers with blue probes for oral use and red probes for axillary or rectal use. To prevent cross-contamination, a disposable cover is placed over the thermometer probe before the temperature is taken. By changing the disposable cover after each use, one unit can be used on many patients. Electronic digital thermometers are excellent for home use because they eliminate the hazard of a mercury spill that occurs when a clinical thermometer is broken (figure 15-4). The small battery-operated unit usually will register the temperature in about 60 seconds on a digital display screen. Disposable probe covers prevent contamination of the probe.

Tympanic thermometers are specialized electronic thermometers that record the aural temperature in the ear (figure 15-5). A disposable plastic cover is placed on the ear probe. By inserting the probe into the auditory canal and pushing a scan button, the temperature is recorded on the screen within 1–2 seconds. It is important to read and follow instructions while using this thermometer to obtain an accurate reading.

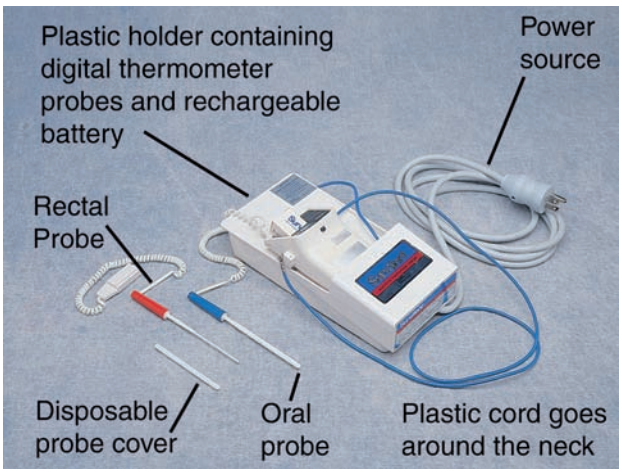

FIGURE 15-3 An electronic thermometer registers the temperature in easy-to-read numbers on a viewer.

FIGURE 15-4 Electronic digital thermometers are excellent for home use. *(Courtesy of Omron Healthcare Inc., Vernon Hills, IL)*

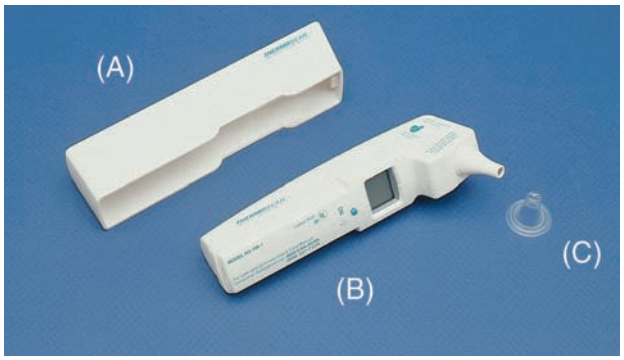

FIGURE 15-5 Tympanic thermometers record the aural temperature in the ear. Parts include: (A) holder, (B) thermometer, and (C) disposable cover.

Temporal scanning thermometers are specialized electronic thermometers that measure the temperature in the temporal artery of the forehead (figure 15-6). The thermometer probe is placed on the forehead and passed in a straight line across the forehead, midway between the eyebrows and upper hairline. In this area, the temporal artery is less than 2 millimeters (mm) below the skin surface and easy to find. The temperature registers on the screen in 1–2 seconds. This thermometer provides an accurate measurement of internal body temperature, is easy to use, and is noninvasive. It is important to make sure that the area of forehead scanned is not covered by hair, a wig, or a hat. If the person's head is lying on a pillow, the side of the forehead by the pillow should not be used for the measurement. Any type of head covering or a pillow prevents heat from dissipating and causes the reading to be falsely high.

FIGURE 15-6 Temporal scanning thermometers measure the temperature in the temporal artery of the forehead. *(Courtesy of Exergen Corporation, Watertown, MA)*

Plastic or *paper disposable thermometers* are used in some health care facilities (figure 15-7). These thermometers contain special chemical dots or strips that change color when exposed to specific temperatures. Some types are placed on the forehead and skin temperature is recorded. Other types are used orally. Both types are used once and discarded.

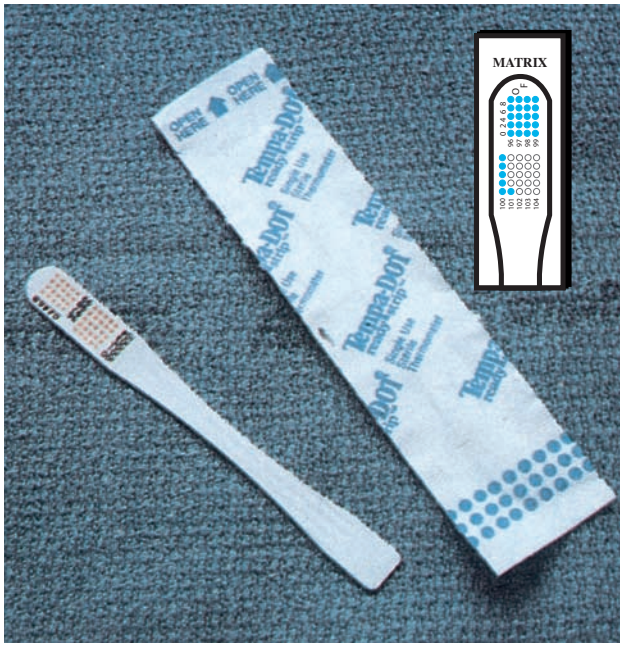

FIGURE 15-7 Plastic disposable thermometers have chemical dots that change color to register body temperature. The matrix shown reads 101°F.

READING AND RECORDING TEMPERATURE

Electronic and tympanic thermometers are easy to read because they have digital displays. Reading a glass clinical thermometer is a procedure that must be practiced. The thermometer should be held at eye level and rotated slowly to find the solid column of mercury or alcohol (figure 15-8). The thermometer is read at the point where the mercury or alcohol line ends. Each long line on a thermometer is read as 1 degree. An exception to this is the long line for 98.6°F (37°C), which is the normal oral body temperature. Each short line represents 0.2 (two-tenths) of a degree. Temperature is always recorded to the next nearest two-tenths of a degree. In figure 15-9, the line ends at 98.6°F (the inset explains the markings for each line).

To record the temperature, write 98^{6} instead of 98.6. This reduces the possibility of making an error in reading. For example, a temperature of 100.2 could easily be read as 102. By writing 100^{2}, the chance of error decreases. If a temperature is taken orally, it is not necessary to indicate that it is an oral reading. If it is taken rectally, place an (R) beside the recording. If it is taken in the axillary area, place an (Ax) beside the record-

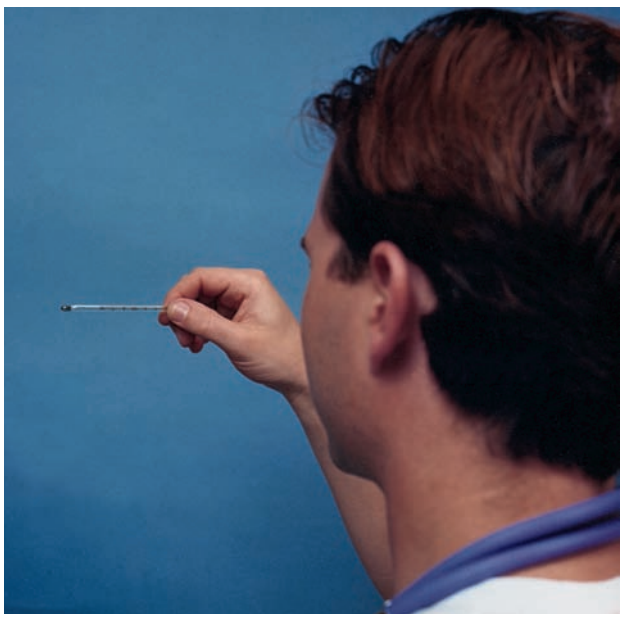

FIGURE 15-8 A clinical thermometer must be held at eye level to find the solid column of mercury or alcohol.

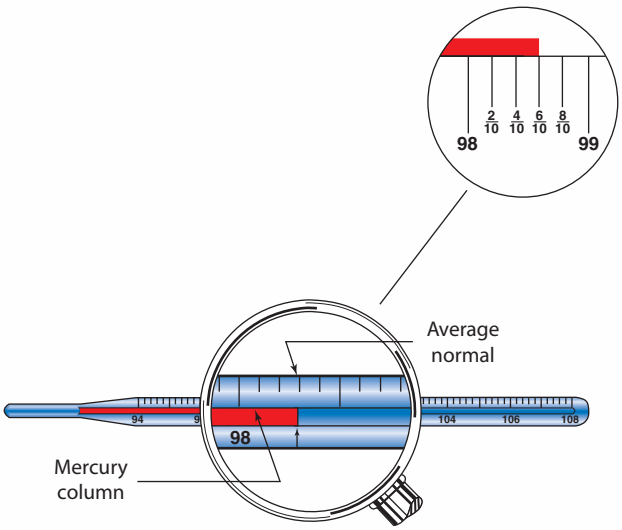

FIGURE 15-9 Each line on a thermometer equals two-tenths of a degree, so the thermometer shown reads 98.6°F.

ing. If it is taken tympanically (aurally), place an (A) beside the recording. For example:

- 98^{6} is an oral reading
- 99^{6} (R) is a rectal reading
- 97^{6} (Ax) is an axillary reading
- 98^{6} (A) is an aural reading

CLEANING THERMOMETERS

Thermometers must be cleaned thoroughly after use. The procedure used varies with different agencies and types of thermometers. In some agencies, the glass clinical thermometer is washed and rinsed. Cool water is used to prevent breakage and to avoid destroying the column of mercury or alcohol. The thermometer is then

FIGURE 15-10 A clinical thermometer can be covered with a plastic sheath that is discarded after each use.

soaked in a disinfectant solution (frequently 70 percent alcohol) for a minimum of 30 minutes before it is used again. Other agencies cover the clinical thermometer with a plastic sheath that is discarded after use (figure 15-10). The probe on electronic thermometers is covered with a plastic sheath that is discarded after each use. These covers prevent the thermometers from coming into contact with each patient's mouth or skin and prevent transmission of germs. Electronic thermometers all use disposable probes so contamination of the thermometer is limited. Some health care facilities do use disinfectants to wipe the outside of electronic thermometers. In most cases, it is best to follow the recommendations of the manufacturer for cleaning and proper care of electronic thermometers. Every health care worker should learn and follow the agency's policy for cleaning and care of thermometers.

STUDENT: *Go to the workbook and complete the assignment sheet for 15:2, Measuring and Recording Temperature. Then return and continue with the procedures.*

PROCEDURE 15:2A

Cleaning a Clinical Thermometer

Equipment and Supplies

Clinical thermometer, soapy cotton balls, small trash bag or waste can, running water, soaking basin with 70 percent alcohol, alcohol sponges or cotton balls, dry cotton balls or gauze pads, thermometer holder, disposable gloves

Procedure

1. Assemble equipment.

PROCEDURE 15:2A

2. Wash hands. Put on gloves if needed.

CAUTION: Follow standard precautions. Wear gloves if the thermometer was used for an oral or rectal temperature and was not covered with a plastic sheath.

3. After using the thermometer, use a soapy cotton ball or gauze pad to wipe the thermometer once from the top toward the tip or bulb (figure 15-11A). Discard the soiled cotton ball in trash bag or waste can.

   NOTE: Rotate the thermometer while wiping it to clean all sides and parts.

4. With the bulb pointed downward, hold the thermometer by the stem and rinse the thermometer in cool water.

CAUTION: Hot water will break the thermometer or destroy the mercury column.

5. Shake the thermometer down to 96°F (35.6°C) or lower.

CAUTION: Hold the thermometer securely between your thumb and index finger. Use a snapping motion of the wrist. Avoid countertops, tables, and other surfaces.

6. Place the thermometer in a small basin or container filled with disinfectant solution (usually 70 percent alcohol). Make sure the thermometer is completely covered by the solution (figure 15-11B).

   NOTE: Thirty minutes is usually the minimum time recommended for soaking.

7. Remove gloves and discard in an infectious waste container. Wash hands.

8. After 30 minutes, remove the thermometer from the soaking solution and use an alcohol cotton ball or alcohol sponge to wipe it from the stem toward the bulb. This removes any sediment from the thermometer.

9. Rinse the thermometer in cool water. Examine it carefully for any signs of breakage. Discard any broken thermometers according to the agency policy for disposal of mercury or mercury-containing items.

10. Read the thermometer to be sure it reads 96°F (35.6°C) or lower. Place it in a clean gauze-lined container. It is now ready for use.

    NOTE: Many health care agencies fill the container or thermometer holder with a disinfectant, usually 70 percent alcohol.

FIGURE 15-11A After each use, use a soapy cotton ball or gauze to wipe the thermometer in a circular motion from the stem to the bulb.

FIGURE 15-11B Soak the thermometer in a disinfectant solution for a minimum of 30 minutes.

PROCEDURE 15:2A

11. Replace all equipment used.
12. Wash hands.

    NOTE: This procedure may vary according to agency policy.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

Practice

Go to the workbook and use the evaluation sheet for 15:2A, Cleaning a Clinical Thermometer, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

PROCEDURE 15:2B

Measuring and Recording Oral Temperature

Equipment and Supplies

Oral thermometer, plastic sheath (if used), holder with disinfectant solution, tissues or dry cotton balls, container for used tissues, watch with second hand, soapy cotton balls, disposable gloves, notepaper, pencil/pen

Procedure

1. Assemble equipment.
2. Wash hands and put on gloves.

CAUTION: Follow standard precautions for contact with saliva or the mucous membrane of the mouth.

3. Introduce yourself. Identify the patient. Explain the procedure.
4. Position the patient comfortably. Ask the patient if he/she has eaten, has had hot or cold fluids, or has smoked in the past 15 minutes.

   NOTE: Eating, drinking liquids, or smoking can affect the temperature in the mouth. Wait at least 15 minutes if the patient says "yes" to your question.
5. Remove the clean thermometer by the upper end. Use a clean tissue or dry cotton ball to wipe the thermometer from stem to bulb.

   NOTE: If the thermometer was soaking in a disinfectant, rinse first in cool water.

CAUTION: Hold the thermometer securely to avoid breaking.

6. Read the thermometer to be sure it reads 96°F (35.6°C) or lower. Check carefully for chips or breaks.

CAUTION: Never use a cracked thermometer because it may injure the patient.

7. If a plastic sheath is used, place it on the thermometer.
8. Insert the bulb under the patient's tongue, toward the side of the mouth (figure 15-12). Ask the patient to hold it in place with the lips, and caution against biting it.

   NOTE: Check to be sure patient's mouth is closed.

PROCEDURE 15:2B

FIGURE 15-12 Insert the bulb of the thermometer under the patient's tongue (sublingually).

9. Leave the thermometer in place for 3–5 minutes.

   NOTE: Some agencies require that a clinical thermometer be left in place for 5–8 minutes. Follow your agency's policy.

   NOTE: If an electronic thermometer is used, hold the thermometer in place until the temperature registers on the screen.

10. Remove the thermometer. Hold it by the stem and use a tissue or cotton ball to wipe toward the bulb.

    NOTE: If a plastic sheath was used to cover the thermometer, there is no need to wipe the thermometer. Simply remove the sheath, taking care not to touch the part that was in the patient's mouth.

CAUTION: Do ***not*** hold the bulb end. This could alter the reading because of the warmth of your hand.

11. Read the thermometer. Record the reading on notepaper.

    NOTE: Recheck the reading and your notation for accuracy.

    NOTE: If the reading is less than 97°F, reinsert the thermometer in the patient's mouth for 1–2 minutes.

12. Clean the thermometer as instructed. Shake down to 96°F (35.6°C) or lower for next use.

13. Check the patient for comfort and safety before leaving.

14. Replace all equipment.

15. Remove gloves and discard in infectious waste container. Wash hands.

16. Record required information on the patient's chart or agency form, for example, date and time, T 98[6], your signature and title. Report any abnormal reading to your supervisor immediately.

Practice

Go to the workbook and use the evaluation sheet for 15:2B, Measuring and Recording Oral Temperature, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

PROCEDURE 15:2C

Measuring and Recording Rectal Temperature

Equipment and Supplies

Rectal thermometer, plastic sheath (if used), lubricant, tissues/cotton balls, waste bag or container, watch with second hand, paper, pencil/pen, soapy cotton ball, disposable gloves

NOTE: A manikin is frequently used to practice this procedure.

Procedure

1. Assemble equipment.
2. Wash hands and put on gloves.

CAUTION: Follow standard precautions if contact with rectal discharge is possible.

3. Introduce yourself. Identify the patient. Explain the procedure. Screen unit, draw curtains, and/or close door to provide privacy for the patient.
4. Remove rectal thermometer from its container. If the thermometer was soaking in a disinfectant, hold it by the stem end and rinse in cool water. Use a dry tissue/cotton ball to wipe from stem to bulb. Check that the thermometer reads 96°F (35.6°C) or lower. Check condition of thermometer. If a plastic sheath is used, position it on the thermometer.

CAUTION: Breaks in a thermometer can injure the patient. Never use a cracked thermometer.

5. Place a small amount of lubricant on the tissue. Roll the bulb end of the thermometer in the lubricant to coat it. Leave the lubricated thermometer on the tissue until the patient is properly positioned.
6. Turn the patient on his or her side. If possible, use Sims' position (lying on left side with right leg bent up near the abdomen). Infants are usually placed on their backs, with legs raised and held securely, or on their abdomens (figure 15-13).
7. Fold back covers just enough to expose the anal area.

   NOTE: Avoid exposing the patient unnecessarily.
8. With one hand, raise the upper buttock gently. With the other hand, insert the

FIGURE 15-13 The infant can be positioned on the back or abdomen for a rectal temperature.

PROCEDURE 15:2C

lubricated thermometer approximately 1 to 1½ inches (½ to 1 inch for an infant) into the rectum. Tell the patient what you are doing.

NOTE: At times, rotating the thermometer slightly will make it easier to insert.

CAUTION: Never force the thermometer. It can break. If you are unable to insert it, obtain assistance.

9. Replace the covers. Keep your hand on the thermometer the entire time it is in place.

CAUTION: ***Never*** let go of the thermometer. It could slide further into the rectum or break.

10. Hold the thermometer in place for 3–5 minutes.

NOTE: If an electronic thermometer is used, hold the thermometer in place until the temperature registers on the screen.

11. Remove the thermometer gently. Tell the patient what you are doing.
12. Remove plastic sheath, if used, and discard it or use a tissue to remove excess lubricant from the thermometer. Wipe from stem to bulb. Hold by the stem area only. Discard the tissue into a waste container.
13. Read and record. Recheck your reading for accuracy. Remember to place an (R) next to the recording to indicate a rectal temperature was taken.
14. Reposition the patient. Observe all safety checkpoints before leaving the patient.
15. Clean the thermometer as instructed in Procedure 15:2A, Cleaning a Clinical Thermometer.
16. Replace all equipment.
17. Remove gloves and discard in infectious waste container. Wash hands.
18. Record required information on the patient's chart or agency form, for example, date and time, T 99[6] (R), your signature and title. Report any abnormal reading immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:2C, Measuring and Recording Rectal Temperature, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

PROCEDURE 15:2D

Measuring and Recording Axillary Temperature

Equipment and Supplies

Oral thermometer, plastic sheath (if used), disposable gloves (if needed), tissues/cotton balls, towel, waste container, watch with second hand, paper, pencil/pen, soapy cotton ball

Procedure

1. Assemble equipment.
2. Wash hands. Put on gloves if necessary.

PROCEDURE 15:2D

CAUTION: Follow standard precautions if contact with open sores or body fluids is possible.

3. Introduce yourself. Identify the patient. Explain the procedure.
4. Remove oral thermometer from its container. Use a tissue to wipe from stem to bulb. Check thermometer for damaged areas. Read the thermometer to be sure it reads below 96°F (36.5°C). Place a plastic sheath on the thermometer, if used.
5. Expose the axilla and use a towel to pat the armpit dry (figure 15-14A).

   NOTE: Moisture can alter a temperature reading. Do not rub area hard because this too can alter the reading.
6. Raise the patient's arm and place the bulb end of the thermometer in the hollow of the axilla (figure 15-14B). Bring the arm over the chest and rest the hand on the opposite shoulder.

   NOTE: This position holds the thermometer in place.
7. Leave the thermometer in place for 10 minutes.

   NOTE: If an electronic thermometer is used, hold the thermometer in place until the temperature registers on the screen.
8. Remove the thermometer. Remove sheath, if used, and discard. Wipe from stem to bulb to remove moisture. Hold by the stem end only.

FIGURE 15-14A Before taking an axillary temperature, use a towel to pat the armpit dry.

FIGURE 15-14B To take an axillary temperature, insert the bulb end of the thermometer in the hollow of the axilla or armpit.

CAUTION: Holding the bulb end will change the reading.

9. Read and record. Check your reading for accuracy. Remember to mark (Ax) by the recording to indicate axillary temperature.
10. Reposition the patient. Be sure to check for safety and comfort before leaving.
11. Clean the thermometer as instructed.
12. Replace all equipment used.
13. Remove gloves if worn and discard in an infectious waste container. Wash hands.
14. Record required information on the patient's chart or agency form, for example, date and time, T 97^{6} (Ax), your signature and title. Report any abnormal reading immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:2D, Measuring and Recording Axillary Temperature, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

PROCEDURE 15:2E

Measuring and Recording Tympanic (Aural) Temperature

Equipment and Supplies

Tympanic thermometer, probe cover, paper, pencil/pen, container for soiled probe cover

Procedure

1. Assemble equipment.

   NOTE: Read the operating instructions so you understand exactly how the thermometer must be used.

2. Wash hands. Put on gloves if needed.

CAUTION: Follow standard precautions if contact with open sores or body fluids is possible.

3. Introduce yourself. Identify the patient. Explain the procedure.

4. Remove the thermometer from its base. Set the thermometer on the proper mode according to operating instructions. The equal mode is usually used for newborn infants, the rectal mode for children under 3 years of age, and the oral mode for children over 3 years of age and all adults. In areas where core body temperatures are recorded, such as critical care units, the core mode may be used.

5. Install a probe cover according to instructions. This will usually activate the thermometer, showing the mode selected and the word *ready*, indicating the thermometer is ready for use.

CAUTION: Do not use the thermometer until ***ready*** is displayed because inaccurate readings will result.

6. Position the patient. Infants under 1 year of age should be positioned lying flat with the head turned for easy access to the ear. Small children can be held on the parent's lap, with the head held against the parent's chest for support. Adults who can cooperate and hold the head steady can either sit or lie flat. Patients in bed should have the head turned to the side, and stabilized against the pillow.

7. Hold the thermometer in your right hand to take a temperature in the right ear, and in your left hand to take a temperature in the left ear. With your other hand, pull the ear pinna (external lobe) up and back on any child over 1 year of age and on adults (figure 15-15A). Pull the ear pinna straight back for infants under 1 year of age.

   NOTE: Pulling the pinna correctly straightens the auditory canal so the probe tip will point directly at the tympanic membrane.

8. Insert the covered probe into the ear canal as far as possible to seal the canal (figure 15-15B). Do not apply pressure.

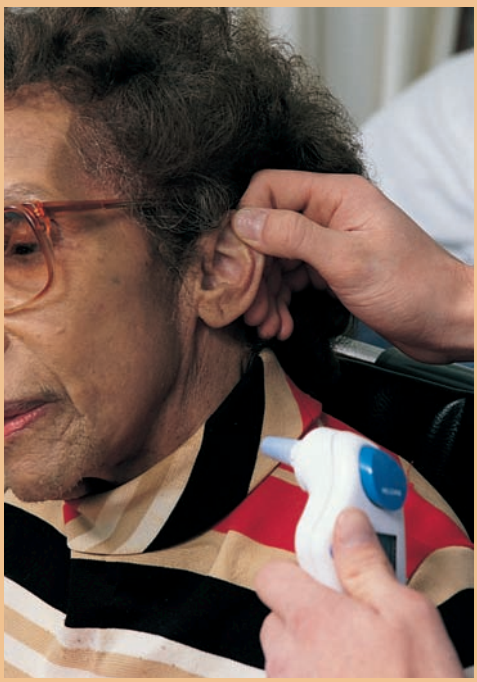

FIGURE 15-15A Before inserting the tympanic thermometer, pull the pinna up and back on adults and children older than 1 year.

PROCEDURE 15:2E

FIGURE 15-15B After inserting the covered probe of the tympanic thermometer into the ear canal, press the scan or activation button and hold the thermometer steady until the temperature reading is displayed.

9. Rotate the thermometer handle slightly until it is aligned with the patient's jaw. Hold the thermometer steady and press the scan or activation button. Hold it for the required amount of time, usually 1–2 seconds, until the reading is displayed on the screen.
10. Remove the thermometer from the patient's ear. Read and record the temperature. Place an (A) by the recording to indicate tympanic temperature.

    NOTE: The temperature will remain on the screen until the probe cover is removed.

CAUTION: If the temperature reading is low or does not appear to be accurate, change the probe cover and repeat the procedure. The opposite ear can be used for comparison.

11. Press the eject button on the thermometer to discard the probe cover into a waste container.
12. Return the thermometer to its base.
13. Reposition the patient. Observe all safety checkpoints before leaving the patient.
14. Remove gloves if worn and discard in an infectious waste container. Wash hands.
15. Record required information on the patient's chart or agency form, for example, date and time, T 98° (A), your signature and title. Report any abnormal reading immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:2E, Measuring and Recording Tympanic (Aural) Temperature, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

PROCEDURE 15:2F

Measuring Temperature with an Electronic Thermometer

Equipment and Supplies

Electronic thermometer with probe, sheath (probe cover), paper, pen/pencil, container for soiled sheath

Procedure

1. Assemble equipment.

   NOTE: Read the operating instructions for the electronic thermometer so you understand how the particular model operates.

2. Wash hands. Put on gloves if needed.

   CAUTION: Follow standard precautions. Always wear gloves if you are taking a rectal temperature.

   NOTE: Many health care facilities do not require gloves for an oral temperature taken with an electronic thermometer because there is usually no contact with oral fluids. Follow agency policy.

3. Introduce yourself. Identify the patient. Explain the procedure.

4. Position the patient comfortably and correctly.

   NOTE: For an oral temperature, ask the patient if he/she has eaten, has had hot or cold fluids, or has smoked in the past 15 minutes. Wait at least 15 minutes if the patient answers "yes."

   NOTE: For a rectal temperature, position the patient in Sims' position if possible.

5. If the probe has to be connected to the thermometer unit, insert the probe into the correct receptacle. If the thermometer has an "on" or "activate" button, push the button to turn on the thermometer.

6. Cover the probe with the sheath or probe cover.

   NOTE: For a rectal temperature, the sheath must be lubricated.

7. Insert the covered probe into the desired location. Most probes are heavy, so it is usually necessary to hold the probe in position (figure 15-16A).

   CAUTION: Hold on to the probe at all times for a rectal temperature.

8. When the unit signals that the temperature has been recorded, remove the probe.

   NOTE: Many electronic thermometers have an audible "beep." Others indicate that temperature has been recorded

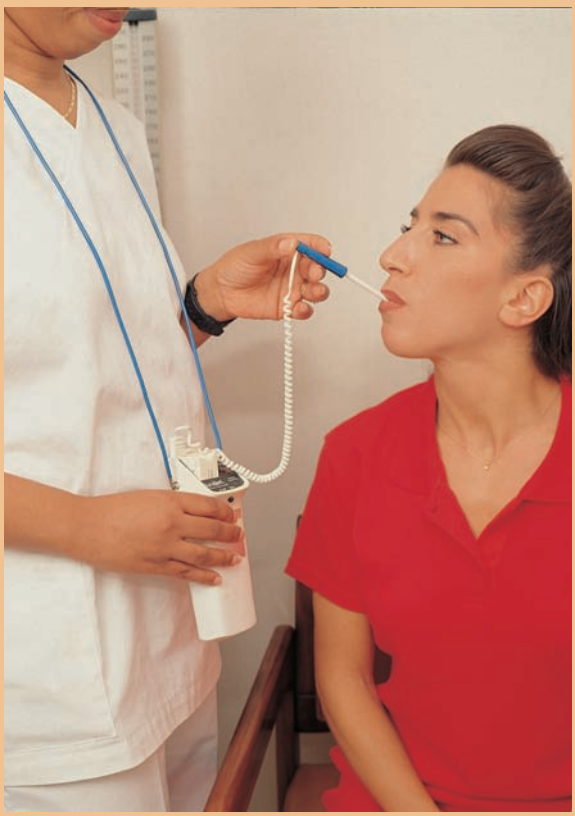

FIGURE 15-16A While taking a temperature, hold the probe of the electronic thermometer in place.

PROCEDURE 15:2F

when the numbers stop flashing and become stationary.

9. Read and record the temperature. Recheck your reading for accuracy.

   NOTE: Remember to place an (R) next to rectal readings or an (Ax) next to axillary readings.

10. Without touching the sheath or probe cover, discard the sheath in an infectious waste container (figure 15-16B). Most thermometers have an eject button that is pushed to remove the sheath.

FIGURE 15-16B Discard the probe cover in an infectious waste container without touching the cover.

11. Reposition the patient. Observe all safety checkpoints before leaving the patient.
12. Return the probe to the correct storage position in the thermometer unit. Turn off the unit if this is necessary. Place the unit in the charging stand if the model has a charging unit.
13. Replace all equipment.
14. Remove gloves if worn and discard in an infectious waste container. Wash hands.
15. Record required information on the patient's chart or agency form, for example, date and time, T 98[8], your signature and title. Report any abnormal reading immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:2F, Measuring Temperature with an Electronic Thermometer, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

PROCEDURE 15:2G

Measuring and Recording Temporal Temperature

Equipment and Supplies

Temporal scanning thermometer, paper, pen/pencil

Procedure

1. Assemble equipment.

   NOTE: Read the operating instructions for the temporal scanning thermometer so you understand how the particular model works.

2. Wash hands.
3. Introduce yourself. Identify the patient. Explain the procedure.
4. Remove the protective cap on the lens of the thermometer. Hold the thermometer upside down to clean the lens with an alcohol wipe and allow it to dry. Check the lens for cleanliness after it has dried.

   NOTE: Holding the thermometer upside down prevents excess moisture from entering the sensor area. The moisture will not harm the sensor, but a temperature cannot be taken until the sensor lens is dry.

5. Position the patient comfortably. Adults who can cooperate and hold the head steady can either sit or lie flat. Infants younger than 1 year should be positioned lying flat on the back. Small children can be held on the parent's lap, with the head held against the parent's chest for support, or lying flat.
6. Check the forehead to make sure there is no sign of perspiration. If perspiration is present, use a towel to pat the forehead dry. Make sure no covering, such as a hat, wig, or hair, is on the forehead. If the patient was lying on a pillow, do not use the side of the forehead that was on the pillow.

   CAUTION: Head coverings or a pillow prevent heat from dissipating from the forehead and cause a falsely high temperature reading.

7. Gently position the probe flat on the center of the forehead, midway between the eyebrow and hairline. Press and hold the *scan* button.
8. Slide the thermometer across the forehead lightly and slowly (figure 15-17). Keep the sensor flat and in contact with the skin until you reach the hairline on the side of the face.

   NOTE: The thermometer will emit a beeping sound and a red light will blink to indicate that a measurement is taking place.

9. Release the *scan* button and remove the thermometer from the head.

FIGURE 15-17 To take a temporal temperature, hold the scan button while lightly sliding the thermometer across the forehead midway between the eyebrow and hairline. *(Courtesy of Exergen Corporation, Watertown, MA)*

PROCEDURE 15:2G

NOTE: If sweating is profuse and you are not able to dry the forehead completely, scan the temperature as normal but keep the scan button depressed when the thermometer is removed from the forehead. Immediately nestle the thermometer on the neck directly behind the earlobe. Release the button and read the temperature.

10. Read and record the temperature that is displayed on the thermometer. Double-check your reading.
11. Press and release the activation button quickly to turn off the thermometer. Put the protective cap on the lens to protect the lens.

    NOTE: Most thermometers will turn off automatically after 30 seconds to 1 minute.
12. Reposition the patient. Observe all safety checkpoints before leaving the patient.
13. Replace all equipment. Wipe the outside of the thermometer with an alcohol wipe or disinfectant.
14. Wash hands.
15. Record required information on the patient's chart or agency form, for example, date and time, T 99^{8}, your signature, and your title. Report any abnormal reading immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:2G, Measuring and Recording Temporal Temperature, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

15:3 INFORMATION

Measuring and Recording Pulse

Pulse is a vital sign that you will be required to take. There are certain facts you must know when you take this measurement. This section provides the main information.

Pulse refers to the pressure of the blood pushing against the wall of an artery as the heart beats and rests. In other words, it is a throbbing of the arteries that is caused by the contractions of the heart. The pulse is more easily felt in arteries that lie fairly close to the skin and can be pressed against a bone by the fingers.

The pulse can be felt at different arterial sites on the body. Some of the major sites are shown in figure 15-18 and include:

- *Temporal*: on either side of the forehead
- *Carotid*: at the neck on either side of the trachea
- *Brachial*: inner aspect of forearm at the antecubital space (crease of the elbow)
- *Radial*: at the inner aspect of the wrist, above the thumb
- *Femoral*: at the inner aspect of the upper thigh where the thigh joins with the trunk of the body
- *Popliteal*: behind the knee
- *Dorsalis pedis*: at the top of the foot arch

NOTE: Pulse is usually taken over the radial artery.

Each time a pulse is measured, three different facts must be noted: the rate, the rhythm, and the volume of the pulse. These facts are important to

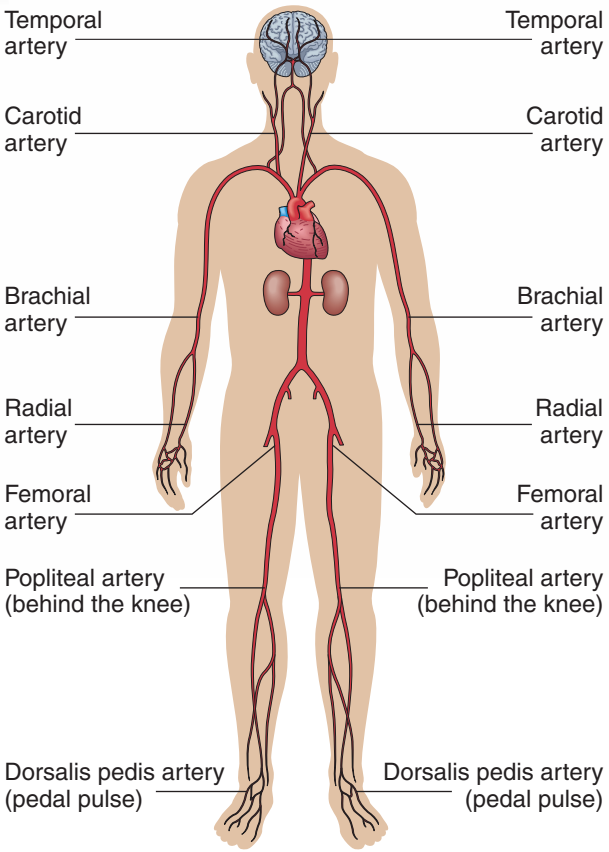

FIGURE 15-18 Major pulse sites.

provide complete information about the pulse. For example, a pulse of 82, strong and regular, is much different than a pulse of 82, weak and very irregular.

The **rate** of the pulse is measured as the number of beats per minute. Pulse rates vary among individuals, depending on age, sex, and body size:

- *Adults*: general range of 60–100 beats per minute
- *Adult men*: 60–70 beats per minute
- *Adult women*: 65–80 beats per minute
- *Children aged over 7*: 70–100 beats per minute
- *Children aged from 1–7*: range of 80–110 beats per minute
- *Infants*: 100–160 beats per minute
- **Bradycardia:** a pulse rate under 60 beats per minute
- **Tachycardia:** a pulse rate over 100 beats per minute (except in children)

NOTE: Any variations or extremes in pulse rates should be reported immediately.

Rhythm of the pulse is also noted. Rhythm refers to the regularity of the pulse, or the spacing of the beats. It is described as *regular* or *irregular*. An **arrhythmia** is an irregular or abnormal rhythm, usually caused by a defect in the electrical conduction pattern of the heart.

Volume, or the strength or intensity of the pulse, is also noted. It is described by words such as *strong, weak, thready*, or *bounding*.

Various factors will change pulse rate. Increased, or accelerated, rates can be caused by exercise, stimulant drugs, excitement, fever, shock, nervous tension, and other similar factors. Decreased, or slower, rates can be caused by sleep, depressant drugs, heart disease, coma, physical training, and other similar factors.

STUDENT: *Go to the workbook and complete the assignment sheet for 15:3, Measuring and Recording Pulse. Then return and continue with the procedure.*

PROCEDURE 15:3

Measuring and Recording Radial Pulse

Equipment and Supplies

Watch with second hand, paper, pencil/pen

Procedure

1. Assemble equipment.
2. Wash hands.
3. Introduce yourself. Identify the patient. Explain the procedure.
4. Place the patient in a comfortable position, with the arm supported and the palm of the hand turned downward.

   NOTE: If the forearm rests on the chest, it will be easier to count respirations after taking the pulse.

PROCEDURE 15:3

5. With the tips of your first two or three fingers, locate the pulse on the thumb side of the patient's wrist (figure 15-19).

   NOTE: Do not use your thumb; use your fingers. The thumb contains a pulse that you may confuse with the patient's pulse.

6. When the pulse is felt, exert slight pressure and start counting. Use the second hand of the watch and count for 1 full minute.

   NOTE: In some agencies, the pulse is counted for 30 seconds and the final number multiplied by 2. To detect irregularities, it is better to count for 1 full minute.

7. While counting the pulse, also note the volume (character or strength) and the rhythm (regularity).

FIGURE 15-19 To count a radial pulse, put the tips of two or three fingers on the thumb side of the patient's wrist.

8. Record the following information: date, time, rate, rhythm, and volume. Follow your agency's policy for recording.
9. Check the patient before leaving. Observe all safety precautions to protect the patient.
10. Replace all equipment used.
11. Wash hands.
12. Record all required information on the patient's chart or agency form, for example, date, time, P 82 strong and regular, your signature and title. Report any unusual observations immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:3, Measuring and Recording Radial Pulse, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

15:4 INFORMATION

Measuring and Recording Respirations

Respirations are another vital sign that you must observe, count, and record correctly. This section provides the main points you must note when counting and recording the quality of respirations.

Respiration is the process of taking in oxygen (O_2) and expelling carbon dioxide (CO_2) from the lungs and respiratory tract. One respiration consists of one inspiration (breathing in) and one expiration (breathing out).

Each time respiration is measured, three different facts must be noted: the rate, the character, and the rhythm of respirations. These three facts provide complete information about how the patient is breathing. For example, a respiration

measurement of 18, deep and regular, is much different than a measurement of 18, very shallow and irregular.

Rate of respirations counts the numbers of breaths per minute. The normal rate for respirations in adults is a range of 12–20 breaths per minute. In children, respirations are slightly faster than those for adults and average 16–30 per minute. In infants, the rate may be 30–50 per minute.

In addition to rate, the character and rhythm of respirations should be noted. **Character** refers to the depth and quality of respirations. Words used to describe character include *deep, shallow, labored, difficult, stertorous* (abnormal sounds like snoring), and *moist*. Rhythm refers to the regularity of respirations, or equal spacing between breaths. It is described as *regular* or *irregular*.

The following terminology is used to describe abnormal respirations:

- **Dyspnea:** difficult or labored breathing
- **Apnea:** absence of respirations, usually a temporary period of no respirations
- **Tachypnea:** rapid, shallow respiratory rate above 25 respirations per minute
- **Bradypnea:** slow respiratory rate, usually below 10 respirations per minute
- **Orthopnea:** severe dyspnea in which breathing is very difficult in any position other than sitting erect or standing
- **Cheyne–Stokes:** abnormal breathing pattern characterized by periods of dyspnea followed by periods of apnea; frequently noted in the dying patient
- **Rales:** bubbling or noisy sounds caused by fluids or mucus in the air passages
- **Wheezing:** difficult breathing with a high-pitched whistling or sighing sound during expiration; caused by a narrowing of bronchioles (as seen in asthma) and/or an obstruction or mucus accumulation in the bronchi
- **Cyanosis:** a dusky, bluish discoloration of the skin, lips, and/or nail beds as a result of decreased oxygen and increased carbon dioxide in the bloodstream

Respirations must be counted in such a way that the patient is unaware of the procedure. Because respirations are partially under voluntary control, patients may breathe more quickly or more slowly when they become aware of the fact that respirations are being counted. Do not tell the patient you are counting respirations. Also, leave your hand on the pulse site while counting respirations. The patient will think you are still counting pulse and will not be likely to alter the respiratory rate.

STUDENT: *Go to the workbook and complete the assignment sheet for 15:4, Measuring and Recording Respirations. Then return and continue with the procedure.*

PROCEDURE 15:4

Measuring and Recording Respirations

Equipment and Supplies

Watch with second hand, paper, pen/pencil

Procedure

1. Assemble equipment.
2. Wash hands.
3. Introduce yourself. Identify the patient.
4. After the pulse rate has been counted, leave your hand in position on the pulse site and count the number of times the chest rises and falls during 1 minute (figure 15-20).

   NOTE: This is done so the patient is not aware that respirations are being counted. If patients are aware, they can alter their rate of breathing.
5. Count each expiration and inspiration as one respiration.

PROCEDURE 15:4

FIGURE 15-20 Positioning the patient's hand on his or her chest makes it easier to count pulse and respiration.

6. Note the depth (character) and rhythm (regularity) of the respirations.
7. Record the following information: date, time, rate, character, and rhythm.
8. Check the patient before leaving the area. Observe all safety precautions to protect the patient.
9. Replace all equipment.
10. Wash hands.
11. Record all required information on the patient's chart or agency form, for example, date, time, R 16 deep and regular (or even), your signature and title. Report any unusual observations immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:4, Measuring and Recording Respirations, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

15:5 INFORMATION

Graphing TPR

In some agencies, you may be required to chart temperature, pulse, and respirations (TPR) on graphic records. This section provides basic information about these records.

Graphic sheets are special records used for recording temperature, pulse, and respirations. The forms vary in different health care facilities, but all contain the same basic information. The graphic chart presents a visual diagram of variations in a patient's vital signs. The progress is easier to follow than a list of numbers that give the same information. Graphic charts are used most often in hospitals and long-term-care facilities. However, similar records may be kept in medical offices or other health care facilities. Patients are sometimes taught how to maintain these records.

Some charts make use of color coding. For example, temperature is recorded in blue ink, pulse is recorded in red ink, and respirations are recorded in green ink. Other agencies use blue ink for 7 A.M. to 7 P.M. (days) and red ink for 7 P.M. to 7 A.M. (nights). Follow the policy of your institution.

Factors that affect vital signs are often included on the graph. Examples include surgery, medications that lower temperature (such as aspirin), and antibiotics.

The graph is a medical record, so it must be neat, legible, and accurate. Double-check all information recorded on the graph. If an error occurs, it should be crossed out carefully with red ink and initialed. Correct information should then be inserted on the graph.

STUDENT: *Read the complete procedure for 15:5, Graphing TPR. Then go back and start doing the procedure. Your assignment will follow the procedure.*

PROCEDURE 15:5

Graphing TPR

Equipment and Supplies

Blank TPR graphic sheets in the workbook, TPR sample graph, assignment sheets on graphing in the workbook, pen, ruler

Procedure

1. Assemble equipment.
2. Examine the sample graphic sheet (figure 15-21). This will vary, depending on the agency. However, most graphic sheets contain time blocks across the top and number blocks for TPRs on the side. Note areas for recording temperature, pulse, and respirations. Refer to the example while completing the procedure steps.
3. Using a blank graphic sheet, fill in patient information in the spaces provided at the top. Write last name first in most cases. Be sure patient identification, hospital, and room number are accurate.

   NOTE: Forms vary. Follow directions as they apply to your form.

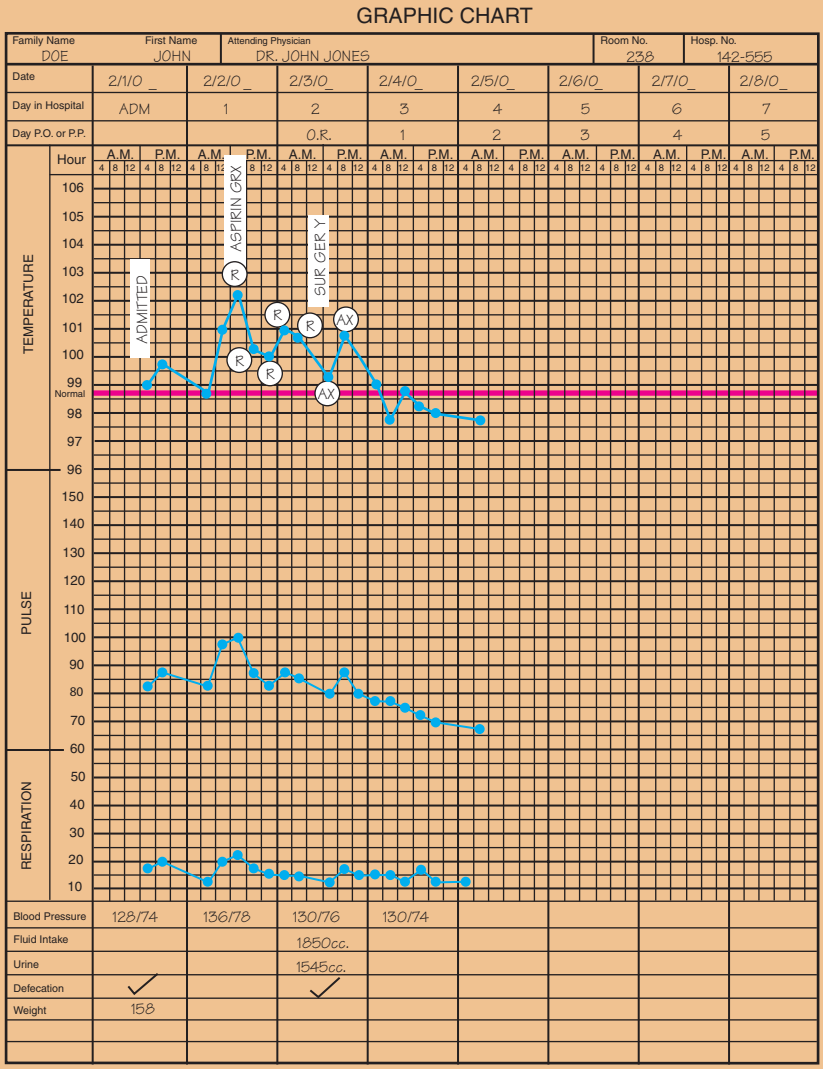

FIGURE 15-21 A sample graphic sheet.

PROCEDURE 15:5

4. Fill in the dates in the spaces provided after DATE.

   NOTE: A graphic chart provides a day-to-day visual representation of the variations in a patient's TPRs.

5. If your chart calls for DAY IN HOSPITAL below the dates, enter *Adm* under the first date. This stands for day of admission. The second date would then be day *1*, or first full day in the hospital. The third date would be day *2*, and so forth.

6. Some graphs contain a third line, DAYS PO or PP, which means days post-op (after surgery) or postpartum (after delivery of a baby). The day of surgery would be shown as *OR* or *Surgery*. The next day would be day *1*, or first day after surgery. The day of delivery of a baby is shown as *Del*, with the next day as day *1*, or first day after delivery. Numbers continue in sequence for each following day.

7. Go to the Assignment Sheet #1. Note the TPRs. On the graphic sheet, find the correct *Date and Time* column. Move down the column until the correct temperature number is found on the side of the chart. Mark this with a dot (•) in the box. Do the same for the pulse and respirations.

CAUTION: Double-check your notations. Be sure they are accurate.

CHECKPOINT: Your instructor will check your notations.

8. Repeat step 7 for the next TPR. Check to be sure you are in the correct time column. Mark the dots clearly under the time column and at the correct temperature measurement, pulse rate, or respiration rate.

9. Use a straight paper edge or ruler to connect the dots for temperature. Do the same with the dots for pulse and, finally, with the dots for respiration.

   NOTE: A ruler makes the line straight and neat, and the readings are more legible.

10. Continue to graph the remaining TPRs from Assignment Sheet #1. Double-check all entries for accuracy. Use a ruler to connect all dots for each of the vital signs.

11. Any drug that might alter or change temperature or other vital sign is usually noted on the graph in the time column closest to the time when the drug was first given. Turn the paper sideways and write the name of the drug in the correct time column. Aspirin is often recorded in this column because it lowers temperature. A rapid drop in body temperature would be readily explained by the word *aspirin* in the time column. Antibiotics and medications that alter heart rate are also noted in many cases.

12. Other events in a patient's hospitalization are also recorded in the time column. Examples include surgery and discharge. In some hospitals, if the patient is placed in isolation, this is also noted on the graph.

13. Blood pressure, weight, height, defecation (bowel movements), and other similar kinds of information are often recorded in special areas at the bottom of the graphic record. Record any information required in the correct areas on your form.

14. Recheck your graph for neatness, accuracy, and completeness of information.

Practice

Go to the workbook and complete Assignment Sheet #1 for Graphing TPR. Give it to your instructor for grading. Note all changes. Then complete Assignment Sheet #2 for Graphing TPR in the workbook. Repeat this process by completing Graphing TPR assignments #3 to #5 until you have mastered graphic records.

Final Checkpoint Your instructor will grade your performance on this skill according to the accuracy of the completed assignments.

15:6 INFORMATION

Measuring and Recording Apical Pulse

An **apical pulse** is a pulse count taken with a stethoscope at the apex of the heart. The actual heartbeat is heard and counted. A **stethoscope** is an instrument used to listen to internal body sounds. The stethoscope amplifies the sounds so they are easier to hear. Parts of the stethoscope include the earpieces, tubing, and bell or thin, flexible disk called a *diaphragm* (figure 15-22). The tips of the earpieces should be bent forward when they are placed in the ears. The earpieces should fit snugly but should not cause pain or discomfort. To prevent the spread of microorganisms, the earpieces and bell/diaphragm of the stethoscope should be cleaned with a disinfectant such as alcohol before and after every use.

Usually, a physician orders an apical pulse. It is frequently ordered for patients with irregular heartbeats, hardening of the arteries, or weak or rapid radial pulses. Because children and infants have very rapid radial pulse counts, apical pulse counts are usually taken (figure 15-23). It is generally easier to count a rapid pulse while listening to it through a stethoscope than by feeling it with your fingers.

It is important that you protect the patient's privacy when counting an apical pulse. Avoid exposing the patient during this procedure.

FIGURE 15-22 Parts of a stethoscope.

FIGURE 15-23 An apical pulse is frequently taken on infants and small children because their pulses are more rapid.

Two separate heart sounds are heard while listening to the heartbeat. The sounds resemble a "lubb-dupp." Each lubb-dupp counts as one heartbeat. The sounds are caused by the closing of the heart valves as blood flows through the chambers of the heart. Any abnormal sounds or beats should be reported immediately to your supervisor.

A **pulse deficit** is a condition that occurs with some heart conditions. In some cases, the heart is weak and does not pump enough blood to produce a pulse. In other cases, the heart beats too fast (tachycardia), and there is not enough time for the heart to fill with blood; there-

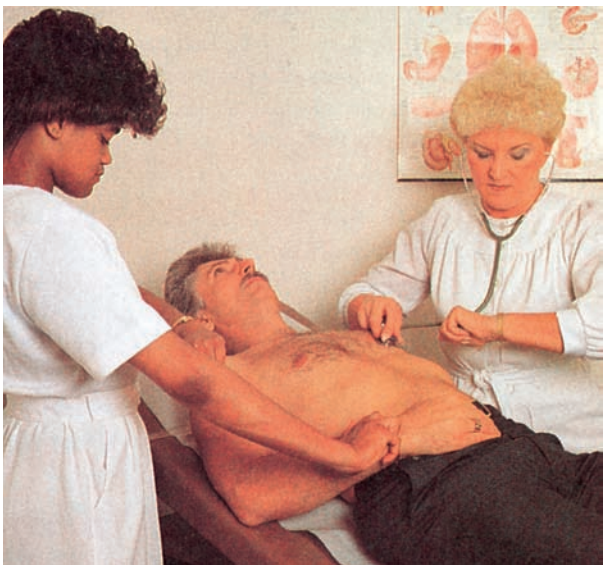

FIGURE 15-24 To determine a pulse deficit, one person should count an apical pulse while another person is counting a radial pulse.

fore, the heart does not produce a pulse during each beat. In such cases, the apical pulse rate is higher than the pulse rate at other pulse sites on the body. For the most accurate determination of a pulse deficit, one person should check the apical pulse while a second person checks another pulse site, usually the radial pulse (figure 15-24). If this is not possible, one person should first check the apical pulse and then immediately check the radial pulse. Then, subtract the rate of the radial pulse from the rate of the apical pulse. The difference is the pulse deficit. For example, if the apical pulse is 130 and the radial pulse is 92, the pulse deficit would be 38 (130 – 92 = 38).

STUDENT: *Go to the workbook and complete the assignment sheet for 15:6, Measuring and Recording Apical Pulse. Then return and continue with the procedure.*

PROCEDURE 15:6

Measuring and Recording Apical Pulse

Equipment and Supplies

Stethoscope, watch with second hand, paper, pencil/pen, alcohol or disinfectant swab

Procedure

1. Assemble equipment. Use alcohol or a disinfectant to wipe the earpieces and the bell/diaphragm of the stethoscope.
2. Wash hands.
3. Introduce yourself. Identify the patient and explain the procedure. If the patient is an infant or child, explain the procedure to the parent(s).

   NOTE: It is usually best to say, "I am going to listen to your heartbeat." Some patients do not know what an apical pulse is.
4. Close the door to the room. Screen the unit or draw curtains around the bed to provide privacy.
5. Uncover the left side of the patient's chest. The stethoscope must be placed directly against the skin.

   NOTE: If the diaphragm of the stethoscope is cold, warm it by placing it in the palm of your hand before placing it on the patient's chest.
6. Place the stethoscope tips in your ears. Locate the apex of the heart, 2–3 inches to the left of the breastbone. Use your index finger to locate the fifth intercostal (between the ribs) space at the midclavicular (collarbone) line (figure 15-25). Place the bell/diaphragm over the apical region and listen for heart sounds.

CAUTION: Be sure the tips of the stethoscope are facing forward before placing them in your ears.

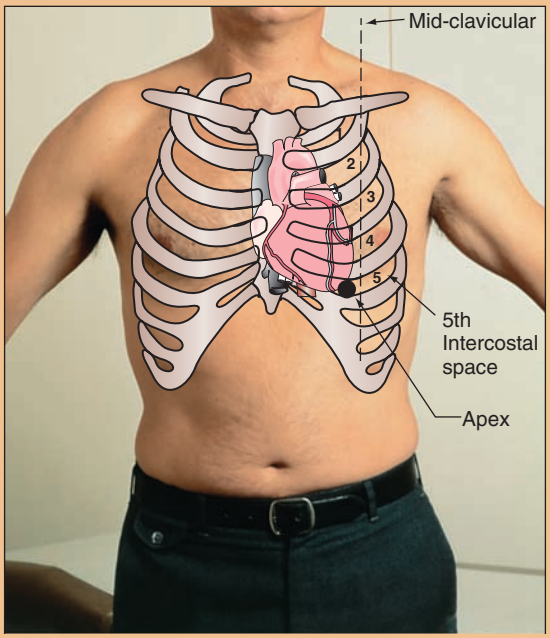

FIGURE 15-25 Locate the apex of the heart at the fifth intercostal (between the ribs) space by the midclavicular (middle of the collarbone) line.

PROCEDURE 15:6

7. Count the apical pulse for 1 full minute. Note the rate, rhythm, and volume.

   NOTE: Remember to count each lubb-dupp as one beat.

8. If you doubt your count, recheck your count for another minute.

9. Record your reading. Note date, time, rate, rhythm, and volume. Chart according to the agency policy. Some use an *A* and others use an *AP* to denote apical pulse.

NOTE: If both a radial and apical pulse are taken, it may be recorded as A82/R82. If a pulse deficit exists, it should be noted. For example, with A80/R64, there is a pulse deficit of 16 (that is, 80 – 64 = 16). This would be recorded as A80/R64 Pulse deficit: 16.

10. Check all safety and comfort points before leaving the patient.

11. Use an alcohol or disinfectant swab to clean the earpieces and the bell/diaphragm of the stethoscope. If the tubing contacted the patient's skin, wipe the tubing with a disinfectant. Replace all equipment.

12. Wash hands.

13. Record all required information on the patient's chart or agency form. For example: date, time, AP 86 strong and regular, your signature and title. If any abnormalities or changes were observed, note and report these immediately.

Practice

Go to the workbook and use the evaluation sheet for 15:6, Measuring and Recording Apical Pulse, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

15:7 INFORMATION

Measuring and Recording Blood Pressure

Blood pressure (BP) is one of the vital signs you will be required to take. It is important that your recording be accurate and that you understand what the blood pressure reading means.

Blood pressure is a measurement of the pressure that the blood exerts on the walls of the arteries during the various stages of heart activity. Blood pressure is read in millimeters (mm) of mercury (Hg) on an instrument known as a *sphygmomanometer*.

There are two types of blood pressure measurements: systolic and diastolic. **Systolic** pressure occurs in the walls of the arteries when the left ventricle of the heart is contracting and pushing blood into the arteries. **Diastolic** pressure is the constant pressure in the walls of the arteries when the left ventricle of the heart is at rest, or between contractions. Blood has moved forward into the capillaries and veins, so the volume of blood in the arteries has decreased.

Normal values and classifications for diastolic and systolic pressure are shown in table 15-2.

Blood pressure is recorded as a fraction. The systolic reading is the top number, or numerator. The diastolic reading is the bottom number, or denominator. For example, a systolic reading of 120 and a diastolic reading of 80 is recorded as 120/80.

Pulse pressure is the difference between systolic and diastolic pressure. The pulse

TABLE 15-2 Classifications of Blood Pressure in Adults

	Blood Pressure Level Millimeters of Mercury (mm Hg)		
Category	**Systolic**		**Diastolic**
Normal blood pressure	<120	and	<80
Normal range	100–120	and	60–80
Prehypertension	120–139	or	80–89
Hypertension			
Stage 1 Hypertension	140–159	or	90–99
Stage 2 Hypertension	≥160	or	≥100

Legend: < less than; ≥ greater than or equal to

pressure is an important indicator of the health and tone of arterial walls. A normal range for pulse pressure in adults is 30 to 50 mm Hg. For example, if the systolic pressure is 120 mm Hg and the diastolic pressure is 80 mm Hg, the pulse pressure is 40 mm Hg (120 − 80 = 40). The pulse pressure should be approximately one third of the systolic reading. A high pulse pressure can be caused by an increase in blood volume or heart rate, or a decrease in the ability of the arteries to expand.

Prehypertension is indicated when pressures are between 120 and 139 mm Hg systolic or 80 and 89 mm Hg diastolic. Prehypertension is a warning that high blood pressure will develop unless steps are taken to prevent it. Research has proven that prehypertension can harden arteries, dislodge plaque, and block vessels that nourish the heart. Proper nutrition and a regular exercise program are the main treatments for prehypertension.

Hypertension, or high blood pressure, is indicated when pressures are greater than 140 mm Hg systolic and 90 mm Hg diastolic. Common causes include stress, anxiety, obesity, high salt intake, aging, kidney disease, thyroid deficiency, and vascular conditions such as arteriosclerosis. Hypertension is often called a "silent killer" because most individuals do not have any signs or symptoms of the disease. If hypertension is not treated, it can lead to stroke, kidney disease, and/or heart disease.

Hypotension, or low blood pressure, is indicated when pressures are less than 90 mm Hg systolic and 60 mm Hg diastolic. Hypotension may occur with heart failure, dehydration, depression, severe burns, hemorrhage, and shock. *Orthostatic*, or postural, hypotension occurs when there is a sudden drop in both systolic and diastolic pressure when an individual moves from a lying to a sitting or standing position. It is caused by the inability of blood vessels to compensate quickly to the change in position. The individual becomes lightheaded and dizzy, and may experience blurred vision. The symptoms last a few seconds until the blood vessels compensate and more blood is pushed to the brain.

Many factors can influence blood pressure readings. These factors can cause blood pressure to be high or low. Some examples include:

- *Factors causing changes in readings*: force of the heartbeat, resistance of the arterial system, elasticity of the arteries, volume of blood in the arteries, and position of the patient (lying down, sitting, or standing)
- *Factors that may increase blood pressure*: excitement, anxiety, nervous tension, exercise, eating, pain, obesity, smoking, and/or stimulant drugs
- *Factors that may decrease blood pressure*: rest or sleep, depressant drugs, shock, dehydration, hemorrhage (excessive loss of blood), and fasting (not eating)

A **sphygmomanometer** is an instrument used to measure blood pressure in millimeters of mercury (mm Hg). There are three main types of sphygmomanometers: mercury, aneroid, and electronic. The mercury sphygmomanometer has a long column of mercury (figure 15-26). Each mark on the gauge represents 2 mm Hg. The mercury sphygmomanometer must always be placed on a flat, level surface or mounted on a wall. If it is calibrated correctly, the level of mercury should be at zero when viewed at eye level. Even though the mercury sphygmomanometer has proven to be the most accurate instrument for measuring blood pressure, the Occupational Health and Safety Administration (OSHA) discourages its use because of the possibility of a mercury spill and contamination. The aneroid sphygmomanometer does not have a mercury column (figure 15-27A). However, it is calibrated in mm Hg. Each line represents 2 mm Hg pressure. When the cuff is deflated, the needle must be on zero (figure

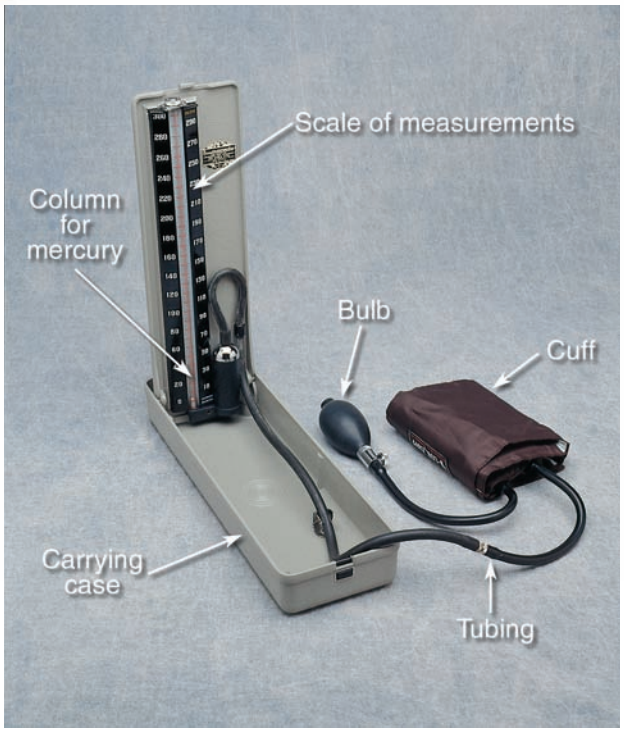

FIGURE 15-26 The gauge on a mercury sphygmomanometer has a column of mercury.

FIGURE 15-27A The gauge on an aneroid sphygmomanometer does not contain a column of mercury.

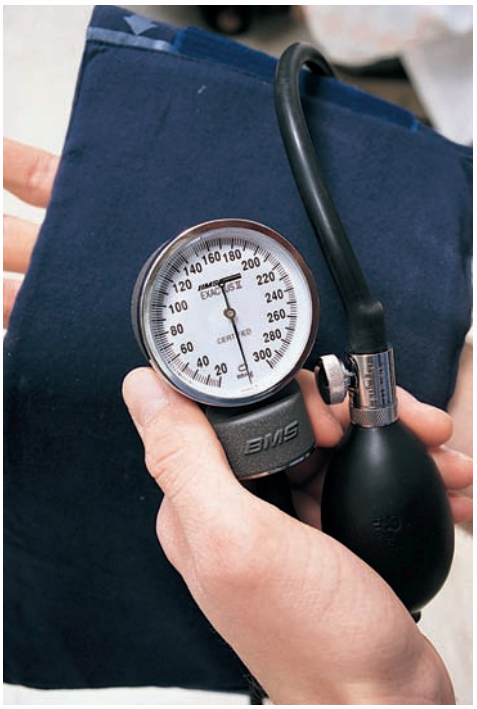

FIGURE 15-27B If the needle is not on zero when the aneroid cuff is deflated, the sphygmomanometer should not be used until it is recalibrated.

FIGURE 15-28 Electronic sphygmomanometers provide a digital display of blood pressure and pulse readings.

15-27B). If the needle is not on zero, the sphygmomanometer should not be used until it is recalibrated. Electronic sphygmomanometers are used in many health care facilities (figure 15-28). Blood pressure and pulse readings are shown on a digital display after a cuff is placed on the patient.

In order to obtain accurate blood pressure readings, it is important to observe several factors. The American Heart Association (AHA) recommends that the patient sit quietly for at least 5 minutes before blood pressure is taken. The AHA also recommends that two separate readings be taken and averaged, with a minimum wait of 30 seconds between readings.

The size and placement of the sphygmomanometer cuff is also important (figure 15-29). The cuff contains a rubber bladder that fills with air to apply pressure to the arteries. Cuffs that are too wide or too narrow give inaccurate readings. A

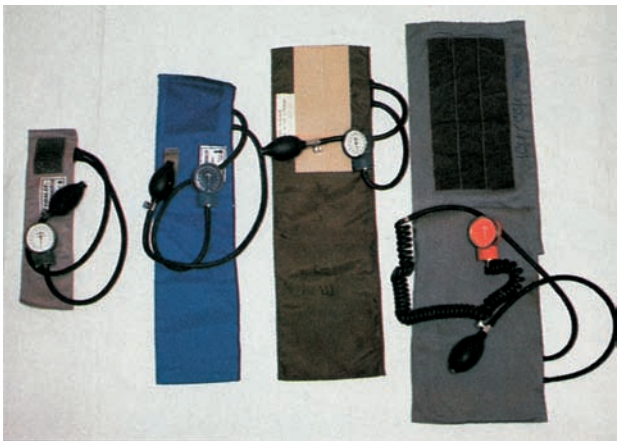

FIGURE 15-29 It is important to use the correct size cuff because cuffs that are too wide or too narrow will result in inaccurate readings.

cuff that is too small will give an artificially high reading; if it is too large it will give an artificially low reading. To ensure the greatest degree of accuracy, the width of the cuff should be approximately 40 percent of the circumference (distance around) of the patient's upper arm. The length of the bladder should be approximately 80 percent of the circumference of the patient's upper arm. The patient should be seated or lying comfortably and have the forearm supported on a flat surface. The area of the arm covered by the cuff should be at heart level. The arm must be free of any constrictive clothing. The deflated cuff should be placed on the arm with the center of the bladder in the cuff directly over the brachial artery, and the lower edge of the cuff 1 to 1½ inches above the antecubital area (bend of the elbow).

A final point relating to accuracy is placement of the stethoscope bell/diaphragm. The bell/diaphragm should be placed directly over the brachial artery at the antecubital area and held securely but with as little pressure as possible.

For a health care worker, a major responsibility is accuracy in taking and recording blood pressure. You should *not* discuss the reading with the patient. This is the responsibility of the physician because the information may cause a personal reaction that can affect the treatment. Only the physician should determine whether an abnormal blood pressure is an indication for treatment.

STUDENT: *Go to the workbook and complete the assignment sheets for 15:7, Measuring and Recording Blood Pressure, Reading a Mercury Sphygmomanometer, and Reading an Aneroid Sphygmomanometer. Then return and continue with the procedure.*

PROCEDURE 15:7

Measuring and Recording Blood Pressure

Equipment and Supplies

Stethoscope, sphygmomanometer, alcohol swab or disinfectant, paper, pencil/pen

Procedure

1. Assemble equipment. Use an alcohol swab or disinfectant to clean the earpieces and bell/diaphragm of the stethoscope.
2. Wash hands.
3. Introduce yourself. Identify the patient. Explain the procedure.

   NOTE: If possible, allow the patient to sit quietly for 5 minutes before taking the blood pressure.

   NOTE: Reassure the patient as needed. Nervous tension and excitement can alter or elevate blood pressure.
4. Roll up the patient's sleeve to approximately 5 inches above the elbow. Position the arm so that it is supported, comfortable, and close to the level of the heart. The palm should be up.

   NOTE: If the sleeve constricts the arm, remove the garment. The arm must be bare and unconstricted for an accurate reading.
5. Wrap the deflated cuff around the upper arm 1 to inches above the elbow and over the brachial artery. The center of

PROCEDURE 15:7

the bladder inside the cuff should be over the brachial artery.

CAUTION: Do not pull the cuff too tight. The cuff should be smooth and even.

6. Determine the palpatory systolic pressure (figure 15-30A). To do this, find the radial pulse and keep your fingers on it. Inflate the cuff until the radial pulse disappears. Inflate the cuff 30 mm Hg above this point. Slowly release the pressure on the cuff while watching the gauge. When the pulse is felt again, note the reading on the gauge. This is the palpatory systolic pressure.
7. Deflate the cuff completely. Ask the patient to raise the arm and flex the fingers to promote blood flow. Wait 30–60 seconds to allow blood flow to resume completely.
8. Use your fingertips to locate the brachial artery (figure 15-30B). The brachial artery is located on the inner part of the arm at the antecubital space (area where the elbow bends). Place the stethoscope over the artery (figure 15-30C). Put the earpieces in your ears.

FIGURE 15-30A Determine the palpatory systolic pressure by checking the radial pulse as you inflate the cuff.

FIGURE 15-30B Locate the brachial artery on the inner part of the arm at the antecubital space.

NOTE: Earpieces should be pointed forward.

9. Check to make sure the tubings are separate and not tangled together.
10. Gently close the valve on the rubber bulb by turning it in a clockwise direction. Inflate the cuff to 30 mm Hg above the palpatory systolic pressure.

NOTE: Make sure the sphygmomanometer gauge is at eye level.

11. Open the bulb valve slowly and let the air escape gradually at a rate of 2–3 mm Hg per second (or per heartbeat if the heart rate is very slow).

NOTE: Deflating the cuff too rapidly will cause an inaccurate reading.

PROCEDURE 15:7

FIGURE 15-30C Place the stethoscope over the brachial artery as you listen for the blood pressure sounds.

12. When the first sound is heard, note the reading on the manometer. This is the systolic pressure.
13. Continue to release the air until there is an abrupt change of the sound, usually soft or muffled. Note the reading on the manometer. Continue to release the air until the sound changes again, becoming first faint and then no longer heard. Note the reading on the manometer. The point at which the first change in sound occurs is the diastolic pressure in children. The diastolic pressure in adults is the point at which the sound becomes very faint or stops.

    NOTE: If you still hear sound, continue to the zero mark. Record both readings (the change of sound and the zero reading). For a systolic of 122 and a continued diastolic of 78, this can be written as 122/78/0.
14. Continue to listen for sounds for 10–20 mm Hg below the last sound. If no further sounds are heard, rapidly deflate the cuff.
15. If you need to repeat the procedure to recheck your reading, completely deflate the cuff, wait 1 minute, and repeat the procedure. Ask the patient to raise the arm and flex the fingers to promote blood flow.

    CAUTION: If you cannot obtain a reading, report to your supervisor promptly.
16. Record the time and your reading. The reading is written as a fraction, with systolic over diastolic. For example, BP 124/72 (or 124/80/72 if the change in sound is noted).
17. Remove the cuff. Expel any remaining air by squeezing the cuff. Use alcohol or a disinfectant to clean the stethoscope earpieces and diaphragm/bell. Replace all equipment.
18. Check patient for safety and comfort before leaving.
19. Wash hands.
20. Record all required information on the patient's chart or agency form, for example, date, time, BP 126/74, your signature and title. Report any abnormal readings immediately to your supervisor.

Practice

Go to the workbook and use the evaluation sheet for 15:7, Measuring and Recording Blood Pressure, to practice this procedure. When you believe you have mastered this skill, sign the sheet and give it to your instructor for further action.

Final Checkpoint Using the criteria listed on the evaluation sheet, your instructor will grade your performance.

TODAY'S RESEARCH: TOMORROW'S HEALTH CARE

An artificial heart that eliminates the need for heart transplants?

Artificial hearts have been in use for many years. They are used to keep a patient alive until a heart transplant can be found. The first artificial heart was used on Barney Clark, a Seattle dentist, in 1982. It was implanted by Dr. William DeVries. This heart, the Jarvik-7, was connected to an electrical generator the size of a refrigerator. Wires connected the heart with the generator. Barney Clark lived for 112 days connected to this device.

Now researchers have developed a new type of artificial heart. By using miniaturized electronics and high-capacity lithium batteries, scientists have created a heart that allows a patient to wear a battery pack on his or her waist. Electrical energy passes through the patient's skin to power the implanted heart. This allows the patient to resume many normal daily activities. The patient is no longer attached by wires to a power source. Patients have lived for many months with this type of heart while waiting for a suitable transplant.

Researchers are now working on an artificial heart that will work with or in place of a patient's damaged heart. This heart will have computerized intelligence to understand when additional blood is needed by the body. It will be able to respond to the demands of the body, and increase or decrease the heart rate as needed. It will be created from materials that will not cause a rejection reaction in the body. And finally, it will last for many years.

CHAPTER 15 SUMMARY

Vital signs are important indicators of health states of the body. The four main vital signs are temperature, pulse, respiration, and blood pressure.

Temperature is a measurement of the balance between heat lost and heat produced by the body. It can be measured orally, rectally, aurally (by way of the ear), temporally, and between folds of skin. An abnormal body temperature can indicate disease.

Pulse is the pressure of the blood felt against the wall of an artery as the heart contracts or beats. Pulse can be measured at various body sites, but the most common site is the radial pulse, which is at the wrist. The rate, rhythm, and volume (strength) should be noted each time a pulse is taken. An apical pulse is taken with a stethoscope at the apex of the heart. The stethoscope is used to listen to the heartbeat. Apical pulse is frequently taken on infants and small children with rapid pulse rates.

Respiration refers to the breathing process. Each respiration consists of an inspiration (breathing in) and an expiration (breathing out). The rate, rhythm, and character, or type, of respirations should always be noted.

Blood pressure is the force exerted by the blood against the arterial walls when the heart contracts or relaxes. Two measurements are noted: systolic and diastolic. An abnormal blood pressure can indicate disease.

Vital signs are major indications of body function. The health care worker must use precise methods to measure vital signs so results are as accurate as possible. A thorough understanding of vital signs and what they indicate will allow the health care worker to be alert to any abnormalities so they can be immediately reported to the correct individual.

INTERNET SEARCHES

Use the suggested search engines in Chapter 12:4 of this textbook to search the Internet for additional information on the following topics:

1. *Organization*: find the American Heart Association Web site to obtain information on the heart, pulse, arrhythmias, and blood pressure
2. *Vital signs*: research body temperature, pulse, respiration, blood pressure, and apical pulse
3. *Temperature scales*: research Celcius (Centigrade) versus Fahrenheit temperatures: try to

locate conversion charts that can be used to compare the two scales

4. *Diseases*: research hypothermia, fever or pyrexia, hypertension, hypotension, and heart arrhythmias.

REVIEW QUESTIONS

1. List the four (4) main vital signs.
2. State the normal value or range for an adult for each of the following:
   a. oral temperature
   b. rectal or temporal temperature
   c. axillary or groin temperature
   d. pulse
   e. respiration
3. What three (3) factors must be noted about every pulse?
4. Why is an apical pulse taken?
5. What is the pulse deficit if an apical pulse is 112 and the radial pulse is 88?
6. Differentiate between hypertension and hypotension, and list the basic causes of each.
7. How does systolic pressure differ from diastolic pressure? What are the normal ranges for each?
8. Define each of the following:
   a. bradycardia
   b. arrhythmia
   c. dyspnea
   d. tachypnea
   e. rales