Part III: Vital signs

Lecture Outlines

- Body temperature.
- Pulse.
- Respiration.
- Blood Pressure.

Learning Objectives

At the end of this chapter, the student should be able to:

1. Discuss the concept of vital signs and times to assess vital signs.

2. Identify factors affecting changes in vital signs.

3. Describe methods of measuring vital signs.

4. Identify sites used to measure vital signs.

5. Define terms and abbreviations used when assessing vital signs.

6. Describe actual situations of measuring vital signs
Vital Signs

Vital signs are measures of various physiological status, often taken by health professionals, in order to assess the most basic body functions. When these values are not zero, they indicate that a person is alive. All of these vital signs can be observed, measured, and monitored. This will enable the assessment of the level at which an individual is functioning. Normal ranges of measurements of vital signs change with age and medical condition.

Vital signs are useful in detecting or monitoring medical problems. Vital signs can be measured in a medical setting, at home, at the site of a medical emergency, or elsewhere.

Vital Signs

Are measurements of the body's most basic functions:
1. Body temperature (Temp).
2. Pulse/heart rate.
3. Respiration.

When to Assess Vital Signs

1. Upon admission to any healthcare agency.
2. Based on agency institutional policy and procedures.
3. Any time there is a change in the patient’s condition.
4. Before and after surgical or invasive diagnostic procedures.
5. Before and after activity that may increase risk.
6. Before and after administering medications that affect cardiovascular or respiratory functioning.

**Physiological Basis of Body Temperature**

Body temperature is the balance between the heat production due to chemical activities by the body and heat lost from the body through radiation, conduction, convection, and vaporization (evaporation).

**Types of body temperature**

1. **Core temperature**: is the temperature of deep tissues of the body, e.g., cranium, thorax and abdominal cavity. It remains relatively constant (37°C or 98.6°F).
   True core temperature readings can only be measured by invasive means, such as placing a temperature probe into the esophagus, pulmonary artery or urinary bladder.
   Non-invasive sites such as the rectum, oral cavity, axilla, temporal artery (forehead) and external auditory canal are accessible and are believed to provide the best estimation of the core temperature.

2. **Surface temperature**: is the temperature of the skin, the subcutaneous tissue and fat. It, by contrast rises and falls in response to the environmental changes.
   When measured orally, the average body temperature of an adult is between 36.7°C (98°F) and 37°C (98.6°F).
Assessing Body Temperature

The normal range of the body temperature is between 36.2 to 37.2 C°.

Factors Affecting Body's heat production

1. **Basal metabolic rate (BMR):** The basal metabolic rate is the rate of energy utilization in the body to maintain essential activities such as breathing. BMRs vary with age and sex.

2. **Muscle activity:** it including shivering, can greatly increase metabolic rate.

3. **Thyroxin output:** increased thyroxin output increases the rate of cellular metabolism throughout the body.

4. **Epinephrine and epinephrine** and sympathetic stimulation, these immediately increase the rate of cellular metabolism in many body tissues.

5. **Age:** very young and very old are more sensitive to change in environmental temperature due to decreased thermoregulatory controls

6. **Gender:** women tend to have more function in body temperature than men the increase in progesterone secretion at ovulation increase body temperature.

7. **Diurnal variation:** body temperature normally change throughout the day, varying as much as 1 C° (1.8 ºF) between the early morning and the late afternoon.

8. **Exercise:** Hard work or strenuous exercise can increase body temperature to as high as 38.3C° to 40 C°(101 to 104 ºF) measured orally.
Alterations in Body Temperature

**Pyrexia:** A body temperature above the usual range is called pyrexia, hyperthermia, or (in lay terms) fever. A very high temperature, e.g. 41°C (105°F) is called hyperpyrexia.

**Common types of fevers**

1. **Intermittent Fever:** during this type of fever, the body temperature alternates at regular intervals between periods of fever and periods of normal temperatures.

2. **Remittent Fever:** during this type of fever, a wide range of temperature fluctuations occurs over the 2 hour period, all of which are above normal.

3. **Relapsing Fever:** In a relapsing fever, short febrile periods of a few days are interspersed with periods of 1 or 2 days of normal temperature.

4. **Constant Fever:** during a constant fever, the body temperature fluctuates minimally but always remains elevated.

**Clinical Signs of Fever**

**A: Onset (cold or chill stage)**

1. increased heart rate and respiratory rate and depth.

2. Shivering due to increased skeletal muscle tension and contraction.

3. Cold skin due to vasoconstriction.

4. Cyanotic nail beds due to vasoconstriction.

5. Complain of feeling cold.

7. Rise in body temperature.

**B: Course**

1. Skin feels warm.
2. Increased pulse and respiratory rate.
3. Increased thirst.
4. Mild to severe dehydration.
5. Drowsiness, restlessness, or delirium and convulsions due to irritation of the nerve cells.
7. Malaise, weakness, and aching muscles due to protein breakdown.

**C: Abatement stage**

1. Flushed and warm skin.
2. Sweating.
3. Decreased shivering.
4. Possible dehydration.

**Treatment of Increasing Body Temperature**

1. Antipyretics.
2. Cold sponge bath.
3. Cold compresses.

**Nursing Interventions for patient with Fever**

1. Monitor vital signs.
2. Assess skin color and temperature.
3. Monitor WBCs count and other pertinent laboratory records.
4. Remove excess clothes when the patient feels warm, but provide extra warmth when the patient feels chilled.
5. Measure intake and output.
6. Reduced physical activity to limit heat production.
7. Provide oral hygiene to keep the mucous membranes moist. They can become dry and cracked as a result of excessive fluid loss.
8. Applied moist cold applications such as cold compresses tepid sponge and ice bag to increase loss through conduction.
9. Provide cool circulating air by using a fan to increase heat loss through convection.

Hypothermia

Hypothermia: it is a core body temperature below the lower limit of normal. The ability of hypothalamus to regulate temperature is greatly impaired when the body temperature falls below 34.5°C (94 °F), and death usually occurs when the temperature falls below 34 C° (93.2 °F).

Physiological Process of hypothermia

1. Excessive cold environment.
2. Inadequate heat production to counteract the heat loss.
3. Impaired hypothalamus thermoregulation.

Clinical signs of hypothermia

1. Decreased body temperature.
2. Pale, cool, waxy skin.
3. Hypotension.
4. Decrease urine output.
5. Lack of muscle coordination.
7. Drowsiness may progressing to coma.

Sites for Assessing Body Temperature

1. **Orally (common way).** 37° C (3 – 5 min). It is the more common type used to assess body temperature. The oral cavity temperature is considered to be reliable when the thermometer is placed posteriorly into the sublingual pocket (Hamilton and Price, 2007). This landmark is close to the sublingual artery, so this site tracks changes in core body temperature.

2. **Axillary (safe way).** 36° C + 0.5° C (10 min). Temperature is measured at the axilla by placing the thermometer in the central position and adducting the arm close to the chest wall. The literature suggests that this is an unreliable site for estimating core body temperature because there are no main blood vessels around this area (Sund-Levander and Grodzinsky, 2009), therefore should add 0.5°C to the actual reading.

3. **Rectal (accurate reading).** 37° C – 0.5° C (2 – 3 min). Rectal temperature is said to be the most accurate method for measuring the core temperature (Lefrant et al, 2003), and should reduce 0.5°C to the actual reading.
4. Tympanic membrane.

The tympanic thermometer senses reflected infrared emissions from the tympanic membrane through a probe placed in the external auditory canal (Davie and Amoore, 2010). This method is quick (<1 minute), minimally invasive and easy to perform. It has been reported to estimate rapid fluctuations in core temperature accurately because the tympanic membrane is close to the hypothalamus (Stanhope, 2006).

Contraindications of oral thermometer

1. The child under 6 years.
2. Unconscious patients.
3. Psychiatric patients.
4. Patient who cannot breath from his nose
5. Mouth surgery or infection.
6. Patient on oxygen mask.

Contraindications of rectal thermometer

1. With patients who have rectal surgery.
2. With patients who have any rectal disorders (hemorrhoids. Rectal fissure..etc.).
3. Patients complain from diarrhea.

Types of Thermometers

1. Electronic thermometer.
2. Glass thermometer.
4. Tympanic membrane thermometer.

### Alterations in Thermoregulation

<table>
<thead>
<tr>
<th>Alterations</th>
<th>Definition</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat exhaustion</strong></td>
<td>An increase in body temperature (38°C–40°C, 100.4°F–104.0°F) in response to environmental conditions that, in turn, causes diaphoresis (profuse perspiration).</td>
<td>• Loss of excessive amounts of water and sodium from perspiring leads to thirst, nausea, vomiting, weakness, and disorientation.</td>
</tr>
<tr>
<td><strong>Heat stroke</strong></td>
<td>A critical increase in body temperature (41°C–44°C, 100.6°F–112.0°F) resulting from exposure to high environmental temperature.</td>
<td>• Dry, hot skin is the most important sign.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The person becomes confused or delirious and experiences thirst, abdominal distress, muscle cramps, and visual disturbances.</td>
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<tr>
<td></td>
<td></td>
<td>• Loss of consciousness occurs if</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>A body temperature of 35°C (95°F) or lower resulting from cold weather exposure or artificial induction</td>
<td></td>
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<td>------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>- Decrease in metabolism leads to impaired mental functioning and depressed pulse, respiration, and blood pressure; can result in cardiac arrest if untreated.</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frostbite</th>
<th>Freezing of the body’s surface areas (earlobes, fingers, and toes) in extremely low temperatures.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Circulatory impairment may be followed by gangrene.</td>
</tr>
</tbody>
</table>

**Conversion Formulas**

Sometimes a health professional staff need to convert a Celsius reading to Fahrenheit, or vice versa.
a. To convert from Fahrenheit to Celsius, deduct 32 from the Fahrenheit, and then multiply by $\frac{5}{9}$

$$C = (\text{Fahrenheit temperature} - 32) \times \frac{5}{9}$$

For example, convert 98.6 Fahrenheit reading to Celsius reading

$$C = (98.6 - 32) \times \frac{5}{9}$$

$$C = (66.6) \times \frac{5}{9}$$

$$C = 37 \text{ Celsius degree.}$$

b. To convert from Celsius to Fahrenheit, multiply the Celsius reading by the fraction $\frac{9}{5}$ and then add 32.

For example, convert 37 Celsius degree to Fahrenheit reading

$$F = (37 \times \frac{9}{5}) + 32$$

$$F = (66.6) + 32$$

$$F = 98.6 ^\circ F$$

Nursing Diagnosis

= Potential altered body temperature related to:

a. illness or trauma affecting temperature regulation.
b. medication or vigorous activity.

= **Altered body temperature (hypothermia)** related to exposure to excessively hot environment, increase metabolic rate, or dehydration.

= **Altered body temperature (hypothermia)** related exposure to excessively cool environment, debilitating or trauma, or lack of adequate clothing and shelter.

= **Ineffective thermoregulation** related to decreased basal metabolism secondary to aging, or trauma, or illness.

= **Risk for imbalanced body temperature**, at risk for failure to maintain body temperature within normal range.
Pulse

Pulse is a wave of blood created by contraction of the left ventricle of the heart. The heart is a pulsate pump and the blood enters the arteries with each heartbeat, causing pressure pulses or pulse waves.

Pulse assessment is the measurement of a pressure pulsation created when the heart contracts and ejects blood into the aorta.

Characteristics of Pulse

1. Quality.
2. Rate.
3. Rhythm, and
4. Volume (strength or amplitude).

1. **Pulse quality** refers to the ‘‘feel’’ of the pulse, its rhythm and forcefulness.
2. **Pulse rate** is an indirect measurement of cardiac output obtained by counting the number of apical or peripheral pulse waves over a pulse point.

- A normal pulse rate for adults is between 60 and 100 beats per minute.
- **Bradycardia** is a heart rate less than 60 beats per minute in an adult.
- **Tachycardia** is a heart rate in excess of 100 beats per minute in an adult.

3. **Pulse rhythm** is the regularity of the heartbeat. It describes how evenly the heart is beating:

- **Regular** (the beats are evenly spaced) or,
- **Irregular** (the beats are not evenly spaced).
- **Dysrhythmia** (arrhythmia) is an irregular rhythm caused by an early, late, or missed heartbeat.

4. **Pulse volume** is a measurement of the strength or amplitude of force exerted by the ejected blood against the arterial wall with each contraction.

- It is described as normal (full, easily palpable).
- Weak (thready and usually rapid), or
- Strong (bounding).

## Pulse Volume Scale

<table>
<thead>
<tr>
<th>SCALE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Absent pulse</td>
</tr>
<tr>
<td>1</td>
<td>Weak and thready pulse</td>
</tr>
<tr>
<td>2</td>
<td>Normal pulse</td>
</tr>
<tr>
<td>3</td>
<td>Bounding pulse</td>
</tr>
</tbody>
</table>

## Factors Contribute to Increase Pulse Rate

1. Pain.
2. Fever.
3. Stress, exercise.
4. Bleeding.
5. Decrease in blood pressure.
6. Some medications as (adrenalin, aminophylline).

## Factors May Slow The Pulse

1. Rest.
2. Increasing age.
3. People with thin body size.
4. Some Medications.
5. Thyroid gland disturbances.

## Pulse Point Assessment
<table>
<thead>
<tr>
<th>Pulse Point</th>
<th>Anatomical location</th>
<th>Assessment Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporal</td>
<td>over temporal bone, superior and lateral to eye.</td>
<td>Accessible; used routinely for infants and when radial is inaccessible.</td>
</tr>
<tr>
<td>Carotid</td>
<td>bilateral, under lower jaw in neck along medial edge of sternocleidomastoid muscle.</td>
<td>Accessible; used routinely for infants and during shock or cardiac arrest when other peripheral pulses are too weak to palpate; also used to assess cranial circulation.</td>
</tr>
<tr>
<td>Apical</td>
<td>left midclavicular line at fourth to fifth intercostal space.</td>
<td>Used to auscultate heart sounds and assess apical-radial deficit.</td>
</tr>
<tr>
<td>Brachial</td>
<td>inner aspect between groove of biceps and triceps muscles at antecubital fossa.</td>
<td>Used in cardiac arrest for infants, to assess lower arm circulation, and to auscultate blood pressure.</td>
</tr>
<tr>
<td>Radial</td>
<td>inner aspect of forearm on thumb side of wrist.</td>
<td>Accessible; used routinely in adults to assess character of peripheral pulse.</td>
</tr>
<tr>
<td>Ulnar</td>
<td>outer aspect of forearm on finger side of wrist</td>
<td>Used to assess circulation to ulnar side of hand and to perform the Allen's test.</td>
</tr>
<tr>
<td>Femoral</td>
<td>in groin, below inguinal ligament (midpoint between symphysis pubis and anterosuperior iliac spine).</td>
<td>Used to assess circulation to legs and during cardiac arrest.</td>
</tr>
<tr>
<td><strong>Popliteal</strong></td>
<td>behind knee, at center in popliteal fossa.</td>
<td>Used to assess circulation to legs and to auscultate leg blood pressure.</td>
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<td>--------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Posterior tibial</strong></td>
<td>inner aspect of ankle between Achilles tendon and tibia (below medial malleolus).</td>
<td>Used to assess circulation to feet.</td>
</tr>
<tr>
<td><strong>Dorsalis pedis</strong></td>
<td>over instep, midpoint between extension tendons of great and second toe</td>
<td>Used to assess circulation to feet.</td>
</tr>
</tbody>
</table>
Pulse Points and Pressure Points

- External Maxillary
- Temporal
- Carotid
- Brachial
- Ulnar
- Radial
- Femoral
- Posterior Tibial
- Popliteal
- Dorsalis Pedis
Figure 27–23  ■ Taking an apical pulse using the flat disc of the stethoscope. Note how the amplifier is held against the chest.
Peripheral Pulse Assessment
A peripheral pulse, usually the radial pulse, is assessed by palpation for all individual except:

a. newborns and children up to 2 or 3 years. Apical pulse is assessed in these clients.

b. very obese or elderly clients, whose radial pulse may be difficult to palpate. Doppler equipment may be used for these clients, or the apical pulse is assessed.

c. Individual with heart disease, who require apical pulse assessment.

d. Individuals in whom the circulation to a specific body part must be assessed, e.g. following leg surgery the pedal (dorsalis pedis) is assessed.

Apical Pulse Assessment
Assessment of the apical pulse is indicator for clients whose peripheral pulse is irregular as well as for clients with known cardiovascular, pulmonary, and renal diseases. It is commonly assessed prior to administering medications that effect heart rate. The apical side is also used to assess the pulse for newborns, infants, and children up to 2-3 years old.
Apical – Radial Pulse

An apical-radial pulse may need to be assessed for clients with certain cardiovascular disorders. Normally the apical and radial rates are identical. An apical pulse rate greater than a redial pulse rate can indicate that the thrust of the blood from the heart is too feeble for the wave to be felt at the peripheral pulse site, or it can indicate the vascular disease is preventing impulses from being transmitted. Any discrepancy between the two pulse rates need to be reported promptly. In no instance is the radial pulse greater than the apical pulse.

Pulse deficit

Pulse deficit is the difference in the apical pulse and the radial pulse. These should be taken at the same time, which will require that 2 people take the pulse. One with a stethoscope and one at the wrist. Count for 1 full minute. Then subtract the radial from the apical. This is the Pulse Deficit.
Respiration

- Pulmonary ventilation (breathing): movement of air in and out of the lungs.
- Inspiration (inhalation) is the act of breathing in.
-Expiration (exhalation) is the act of breathing out.

Factors Affecting Respiration

1. Pain, anxiety, exercise.
2. Medications.
3. Trauma.
4. Infection.
5. Respiratory and cardiovascular disease.
6. Alteration in fluids, electrolytes, acid-base balances.

Assessing Respirations

- Inspection.
- Listening with stethoscope.
- Monitoring arterial blood gas results.
- Using a pulse oximeter.

Control of Breathing

Respiration is controlled by:

1. Respiratory center in the medulla oblongata and the pons of the brain.
2. Chemoreceptors located centrally in the medulla in peripherally in the carotid and aortic bodies.
These centers and receptors respond to changes in the concentration of oxygen \((\text{O}_2)\), carbon dioxide \((\text{CO}_2)\), and hydrogen \((\text{H}^+\)) levels in the arterial blood.

**Characteristics of Normal and Abnormal Breathing Sounds**

- **Eupnea:** refers to easy respirations with a normal rate of breaths per minute that is age specific.
- **Bradypnea:** is a respiratory rate of 10 or fewer breaths per minute.
- **Hypoventilation:** is characterized by shallow respirations.
- **Tachypnea:** is a respiratory rate greater than 24 breaths per minute.
- **Hyperventilation:** is characterized by deep, rapid respirations.

The nurse can also observe alterations in the movement of the chest wall:

- **Costal (thoracic) breathing:** occurs when external intercostal muscles and the other accessory muscles are used to move the chest upward and outward.
- **Diaphragmatic (abdominal) breathing:** occurs when the diaphragm contracts and relaxes as observed by movement of the abdomen.
- **Dyspnea:** refers to difficulty in breathing as observed by labored or forced respirations through the use of accessory muscles in the chest and neck to breathe. Dyspnea clients are acutely aware of their respirations and complain of shortness of breath.
• **Apnea**: respirations cease *for several seconds*. Persistent cessation is called *respiratory arrest*.

• **Cheyne–Stockes respiration**: respiratory rhythm is irregular, characterized by alternating periods of apnea and hyperventilation. The respiratory cycle begins with slow, shallow breaths that gradually increase to abnormal depth and rapidity. Gradually breathing slows and becomes shallower, climaxing in a 10 to 20 seconds period of apnea before respiration resumes.

• **Kussmaul respiration**: respirations are abnormally deep but regular, similar to hyperventilation. Characteristic of clients with diabetic ketoacidosis.

• **Orthopnea**: respiratory condition in which a person must sit or stand in order to breathe deeply or comfortably.

**Assessment of respiration includes;**

• **Depth** [by assessing the degree of excursion or movement in the chest wall; shallow, deep or normal.

• **Rhythm**.

• **Rate** the nurse observes a full inspiration & expiration when counting.

**Normal range**: 12 – 20 breath / minute

**Sites of breathing measurement**

Normal breathing is slightly observable, effortless, quiet, automatic, and regular. It can be assessed by observing chest wall expansion and bilateral symmetrical movement of the thorax.
Another method the nurse can use to assess breathing is to place the back of the hand next to the client’s nose and mouth to feel the expired air.

**IMPORTANT NOTE:**

- (Nurse must not tell the patient that he or she will assess his respiration because the patient can control his breathing so that will give a wrong assessment).
- A complete cycle of an inspiration composes one respiration.

### Patterns of Respiration

<table>
<thead>
<tr>
<th>Respiration</th>
<th>Desperation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>12 – 20 breath / minute</td>
</tr>
<tr>
<td>Tachypnea</td>
<td>24b / min shallow</td>
</tr>
<tr>
<td>Bradypnea</td>
<td>10 b / min Regular</td>
</tr>
<tr>
<td>Hyperventilation</td>
<td>Increased rate and depth</td>
</tr>
<tr>
<td>Hypoventilation</td>
<td>Decreased rate and depth Irregular</td>
</tr>
</tbody>
</table>
Blood Pressure

Blood pressure: is the force required by the heart to pump blood from the ventricles of the heart into the arteries.
It is measured in systolic and diastolic pressure.

- **Systolic pressure**: it is known as the force to pump blood out of the heart pump (ventricles).
- **Diastolic pressure**: it is known as relaxation period of the heart

Sites for measurement of Blood Pressure

- The most common site for indirect blood pressure measurement is the client’s arm over the brachial artery.
- When the client's condition prevents auscultation of the brachial artery, the nurse should assess the blood pressure in the forearm or leg sites.
- When pressure measurements in the upper extremities are not accessible, the popliteal artery, located behind the knee, becomes the site of choice.
- The nurse can also assess the blood pressure in other sites, such as the radial artery in the forearm and the posterior tibial or dorsalis pedis artery in the lower leg.
- Because it is difficult to auscultate sounds over the radial, tibial, and dorsalis pedis arteries, these sites are usually palpated to obtain a systolic reading.

- **The normal BP** is 120/80 mmHg.
• **Hypertension**: refers to a systolic blood pressure more than 120 mm Hg or 20 to 30 mm Hg more the client’s normal systolic pressure.

• **Hypotension**, refers to a systolic blood pressure less than 90 mm Hg or 20 to 30 mm Hg below the client’s normal systolic pressure.

**Factors increasing blood pressure**:  
1. **Age**: in older adults, the diastolic pressure often increase as a result of the reduced compliance of the arteries.  
2. **Exercise**: physical activity increase both the cardiac output and hence blood pressure, thus, a rest of 20 to 30 minutes following exercise is indicated before the blood pressure can be reliably assessed.  
3. **Stress**: stimulation of the sympathetic nervous system increases cardiac output and vasoconstriction of the arterioles, thus increasing the blood pressure reading, however, severe pain can decrease blood pressure greatly and cause shock by inhibiting the vasomotor center and producing vasodilatation.  
4. **Obesity**.  
5. **Sex**: after puberty, females usually have lower blood pressure than males of the same age, this difference is thought to be due to hormonal variations. After menopause, women generally have higher blood pressure than before.  
6. **Medications**: many medications may increase or decrease the blood pressure.  
7. **Disease process**: any condition affecting the cardiac output, blood viscosity, and or compliance of the arteries has a direct effect on the blood pressure.
Selected Conditions Affecting Blood Pressure

<table>
<thead>
<tr>
<th>Condition</th>
<th>Effect</th>
<th>Possible cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>Increase</td>
<td>Increases metabolic rate</td>
</tr>
<tr>
<td>Stress</td>
<td>Increase</td>
<td>Increases cardiac output</td>
</tr>
<tr>
<td>Arteriosclerosis</td>
<td>Increase</td>
<td>Decrease artery compliance</td>
</tr>
<tr>
<td>Obesity</td>
<td>Increase</td>
<td>Increases peripheral resistance</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>Decrease</td>
<td>Decreases blood volume</td>
</tr>
<tr>
<td>Low hematocrit</td>
<td>Decrease</td>
<td>Decreases blood viscosity</td>
</tr>
<tr>
<td>External heat</td>
<td>Decrease</td>
<td>Increases vasodilation and thus decreases peripheral vascular resistance.</td>
</tr>
<tr>
<td>Exposure to cold</td>
<td>Increase</td>
<td>Causes vasoconstriction and thus increases peripheral vascular resistance.</td>
</tr>
</tbody>
</table>

Equipment for Assessing Blood Pressure

- Stethoscope and sphygmomanometer.
- Electronic or digital devices.
- Alcohol cotton swap.

Measurement of blood pressure

- When taking a blood pressure using a stethoscope, the nurse identifies five phases in the series of sound called Korotkoff's sounds.
- **First**, the nurse pumps the cuff up to about 30 mmHg above the point where the last sound is heard, that is the point when the blood flow in the artery is stopped.
Then the pressure is released slowly (2 to 3 mmHg per sound), while the nurse observes the pressure readings on the manometer and relates them to the sounds heard through the stethoscope.

**Phases (Korotkoff’s Sounds Correlated to Pressure Dynamics)**

**Phase I:** The period initiated by the first faint clear tapping sound. These sounds gradually become more intense.

**Phase II:** The period during which the sounds have a swishing quality.

**Phase III:** The period during which the sounds are crisper and more intense.

**Phase IV:** The period during which the sounds become muffled and have a soft, blowing quality.

**Phase V:** The period where the muffled, blowing sound disappear.

**Pulse Pressure**

Pulse pressure is the numeric difference between the systolic and diastolic blood pressure. For example, if the resting blood pressure is 120/80 millimeters of mercury (mm Hg), the pulse pressure is 40.

a. A pulse pressure within 40 is the normal and healthy pulse pressure.

b. A pulse pressure greater than 40 mm Hg is abnormal. A high pulse pressure may be a strong predictor of heart problems (valve regurgitation), especially for older adults.

c. A pulse pressure lower than 40 may mean a patient have poor heart function.
Figure 27–29 | Automatic blood pressure monitors register systolic, diastolic, and mean blood pressures.