

Vital signs measure the basic functions of body. Include body temperature, blood pressure, pulse and respiratory (breathing) rate. Normal ranges for these signs vary by age, BMI and other factors. Pediatric vital signs aren't the same as adult vital signs. The measurements check general physical health. AND It is the first step of any medical exam or evaluation.

There are four main vital signs:

- Body temperature.
- Pulse (heart rate).
- Blood pressure.
- Respiratory rate (breathing rate).

Body temperature

Reflects the balance between the heat produced and the heat lost from the body.

- Measured by heat units called degrees
- Heat is generated by metabolic processes in the core tissues of the body, transferred to the skin surface by the circulating blood, and then dissipated to the environment.

There are two kinds of Body Temperature

a. Core temperature: Is the temperature of internal organs and it remains constant most of the time (37c); with range of 36.7-37.2c.

b. Surface Temperature: is the temperature of the skin, subcutaneous tissue & fat cells and it rises & falls in response to the environment.

Regulation of body temperature:

The body temperature regulated by thermoregulatory center in the hypothalamus

Sites for measurement of body temperature:

Oral temperature: It is the most commonly used method, is considered very convenient and reliable. Place the thermometer under the tongue and close the lips around it. The posterior sublingual pocket is the area that gives the highest reliability.

Tympanic temperature: In this method, the thermometer is inserted into the ear canal. This site is convenient but less accurate and hence not recommended.

Axillary temperature: In this, place the thermometer in the axilla while adducting the arm of the patient. This site is convenient but generally considered less accurate and hence not recommended.

Skin temperature: Digital thermometer can be used to measure the quick temperature from the skin of the forehead. It has been widely used now in this COVID-19 pandemic to avoid cross-contamination as the thermometer is kept 3-5cm away from the patient's forehead.

Body temperature is affected by many sources of internal and external variables. Besides the site of measurement, the time of day is an essential factor leading to variability in the temperature record.

Oral temperature:

- Is the most common site for temp measurement.

This site is inconvenient for

- Unconscious patients,
- Infants and children,
- Patients with ulcer or sore of the mouth, and surgery of the mouth.
- Pts. with persistent cough.

Advantage – easy access & pts. Comfort

Disadvantage: It can lead to a false reading if a person has taken hot or cold food/ drink by mouth, & has smoked so we have to wait for at least 10-15min, after meal or smoking.

Axillary temperature:

- The axillary site may be used when both oral is contraindicated or when these sites are inaccessible.

- It is safe and non-invasive measurement.
- Is recommended for newborn and infants

Disadvantage

- Long time (5-10min.)
- Less accurate as it is not close to major vessels.

Tympanic Temperature:

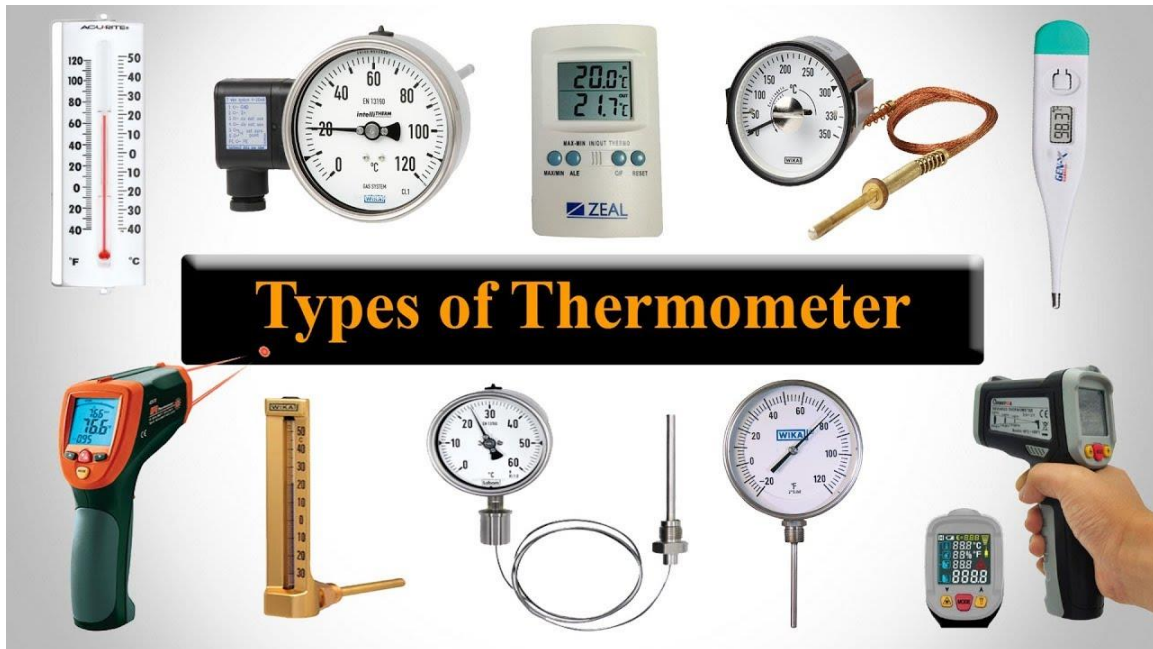
- Placed in to the client's outer ear canal.
- It reflects the core body temperature
- Is readily accessible and rapid temp.
- Readings in pediatric or unconscious pts.
- It is very fast method 1 to 2 seconds.

•Disadvantages:

- It may be uncomfortable involves risk of injuring the membrane
- Presence of cerumen (wax) can affect the reading or otitis media (infection of the middle ear).

Types of Thermometer

1. Mercury-in-glass thermometer
2. Electronic thermometer
3. Chemical disposable thermometer



Factors that can effect on body temperature include:

- Being in a hot or cold environment.
- Exercise.
- Eating hot or cold foods and beverages.
- Strong emotions.

Medical conditions that can cause your body temperature to change include:

- Stress.
- Infection.
- Hypothyroidism.
- Dehydration.
- Sunburn.
- Rheumatoid arthritis.
- Hormonal changes.

As age, body isn't able to regulate body temperature as well as it should. That's why may note more frequent temperature changes if 65 or older.

Pulse:

Is a wave of blood created by contraction of the left ventricle of the heart.

- Pulse wave represent the stroke volume (amount of blood that enters the arteries with each ventricular contraction).
- Pulse rate is regulated by autonomic nervous system.
- Nurse should assess heartbeat and peripheral pulse.

Pulse

Peripheral Pulse: is a pulse located in the periphery of the body e.g. in the foot, hand and or neck.

Apical Pulse (central pulse): it is located at the apex of the heart. Apex located on the left side of the sternum under the 4th ,5th , or 6th intercostal space.

The PR is expressed in beats/ minute (BPM)

The difference between peripheral and apical pulse is called pulse deficit, and it is usually zero.

Factors Affecting Pulse Rates

- Age** the average pulse rate of an infant ranges from 100 to 160 BPM

The normal range of the pulse in an adult is 60 to 100 BPM

- Gender:** after puberty the average males PR is slightly lower than female.
- Exercise:** PR increase with exercise.
- Fever:** increases PR in response to the lowered B/P that results from peripheral vasodilatation – increased metabolic rate.
- Stress:** in response to stress sympathetic nerve stimulation increase overall activity of heart.
- Medication:** Cardiac medication such as digoxin decrease heart rate, while epinephrine increases heart rate.

•**Hemorrhage:** (bleeding) increase pulse rate, but become weak.

•**Position changes:** a sitting or standing position blood usually pools in dependent vessels of the venous system. Pooling result in decrease in the venous blood return to heart and subsequent decrease in BP increases heart rate

Pulse Sites

- Radial
- Temporal
- Carotid
- Femoral
- Brachial
- Popliteal
- Posterior tibial
- Pedal
- Apical

Characteristic of Pulse

1-Pulse Rate

- Normal 60-100 b/min (72/min)
- Adult PR > 100 BPM is called tachycardia
- Adult PR < 60 BPM is called bradycardia

Tachycardia: fast heart rate.

Bradycardia: heart rate less than 60 BPM.

2- Pulse Rhythm The pattern and interval between the beats. Irregular beats rhythm is referred dysrhythmia or arrhythmia.

3- Pulse Volume: the force of blood with each beat

4- Elasticity of arterial wall: A healthy, normal artery feels, straight, smooth, soft and pliable.

Health conditions that can affect on pulse may include, but aren't limited to, the following:

- An infection.
- Dehydration.
- Stress.
- Anxiety.
- Thyroid conditions.
- Anemia.
- Shock.
- Arrhythmia.

Age Infant

(0–12 months)

Child

(1–11 years)

Teenager

(12 years and up) pulse rate 100–160 bpm 20–70bpm 60–100 bpm

How to check the pulse

- Using the first and second fingertips, press firmly but gently on the arteries until feel a pulse.
- Start counting the pulse when the clock's second hand is on the 12.
- Count pulse for 60 seconds (or for 30 seconds and then multiply by 2 to calculate beats per minute).
- When counting, don't watch the clock continuously, but concentrate on the beats of the pulse.

Blood Pressure

Blood Pressure: It is the force exerted by the blood against the walls of the arteries.

- It is expressed in terms of millimeters of mercury (mm of Hg).

There are two type of blood pressure measure:

1- Systolic pressure: is the pressure of the blood as result of contraction of the ventricular, pressure of the height of the blood wave.

2-Diastolic pressure: is the pressure when ventricles are at rest.

•Pulse Pressure: is the different between diastolic and systolic pressure.

BP is measured by using an instrument called Bp cuff (sphygmomanometer) & stethoscope and Typical blood pressure for a healthy adult is 120/80 mmHg (pulse pressure of 40).

Brachial artery and popliteal artery are most commonly used.

Sites of check BP

Increased Blood Pressure

A persistently high Bp, measured for greater than three times is called hypertension & that persistently less than normal range is called hypotension.

A diagnosis of hypertension is made when the systolic pressure is 140 mm Hg or higher or the diastolic pressure is 90 mm Hg or higher.

-Type of hypertension:

•**Primary hypertension** (also called essential hypertension) has no known cause.

•**Secondary hypertension:** which is much less common than primary hypertension, is caused by another disease condition. Some of the common causes of secondary hypertension are kidney disease, disorders of the adrenal cortex, and disorders of the aorta.

There are many risk factors for the development of hypertension:

•Significant risks are a family history of hypertension, race, aging, and metabolic disorders such as type 2 diabetes mellitus, obesity, and high cholesterol.

- Lifestyle risk factors include a sedentary lifestyle; high dietary intake of salt, fats, and calories; use of oral contraceptives in women; and sleep apnea.
- Other high-risk factors include cigarette smoking and regular alcohol consumption.

Decreased Blood Pressure

- Hypotension:** is below-normal blood pressure.

Low blood pressure measurement:

Low blood pressure (hypotension) is a reading of 90/60 mm Hg or lower. This can be normal for some people and not a cause for concern. However, low blood pressure can cause symptoms of an underlying health condition. Talk to your healthcare provider if you have a low blood pressure reading and experience:

- a. Dizziness.
- b. Fainting.
- c. Nausea.
- d. Cold sweats.
- e. Blurred vision.

Normal blood pressure for children:

Pediatric blood pressure, or a child's blood pressure, varies based on their age.

Factors that can affect your blood pressure reading include, but aren't limited to:

- Caffeine or beverages containing alcohol.
- Certain medications.
- Weight loss or weight gain.
- Cold temperatures.
- Exercise.
- A full bladder.
- A full stomach.

- The amount of salt in your diet.
- Smoking.
- Stress.

The American Heart Association recommends the following guidelines for blood pressure monitoring:

- a. Nonsmoking, non-caffeinated drinks, or exercise for 30 minutes before taking blood pressure.
- b. Bladder emptying
- c. Relax for 5 minutes before taking the measurement.

Sitting with back supported (don't sitting on a couch or soft chair). Keep feet on the floor uncrossed. Place client arm on a solid flat surface (like a table) with the upper part of the arm at heart level.

Age Systolic blood pressure (top number) mm Hg

Diastolic blood pressure

(Bottom number) mm Hg

- 0 to 3 months (newborn) 65 to 85. 45 to 55.
- 3 to 6 months 70 to 90. 50 to 65.
- 6 to 12 months 80 to 100. 55 to 65.
- 1 to 3 years 90 to 105. 55 to 70.
- 3 to 6 years 95 to 110. 60 to 75.
- 6 to 12 years 100 to 120. 60 to 75.
- 12 to 17 years 100 to 120. 70 to 80.

Take multiple readings. When you measure, take 2 to 3 readings one minute apart and record all the results.

Take your blood pressure at the same time every day,

Record the date, time, and blood pressure reading.

Respiration:

Is the act of breathing and includes external and internal respiration.

•**External respiration:** is interchange of oxygen (O₂) and carbon dioxide (CO₂) between alveoli of the lung and pulmonary blood.

•**Internal respiration:** is interchange of the same gases between the circulating blood and the cell of the body tissue

•**Inhalation:** is the intake of air into the lungs.

•**Exhalation:** is breathing out or the movements of gases from the lung to atmosphere.

Ventilation: is the movement of air in and out of the lung.

- **Hyperventilation:** very deep rapid respirations.

- **Hypoventilation:** very shallow respirations.

Factors Affecting Respiratory Rate, Depth, and Movements :

- ❖ Asthma.
- ❖ Anxiety.
- ❖ Pneumonia.
- ❖ Heart disease.
- ❖ Lung disease.
- ❖ Substance use disorder.

The relationship of one respiration to four heartbeats is fairly consistent in healthy people.

•**Eupnea-** normal breathing rate and depth

•**Bradypnea-** a decrease in respiratory rate

•**Tachypnea** - an increased respiratory rate

•**Apnea:** refers to periods during which there is no breathing.

•**Dyspnea:** is difficult or labored breathing.

•**Orthopnea:** dyspneic people can often breathe more easily in an upright position.

Respiration

•**Rhythm:** it refers to the time between one breath to the next one.

Respiratory rhythm can be described as **regular** or **irregular**

•**Depth:** described as normal, deep or shallow.

Deep: a large volume of air inhaled & exhaled, inflates most of the lungs.

Shallow: exchange of a small volume of air minimal use of lung tissue.

Check respiratory rate by:

Finding a quiet location to sit down and relax.

Use your watch and count how many breaths take in 60 seconds.

See chest rising and falling with each breath to get an accurate measurement.

Respiratory rate according to age group Age Average Range/Min

New born 35 (30-80)

1-3 years 30 (20-40)

4-11 years 20 (15-25)

Teen years 19 (15-20)

Adult 16 (12-20)

Older adult (>70 years) 16 (15-20)