

Introduction to VitalSigns

Vital signs serve as a starting point in assessing the overall functioning of the body and are a snapshot of a point in time that reflects the immediate status of a baseline or trends of the values over time. Vital signs include the measurement of temperature, pulse, respirations, blood pressure, and O₂ saturation.

There are normally five vital signs that are measured: temperature, pulse, respirations, blood pressure, and pain. Oxygen saturation is also frequently included.

The nurse must be able to do the following:

- Measure vital signs correctly.
- Use the equipment needed for vital sign measurements correctly.
- Understand what the vital signs tell you about the client.
- Be organized and use a systematic approach when measuring vital signs.
- Delegate vital sign measurements to other healthcare providers.
- Analyze and interpret trends over time.
- Respond to changes in vital signs quickly and appropriately.
- Communicate and document findings accurately.

Vital signs alone are not enough to evaluate body functioning or determine problem-solving steps. Vital signs are one set of clues used in collaboration with other physiological measurements and assessment findings for the basis of problem solving and indication of basic body functioning.

Abnormal Vital Signs

- The client's baseline range of vital signs, which may or may not typically run in the normal range, in comparison to current findings.
- The client's health history, therapies, and prescribed and over-the-counter medications as these may predictably affect one or more vital signs; the impact of vital sign measurements on medication administration, and vice versa. Some medications are only given when a particular vital sign is within a particular range. And some medications are contraindicated when certain vital signs are within a certain range.
- Environmental factors may falsely affect vital signs (such as the effect of a warm, humid room on the client's temperature).
- Ensure that the vital sign equipment is working correctly prior to measurement in order to provide accurate findings, and select the correct equipment for the client's condition and characteristics (such as age and size).
- An acute episode of anxiety can cause the physiologic response of an increased pulse rate.
- A low heart rate means the body is receiving less blood/perfusion, which can cause decreased cardiac output.
- Ineffective, rapid respirations result in a decrease in serum oxygen and impaired gas exchange.
- A client who has had a surgical procedure is likely to be in acute pain, which impacts vital sign results.
- A decreased pulse oximetry indicates insufficient oxygen in the blood and, therefore, ineffective peripheral tissue perfusion.

Vital Signs With Pediatric Clients

The client's age, gender, activity, medication, and health status influence their vital signs.

Compared with adults, in infants and children:

- pulse and respirations run higher
- blood pressure runs lower

- brachial and apical pulse are the best sites for assessing pulse
- respirations tend to be less regular in

infants. Vital signs in older adults are influenced by aging.

Delegating Vital Signs

Vital sign measurements are the nurse's responsibility. However, when appropriate, nurses may delegate them to unlicensed nursing assistant personnel after the nurse has determined that the client's condition is stable. The nurse must review the vital sign data and use nursing knowledge to follow the nursing process based on the data obtained. The skill of apical pulse measurement cannot be delegated. The nurse completes the vital signs upon admission to establish baseline vital signs and to assess the client's stability before delegating.

Determining Client Health by Monitoring Vital Signs

Recall from previous knowledge that:

- Vital signs and other physiological measurements often provide the basis for problem solving.
- Careful technique ensures accurate findings.
- Temperature, pulse, respirations, blood pressure, and oxygen saturation are usually assessed at the same time at set intervals.
- The ability to obtain accurate measurements of vital signs is critical because vital signs are an indication of basic body functioning.
- It is appropriate to begin the physical assessment by obtaining this data.
- The skills required to measure vital signs are simple, but the simplicity should never reduce the critical value of the task.

Changes in vital signs signal a change in physiological function and can change based on many factors, such as:

- environmental temperature
- physical exertion
- effects of illness

Assessment of vital signs

provides:

- cues for identifying nursing diagnoses, implementing planned interventions, and evaluating outcomes
- monitoring of a client's condition, identification of problems, and evaluation of intervention responses
- data used to determine a client's health status and need for medical or nursing interventions

Considerations for Vital Signs

Vital signs are interrelated. A rise in temperature of one degree Fahrenheit may cause an increase in the pulse rate by four beats per minute. Respiratory rates and blood pressure readings also increase with a rise in temperature. When blood pressure falls because of a hemorrhage, the pulse and respirations increase to compensate.

Client Condition

A client's condition determines when, where, how, and by whom vital signs are measured.

- The frequency of vital sign measurements is kept to a minimum but will likely be increased as the client's condition worsens and becomes more acute.
- The nurse is responsible for judging whether more frequent assessments are necessary.

Assessing Client Status

Nurses measure vital signs to assess a client's status as part of:

- baseline, admission, and routine physical assessments
- a review for change in a client's condition

- before, during, and after certain medications and/or blood administration
- a healthcare provider's order and in preparation for a healthcare provider's exam
- a facility's standard of practice and policy
- before, during, and after an invasive procedure and/or nursing interventions that impact a vital sign

Delegating Vital Sign Measurements

- Vital sign measurements are the nurse's responsibility. However, when appropriate, they may be delegated to unlicensed nursing assistant personnel after the nurse has determined that the client's condition is stable.
- The nurse must review the vital sign data and use nursing knowledge to follow the nursing process based on the data obtained.

Note: A nurse cannot delegate the skill of measuring an apical pulse.

Interrelated Vital Signs

An increased temperature may cause an increased pulse rate.

An increased temperature may cause an increased respiratory rate.

An increased temperature may cause an increased blood pressure.

A decreased blood pressure may cause an increased pulse rate.

A decreased blood pressure may cause an increased respiratory rate.

Normal Ranges of Vital Signs

Vital sign monitoring is a fundamental component of nursing care. As you learn to assess vital signs, it is

important to know the normal values so that you will be able to recognize and respond to abnormal vital signs.

Review the image shown here for the acceptable ranges of vital signs in adults.

A client's age, gender, activity, medications, and health status influence

vital signs. Compared with adults, in infants and children:

- pulse and respirations run higher
- blood pressure runs lower
- brachial and apical pulse are the best sites for assessing pulse
- respirations tend to be less regular in

infants. Vital signs in older adults are influenced by

aging.

Assessing Vital Signs

Compared with adults:

- The pulse rate tends to run higher in infants and children.
- The respiratory rate tends to run higher in infants and children.
- The blood pressure tends to run lower in infants and children.
- The apical and brachial pulse are the best sites for assessing pulse in infants and children.
- The respirations tend to be less regular in infants.

Analyzing Vital Signs

These are typical factors that impact vital sign measurements:

- The client's baseline range of vital signs, which may or may not typically run in the normal range.
- The client's health history, therapies, and prescribed and over-the-counter medications as these may predictably affect one or more vital signs.
- Environmental factors may falsely affect vital signs (such as the effect of a warm, humid room on the client's temperature).
- Some medications are only given when a particular vital sign is within a particular range. And some medications

are contradicted when certain vital signs are within a certain range.

- *Vital sign equipment must be working correctly before measurements in order to provide accurate findings.*
- *Equipment must be selected correctly for the client's condition and characteristics (such as age and size).*

Priority Hypothesis and Documentation

There are many causes for abnormal vital signs that the nurse can act upon. Possible nursing diagnoses focus on when a client's vital signs are abnormal, including:

- *risk for imbalanced body temperature (hyperthermia or hypothermia)*
- *ineffective thermoregulation*
- *activity intolerance*
- *anxiety*
- *decreased cardiac output*
- *deficient or excess fluid volume*
- *impaired gas exchange*
- *acute pain*
- *ineffective peripheral tissue perfusion*
- *risk of injury*

It is very important to accurately record and report vital sign measurements in the client's electronic medical record (EMR).

- *Inform the healthcare provider of abnormal vital signs and subsequent follow-up assessment data you obtain.*
- *Document the route and site used to obtain temperature, blood pressure, pulse, and oxygen saturation.*
- *Document when vital signs are abnormal for the client's expected values by recording the finding, any intervention, and client response.*
- *Early Warning Scores (EWS) are used by many healthcare organizations. When vital sign measurements are entered into the EMR, this system identifies subtle changes which may be the first signs of a change in the client's condition and alerts nurses.*

Documenting Vital Signs

- *Inform the healthcare provider of abnormal vital signs and subsequent follow-up assessment data you obtain. Document the route and site used to obtain temperature, blood pressure, pulse, and oxygen saturation. Document when vital signs are abnormal for the client's expected values by recording the finding, any intervention, and client response.*
- *Documentation is important but not until after priority nursing actions have been taken, such as analyzing the vital signs and notifying the healthcare provider when appropriate.*
- *Early warning scores (EWS) are used by many healthcare organizations. When vital sign measurements are entered into the electronic health record (EHR), EWS identifies subtle changes, which may be the first signs of a change in the client's condition, and alerts nurses. The nurse should never ignore the EWS and an EWS warning does not require a healthcare provider to be notified. Further assessment would be the next step to determine the proper course of action.*

Obtaining Vital Signs

The client's baseline range of vital signs may or may not typically run in the normal range. The client's health history, therapies, and prescribed and over-the-counter medications may predictably affect one or more vital signs. Some medications are only given when a particular vital sign is within a particular range. And some medications are contradicted when certain vital signs are within a certain range.

This blood pressure is the baseline for this client. It is elevated in terms of the standard parameters but, for this client, it is normal and there are no additional cues for concern. Before giving the medication as ordered, the nurse would still complete

the

nursing assessment in case there are other factors of concern and assess the client after the dose has taken effect to determine the effect on the client and the blood pressure.

Assessing Vital Signs

The client's respiratory rate and pulse oximetry findings require immediate action. The priority here is to stabilize the client with regard to airway, breathing, and circulation (ABCs), which would include assessing the client for additional cues of respiratory distress to be immediately addressed.

After stabilizing the client and addressing their urgent needs, the nurse will call the healthcare provider to discuss the status and establish a plan of care. Calling them right away would not be the priority.

Vital sign results must not be taken as an isolated value but should be used as a guide based on many factors that may affect the assessment. The client's age and health status, as well as the typical normal range for this client, are all cues that help determine the course of action. Also, was the equipment functioning correctly? Was the correct size of blood pressure cuff used? Had the client just been up walking? Is the room too warm? Is the client in pain? There are several vital signs here that are abnormal, not just one. Together they paint a picture, but not in isolation. More data is needed to determine actions to take after the client is stabilized.

Elevated Pulse Rate

Aging is not a known contributing factor to an elevated pulse rate. An elevated pulse is more typical in infants and children.

The nurse would determine if this pulse rate is typical for this client, given what their baseline has been and medical history/status. Activity can cause a temporary elevation in pulse rate.

Here is a memory aid to help as you look for cues: 3 Hs and P

- hypoxia
- hyperthermia
- hypovolemia
- pain

Temperature

Introduction to Temperature

Radiation: Heat is transferred between the surfaces of two objects without direct contact. Surgical rooms are cool, and the client's skin is exposed, so radiant heat loss can be significant.

Conduction: Heat is transferred from one object to another through direct contact. Conductive heat loss is minimized when a person wears several layers of clothing.

Convection: Heat is transferred away through air movement. Convective heat is lost when a person is using a fan to cool down. Heat is lost faster when the skin is moistened.

Evaporation: The constant transfer of heat energy occurs when a liquid becomes a gas, such as with perspiration.

Treatment of Fever

Shivering is the involuntary skeletal muscle movement as a response to bodily temperature differences and greatly increases heat production and is therefore counterproductive in a client with a fever.

To treat a fever, maximize heat loss by limiting blankets and clothing without causing shivering and keeping the client's clothing and bed linens dry, controlling the room temperature, and applying a damp cloth to the forehead. It is no longer recommended practice to use baths and ice packs to reduce fever due to the risk for inducing shivering.

Tympanic Thermometer

Tympanic thermometer measurements are reflective of core body temperature, not body surface temperature. They provide a rapid reading. Tympanic thermometers are the most accurate compared to oral, axillary and rectal. They are also not influenced by environmental temperatures.

Thermoregulation, Heat Loss, and Heat Production

Heat Loss

Heat loss is a normal process that occurs through radiation, conduction, convection, and evaporation.

Radiation: Heat is transferred between the surfaces of two objects **without direct contact**.

- Peripheral vasodilation = increased blood flow from internal organs to skin = increased radiant heat loss
- Peripheral vasoconstriction = lessens radiant heat loss
- Consider these scenarios:
 - When surgical rooms are cool and the patient's skin is exposed, radiant heat loss can be significant.
 - If the temperature in the patient's room is warmer than the skin, the body will absorb heat through radiation.
 - If the client is standing, they will have a greater surface area exposed than when sitting or lying in a fetal position, and therefore radiant heat loss is greater.
 - Removing a patient's clothing or blankets promotes radiant heat loss.
 - The patient dressed in dark, closely woven clothing will lose less heat to

radiation. **Conduction:** Heat is transferred from one object to another **through direct contact**.

- Conductive heat is lost when warm skin touches a cooler object such as the use of an ice pack or a cool cloth.
- Conductive heat loss is minimized when a person wears several layers

of clothing. **Convection:** Heat is transferred away **through air movement**.

- Convective heat is lost when a person is using a fan to cool down. Heat is lost faster when the skin is moistened.

Evaporation: The constant transfer of heat energy occurs when a liquid becomes a gas.

- Water and heat loss occurs when moisture from the skin (perspiration, to cool the skin) and from the lungs (respiration) evaporates constantly, approximately 600 to 900 mL a day.
- Diaphoresis: visible perspiration (typically the forehead and upper thorax)

Heat Production
Metabolism is the chemical reaction in all cells of the body, and this reaction produces heat. The higher the metabolism, the more heat that is produced, and vice versa. The production of heat occurs during rest, voluntary movements, involuntary shivering, and non-shivering thermogenesis.

Basal metabolism: The basal metabolic rate (BMR) is the heat produced by the body at absolute rest.

- Absence of thyroid hormones reduces BMR by half = decreased heat production
- Large amounts of thyroid hormones greatly increase the BMR = increased heat production
- BMR in men is higher than in women due to the hormone testosterone.

Voluntary movements: muscular activity during exercise requires more energy = BMR increases during activity = heat production greatly

increases. **Shivering:** involuntary skeletal muscle movement as a response to bodily temperature differences.

- The bodily temperature differences result in significant energy demands and lead to increasing heat production to balance body temperature that helps the shivering stop.
- This draining of energy sources can be serious, particularly for clients who are vulnerable.
- Shivering will increase the body temperature as it is intended to do. Therefore, be aware that shivering in a client with a fever is counterproductive.

Non-Shivering Thermogenesis: occurs in those who cannot shiver in order to increase heat production (such as neonates who instead metabolize brown fat to produce heat).

Thermoregulation

In order to function effectively, the body's temperature must remain in the optimal range of 36°C to 38°C (96.8°F to 100.4°F). Tom's current temperature along with the fact that he is perspiring indicates his temperature is **elevated** (not normal), and the perspiration is his body's attempt to **decrease** (not maintain) his temperature by means of **evaporative** (not radiant, conductive, or convective) heat **loss** (not production).

Evaporative heat loss is the constant transfer of heat energy when a liquid becomes a gas. Water and heat loss occurs when moisture from the skin (perspiration, to cool the skin) and from the lungs (respiration) evaporates constantly, approximately 600 to 900 mL a day.

Factors Affecting Body Temperature

Age

During infancy, temperature regulation is unstable because of immature physiological mechanisms, which often continue to be the case until puberty. In older adults, the normal range lowers and a body temperature of 95°F is not unusual for some in cold weather; however, the average body temperature in older adults is 35°C-36.1°C (95°F-97°F). With aging, sensitivity to temperature extremes develops because of deteriorating control of the mechanisms, less subcutaneous tissue, and decreased metabolism.

Gender and Hormone Levels

Women generally have greater variations in body temperature than men due to hormonal changes during ovulation and menopause. These fluctuations during ovulation help predict fertility. During menopause, the hormonal changes cause periods of intense heat and perspiration (called hot flashes). Also, as mentioned earlier, men have a higher basal metabolic rate (BMR) than women due to the hormone testosterone.

Exercise

The need for increased blood supply to the muscles and carbohydrate/fat breakdown increases metabolism and therefore heat production and body temperature.

Circadian Rhythm and Time of Day

Body temperature increases steadily throughout the day from its lowest point sometime in the middle of the night throughout early morning to a maximum around 1600. Then it begins to decline back to the lowest point.

Stress

Hormonal and neural stimulation caused by physical and emotional stress increases metabolism and therefore increases heat production and body temperature. An example of this would be an increased temperature in a client who is anxious.

Environment

Warm and cold environments impact the body temperature of a person whose heat-loss mechanisms do not adequately regulate body temperature.

Routes of Temperature Measurement

Temperatures can be taken at the following sites: oral, rectal, tympanic membrane, temporal artery, esophageal, pulmonary artery, axillary, or urinary bladder.

Normal ranges vary by site of the measurement. For example, the average oral temperature for young adults is 37°C (98.6°F) whereas in older adults the average core temperature is between 35° and 36.1 °C (95° to 97°F). Consistent use of one site of measurement allows for comparison and monitoring of patterns.

Hypothalamus Functionality

Alterations in temperature control will result if the hypothalamus or spinal cord is diseased or damaged.

Relevant Temperature Measurements

These findings are normal for an older adult at this time of day and at these measurement sites.

Body temperature increases steadily throughout the day from its lowest point around 0600 to a maximum around 1600. Normal ranges vary by the site of the measurement. In older adults, the average core temperature is between 35° and 36.1°C. The average oral temperature range is 36° to 38°C. This normalcy is further verified by the proof that the client's circulation is adequate with warm skin and pink mucous membranes.

Elevated Body Temperature

Temperature elevations are frequently the sign of illness. Temperatures exceeding 105 degrees Fahrenheit also have the potential to damage normal body cells and therefore intervention is often necessary. Obtaining a single body temperature measurement is only one small piece of the puzzle and does not present the whole picture. It is important to monitor body temperature throughout the day at different times and compare these measurements to the client's baseline temperature at those same times. The terms pyrexia, febrile, and hyperthermia are used to describe the condition of having above normal body temperatures. Fever is actually a body defense. Elevated body temperature destroys invading bacteria. However, an elevated body temperature can

have negative effects on the body when the rise of body temperature accelerates beyond the body's ability to regulate it. Learn more below.

Negative Effects of Elevated Body Temperature

- During a fever, the body's metabolism increases as the body's thermoregulation mechanisms kick in. This increased metabolism results in additional oxygen requirements. If the body cannot meet this demand for more oxygen, cellular hypoxia occurs.
- Cellular hypoxia in the tissue of the heart (myocardium) = angina (chest pain)
- Cellular hypoxia in the tissue of the brain (cerebrum) = confusion
- Increased oxygen demands = increased respirations (to bring in more oxygen) = water loss (through respirations) = fluid volume deficit
- Increased body temperature = diaphoresis (sweating to cool the skin) = water loss = fluid volume deficit

Types of Elevated Body Temperature and Nursing Implications

Fever (Pyrexia) Exposure to someone with Influenza A

Fever is also known as a febrile episode.

Pathophysiology

- Mild fever up to 39°C (102.2°F) enhances the body's immune system.
- ↑ white blood cell (WBC) count = ↓ bacterial growth
- ↑ interferon = ↓ virus growth
- ↑ energy demands = ↑ metabolism = increased O₂ demands = ↑ heart rate (HR) ↑ respiratory

rate (RR) Symptoms

- ≥ 38°C (100.4°F, adult or child)
- Chills, shivers, feels cold (body's attempt to release heat)
- Advanced fever: feels warm and dry, then the skin becomes warm and flushed (vasodilation) and diaphoresis occurs (evaporation to release heat)
- Hypoxia (due to increased O₂ demands), diaphoresis, dehydration (due to fluid loss from diaphoresis and ↑ RR)
- Elevated WB

C Nursing

Implications

- Stress caused by fever is particularly dangerous for clients with cardiac or respiratory issues (increased oxygen demands = hypoxia).
- Excessive diaphoresis and RR lead to fluid imbalance/dehydration.
- Fever reduction interventions are encouraged to help the body to

release heat. **Hyperthermia** Discovery of disease in the 19

Pathophysiology

- Unlike fever, hyperthermia is caused by disease/trauma to the hypothalamus
- Hyperthermia results in impairment of heat-loss mechanisms
- The body can't promote heat loss or decrease the production of heat. Therefore, the temperature continues to increase.
- Recall that malignant hyperthermia is a genetic predisposition to uncontrolled production of heat after receiving certain anesthetics.

Symptoms

- Same as

a fever **Nursing**

Implications