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TEXTBOOK OF NURSING FOUNDATION-I

From Fundamentals to Excellence in Nursing Care

As per Revised INC syllabus for BSc Nursing

INCLUDES VIDEOS, OSCE AND MODULES



Semester-I



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Contents

1. Introduction of Health and Illness **1**

Maslow's Hierarchy of Needs *5*
Health-Illness Continuum *7*
Factors Influencing Health *8*
Illness *11*
Impact of Illness On the Patient and Family *13*

2. Healthcare Delivery System **18**

Levels of Illness Prevention *20*
Levels of Care *22*
Types of Healthcare Agencies *26*
Healthcare Team *31*
Trends and Challenges of Healthcare Delivery System in India *32*
Issues in Healthcare Delivery Related to Nursing in India *32*
Nurses: A Vital Part of Healthcare Delivery System *34*

3. History of Nursing and Nursing as a Profession **36**

History of Nursing *37*
History of Nursing in India *37*
Contribution of Florence Nightingale *37*
Nursing *40*
Nursing as Profession *49*
Values *50*
Code of Ethics and Professional Conduct for Nurses *50*

4. Communication and Nurse-Patient Relationship **55**

Methods of Effective Communication *67*
Therapeutic Nurse-Patient Relationship *73*
Nontherapeutic Communication Techniques *73*
Barriers to Effective Communication *73*
Phases of the Nurse-Patient Relationship *77*
Communicating Effectively with Patients, Families, and Team Members *82*
Effective Communication with the Vulnerable Population *84*
Communication with Nursing Process *86*

5. Documentation and Reporting **89**

Principles of Effective Documentation *90*
Types of Documentation *92*
Common Nursing Documentation Formats *95*
Reporting in Nursing Practice *100*
Do's and Don'ts of Documentation *101*
Legal and Ethical Considerations for Documentation *101*
Nursing Informatics and Nursing Clinical Information System *103*

6. Vital Signs **105**

Introduction: Vital Signs: the Body's Silent Communicators *106*
Body Temperature *106*
Temperature Alterations *112*
Pulse *129*
Respiration *137*
Blood Pressure *143*
Guidelines for Taking Vital Signs: Nurses Roles and Responsibilities *154*
Documenting Vital Signs *155*

7. Equipment and Linen **165**

Goods and Supplies Used in Hospitals *166*
Types of Equipment in Hospital *168*
Linen *172*
Rubber Items *176*
Metal (Stainless Steel Items) *177*
Enamelware *178*
Glassware Items *178*
Plastic Items *179*
Indent Process for Hospital Equipments *181*
Inventory Management *182*

8. Introduction to Infection Control in Clinical Setting Infection **185**

Nature of Infection *186*
Chain of Infection *186*
Types of Infection *189*
Stages of Infection *198*
Factors Increasing Susceptibility to Infection *199*
Body Defenses Against Infection *200*
Healthcare-Associated Infection (HAIs)/(Nosocomial Infection) *202*
Concept of Medical and Surgical Asepsis *203*
Hand Hygiene *205*
Personal Protective Equipment (PPE) *207*
Standard Precautions *213*
Biomedical Waste Management *215*
Role of Healthcare Workers in Infection Control in Clinical Settings *220*

9. Comfort, Rest and Sleep, Pain **225**

Comfort 226

Definition *226*
Dimensions of Comfort *226*
Factors Influencing Comfort *226*
Comfort in Nursing Care *227*
Importance of Comfort in Healthcare *229*
Kolcaba's Comfort Theory *229*
Comfort Measures *230*
Metrics to Monitor Improvements after Comfort Interventions *231*



Comfort Devices *233*
Positioning *234*
Bedmaking *236*

Sleep and Rest 246

Electrophysiological Definition of Sleep *247*
Anatomy of Sleep Regulation *247*
Physiology of Sleep Regulation *248*
Sleep Phases and Stages *248*
Rapid Eye Movement Sleep *249*
Sleep Requirement of Individuals *250*

Pain and Discomfort 253

Pain Syndromes *257*
Causes and Determinants of Pain *258*
Diagnosis and Evaluation of Pain *260*
Pain Management *262*

10. Promoting Safety in the Healthcare Environment 271

Physical Environmental Factors Promoting Safety in the Healthcare Environment *271*
Reduction of Physical Hazards *285*
Fall Risk Assessment *289*
Safety Devices *293*

11. Hospital Admission and Discharge 306

Admission to the Hospital Unit and Preparation of Unit *306*
Discharge from the Hospital *310*
Common Errors, Do's and Don'ts during Admission and Discharge *319*

12. Mobility and Immobility 321

Elements of Normal Movement *322*
Alignment and Posture *323*
Joint Mobility *324*
Balance *324*
Coordinated Movement *324*
Principles of Body Mechanics *325*
Factors Affecting Body Alignment and Activity *325*
Exercise: Types and Benefits *328*
Effects of Immobility *332*
Maintenance of Normal Body Alignment and Activity *333*
Alteration in Body Alignment and Mobility *335*
Nursing Care Plan for Patient with Impaired Body Alignment and Mobility *340*
Mechanical Devices and Aids *342*
Assisting Clients with Ambulation *345*
Care of Patients with Casts and Immobilization Devices *356*

13. Patient Education 359

Definition *360*
Teaching Process vs. Nursing Process *360*

Learning *362*
Importance of Patient Teaching *362*
Purposes of Patient Teaching *363*
Patient Teaching (Process) *364*
Nursing Process for Patient and Caregiver Education *365*

14. First Aid and Emergencies **372**

First Aid *372*
First Aid Management of Wounds *384*
First Aid Management of Hemorrhage *387*
First Aid Management of Shock *391*
Musculoskeletal Injuries: Fractures, Dislocations, Muscle Injuries *392*
Respiratory Emergencies and Basic CPR *397*
Unconsciousness *403*
Foreign Objects: Eye, Ear, Nose, Skin, and Ingested *408*
Burn and Scalds *408*
Effects of Heat and Frostbite *412*
Poisoning, Bites and Stings *417*
Community Emergencies *423*

First Aid Module **443**

Objective Structured Clinical Examination **465**

Index ***477***

CHAPTER 6

Vital Signs

LEARNING OBJECTIVES

After completing this chapter, the learner will be able to:

- Explain the importance of vital signs and guidelines for accurate measurement.
- Define body temperature, its regulation, and mechanisms of heat production/loss.
- Identify factors influencing body temperature.
- Describe sites, equipment, and techniques for temperature assessment.
- Differentiate temperature alterations: hyperthermia, heat cramps, heat exhaustion, heatstroke, hypothermia, fever.
- Explain the use of hot and cold applications in nursing care.
- Define pulse and explain its physiology and regulation.
- State characteristics of a normal pulse.
- Describe pulse assessment sites, equipment, and technique.
- Identify pulse alterations: tachycardia, bradycardia, arrhythmias.
- Define respiration and describe its mechanism, physiology, and regulation.
- Identify characteristics of normal respiration and influencing factors.
- Describe techniques for assessing respiration and oxygen saturation (SpO_2).
- Recognize alterations: dyspnea, apnea, tachypnea, hypoventilation.
- Define blood pressure and explain its physiology and regulation.
- Describe characteristics of blood pressure.
- List factors influencing blood pressure.
- Identify common errors in BP assessment.
- Recognize alterations: hypertension, hypotension.
- Explain the importance of proper documentation of vital signs.
- Value vital signs as essential indicators of patient health and safety.
- Respect patient dignity, privacy, and comfort during assessment.
- Show empathy to patients with temperature, pulse, respiratory, or BP alterations.
- Appreciate accuracy, consistency, and timeliness in vital sign measurement.
- Demonstrate vigilance and responsibility in monitoring abnormal findings.
- Maintain integrity and honesty in documentation.
- Measure body temperature accurately using correct site, equipment, and technique.
- Apply hot and cold therapies safely.
- Palpate and auscultate pulse at appropriate sites.
- Assess pulse characteristics (rate, rhythm, strength, equality).
- Count respiratory rate discreetly and measure SpO_2 with oximeter.
- Identify abnormal breathing patterns during assessment.
- Measure blood pressure using proper cuff size, positioning, and technique.
- Detect Korotkoff sounds accurately and avoid common errors.
- Record and document all vital signs promptly and correctly.

Chapter Outline

- Introduction
- Body Temperature
  - Definition
  - Physiology, regulation
  - Factors affecting body temperature
  - Assessment of body temperature—sites, equipment, technique
  - Temperature alterations: Hyperthermia, heat cramps, heat exhaustion, heatstroke, hypothermia
  - Fever/pyrexia → Definition, causes, stages, types and nursing management
  - Hot and cold applications
- Pulse
  - Definition, physiology, regulation
  - Characteristics
  - Factors affecting pulse
  - Assessment of pulse—sites, equipment, technique
  - Alterations in pulse
- Respiration
  - Definition
  - Physiology, regulation
  - Mechanics of breathing
  - Characteristics of respiration
  - Factors affecting respiration
  - Assessment of respirations—technique

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- Arterial oxygen saturation
- Alterations in respiration

- Blood pressure
  - Definition
  - Physiology, regulation
  - Characteristics
  - Factors affecting blood pressure
  - Assessment of BP—sites, equipment, technique
  - Common errors in BP assessment
  - Alterations in blood pressure
- Guidelines for taking vital signs
- Documenting vital signs

INTRODUCTION: VITAL SIGNS: THE BODY'S SILENT COMMUNICATORS

Vital signs, often referred to as cardinal signs, provide crucial information about the body's physiological state and essential homeostatic balance. The primary assessments include temperature, pulse, respiration, and blood pressure. In modern healthcare, we also evaluate oxygen saturation, pain, and distress. In a normal healthy individual the vital signs remain constant. They are called VITAL because:

- ❖ These findings are governed by vital organs and often reveal even the slightest deviation from the normal body functions.
- ❖ Any improvement or deterioration in the condition of the client may be reflected by the observation of these signs.
- ❖ Significant variations in these findings may indicate problems like insufficient consumption of oxygen, electrolyte imbalances, bacterial invasion, blood depletion etc.
- ❖ Client's emotional state also may cause significant variations in these signs.

These measurements should be checked and recorded regularly, with a higher frequency for unstable patients. Changes in vital signs may signify the need for medical and nursing intervention. To ensure accuracy, nurses must utilize proper assessment techniques. Assessment of vital signs allows the nurse to identify the conditions of the client and plan the needed nursing interventions.

BODY TEMPERATURE

Definition

It refers to the degree of heat maintained by the body or the balance between heat produced in the tissues and heat lost to the environment. The range of normal body temperature is: 35.9–38°C (96.7–100.5°F).

Types of Body Temperature

See **Table 6.1**.

Table. 6.1: Types of body temperature.

Type	*Meaning*	*Normal range*	*Key feature*
Core temperature	Temperature of internal organs (brain, chest, abdomen, pelvis)	36.5–37.5°C	Stay constant (Core = Constant)
Surface temperature	Temperature of skin and fat under the skin; reacts to the environment (hot/cold)	20–40°C	Fluctuates (Surface = Shifts)

Physiology and Regulation of Body Temperature

The body temperature reflects the balance between the amount of heat produced by body processes and the amount of heat lost to the external environment. The **Figure 6.1** depicts the various methods of heat loss and heat loss by the body.

Heat Production: Thermogenesis

This requires the normal function of heat-production processes. Heat production occurs during rest, metabolism, voluntary movements, involuntary shivering, and non-shivering thermogenesis.

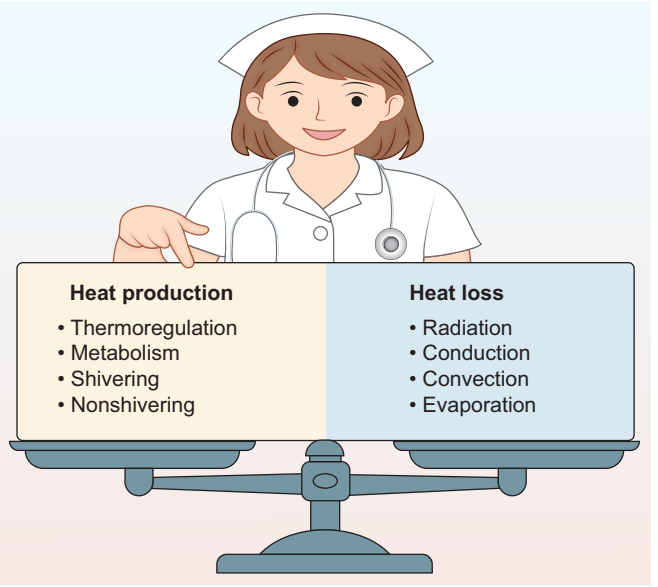

Fig. 6.1: Physiology of heat regulation.

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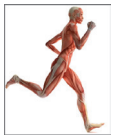
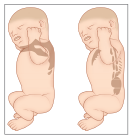
Basal metabolic rate (BMR): Heat is produced in the body through metabolism. Cellular chemical reactions require energy in the form of adenosine triphosphate (ATP). The amount of energy used for metabolism is the metabolic rate. Activities requiring additional chemical reactions increase the metabolic rate. As metabolism increases, extra heat is produced. When metabolism decreases, less heat is produced. Metabolic rates decrease as age increases. For example, children have a higher BMR than adults.



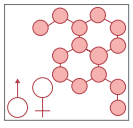
Voluntary movements (muscle activity): Voluntary movements, like exercise, demand extra energy, significantly increasing the body's metabolic rate up to 2000 times the resting level. Heat production in the body can rise as much as 50 times higher than normal levels during intense physical activity.



Shivering: Shivering is an involuntary body response to temperature differences in the body. The skeletal muscle movement during shivering requires significant energy. Shivering can increase heat production 4 to 5 times greater than normal. Heat is produced to equalize body temperature.



Nonshivering: Nonshivering thermogenesis occurs primarily in neonates. Vascular brown adipose tissue present at birth is metabolized for heat production.



Hormones: When the thyroxine level increases in the body, the rate of cellular metabolism also increases because of the chemical thermogenesis. Other hormones like epinephrine, nor-epinephrine and sympathetic stimulation/stress response directly affect the liver and muscle cells and increase the cellular metabolism, thereby increasing the heat production.



Fever: Fever increases the cellular metabolism and, therefore, more heat is produced.

Heat Loss/Thermolysis (Fig. 6.2)

- **Radiation:** Transfers heat without direct contact. Peripheral vasodilation increases heat loss; vasoconstriction minimizes it. Up to 85% of body heat is lost via radiation. Mostly occurs in the form of infrared rays.
- **Conduction:** Direct heat transfer between objects. The amount of heat transferred depends on the temperature difference and the amount and duration of the contact. Ice packs increase conductive heat loss, while warm packs can increase heat gain.
- **Convection:** It is the dispersion of heat by air currents and the heat loss through air movement. Fans amplify convective heat loss, especially with moistened skin.
- **Evaporation:** Converts liquid to gas, losing heat (0.6 calorie per gram of water). Continuous evaporation from skin and lungs results in significant heat loss, regulated by sweat glands in response to increased body temperature or stress. This continuous and unnoticed water loss is called insensible water loss; along with this, heat is also lost, which is called insensible heat loss, and 10% of the basal heat is lost in this method.
- **Diaphoresis:** Visibly decreases body temperature through perspiration on the forehead and upper thorax.

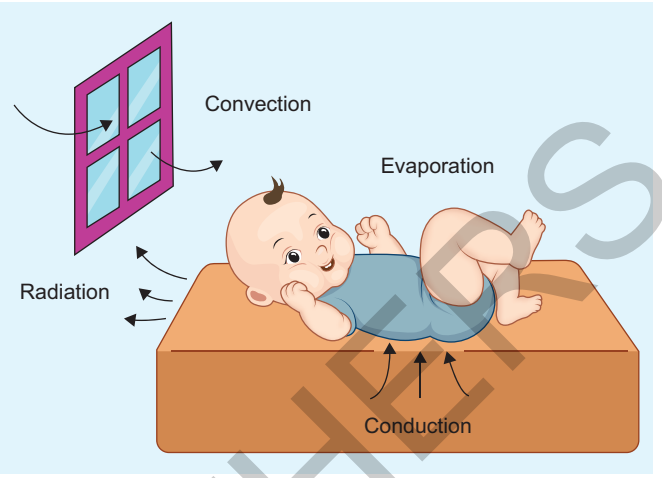


Fig. 6.2: Various methods of heat loss.

Regulation of Body Temperature

Body temperature regulation is a complex process involving physiological and behavioral mechanisms to maintain a stable internal environment. It involves:

Components of Temperature Regulation

- **Sensors:** Located in the skin (shell) and core organs, they detect changes in body temperature.
- **Integrator:** The hypothalamus acts as the body's thermostat, processing sensory input and initiating appropriate responses.
- **Effector system:** Adjusts heat production and heat loss to maintain homeostasis.

Responses to Cold Exposure

When the body is cold, the following physiological responses occur to increase body temperature:

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- **Shivering:** Increases heat production through muscle activity.
- **Inhibition of sweating:** Prevents further heat loss.
- **Vasoconstriction:** Narrows blood vessels in the skin to reduce heat loss from the body surface.

Neural and Vascular Control

The **hypothalamus** plays a central role:

- **Anteriorhypothalamus:** Controls **heat loss**
  - Induces sweating
  - Causes vasodilation
  - Inhibits heat production
- **Posterior hypothalamus:** Promotes **heat production**
  - Triggers shivering
  - Causes vasoconstriction

Note

Any injury to the hypothalamus or spinal cord can significantly impair thermoregulation.

Behavioral Control

Humans adapt to temperature changes during different climates through conscious behaviors. The effective behavioral regulation of the body temperature depends on environmental severity, sensory perception, cognitive status and emotional state, and physical mobility and independence of the person. However,infants, older adults, the ill, or unconscious individuals may have impaired behavioral responses and may need assistance. The various ways of behavior regulation in different weather are depicted in **Table 6.2**.

Table 6.2: Behavior regulations manifested for cold and hot environments.

Environment	*Behavior regulations*	*Example*
Cold	Wear warm clothing	Layered, insulated attire
	Move to heated areas	Use heated rooms/ shelter
	Increase physical activity	Walk, gentle exercises
Hot	Remove excess clothing	Wear light, loose attire
	Seek cooler surroundings	Shade, fans, AC
	Reduce activity levels	Rest during peak heat

Factors Affecting Body Temperature

To remember

REMEMBER

Acronym
"HALTES"

Many factors affect body temperature. Changes happen when heat production and heat loss become unbalanced due to physical or behavioral reasons. Nurses should consider these factors as depicted in **Table 6.3**, when checking temperature and noticing any changes from normal.

Table 6.3: Factors affecting body temperature.

Factor	*Details*
H: Hormones and gender 	❑ Hormonal fluctuations significantly affect body temperature, especially in women. Such as: • Body temperature among women may fluctuate by 0.3 to 0.6°C due to menstrual cycles and hormonal changes • Menopause in women leads to more stable body temperatures as hormonal activity decreases ❑ Hormones influence the hypothalamus, the brain's temperature-regulating center.
A: Age 	❑ Age-related changes impact the body's ability to regulate temperature ❑ Infants have immature thermoregulation and are more vulnerable to temperature changes ❑ Older adults may have diminished responses to environmental temperature extremes ❑ Infections and developmental stages of the immune system can influence temperature control

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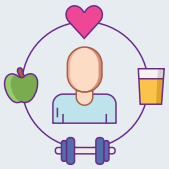
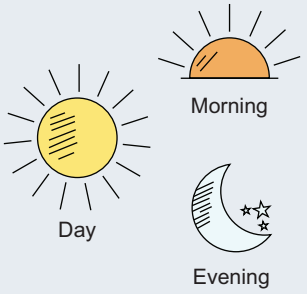
Factor	*Details*
L: Lifestyle and habits 	❑ Daily activities and routines also contribute to variations in body temperature, such as: • **Exercise:** Increases metabolic activity, raising body temperature. • **Eating:** Slightly raises body temperature through digestion. • **Fasting:** May lower body temperature due to reduced metabolic activity. • **Hot/cold beverages:** Can alter oral temperature readings slightly but not core temperature.
T: Time of day (circadian rhythm) 	❑ Our body's internal clock, or circadian rhythm, influences temperature regulation, like • **Lowest temperature** is noted typically, between 2:00 AM and 6:00 AM • **Highest temperature** is noted usually between 1:00 PM and 6:00 PM • **Night-shift workers** may need 1 to 3 weeks to reset their rhythm ❑ Circadian rhythm stability is maintained with age
E: Environment 	❑ Environmental conditions have a direct effect on body heat ❑ Various external factors like hot or cold air, humidity, and airflow can alter body temperature ❑ Prolonged exposure in extreme conditions influence internal temperature regulation
S: Stress and anxiety 	❑ Emotional and psychological states also impact body temperature ❑ Stress response: Activates the nervous system, which can increase body temperature ❑ Temporary effects: Emotional stress can lead to short-term temperature fluctuations.

Assessment of Body Temperature

Purposes

- ❖ To establish baseline data for subsequent evaluation
- ❖ To identify whether the core temperature is within the normal range
- ❖ To determine changes in the response to specific therapies
- ❖ To monitor clients at risk for imbalanced body temperature

To check body temperature correctly, nurses must

- ❖ Use the right equipment
- ❖ Choose the proper site
- ❖ Follow the right method

They should understand the readings, notice any changes, and respond as needed. Nurses also teach patients and caregivers how to measure temperature, know what's normal, and report any unusual results.

Sites for Checking Temperature

Nurses must choose an alternate and appropriate site according to the patient's condition. The most common sites are oral, axillary, rectal, tympanic membrane and temporal artery or skin. Each one has its advantages and disadvantages. Detail of these sites' information is shown in the **Tables 6.4 and 6.5**.

Types of Thermometers (Table 6.6)

These are the types of thermometers used in clinical settings:

- ❖ Mercury-in-glass thermometers
- ❖ Electronic thermometers
- ❖ Chemical disposable thermometers
- ❖ Temporal artery thermometer
- ❖ Temperature-sensitive tape
- ❖ Infrared thermometers

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Table 6.4: Sites for checking temperature.

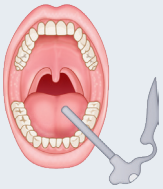
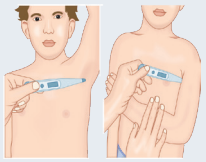
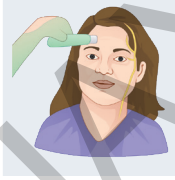
Site/normal temperature (°F/°C)	*Location and advantages*	*Instructions and disadvantages*	*Duration*
Oral (O′) 98.6°F/37.0°C 	❑ Thermometer placed under tongue (posterior sublingual pocket) ❑ Easy, common, comfortable	❑ Avoid hot/cold drinks or smoking 20—30 minutes before checking ❑ Patients must be awake and alert while checking ❑ Not suitable for infants, unconscious, or oral issues ❑ Can break if bitten ❑ Can injure the mouth after surgery	❑ Leave in place for 3 minutes ❑ Measures ~0.5°C less than rectal
Axillary (AX′) 97.6°F/36.6°C 	❑ Bulb placed in center of armpit, arm across chest ❑ Safe, noninvasive ❑ Good for children and infants	❑ Less accurate (not near major vessels) ❑ Can be affected by bathing or skin friction	❑ Leave in place 5 minutes ❑ Measures ~0.5°C less than oral
Rectal (R′) 99.6°F/37.6°C 	❑ Considered as very accurate ❑ Insert lubricated bulb 1–1.5 inches into rectum (adults), 0.5 inches for infants ❑ Most reliable; measures core temperature	❑ Used if oral is unsafe ❑ Not suitable for patients with rectal conditions and myocardial infarction, diarrhea ❑ Immunocompromised, has clotting disorders ❑ Inconvenient and unpleasant, difficult for patients who cannot turn ❑ May give inaccurate reading if the patient's stool interferes with reading ❑ Requires privacy	❑ Leave in place for 1 minute ❑ Measures 1°F higher than oral ❑ and 2°F higher than axillary
Ear/tympanic (T′) 99.6°F/37.6°C 	❑ Estimates the core temperature ❑ Placed in the outer ear canal, close to hypothalamus ❑ Fast, ideal for children/ unconscious patients	❑ Pull ear up and back (adults), down and back (children) ❑ May be affected by earwax or infections ❑ Risk of injury ❑ Repeated measures vary ❑ Right and left reading also differ ❑ Not for patients with ear issues	Takes 2–3 seconds
Temporal artery (TA′) Chemical thermometer 	❑ Slide thermometer across forehead ❑ Good for all ages ❑ Useful after oral surgery, for unconscious/mouth-breathing patients ❑ Very fast, safe and non-invasive	❑ Use exposed side of forehead ❑ Avoid covered areas (hair, pillows) ❑ Not ideal for combative children or some newborns ❑ Requires electronic equipment ❑ Expensive ❑ If sweating, we cannot use this method	Take a few seconds

Table 6.5: Sites and their temperature variations.

Site	*Average temperature*	*Normal range (°C)*	*Normal range (°F)*
Oral	37.0°C	36.3–37.2°C	97.3–99.0°F
Rectal	37.5°C	36.5–37.7°C	97.7–99.9°F
Axillary	36.5°C	36.0–37.0°C	96.8–98.6°F
Tympanic	37.5°C	36.5–37.7°C	97.7–99.9°F
Temporal artery	37.0°C	36.3–37.2°C	97.3–99.0°F

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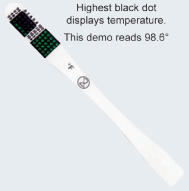
Table 6.6: Types of thermometers used in clinical settings.

Type	*Description*	*Sub-types*	*Advantages*	*Disadvantages*
Mercury-in-glass thermometer 	A glass tube (plastics also available) sealed at one end with mercury in a bulb at the other. The mercury rises when exposed to heat and is calibrated from 35 to 42°C, marked in 0.1°C intervals	***Oral*:** Long, slender tip for under the tongue **Rectal:** Short, blunt tip to prevent tissue injury **Axillary:** Shorter, thicker version for underarm use	❑ Low cost ❑ Widely available ❑ High accuracy	❑ Fragile ❑ Time-consuming (3–5 minutes) ❑ Risk of mercury exposure(hazardous) **Note:** This thermometer is not recommended because of the risk mentioned.
Electronic thermometers 	Display unit with rechargeable battery, probe with disposable plastic cover, and audio alert signals peak reading	❑ **Standard probe thermometer:** For oral, rectal, or axillary use ❑ **Tympanic thermometer:** Measures infrared heat from the eardrum	❑ Quick (20–50 seconds for probe, 2–5 seconds for tympanic) ❑ Easy to read ❑ Minimizes contact	❑ Expensive ❑ Requires charging/ batteries
Temperature-sensitive tape 	❑ Temperature-sensitive tape does not indicate core body temperature ❑ It contains liquid crystals that change color according to the skin temperature. To apply the tape, the skin must be clean and dry		❑ Noninvasive ❑ Easy home use ❑ Useful in infants	❑ Approximate reading only ❑ Not true core temperature ❑ Less accurate
Chemical disposable thermometers 	❑ **Plastic strips with chemical dots:** For oral or axillary use ❑ **Temperature-sensitive patches/tapes:** Applied to forehead or abdomen		❑ Hygienic ❑ Ideal for newborns or during mass screening ❑ Low cost	
Temporal artery thermometer 	❑ An infrared scanner slides across the forehead to measure heat from the temporal artery. It takes multiple readings per second and gives the most accurate result. If the forehead has perspiration on the forehead, we can touch behind the earlobe		❑ Fast, accurate, and noninvasive ❑ Does not require positioning (unlike tympanic type) ❑ Not affected by smoking, eating, or coughing ❑ Suitable for all ages	
Infrared thermometers 	❑ Detect body temperature by sensing infrared energy emitted by a heat source, in this case, the tympanic membrane in the ear canal ❑ The device does not come into direct contact with the eardrum but detects the emitted infrared radiation to estimate temperature	Ear-based (tympanic)	❑ These thermometers offer fast and relatively accurate reading ❑ Noncontact with eardrum	Affected by earwax or improper positioning

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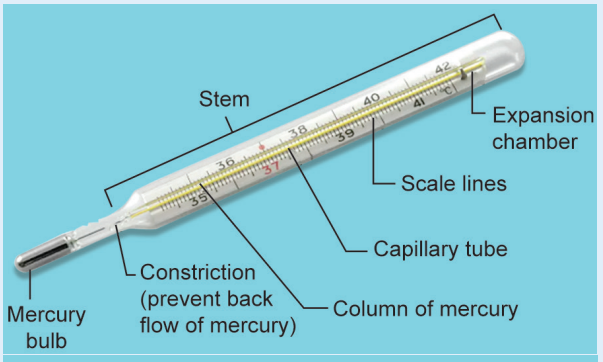
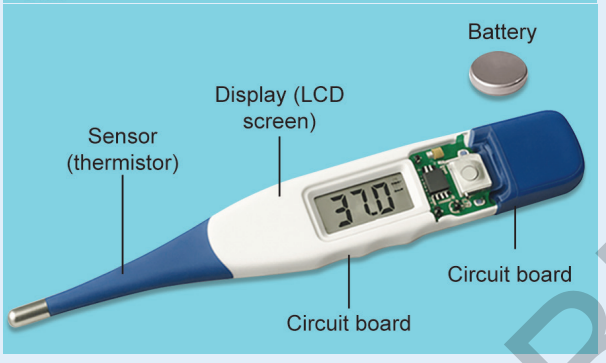
DO YOU KNOW?

Parts of Thermometer





Temperature Conversion Formula

Temperature Conversion Formulas

Fahrenheit to Celsius:
$C = (F - 32) \times 5/9$
Celsius to Fahrenheit
$F = (C \times 9/5) + 32$

Exercise Time

1. Convert 101.4°F to Celcius:

2. Convert 39.2°C to Fahrenheit:

TEMPERATURE ALTERATIONS

There are two primary alterations in body temperature
1. Pyrexia
2. Hypothermia

Pyrexia/Fever

A body temperature above the usual range is called pyrexia, hyperthermia or fever. The person who has a fever is referred to as febrile, and no fever is called afebrile.

Definition

Fever, or pyrexia, is when a body temperature rises above 100.4°F (38°C) due to a change in the body's internal thermostat, the hypothalamus. It's often the body's response to infection or inflammation.

Causes of Fever

The various causes of fever are summarized in **Table 6.7**.

Types and Fever Patterns

The **Figure 6.3** depicts the types of fever patterns.

Table 6.7: The common causes of fever.

Cause	*Example*
Exposure to hot environments	A construction worker develops heat exhaustion after working long hours under the sun without proper hydration
Excessive exercise	A marathon runner collapses due to exertional heat stroke after prolonged running in hot weather
Neurogenic factors (hypothalamic dysfunction)	A patient with severe head trauma develops uncontrolled high body temperature due to hypothalamic dysfunction
Dehydration due to excessive fluid loss	An elderly person with severe diarrhea and vomiting becomes dehydrated and febrile
Side effects of certain drugs	A child develops drug-induced hyperthermia after receiving too many antipsychotics
Infections and inflammation	A patient with pneumonia develops fever as the body's defense mechanism against infection
Heavy bleeding (hemorrhage)	A woman experiences postpartum hemorrhage and shows altered body temperature due to circulatory shock

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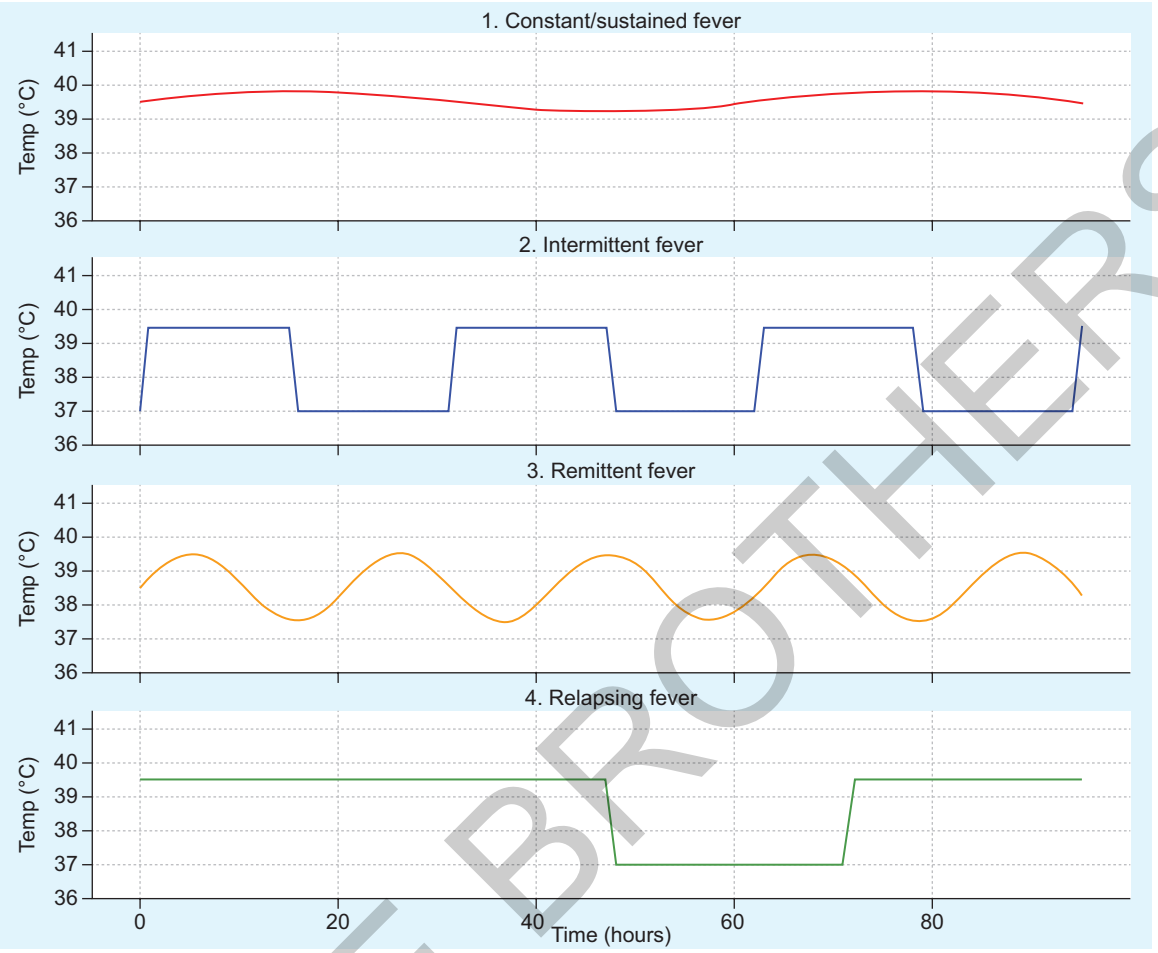

Fig. 6.3: Fever patterns.

Common Types of Fever

- **Constant/sustained fever:** Body temperature remains between 39–40°C with little fluctuation (<1°C) over 24 hours (e.g., pneumonia, typhoid).
- **Intermittent fever/quotidian fever:** Returns to normal at least once in 24 hours; typically peaks in the evening (e.g., septicemia, malaria).
- **Remittent fever:** Fluctuates but does not return to normal, like more than 2°C in 24 hours, all will be above normal (e.g., TB, viral/bacterial infections).
- **Relapsing fever:** Periods of fever interspersed with normal temperature.
- **Irregular fever:** Temperature alternates between fever and normal (e.g., influenza, cancer).
- **Fastigium or stadium:** In this, the body temperature has reached its maximum and remains fairly constant at a high level.
- **Fever spike:** The patient may have a normal temperature, but suddenly the temperature will rise and then it will come back to normal (bacterial infections).
- **Crisis:** A sudden return to normal temperature from a very high fever, occurring within a few hours to a few days.
- **True crisis:** The body temperature returns to normal rapidly following a high-grade fever, and the patient's overall condition shows significant improvement.
- **False crisis:** Although the temperature drops quickly after a high fever, the patient's condition does not improve. This is considered a warning sign.
- **Lysis:** The fever subsides gradually in a fluctuating (zigzag) pattern over 2–7 days before reaching normal levels. During this time, associated symptoms also gradually disappear.
- **Inverse fever:** In this uncommon fever pattern, the highest body temperature is recorded in the morning, and the lowest in the evening, opposite to the usual fever pattern.
- **Hectic or swinging fever:** Characterized by a significant difference between the highest and lowest temperatures recorded within 24 hours.

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Grades of Fever

See **Table 6.7**.

Phases of Fever

See **Table 6.8**.



ROLE OF NURSE

Nursing Interventions Checklist: Fever Management

- ❑ Monitor vital signs
- ❑ Assess skin color and temperature
- ❑ Monitor white blood cell count, hematocrit value, and other pertinent lab results (infection/dehydration)
- ❑ Remove excess blankets if the client feels warm; provide warmth if the client feels chilled
- ❑ Ensure adequate nutrition and fluid intake (2,500–3,000 mL/day)
- ❑ Measure intake and output
- ❑ Reduce physical activity, especially during the flush stage
- ❑ Administer antipyretics as ordered
- ❑ Provide oral hygiene to maintain moist mucous membranes
- ❑ Provide adequate rest and sleep
- ❑ Never leave the patient alone with high-grade fever

Other Heat Alterations

See **Table 6.9**.

Hypothermia

Hypothermia is a condition in which the core body temperature drops below **35°C (95°F)**. This can slow down essential bodily functions and may become life-threatening if not promptly treated.

Types of Hypothermia

Induced hypothermia

- ❖ A medically controlled lowering of body temperature.
- ❖ Used during certain surgeries to reduce tissue oxygen demand and protect vital organs.

Accidental hypothermia

Occurs unintentionally due to external factors such as:

- ❖ Prolonged exposure to cold environments.
- ❖ Immersion in cold water.

Table 6.8: Phases of fever with their clinical manifestations.

Phase of fever	*Description*	*Clinical manifestations*
Prodromal phase (onset/initial hase)	Early stage when the body temperature begins to rise as the hypothalamic set point increases	❑ Malaise, fatigue ❑ Mild headache ❑ Feeling cold/chilly ❑ Muscle aches ❑ Shivering begins ❑ Pale skin and goosebumps
Chill phase (cold stage)	Body attempts to raise temperature to the new set point; heat production exceeds heat loss	❑ Intense shivering/ rigors ❑ Cold, pale skin ❑ Peripheral vasoconstriction ❑ Increase in heart rate ❑ Goosebumps (piloerection) ❑ Patient may wrap up in blankets
Plateau phase (flush/hot stage)	Temperature stabilizes at the elevated level. Body feels warm as set point is maintained	❑ Hot, flushed skin due to vasodilation ❑ Warm sensation ❑ Reduction or absence of shivering ❑ Increased thirst ❑ Dry mucous membranes ❑ Increased heart and respiratory rate ❑ Possible confusion (in high fever)
Defervescence phase (fever break/crisis phase)	Set point returns to normal; body initiates heat loss through sweating and vasodilation	❑ **If gradual (lysis):** Gradual decline in temperature ❑ **If sudden (crisis):** • Rapid fall in temperature • Profuse sweating • Warm, flushed skin • Dehydration risk • Weakness, fatigue • Drop-in heart rate and blood pressure (in crisis)

Table 6.7: Grades of fever.

Fever grade	*Celsius (°C)*	*Fahrenheit (°F)*	*Description*
Normal	36.1–37.0°C	97.0–98.6°F	Normal body temperature
Low-grade fever	37.1–38.0°C	98.8–100.4°F	Mild fever, often due to minor infection
Moderate fever	38.1–39.0°C	100.6–102.2°F	Typical for the most common infections
High-grade fever	39.1–40.0°C	102.4–104.0°F	Significant fever may require attention
Hyperpyrexia	>41.0°C	>105.8°F	Medical emergency, possible organ damage

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Table 6.9: Other common conditions of heat alterations.

Condition	*Meaning/concept*	*Causes/classifications*	*Diagnosis*	*Management*
Hyperthermia	An elevated body temperature due to failed thermoregulation, where the body produces or absorbs more heat than it disperses. Range: >37.5–38.3°C (99.5–100.9°F)	❑ Heat stroke ❑ Drug-induced: (e.g., MAO inhibitors, antidepressants, amphetamines, SSRIS) ❑ Endocrinopathies: (e.g., thyrotoxicosis, pheochromocytoma) ❑ CNS damage: (e.g., hemorrhage, seizures, hypothalamic injury)	❑ History and physical examination ❑ Lab tests (CBC, biochemical values, cultures) ❑ Imaging (radiology, CT, MRI)	**Antipyretics:** ❑ *Acetaminophen:* Adults: 325–650 mg q4–6h; Children: 10–15 mg/kg q4–6h ❑ *Ibuprofen:* Adults: 200–400 mg q6h; Children: 5–10 mg/kg depending on severity ***Other antipyretics:*** Indomethacin, naproxen, aspirin **Severe Cases:** ❑ Glucocorticoids ❑ Meperidine ❑ Morphine sulphate ❑ Chlorpromazine
Fever of unknown origin (FUO)	❑ It is a prolonged fever (≥38.3°C on several occasions, lasting >3 weeks) whose cause remains undiagnosed after appropriate evaluation, including at least 1 week of hospital-based investigations ❑ FUO is a clinical syndrome, not a disease. It indicates an underlying condition that is hard to identify. Normally, fever results from infections, inflammation, autoimmune disorders, or malignancy, but in FUO the exact cause remains unclear despite initial assessments. Stepwise evaluation—history, physical examination, and specialized laboratory and imaging tests—is required	**Causes:** ❑ Infections ❑ Neoplasms ❑ Autoimmune/Collagen diseases ❑ Miscellaneous: Metabolic, inherited, drug fevers ❑ Classifications: ❑ Classic FUO: infections, malignancies ❑ Nosocomial FUO: in hospitalized, noninfected patients ❑ Neutropenic FUO: neutrophil count <500/µL ***Examples of FUO in clinical practice*** ❑ A young adult with persistent fever >3 weeks, no cough or chest pain, but finally diagnosed with extra-pulmonary tuberculosis after advanced imaging ❑ An elderly patient with prolonged fever and weight loss, initially thought to have infection, but later diagnosed with lymphoma ❑ A child with repeated fever spikes for several weeks, unresponsive to antibiotics, later found to have systemic juvenile arthritis (an autoimmune cause) ❑ A patient on anticonvulsant therapy (phenytoin) presenting with fever, later identified as drug-induced fever when the temperature normalized after stopping the drug	❑ History, examination, labs, imaging, biopsies	❑ Accurate monitoring of temperature patterns (time, duration, type of fever) is important ❑ Thorough history-taking (travel history, exposure to infections, drug use, chronic illnesses) ❑ Supportive care to be for hydration, nutrition, rest, and fever management ❑ Psychological support to be given for patients and families may feel anxious due to prolonged unexplained illness

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Condition	*Meaning/concept*	*Causes/classifications*	*Diagnosis*	*Management*
Heat illness	When the body's mechanisms fail to regulate temperature in heat, it can lead to life-threatening conditions.	*Risk factors:* ❑ Intense physical activity ❑ Environmental heat/humidity ❑ Poor conditioning or hydration ❑ Age extremes, medications, and alcohol use *Types:* 1. Heatstroke—life-threatening 2. Heat exhaustion can lead to heatstroke 3. Heat cramps—due to electrolyte loss 4. Heat rash—skin irritation 5. Dehydration—fluid and salt loss	❑ Clinical evaluation ❑ Temperature assessment ❑ Hydration/ electrolyte status	*Depends of sub type*
Heat stroke (sun stroke)	Severe hyperthermia with core temperature ≥106°F. A medical emergency	*Causes:* Extreme heat, high humidity, and dehydration *At-risk groups*: Infants, the elderly, outdoor workers, and athletes *Symptoms:* ❑ Confusion, delirium, and fainting ❑ Convulsions, coma ❑ Hot, dry, flushed skin ❑ Strong, rapid pulse	❑ High core temperature ❑ Neurological symptoms ❑ Hot, dry skin	❑ Immediate cooling: Tepid water, fanning, ice packs ❑ Oral/cool IV fluids ❑ Monitor temperature, prevent further heat exposure
Heat exhaustion	Heat-related illness is due to prolonged exposure and dehydration with paleness, dizziness, nausea, vomiting, fainting and moderately increased temperature	*Types:* ❑ Water depletion: Thirst, weakness ❑ Salt depletion: Nausea, cramps	❑ Physical exam ❑ Hydration status	Cool environment, fluids, rest, monitor symptoms
Heat cramps	Painful muscle spasms due to salt/electrolyte loss	Sweating → sodium loss	Symptoms-based	Rest, hydrate with salt-containing fluids, stretching, and massage
Heat rash (prickly heat)	❑ Rash from blocked sweat ducts, common in infants ❑ Red/pink rash, itching, especially in covered areas	Hot, humid environments; occlusive clothing	Visual inspection	Cool air, loose clothing, and hygiene

❖ Inadequate shelter, clothing, or heating in cold conditions.

Pathophysiology

Three main mechanisms contribute to hypothermia:

❖ Excessive heat loss
❖ Inadequate heat production to counter heat loss
❖ Impaired hypothalamic thermoregulation

Figure 6.4 picturises the pathophysiology of hypothermia.

Stages of Hypothermia

Stage	*Temperature*	*Symptoms*
Mild hypothermia	32–35°C (90–95°F)	Shivering, confusion, cold sensations
Severe hypothermia	<32°C (<90°F)	Unconsciousness, bradycardia, hypoventilation

Causes of Hypothermia

❖ Exposure to cold weather
❖ Immersion in cold water

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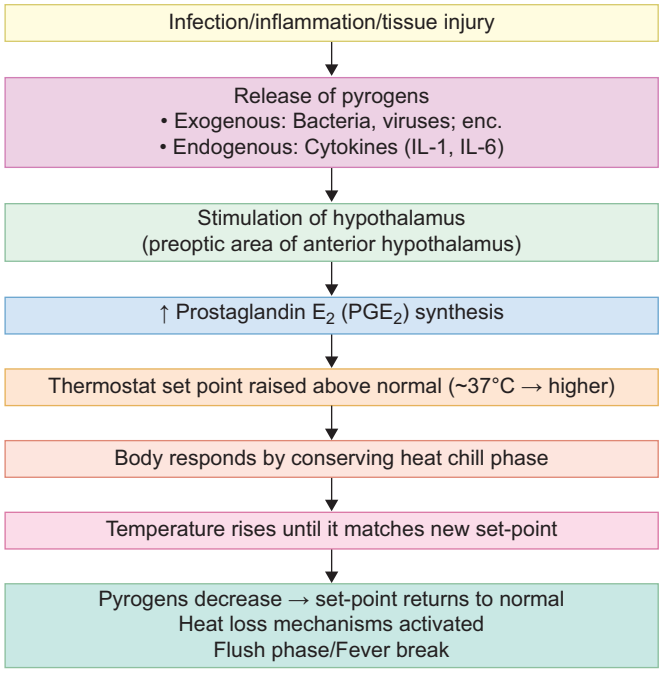

Fig. 6.4: Pathophysiology of hypothermia.

- Prolonged outdoor activity without proper clothing
- Inadequate heating or shelter

Clinical Manifestations

- Decreased body temperature, pulse, and respiration
- Severe shivering (initially)
- Sensations of cold and chills
- Pale, cool, waxy skin
- Frostbite (especially on the nose, ears, fingers, and toes)
- Hypotension
- Decreased urine output
- Lack of muscle coordination
- Disorientation or confusion
- Drowsiness, potentially progressing to coma

Management of Hypothermia

- Gradual rewarming of the body is essential to avoid complications.
- **Passive external warming:**
  - Use of warm blankets and a heated environment.
  - Remove wet clothing and replace it with dry garments.
- **Active external warming:** Application of warming pads or radiant heat.
- **Active internal (core) warming for severe cases:**
  - Administration of warm intravenous fluids
  - Heated and humidified oxygen
  - Warmed gastric or peritoneal lavage (in hospital settings)
- Emergency care should be sought immediately for severe hypothermia.



ROLE OF NURSE

Nursing Interventions

- ❑ Provide a warm, draft-free environment.
- ❑ Remove any wet clothing and replace it with dry garments.
- ❑ Apply warm blankets and use heating devices if available.
- ❑ Keep the client's limbs close to the body to minimize heat loss.
- ❑ Cover the scalp with a cap or turban to prevent heat loss through the head.
- ❑ Offer warm oral fluids if the client is conscious; otherwise, provide warm IV fluids.
- ❑ Monitor vital signs, level of consciousness, and urine output closely.

Measuring Body Temperature: Procedure by Route

Procedure: Preparation before Checking Temperature

- Perform hand hygiene thoroughly using soap and water or hand sanitizer.
- Introduce yourself to the patient and caregivers.
- Verify the patient's identity using at least two identifiers (e.g., name and date of birth).
- Explain the procedure clearly to both the patient and the caregivers.
- Emphasize the importance of cooperation during the procedure to ensure accuracy and comfort.
- Assess the suitability of the site for temperature checking (oral, axillary, tympanic, rectal, or temporal). If the patient is conscious; ask for their preference regarding the site **(Fig. 6.5)**.
- Ensure privacy based on the selected site.
- Wear gloves if required by the method or site of temperature checking.
- Position the patient appropriately according to the selected site (e.g., lying down, sitting upright).
- Check the functionality of the thermometer before using it on the patient.
- Wait the recommended duration as per the selected site and type of thermometer to ensure an accurate reading.

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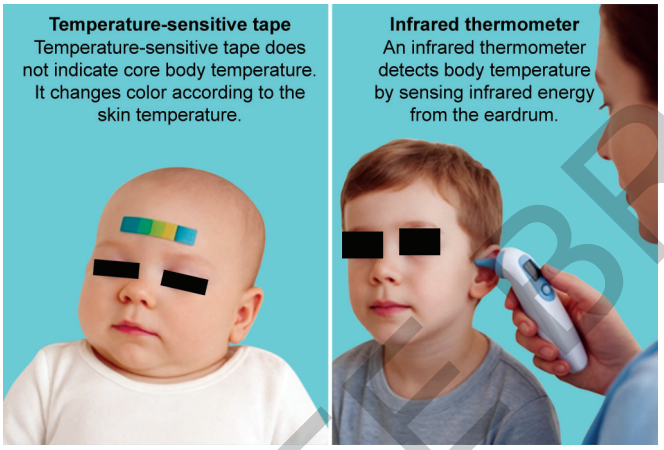
Oral temperature checking



Axillary temperature checking



Tympanic and temporal artery checking



Rectal temperature checking

Fig. 6.5: Different sites for temperature checking.

- Follow the institution's protocol for recording and reporting (In some institutions, regardless of the site used for temperature measurement, readings must be converted and recorded as an oral equivalent. In others, the actual site of measurement should be documented along with the reading (e.g., "R" for rectal, "Ax" for axillary).
- Wash the thermometer and replace it in the designated area.

Tables 6.10 and 6.11 summarizes the procedure for assessing temperature at different sites.

After Care

- Discuss findings with the client as needed
- Replace the articles
- Wash hands
- Compare readings with the previous baseline and/or acceptable value for the client's age.
- Record and report the findings

Nursing Process of a Patient with Alteration with Temperature

See **Table 6.12**.

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Table 6.10: Procedure for assessing temperature at different sites.

Method	*Equipment needed*	*Patient position*	*Procedure summary*	*Type of patients used*
Axillary (underarm)	❑ Electronic/glass thermometer ❑ Blue probe ❑ Probe cover ❑ Waste container ❑ Pen ❑ Medical record	Sitting or supine	❑ Expose shoulder/arm ❑ Apply probe cover or clean probe ❑ Insert probe into dry axilla, arm across chest ❑ Wait for beep ❑ Remove and read ❑ Discard cover or clean probe ❑ Record	Newborns and infants (safe, non-invasive); unconscious or confused patients; patients after oral/rectal surgery where other sites are contraindicated
Oral (mouth)	❑ Electronic/glass thermometer ❑ Blue probe ❑ Probe cover ❑ Waste container ❑ Pen ❑ Medical record	Sitting or supine	❑ Apply probe cover ❑ Place probe under tongue (sublingual pocket, either side of the frenulum) ❑ Wait for beep ❑ Remove and discard cover ❑ Record	Cooperative, alert, and oriented adults and older children; patients without recent oral surgery, trauma, or diseases of the mouth; not suitable for infants, confused, unconscious, or seizure patients
Rectal	❑ Electronic thermometer ❑ Red rectal probe ❑ Probe cover ❑ Lubricant ❑ Gloves ❑ Tissue ❑ Biohazard container ❑ Pen ❑ Medical record	Sim's position (left side, top leg flexed)	❑ Apply gloves ❑ Cover and lubricate probe ❑ Insert 1.5" (adult), 1" (child) when the patient takes a slow deep breath. Never force the thermometer ❑ Wait for beep ❑ Remove and discard cover ❑ Clean area, remove gloves ❑ Record	Critically ill patients; infants and young children (more accurate than axillary); patients where core body temperature is essential (e.g., hypothermia, perioperative). Avoid in: rectal surgery, diarrhea, neutropenia, cardiac patients (risk of vagal stimulation)
Tympanic (Ear)	❑ Tympanic thermometer ❑ Probe cover ❑ Waste container ❑ Pen ❑ Medical record	Sitting	❑ Attach probe cover ❑ Pull ear up/back (adult) or down/back (child) ❑ Insert slowly using a circular motion until snug and press scan ❑ Remove and discard cover ❑ Record side and temp	Adults and children (over 6 months); quick measurement in emergency or outpatient settings; less invasive and well-tolerated. Avoid in: ear infections, excessive earwax, infants under 6 months
Temporal artery	❑ Temporal thermometer alcohol swab ❑ Pen ❑ Medical record	Sitting or lying	❑ Clean probe ❑ Press button, slide across forehead ❑ Touch behind ear ❑ Release button and read ❑ Record side and temperature	All age groups including infants, children, adults, and elderly; non-invasive, fast, useful for screening large groups (e.g., schools, airports); suitable when minimal disturbance is required (sleeping child, ICU)

Table 6.11: Equipment and rationale for assessing temperature at different sites.

Equipment	*Rationale*
Thermometer	To measure the patient's body temperature accurately
Blue probe	Designated for oral/axillary use (color coding prevents cross-contamination with rectal probes)
Probe cover	Provides infection control and prevents cross-contamination between patients
Waste container	For safe disposal of used probe covers to maintain hygiene and prevent spread of infection
Pen	For immediate recording of the temperature reading to avoid errors
Patient's medical record	To document findings for baseline comparison, continuity of care, and clinical decision-making

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Table 6.12: Nursing process on patients with temperature alterations.

Assessment	*Nursing diagnosis*	*Goals*	*Interventions*	*Rationale*	*Evaluation*
Subjective Data ❑ Patient reports "feeling hot" or "burning up" ❑ Complaints of headache, malaise, or body aches ❑ Reports thirst and reduced appetite ❑ Irritability, restlessness, or fatigue expressed verbally Objective Data ❑ Temperature >38.5°C ❑ Dry, warm skin ❑ Flushed face ❑ Tachycardia and increased respiratory rate ❑ Diaphoresis during fever break ❑ Laboratory signs: ↑ WBC count (infection)	**Hyperthermia** related to infection as evidenced by temperature >38.5°C, dry skin, tachycardia, irritability	❑ Maintain body temperature within normal range (36.5–37.5°C) ❑ Prevent complications such as dehydration and seizures	❑ Monitor temperature, pulse, respiration, BP every 2–4 hours ❑ Encourage oral fluids, IV fluids if prescribed ❑ Apply tepid sponge baths or cool compresses (avoid chilling) ❑ Administer antipyretics/antibiotics as prescribed ❑ Provide light clothing, proper ventilation, cooling devices if needed	❑ Early detection helps track fever pattern ❑ Adequate fluids prevent dehydration and electrolyte imbalance ❑ Cooling measures promote heat loss ❑ Medications reduce fever and treat infection ❑ Environmental adjustments prevent further rise in temperature	❑ Temperature reduced to normal ❑ Patient reports increased comfort ❑ Adequate hydration maintained
Subjective Data ❑ Patient states "I feel very cold" or complains of numbness/tingling ❑ Reports fatigue, confusion, or difficulty concentrating ❑ Describes shivering or muscle stiffness Objective Data ❑ Temperature <36°C ❑ Shivering (early), muscle rigidity (late) ❑ Pale, cold, mottled, or cyanotic skin ❑ Slow capillary refill ❑ Bradycardia decreased respiratory rate, hypotension (severe) ❑ Altered mental status: disorientation, drowsiness, unconsciousness	**Hypothermia** related to prolonged cold exposure as evidenced by shivering, pale skin, confusion	❑ Maintain core body temperature within normal limits ❑ Prevent further heat loss and complications (arrhythmia, organ failure)	❑ Monitor core temperature regularly ❑ Provide warm blankets, heated environment ❑ Use warming devices (forced-air warming, warm IV fluids) ❑ Monitor cardiac rhythm and vital signs ❑ Provide warm oral fluids if conscious	❑ Frequent monitoring helps detect worsening hypothermia ❑ External warming prevents further heat loss ❑ Active warming restores body temperature ❑ Cardiac monitoring detects arrhythmias early ❑ Warm fluids improve comfort and increase body temperature	❑ Core temperature gradually normalized ❑ Shivering reduced, skin warm ❑ Patient alert and oriented

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Assessment	*Nursing diagnosis*	*Goals*	*Interventions*	*Rationale*	*Evaluation*
Subjective Data ❑ Caregiver reports infant/elderly patient "feels too hot/cold often" ❑ Patient verbalizes intolerance to temperature changes (too warm or too cold) ❑ Complaints of dizziness, weakness, or discomfort in varying environments ❑ Objective Data ❑ Fluctuating body temperature (fever/hypothermia episodes) ❑ Infants: Excessive crying, irritability, or lethargy ❑ Elderly: Confusion, disorientation, fatigue ❑ Inconsistent responses to environmental temperature (e.g., no sweating, excessive sweating, or inability to shiver)	**Ineffective thermoregulation** related to immature temperature regulation (infants/elderly) or neurological impairment	❑ Maintain stable body temperature appropriate for age	❑ Monitor temperature frequently ❑ Adjust room temperature ❑ Provide appropriate clothing and bedding ❑ Educate family on signs of hypo/hyperthermia	❑ Infants and elderly are more vulnerable to temperature extremes ❑ Environmental control maintains stable temperature ❑ Education ensures early detection and prevention	❑ Temperature maintained within safe range ❑ Family demonstrates correct knowledge of care
Subjective Data ❑ Patientsreport thirst or dry mouth ❑ Complaints of weakness, dizziness, or light-headedness ❑ Reports reduced food and fluid intake Objective Data ❑ Profuse diaphoresis noted ❑ Dry mucous membranes, cracked lips, dry tongue ❑ Concentrated urine or decreased urine output ❑ Tachycardia and hypotension ❑ Poor skin turgor (late sign) ❑ Laboratory: ↑ haematocrit, ↑ serum sodium	**Risk for fluid volume deficit** related to excessive diaphoresis (in fever	❑ Maintain adequate hydration and electrolyte balance	❑ Monitor intake and output ❑ Provide oral/IV fluids ❑ Assess for signs of dehydration (dry lips, low urine output)	❑ Prevents hypovolemia and electrolyte imbalance	❑ Patient well hydrated ❑ Normal urine output and moist mucous membranes

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- Aligned with the revised competency-based BSc Nursing curriculum prescribed by the Indian Nursing Council (INC), offering clear and comprehensive coverage of core nursing concepts.
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Lily Podder PhD RN is an Associate Professor in Obstetrics and Gynecological Nursing at AIIMS Bhopal, Madhya Pradesh, India with over 25 years of experience, recognized for advancing excellence in nursing education and evidence-based practice. Her research contributions are substantial, with over 50 publications and a strong citation record across leading academic platforms. She has received several prestigious recognitions, including the President of India's Gold Medal (2006), Best Nurse Teacher (2011), Best Nurse Researcher (2015), and Best Nurse Educationist (2019), and has served as a faculty exchange scholar in Sweden, reflecting her excellence in teaching, research, and professional leadership. As an accomplished academician, she has authored, contributed to, and reviewed several nursing textbooks and continues to mentor students and researchers. She also serves as a peer reviewer and editorial board member for reputed national and international journals. Her work has been widely recognized through multiple awards for scientific paper and poster presentations. She remains actively engaged in professional organizations, demonstrating her sustained commitment to advancing nursing education and research.

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