स्वस्थवृत्त

PAPER II

PART A

सामाजिक स्वस्थवृत्त

CHAPTER I: JANAPADODHVAMSA

-> Refer to **Charaka Samhita, Vimana Sthana, Adhyaya 3**

CHAPTER II: VAYU / AIR

VAYU

❖ Vayu Guna as per Different Directions (Acharya Sushruta)

- **Purva Vayu Guna**
  Air blowing from the east direction has the following characteristics:
  Guna: Guru, Snigdha
  Rasa: Madhura, Lavana
  Dosha: Rakta, Pitta Karaka

  Yogya Vyakti: Vataja Prakriti, Alpa Kapha Dosha, Shrama
  Ayogya Vyakti: Kaphaja Prakriti, Kshata Ksheena, Visha

- **Dakshina Vayu Guna**
  Air blowing from the south direction has the following characteristics:
  Guna: Laghu
  Rasa: Madhura, Kashaya
  Dosha: Rakta, Pitta Shamaka

  Yogya Vyakti: Netraroga, Ksheena Vyakti (emaciated)

- **Pashchima Vayu Guna**
  Air blowing from the west direction has the following characteristics:
  Guna: Ruksha, Parusha, Khara, Sneha, Balanashaka
  Dosha: Kapha & Medha Shoshana

- **Uttara Vayu Guna**
  Air blowing from the north direction has the following characteristics:
  Guna: Snigdha, Mridu, Shita
  Rasa: Madhura, Kashaya
  Dosha: Does not affect the Dosha much

  Yogya Vyakti: Visha roga; It increases Kleda & Bala and leads to Dhatu Ksheena in healthy individuals

❖ Vayu Karya & Dushita Vayu Karya

- **Vayu Karya**
  Kindling of fire, movement of Surya, Chandra, Nakshatra and Graha, creation of clouds, showering rain, flowing of rivers, maturity of flowers and fruits, germination of seeds, development of plants, classification of seasons, causes dryness, hardness and transformation.

- **Dushita Vayu Karya**
  - Kasa, Shvasa, Vamathu, Pratishyaya, Shiroruja, Jvara, etc.
  - Breaking of mountain peaks, uprooting trees, disturbing the ocean, overflowing of lakes, changing the course of rivers, earthquakes, thunders, storms, clouds, disturbance of the six seasons, spread of epidemics, etc.

❖ Vayushuddhiprakara

(Purification of air)

- **According to Sushruta Samhita**
  - Laksha, Haridra, Ativisha, Abhaya, Harenu, Ela, Valka, Kustha, Priyagu are used in the form of Dhuma.
  - Karpura, Devadaru, Dhup, Chandana, Shreevasa, Sarja, Agaru, Nimba, Somaraji, Gandhaka, Guggulu are used in Havana.
  - Burning drugs like Nagakeshara, Jati, Patola, Nimba, Bilva, Nirgundi, Kamala, etc.
  - Agnihotra is done for purification of the atmosphere. It fills the atmosphere with beneficial nutrients and purifies it. It has catalytic effects in the atmosphere and helps rest natural cycles so as to attain the vital harmony and equilibrium.
  The atmosphere created by performing this ritual is highly appropriate for practicing other spiritual disciplines. Furthermore, Agnihotra may also be used for medicinal purpose or for purifying water resources.

- **According to Astanga Sangraha**
  1) <u>Dupana Karma</u>
     Guggulu, Agaru, Sarjarasa, Vacha, Gorasa, Sarshapa, etc. are used in Dhupana Karma to clean the vitiated / impure air.

  2) <u>Raksha Karma</u>
     Continuous Dhupana Karma with Kantotaka, Trivritta, Vacha, Kustha, Sarshapa, etc. helps to purify & protect the air.

  3) <u>Graha Roga Adhikara</u>
     Dhupana with Vacha, Bhallataka, Kustha, Ghrita, Sarshapa, Nimba patra, Siddharthaka, etc. helps to remove impurities of the air along with the Graha Dosha.

AIR

❖ Composition of Air

Air is a mechanical mixture of gases.
The normal composition of air by volume is approximately:

78.1%	Nitrogen
20.94%	Oxygen
0.9%	Argon
0.03%	Carbon dioxide

The remaining balance is made up of other gases which occur in traces like Neon, Krypton, Xenon, Sulphur dioxide, Hydrogen, Nitrogen dioxide & Helium.
In addition, air also contains water vapours, traces of ammonia & suspended matter such as dust, bacteria, spores & vegetable debris.

❖ Air Atmosphere

1) External Atmosphere
2) Internal Atmosphere

Agents affecting the atmosphere:

i) Physical agents - Temperature, Humidity, Wind velocity, Pressure
ii) Chemical agents - Dust, soot, smoke, other organic & inorganic particles
iii) Biological agents - Bacteria, viruses, etc.

❖ Air Impurity

Air is rendered by:
- Respiration of men & animals
- Combustion of coal, gas, oil, etc.
- Decomposition of organic matter
- Radioactive dusts and isotopes
- Trade, traffic & manufacturing processes

<u>Self-cleansing mechanisms:</u>
- Wind: Dilutes & sweeps away the impurity by its movement.
- Sunlight: Atmospheric temperature & sunlight oxidize the impurities and kills bacteria.
- Rain: Cleanses atmosphere by removing the suspended and gaseous impurities.
- Plant life: Green plants utilize CO_2 and generate O_2; vice versa at night.

❖ Air of Occupied Room

Chemical changes:

- Air becomes progressively contaminated by CO_2, and O_2 content decreases due to metabolic processes.
- An average person at rest gives 0.7 c. ft. per hour & during physical activity may be up to 2 c. ft. per hour.
- In a mixed gathering, the per capita output of CO_2 is taken as 0.6 c. ft. per hour.

Physical changes:

- Rise in temperature; indoor temperature tends to rise due to emanation of body heat
- Increase of humidity; due to moisture evaporated from skin & lungs. The expired air contains about 6% of water vapor.
- Decrease in air movement; in crowded places the natural movement of air is impeded.
- Body odours; Unpleasant odours arise from foul breath, perspiration, bad oral hygiene, dirty clothes, etc. The production of body odours depends upon social status, age & personal hygiene.
- Bacterial pollution; Exhaled air contains microorganisms in suspension which are principally saprophytic and may include pathogenic bacteria. The organisms are discharged into the air during conversation, coughing, sneezing, loud talking, etc.

❖ Thermal Discomfort & Comfort Zones

Thermal discomfort is a subjective sensation which people experience in ill-ventilated and crowded rooms.

Discomfort may be caused due to temperature, humidity, air movement or heat radiation. These factors determine the cooling power of the air with respect to the human body.

Comfort zones:

A comfort zone is the range of effective temperature over which the majority of adults feel comfortable.

Considering only the environmental factors, comfortable thermal conditions are those under which a person can maintain normal balance between production & loss of heat, at normal body temperature & without sweating.

<u>Comfort zones evaluated in India:</u>

- Pleasant & cool	20°C
- Comfortable & cool	20-25°C
- Comfortable	25-27°C
- Hot & Comfortable	27-28°C
- Extremely hot	> 28°C
- Intolerably hot	> 30+

❖ Air Pollution

The term air pollution signifies the presence of substances in the surrounding atmosphere generated by the activities of man. It affects human health, safety and comfort and injures vegetation, animals and other environmental media. This in turn results in chemicals entering the food chain or being present in drinking water and therefore causes additional damage to humans.

Major air pollutants, sources and adverse effects:

Noxious Agent	Sources	Adverse Effects
Oxides of Nitrogen	Automobile exhaust, Gas stove and heaters, Wood burning stoves, Kerosene space heaters	Respiratory tract irritation, Bronchial hyperactivity, Impaired lung defenses
Hydrocarbons	Automobile exhaust, Cigarette smoke	Lung cancer
Ozone discomfort, Sulphur Dioxide	Automobile exhaust, Power plants, Smelters, Oil refineries, Kerosene space heaters	Cough, Asthma, COPD, Respiratory tract irritation, Hospitalization may be necessary; death may occur in case of severe exposure

- **Prevention and Control of Air Pollution**

  WHO recommended the following procedure for the prevention & control of air pollution:

  1) Containment: It is prevention of escape of toxic materials into the ambient air. It is achieved by engineering methods such as enclosure, ventilation and air cleaning.

  2) Replacement: It is the replacement of a technological process causing air pollution by a new process that does not. Increased use of electricity in place of coal has greatly helped in smoke reduction.

  3) Dilution: It is valid so long as it is within the self-cleaning capacity of the environment. E.g.: Some air pollutants are readily removed by the vegetation. The establishment of green belts between industrial and residential area is an attempt at dilution.

4) Legislation: Air pollution is controlled in many countries by suitable legislation; e.g.: Clean air acts; Govt. of India enacted The Air (prevention and control of pollution) Act, 1981

5) International action: To deal with air pollution on a world wide scale, WHO has established an international network of laboratories for the monitoring and study of air pollution. The network consists of two international centers at London and Washington, three centers at Moscow, Nagpur and Tokyo and 20 laboratories in various parts of the world.

- **Disinfection of Air**

1) Mechanical ventilation: Reduces vitiated air and bacterial density.

2) UV radiation: Effective in situations such as operation theaters and infectious diseases wards. UV lamps are shaded and kept in the upper portion of the rooms near the inlet of air as direct exposure of eyes to and skin causes damage.

3) Chemical mists: Triethylene glucol vapous are effective air bactericides, especially against droplet nuclei and dust.

4) Dust control: Application of oil to floors of hospital wards reduces the bacterial content of the air.

❖ Global Warming

Global warming is an unusual rapid increase in earth's average surface temperature over the past century primarily due to excessive accumulation of greenhouse gases.

Greenhouse gases are a group of gases in our atmosphere which act as a blanket over the earth by not allowing heat to radiate by earth's surface to escape into space. In this way, the greenhouse gases keep the earth at the right temperature for animals, plants and humans. The major greenhouse gases are water, vapour, carbon dioxide, methane, nitrous oxide and ozone.

Main causes of Global Warming:

- Increase in the amount of carbon dioxide gas in the atmosphere due to deforestation.
- Increase in the amount of oxides of carbon & nitrogen produces during the combustion of fossil fuel like coal and petroleum partially or completely.
- Collection of chlorofluorocarbon in atmosphere due to use of aerosols in refrigerators and air conditioners & use of foams and fire extinguishers.
- Nitrogen oxides gas is produced by chemical fertilizers used in agriculture and by the combustion of fuel used in automobiles.
- Various biotic activates, agricultural activates and decay of organic wastes produce greenhouse gases.

Effects of Global Warming:

- Heat waves
- Expansion of desert area
- Natural fires in forest lands
- More evaporation of water from oceans and water bodies
- Melting of ice caps in Arctic and Antarctic regions
- Rise of the sea level
- Flooding and submergence of low lying coastal areas
- Increased cloud formation in the atmosphere
- Shorter and warmer winters; longer and hotter summers
- Changes in rainfall pattern
- Disruption in farming
- Increased drought
- Impact on plants, animals and humans

Control & Remedial Measures:

- Reduction in consumption of fossil fuels such as coal and petroleum
- Use of bio-gas plants
- Use of nuclear power plants
- Increasing forestation
- Use of unleaded petrol in automobiles
- Installation of pollution control devices in automobiles and industries

❖ Ventilation

The concept of ventilation implies not only the replacement of vitiated air by a supply of fresh outdoor air, but also control of the quality of the incoming air with regards to its temperature, humidity and purity with a view to provide a thermal environment that is comfortable and free from risk of infection.

Uses of Ventilation:

- Physical conditions of temperature, humidity and movement of air in the room are maintained constant.
- Chemical composition of air inside the room is maintained constant.
- Bacterial contamination of air in the room is reduced.
- Odours are removed from the room.

Ill-effects in unventilated room:

- Discomfort may be felt in a closed or congested room because of changes in the air suc as decrease of oxygen and increase of carbon dioxide, water vapour, bad odour and organic poisons eliminating from the humans.
- Ill-effects may include: Discomfort, restlessness, nausea, vomiting, irritability, giddiness, fainting

Types of Ventilation:

1) Natural Ventilation
2) Mechanical Ventilation

1) Natural Ventilation

It is the simplest system of ventilating small dwellings, schools, offices, etc.
In this method, reliance is placed on certain forces which operate in nature.

i) Wind: Wind is an active force in ventilation. When it blows through a room, it is called deflation. When there is an obstruction, it bypasses and exerts a suction action at its tail end, this is called aspiration. Doors and windows facing each other provide cross ventilation.

ii) Diffusion: Air passes through the smallest opening or spaces by diffusion.

iii) Inequality of temperature: Air flows from high density to low density; it rises when slightly heated and escapes from openings provided high up in the room. Outside air which is cooler and denser, will enter the room through the low inlets.

2) Mechanical Ventilation

i) Exhaust / Vacuum ventilation: In this system, air is exhausted to the outside by exhaust fans, usually driven by electricity. As air is exhausted, a vacuum is created which induces fresh air to enter the room through windows, doors and other inlets.

ii) Plenum ventilation: In this system, fresh air is blown into the room by centrifugal fans so as to create a positive pressure and displace the vitiated air.

iii) Balanced ventilation: This is a combination of the exhaust and plenum system. The blowing fan balances the exhaust fan.

iv) Air conditioning: It is defined as the simultaneous control of all, or at least the first three of the following factors affecting both the physical and chemical conditions of the atmosphere within any confined space or room.
These factors include temperature, humidity, air movement, distribution, dust, bacteria, odour toxic gases, most of which affect in greater or lesser degree the human health and comfort.

❖ High Altitude Health Problems

High altitude can have a pathological effect on humans. It is caused by acute exposure to low partial pressure of oxygen at high altitude. It commonly occurs above 2,400 metres (8,000 ft.). It presents as a collection of non-specific symptoms, acquired at high altitude or in low air pressure, resembling a case of 'flu, carbon monoxide poisoning or a hangover'.

It is difficult to determine who will be affected by altitude sickness as there are no specific factors that correlate with susceptibility to altitude sickness. However, most people can ascend to 2,400 metres without difficulties arising from the altitude.

Travelling in a short time to altitudes ranging from 9,000-15,000 ft. can lead to acute health problems. Acute mountain sickness is manifested as headache and vomiting. Other symptoms include breathlessness, sleeplessness and cough. Sudden induction to such high altitude has profound effect on the body. It can lead to hypertension, blood coagulation disorders and pulmonary hypertension.

The recommendation is that one can safely ascend from sea level to 8,000 ft. in 24 hours.

Symptoms:

- Severe dypsnoea
- Headache
- Vomiting
- Ataxia
- Staggering gait
- Fatigue
- Unconsciousness
- Abdominal pain
- Visual disturbances

CHAPTER III: JALA / WATER

❖ Importance of Water

- Water is an essential nutrient and plays a key role in the human body. Humans can survive up to several weeks without food, but only a few days without water. Every system in the body, from cells and tissues, to vital organs requires water to function.
- Water carries nutrients to all cells in our body and oxygen to our brain.
- Water allows the body to absorb and assimilate minerals, vitamins, amino acids, glucose and other substances.
- Water flushes out toxins and waste.
- Water helps to regulate body temperature.
- Water acts as a lubricant for joints and muscles.
- Water contributes to the maintenance of normal physical functions, as well as the maintenance of normal cognitive functions.
- Water makes up on average 60% of an adult's body weight, from 31% in bones to 83% in lungs.
- The human body cannot store water. Every day we are constantly losing water though breathing, sweating and through the release of urine and faeces. Ensuring that lost fluids are replenished in a timely manner and that our bodies are correctly hydrated is essential for good health and for the body to operate.

Uses of water:

i) Domestic use – drinking, cooking, washing, bathing, flushing, gardening, etc.
ii) Public purpose – cleaning, fountains, ponds, fire protection, etc.
iii) Industrial purpose – processing & cooling
iv) Agricultural purpose – irrigation
v) Power production – hydropower & steam power

❖ Safe & Wholesome Water

Safe & wholesome water is defined as that which is:

- free from pathogenic agents.
- free from harmful chemical substances.
- pleasant to taste, colourless and odourless.
- usable for domestic purposes.

If water does not fulfill the above criteria it is said to be polluted or contaminated. Water pollution is a growing hazard in many developing countries owing to human activity. It is not possible to provide positive health to the community without ample and safe drinking water.

❖ Water Requirements

Water intake includes that which is consumed as food and beverage, along with relatively small volumes of water created by oxidation of food (metabolic water) and breakdown of body tissue. Metabolic water is about 350 to 400 ml/d.
The body in normal condition loses water through sweat, urine and faeces.
The minimum requirement for water is the amount that equals losses and prevents adverse effects of insufficient water, such as dehydration. Given the extreme variability in water needs which are not solely based on differences in metabolism, but also in environmental conditions and activity, there is not a single level of water intake that would ensure adequate hydration and optimal health for half of all apparently healthy persons in all environmental conditions.
However, it is generally accepted that a normal healthy person needs to drink about 8 glasses (2 litres) of water per day.
The fact is that the true amount of water intake depends upon several factors, including gender, age, level of activity and environment.
The adequate water intake is 30 ml/kg body weight in a person with normally functioning kidneys and heart.

As an individual grows older, the need for water intake decreases slightly, but adequate water intake is still just as vital to the body's functioning.

An individual's level of activity is one of the greatest indicators of the amount of water s/he should drink each day. As a person exercises, the body will begin to excrete more water through perspiration and require more water for proper replenishment. For a short bout of exercise (<30 minutes), 1-2 extra glasses will replenish the body. If exercising is for longer periods of time or in warmer climates, a person likely needs to drink at least three extra glasses of water per day to replace any liquid lost during the process.

The environment also affects the amount of water an individual should drink. Individuals in warmer climates should drink more water to compensate for liquid lost through perspiration. Individuals who live at high altitudes may also need to drink more water, as the lack of oxygen in the air prompts more rapid breathing and a greater loss of moisture during respiration. Everyone, regardless of their environment, should drink more water during the summer months, as the heat and extra time spent outside can result in greater liquid loss.

From the standpoint of public health and improvement of the quality of life, water should be provided in adequate volume. A daily supply of 15ß-200 litres per capita is considered as an adequate supply to meet the need for all urban domestic purposes.
In India, 40 litres of water supply per capita per day was the set target to be achieved in rural areas.

❖ Properties of Water

- **According to Ayurveda:**

Divya Jala
Rasa: Avyakta Rasa / Madhura
Guna: Sheeta, Laghu, Snigdha
Vipaka: Madhura
Veerya: Sheeta
Karma: Tridosha shamaka, Amrita

Sheeta Jala
Rasa: Madhura
Guna: Sheeta, Guru
Vipaka: Madhura
Veerya: Sheeta
Karma: Pitta shamaka, Kapha vardhaka, Agni sadaka

Ushna Jala
Rasa: Madhura
Guna: Ushna, Laghu
Vipaka: Madhura
Veerya: Ushna
Karma: Vata-Kapha shamaka, Vata anulomana

- **According to Modern Science:**

Chemical Formula: H_2O
Appearance: Colourless, odourless and tasteless liquid in its natural state
Boiling Point: 100°C
Freezing Point: 0°C
Density: One unique property of water is that in the cold state, it is less dense. Up to 4°C water's density does increase on cooling. But after that point water becomes less dense. This is why ice floats on water.
Viscosity: Water has high viscosity due to very strong intermolecular interactions.
Solvency: Water is an excellent solvent. In fact, it is known as a *Universal Solvent.* Due to a water molecule's polarity, it can dissolve most substances.

❖ Synonyms of Jala

Paniya, Salila, Nira, Kilala, Jala, Ambu, Apa, Vari, Ka, Toya, Paya, Patha, Udaka, Jivana, Vana, Ambha, Arna, Amrita, Ganasara

❖ Types & Sources of Water

- **According to Ayurveda:**
  1) Antariksha Jala (water from the sky)
     - i. Dhara (falling / rain water)
     - ii. Kara (water from hailstones)
     - iii. Taushara (water from dew)
     - iv. Haima (water from snow)

  2) Bhauma Jala (water from the ground)
     - i. Kaupa (water from well)
     - ii. Nadeya (water from river)
     - iii. Sarasa (water from natural lake)
     - iv. Tadaga (water from artificial lake / water tank)
     - v. Prasravana (water from mountains or waterfalls)
     - vi. Audbhida (water from springs)
     - vii. Chauntya (water from step well)
     - viii. Vapi (water from pond)

- **According to Modern Science:**
  1) Rain water

  2) Surface water
     - i. Impounding reservoirs
     - ii. Rivers and streams
     - iii. Tanks, ponds and lakes

  3) Ground water
     - i. Shallow wells
     - ii. Deep wells
     - iii. Springs

❖ Water Pollution

Water pollution occurs when harmful substances - often chemicals or microorganisms - contaminate a stream, river, lake, ocean, aquifer, or other body of water, degrading water quality and rendering it toxic to humans or the environment.
Water is uniquely vulnerable to pollution. Known as a "universal solvent", water is able to dissolve more substances than any other liquid on earth. That is why water is so easily polluted.

Causes:
A major source of water pollution is runoff from agricultural fields, industrial sites, or urban areas. Runoff disrupts the water body's natural balance. For example, agricultural runoff typically includes fertilizer or toxic chemicals. Fertilizer can cause algal blooms (an explosive growth of algae), choking out other plants and decreasing the amount of available oxygen necessary for the survival of other species. Raw sewage is another type of water pollutant. When sewage gets into the drinking water supply, serious stomach and digestive issues may result, including the spread of diseases such as typhoid or dysentery. A third source of water pollution is trash. Improperly disposed of items, such as plastic bags, fishing line, and other materials may accumulate in the water and lead to the premature death of animals that get tangled within the garbage.

Categories of Water Pollution:
i) Groundwater
When rain falls and seeps deep into the earth, filling the cracks, crevices, and porous spaces of an aquifer (basically an underground storehouse of water), it becomes groundwater - one of the least visible but most important natural resources. Groundwater gets polluted when contaminants - from pesticides and fertilizers to waste leached from landfills and septic systems - make their way into an aquifer, rendering it unsafe for human use. Ridding groundwater of contaminants can be difficult to impossible, as well as costly. Once polluted, an aquifer may be unusable for decades, or even thousands of years. Groundwater can also spread contamination far from the original polluting source as it seeps into streams, lakes, and oceans.

ii) Surface water
Covering about 70 percent of the earth, surface water is what fills our oceans, lakes, rivers, etc. Surface water from freshwater sources (that is, from sources other than the ocean) supply a large amount of water for humans. But a significant pool of that water is in peril. According to the most recent surveys on national water quality from the U.S. Environmental Protection Agency, nearly half of the rivers and streams and more than one-third of lakes are polluted and unfit for swimming, fishing, and drinking.
Nutrient pollution, which includes nitrates and phosphates, is the leading type of contamination in these freshwater sources. While plants and animals need these nutrients to grow, they have become a major pollutant due to farm waste and fertilizer runoff. Municipal and industrial waste discharges contribute their fair share of toxins as well. There is also random junk that industry and individuals dump directly into waterways.

iii) Ocean water

Eighty percent of ocean pollution (also called marine pollution) originates on land - whether along the coast or far inland. Contaminants such as chemicals, nutrients, and heavy metals are carried from farms, factories, and cities by streams and rivers into the bays and estuaries; from there they travel out to sea. Meanwhile, marine debris - particularly plastic - is blown in by the wind or washed in via storm drains and sewers. The seas are also sometimes spoiled by oil spills and leaks and are consistently soaking up carbon pollution from the air. The ocean absorbs as much as a quarter of man-made carbon emissions.

iv) Point source

When contamination originates from a single source, it is called point source pollution. Examples include wastewater (also called effluent) discharged legally or illegally by a manufacturer, oil refinery, or wastewater treatment facility, as well as contamination from leaking septic systems, chemical and oil spills, and illegal dumping.
While point source pollution originates from a specific place, it can affect miles of waterways and ocean.

v) Non-point source

Non-point source pollution is contamination derived from diffuse sources. These may include agricultural or storm water runoff or debris blown into waterways from land.

vi) Transboundary

Transboundary pollution is the result of contaminated water from one country spilling into the waters of another. Contamination can result from a disaster - like an oil spill - or the slow, downriver creep of industrial, agricultural, or municipal discharge.

vii) Agricultural

Around the world, agriculture is the leading cause of water degradation. In the United States, agricultural pollution is the top source of contamination in rivers and streams, the second-biggest source in wetlands, and the third main source in lakes. It is also a major contributor of contamination to estuaries and groundwater. Every time it rains, fertilizers, pesticides, and animal waste from farms and livestock operations wash nutrients and pathogens - such as bacteria and viruses - into our waterways. Nutrient pollution, caused by excess nitrogen and phosphorus in water or air, is the number-one threat to water quality worldwide and can cause algal blooms, a toxic soup of blue-green algae that can be harmful to people and wildlife.

viii) Sewage and wastewater

Used water is wastewater. It comes from our sinks, showers, and toilets (sewage) and from commercial, industrial, and agricultural activities (metals, solvents, and toxic sludge). The term also includes storm water runoff, which occurs when rainfall carries road salts, oil, grease, chemicals, and debris from impermeable surfaces into our waterways. More than 80% of the world's wastewater flows back into the environment without being treated or reused.

ix) Oil pollution

Big spills may dominate headlines, but consumers account for the vast majority of oil pollution in our seas, including oil and gasoline that drips from millions of cars and trucks every day. Moreover, nearly half of the estimated 1 million tons of oil that makes its way into marine environments each year comes not from tanker spills but from land-based sources such as factories, farms, and cities. At sea, tanker spills account for about 10 percent of the oil in waters around the world, while regular operations of the shipping industry - through both legal and illegal discharges - contribute about one-third. Oil is also naturally released from under the ocean floor through fractures known as seeps.

x) Radioactive substances

Radioactive waste is any pollution that emits radiation beyond what is naturally released by the environment. It is generated by uranium mining, nuclear power plants, and the production and testing of military weapons, as well as by universities and hospitals that use radioactive materials for research and medicine. Radioactive waste can persist in the environment for thousands of years, making disposal a major challenge. Accidentally released or improperly disposed of contaminants threaten groundwater, surface water, and marine resources.

Health Hazards of Water Pollution:

Waterborne pathogens, in the form of disease-causing bacteria and viruses from human and animal waste, are a major cause of illness from contaminated drinking water. Diseases spread by unsafe water include cholera, giardia, and typhoid.

Even swimming can pose a risk. Health issues such as skin rashes, pinkeye, respiratory infections, and hepatitis can arise from sewage-laden coastal waters.

Common diseases which may occur due to water pollution are:

Dysentery, Aresnicosis, Polio, Trachoma, Typhoid fever, Schistosomiasis, Cholera, Diarrhoea, Malaria, Lead poisoning

When water pollution causes an algal bloom in a lake or marine environment, the proliferation of newly introduced nutrients stimulates plant and algae growth, which in turn reduces oxygen levels in the water. This dearth of oxygen, known as eutrophication, suffocates plants and animals and can create “dead zones”, where waters are essentially devoid of life. In certain cases, these harmful algal blooms can also produce neurotoxins that affect wildlife.

Chemicals and heavy metals from industrial and municipal wastewater contaminate waterways as well. These contaminants are toxic to aquatic life - most often reducing an organism’s life span and ability to reproduce.

Marine ecosystems are also threatened by marine debris, which can strangle, suffocate, and starve animals. Much of this solid debris, such as plastic bags and soda cans, gets swept into sewers and storm drains and eventually out to sea, turning the oceans into trash soup and sometimes consolidating to form floating garbage patches.

❖ Methods of Water Purification

Water purification is a process that is used to remove the impurities present in the water. Water contains several impurities such as physical, chemical, and biological contaminants. Hence the water purification process removes undesirable contaminants, biological impurities, suspended solids, and gases from the water. Along with these contaminations, the water purification process is also used to eliminate Chromium, Lead, Zinc, Copper, Magnesium, Algae, Bacteria, Virus, Parasites, Unpleasant odour.

The main aim of the water purification process is to bring out water which is fits for specific purposes such as drinking, medical, pharmaceutical, chemical, and industrial purposes.

1. Physical Waste Treatment

i) Screening - used as pre-treatment methods to remove more considerable suspended material.
ii) Multi-media Filtration (MMF) - to filter suspended solids.
iii) Membrane Filtration - barrier (micro-filtration, ultra-filtration) or semi-permeable membrane (nano or reverse osmosis) to remove suspended solids and total solids.

2. Chemical Waste treatment

i) Neutralization - A water purification system uses a neutralization process to treat acidic water. It is used for the neutralization of multiple types of effluent before they get discharged into the atmosphere.
pH correction of the water occurs before the biological or physical and chemical treatment stage.

ii) Oxidation / Reduction - Redox reduction is essential for the treatment of the water. Oxidation with ozone and hydrogen peroxide are used to eliminate chlorinated hydrocarbon and pesticides from the water. This process is mainly used to reduce antibiotics, cytostatic drugs, hormones, and other anthropogenic trace substances.

iii) Disinfection - It can be achieved by either adding a disinfectant chemical or by removing the harmful micro-organism. Disinfection can be completed by various process

iv) Chloramines - Chloramines are one of the chemicals which are formed by the reaction of chlorine and ammonia. It is mainly used as primary or secondary disinfection methods. These days most of the public water purification systems use chloramine disinfection methods to get pure and healthy water for drinking purposes.

v) Ultraviolet rays - The use of UV rays plays a vital role in the water purification system. UV rays have high penetration capacity, which kills or suspend the growth of the microbes present in drinking water. A water purification system containing ultra-violate rays is suitable for eliminating different types of biological contamination.

3. Biological Waste Water Treatment

The biological treatment used it wastewater treatment has a single motive to eliminate human and industrial waste without damaging the environment. Various kinds of processes can achieve it. Some of them are:

i) Aerobic Treatment - In this process, organic waste is converted into biogas containing a high concentration of methane and carbon dioxide. It mostly used in the industrial process as it is an energy-efficient process and covert a large amount of organic matter at a moderate temperature. This process occurs in the presence of oxygen.

ii) Anaerobic Treatment - It is a slow process that may take 3 months to complete. During this process, unpleasant smell may appear. The anaerobic bacteria convert organic waste into biogas, which contains a high concentration of methane and carbon dioxide in the absence of oxygen.

Other Water Purification Processes

1. Boiling

Boiling water is one of the cheapest and best ways to purify water. Water is one of the natural solvents which can dissolve almost everything. This property of water makes its natural habitats for various kinds of pathogens which cannot be seen by the naked eye. The boiling of water removes these kinds of pathogenic germs and bacteria.

2. Coagulation & flocculation

This is the first step of the water purification in which some chemicals are added into the water for the removal of the suspended particle from the water. These added particles can be organic such as bacteria, viruses, fungi, algae and any other natural organic compound and inorganic in nature such as clay and silt.

3. Sedimentation

Sedimentation is a physical process that removes suspended particles from the water using gravity. The particle which settles out from the water is called sediment or sludge. The thick layer of sediment is known as consolidation.

4. Filtration

Any mechanical, physical or biological operation which is used to separate solids from the fluids (i.e. Liquid or gas) by adding a medium which only allows the fluids to pass through it but does not allow the solids to pass. The fluids which pass through it is called the filtrate. There are various methods of filtration such as hot filter, cold filter, and vacuum filter.

5. Disinfection

The process of cleaning something to destroy microbes is regarded as disinfection. It could be done by removing harmful micro-organisms or by adding disinfectant chemicals. Disinfection can be achieved by chlorine, chlorine dioxide, chloramine, ozone, and ultra-violate (UV) rays.

6. Distillation

The process of separation of any substance from a liquid mixture through selective boiling and condensation. It could be done to achieve complete or partial separation which results in a higher concentration of the selective compound.

Distillation is one of the water purification methods which utilize heat to collect pure water in the form of vapor. According to the scientific fact, distillation is one of the best water purification methods because the boiling point of water is less as compared to the other water pollutant and disease-causing agent.

In the distillation process to achieve water purification, water is subjected to heat until it reaches its boiling point. After that, water is allowed to vaporize and directed into the condenser to cool. After cooling vapors reverse into water that is clean and pure.

The advantage of distillation is that it affects water purification methods in terms of eliminating bacteria, germs, salts, and other heavy metals like leads, arsenic. The notable disadvantage of distillation is that it is a slow process and requires a heat source for the water purification process. Furthermore, t is only effective for smaller quantity not for the large scale.

7. Chlorination

Chlorine is one of the powerful water purification methods which kills germs, parasites, and other disease-causing agents present in regularly used water. Chlorine is one of the cost-effective water purification methods among all the known water purification methods. It is mostly used in municipal water to deliver pure and safe water for home consumption.

Two examples of different types of water purification systems are:

1. Water purifier

A water purifier is one of the best and trusted water purification system which eliminates all kinds of impurities present in raw water. A water purifier is based on various kinds of advanced technology like reverse osmosis (RO), Ultra-Violate rays (UV-rays), Ultra-Filtration (UF) and many others.

2. Water Softener

It is a type of water purification system which is used to treat hard water. The high concentration of Calcium and Magnesium makes water hard in nature, which is not suitable for health, especially skin health. A water softener replaces the Calcium and Magnesium ion by Sodium ion and makes water soft.

❖ Hardness of Water

The simple definition of water hardness is the amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, largely calcium and magnesium. Depending on the hardness of water, after using soap to wash, one may have feel like there is a film of residue left on the hands. In hard water, soap reacts with the calcium (which is relatively high in hard water) to form "soap scum". When using hard water, more soap or detergent is needed to get things clean, be it hands, hair or laundry. One of the most common causes of cloudy dishes and glassware is hard water.

Many industrial and domestic water users are concerned about the hardness of water. When hard water is heated, such as in a home water heater, solid deposits of calcium carbonate can form. This scale can reduce the life of equipment, raise the costs of heating the water, lower the efficiency of electric water heaters, and clog pipes.
The acidity of vinegar helps to dissolve mineral particles by making them charged. These newly charged particles become attracted to the positive and negative charges in water and can be washed away easily.

But hard water can have some benefits, too. Humans need minerals to stay healthy, and the World Health Organization (WHO) states that drinking-water may be a contributor of calcium and magnesium in the diet and could be important for those who are marginal for calcium and magnesium intake.

Hardness is caused by compounds of calcium and magnesium, and by a variety of other metals. General guidelines for classification of waters are: 0 to 60 mg/L (milligrams per liter) as calcium carbonate is classified as soft; 61 to 120 mg/L as moderately hard; 121 to 180 mg/L as hard; and more than 180 mg/L as very hard.

Water systems using groundwater as a source are mainly concerned with water hardness, since water moves through soil and rock it dissolves small amounts of naturally-occurring minerals and carries them into the groundwater supply. Water is a great solvent for calcium and magnesium, so if the minerals are present in the soil around a water-supply well, hard water may be delivered to homes.

❖ Water testing

Water testing is a broad description for various procedures used to analyze water quality. Millions of water quality tests are carried out daily to fulfill regulatory requirements and to maintain safety.

Testing may be performed to evaluate:
- ambient or environmental water quality - the ability of a surface water body to support aquatic life as an ecosystem.
- wastewater - characteristics of polluted water (domestic sewage or industrial waste) before treatment or after treatment.
- "raw water" quality - characteristics of a water source prior to treatment for domestic consumption (drinking water).
- "finished" water quality - water treated at a municipal water purification plant.
- suitability of water for industrial uses such as laboratory, manufacturing or equipment cooling.

❖ Rainwater Harvesting

Rainwater harvesting denotes the action to capture the rain where it falls or capturing the runoff, and taking measures to store this water and to keep it clean.

There are mainly two classes of rainwater harvesting systems:
i) Systems which collect roof runoff for household use.
ii) Systems used in fields or adjoining catchments to provide supplemental irrigation for agriculture.

The six basic components of a Rain Water Harvesting system include:
i) Catchment: roof surface to collect the rain
ii) Conveyance: channels or pipes from roof or catchment area to storage
iii) Roof washing: 'first flush' diverter system to filter and remove contaminants
iv) Storage: cisterns or tanks where collected rainwater is securely stored
v) Purification: includes filtration, ozone or UV light to purify the collected rainwater for potable use
vi) Distribution: system that delivers the rainwater, usually including a small pump and pressure tank

Advantages of Rainwater Harvesting:
- To make use of a natural resource and reduction of flooding, storm water runoff, erosion, and contamination of surface water.
- It reduces the need for imported water.
- Excellent source of water for landscape irrigation; it does not contain chemicals or dissolved salts and mineral from the soil. No filtration system is required for landscape irrigation.
- Home systems can be relatively simple to install and operate; they may reduce the water bill.
- Promotion of water and energy conservation.

Disadvantages of Rainwater Harvesting:
- Limited and uncertain local rainfall.
- Can be costly to install.
- The payback period varies depending on the size of storage and complexity of the system.
- It requires technical skills to install and provide regular maintenance.
- If not installed correctly, it may attract mosquitoes.
- Certain roof types may seep chemicals, pesticides and other pollutants into the water that can be harmful.

❖ Water Reuse / Recycling

Water reuse (also commonly known as water recycling or water reclamation) reclaims water from a variety of sources, then treats and reuses it for beneficial purposes. Water reuse can provide alternatives to existing water supplies and be used to enhance water security, sustainability, and resilience.

Water reuse can be defined as planned or unplanned.
Unplanned water reuse refers to situations in which a source of water is substantially composed of previously-used water. A common example of unplanned water reuse occurs when communities draw their water supplies from rivers that receive treated wastewater discharges from communities upstream.
Planned water reuse refers to water systems designed with the goal of beneficially reusing a recycled water supply. Often, communities will seek to optimize their overall water use by reusing water to the extent possible within the community, before the water is reintroduced to the environment. Examples of planned reuse include agricultural and landscape irrigation, industrial process water, potable water supplies, and groundwater supply management.

Types of Water Reuse:
Sources of water for potential reuse can include municipal wastewater, industry process and cooling water, storm water, agriculture runoff & return flows, and produced water from natural resource extraction activities. These sources of water are adequately treated to meet “fit-for-purpose specifications” for a particular next use. "Fit-for-purpose specifications” are the treatment requirements to bring water from a particular source to the quality needed, to ensure public health, environmental protection, or specific user needs. For example, reclaimed water for crop irrigation would need to be of sufficient quality to prevent harm to plants and soils, maintain food safety, and protect the health of farm workers. In uses where there is a greater human exposure water may require more treatment.

Uses for Recycled Water:
- Irrigation for agriculture
- Irrigation for landscaping such as parks, rights-of-ways, and golf courses
- Municipal water supply
- Process water for power plants, refineries, mills, and factories
- Indoor uses such as toilet flushing
- Dust control or surface cleaning of roads, construction sites, and other trafficked areas
- Concrete mixing and other construction processes
- Supplying artificial lakes and inland or coastal aquifers
- Environmental restoration

CHAPTER IV: BHUMI & NIVASA STHANA / LAND & HOUSING

❖ Types of Desha

1) Jangala
2) Anupa
3) Sadharana

1) Jangala Desha
- Vata Dosha dominance
- Even land with less plants, thorny plants
- Less rainfall, scanty water sources
- Hot and harsh wind
- Inhabited people will be of firm and lean physique
- Vataja & Pittaja Vyadhi are more common

2) Anupa Desha
- Kapha Dosha dominance
- Opposite to Jangala
- Uneven land with many hills and plants
- Regular rainfall & water is available in abundance
- Mild and cool wind
- Inhabited people have a stronger physique
- Kaphaja Vyadhi are more common

3) Sadharana Desha
- Sama Dosha
- Moderate presence of rain, coldness, heat and wind
- Inhabited people are of moderate height and weight
- Most suitable for Shodhana Karma

❖ Types of Bhumi

1) Parthiva
2) Apya
3) Agni
4) Vayaviya
5) Nabhasa

1) Parthiva Bhumi
Land which is rocky, stable, heavy, bluish-black or black, with many large trees and plants of the same species.

2) Apya Bhumi
Land which is unctuous, cold, has many water sources, tender & unctuous plants of whitish colour.

3) Agni Bhumi
Land which has small rocks of various colours, sparse growth of plants of whitish colour.

4) Vayaviya Bhumi
Land which is dry, with soil of ashen colour, predominant thin trees with.

5) Nabhasa Bhumi
Land which has soft soil, pits in the ground, juice of plants and water is not tasty, sapless but large trees which grow all around, huge mountains, bluish-black soil.

❖ Types of Soil

Mud found in different parts of the world has different properties. The mud composition varies with the place of origin.
Firstly, the mineral constituent of mud varies with the kind of rocks found in the region and the process of soil formation.
Secondly, the properties of the mud are influenced by the flora and fauna of the region.

1) **Black mud** Dark cotton soil having some greasiness. It is rich in minerals and retains water for a long time.
2) **Fango** It is thermal mud from hot springs.
3) **Moors** Composed of minute amounts of inorganic substances as well as Sulphur, sulfates & iron.
4) **Clay** It helps to tighten pores, improves skin tone and perseveres its balance.
    a. Blue clay
    b. Green clay
    c. Yellow clay
    d. Red clay
    e. Pink clay
    f. White clay

❖ Land Pollution

Land pollution is the degradation of earth's land surfaces mostly caused by human activities.

- **Causes of Land Pollution**
    1) Deforestation and soil erosion
    2) Agricultural activities, Fertilizers, Pesticides, Chemicals
    3) Mining activities
    4) Overcrowded landfills
    5) Industrialization
    6) Construction activities
    7) Nuclear waste
    8) Solid waste disposal
    9) Sewage

- **Effects of Land Pollution**
    1) Soil pollution, loss of fertile land
    2) Change in climate patterns, loss of ecosystem
    3) Trees and other plants get compromised, which causes imbalanced rain cycle and disruption of atmosphere
    4) Land contaminated with toxic chemicals and pesticides lead to skin cancer and affects the respiratory system. The toxic chemicals can reach the body through foods and vegetables which are grown on polluted land.
    5) Air pollution & Pollution of underground water sources
    6) Loss of habitat and natural environment for animals

- **Control of Land Pollution**
    1) Increasing awareness & providing education about concepts of reduction, recycle and reuse.
    2) Reduction of pesticides and fertilizers in agricultural activities.
    3) Avoidance of excessive or unnecessary packaging
    4) Proper disposal of garbage
    5) Biodegradable products
    6) Organic gardening and consumption of organic food
    7) Dumping grounds should be constructed away from residential areas

❖ Bhumi Shodhana

- **Dhana Karma**; burning of medicinal plants like Guggulu, Vacha, Haridra, etc.
- **Kala;** not using the vitiated land for some years, over time, the land purifies itself
- **Gokramanata;** allowing the cattles to graze & spreading fresh cow dung over the vitiated land
- **Seka;** sprinkling of disinfectants
- **Ullekhana;** scrapping the upper layer of the vitiated land
- **Marjana;** brooming / wiping of house to take out impurities
- **Lepana;** washing the walls and covering with cow dung to prevent pathogenic agents

❖ Nivasa Yogya Bhumi

Sugandha Yukta Bhumi for Brahmina, Raktagandha Yukta Bhumi for Kshatriya, Dhanyagandha Yukta Bhumi for Vaishya, and Madhyagandha Yukta Bhumi for Shudra

Land which is pleasing for eyes and mind is ideal for construction of housing.

❖ Housing

Housing includes not only the physical structure providing shelter, but also the immediate surroundings and the related community services & facilities. It has become part of the concept of human settlement, which is defined as all places in which a group of people reside and pursue their life goals; the size of the settlement may vary from a single family to millions of people.

Housing is related to 'residential environment', which is defined as the physical structure that man uses and the environs of the structure including all necessary services, facilities, equipment and devices needed or desired for the physical and mental health and social wellbeing of the family and the individual.

- **Social Goals of Housing**

  1) Shelter; house should provide a sanitary shelter which is a basic need.
  2) Family life; hose should provide adequate space for family life and related activities.
  3) Accesses to community facilities; health service, schools, shopping areas, etc.
  4) Family participation in community life; communities are able to pool their efforts and improve the living conditions.
  5) Economic stability; housing is a form of investment of personal savings. It provides economic stability and wellbeing of the family.

❖ Housing Standards

Housing Standards in India are recommended by Environmental Health Criteria (EHC), 1947.

- **Site Selection**
  - Construction is done on elevated area so that the building is not subjected to flooding due to rain.
  - Soil should be dry and safe.
  - Site should be away from breeding places of mosquitoes and flies.
  - Site should have pleasing surrounding and not be affected by excessive dust, smoke, bad odour, noise and traffic.

- **Foundation**
  Foundation must be solid and substantial. The foundation is laid with a bed of cement concrete over the stones to cover the trench. The thickness of the foundation should never be less than 25 inches.

- **Set back**
  - Opening the space all around the house is called set back.
  - It is done to provide natural lighting and ventilation.
  - In rural areas, the built up area should not exceed 1/3 of the total area.
  - In urban areas, the built up area should not exceed 2/3 of the total area.

- **Floor**
  - It should be impermeable so that it can be easily washed and kept clean & dry. Mud floors tend to break up and cause dust; so they are not recommended.
  - The floor must be smooth, free from cracks and damp-proof.
  - The height of the plinth should be 2-3 ft.

- **Walls**
  - Walls should be reasonably strong.
  - They should have a low heat capacity and be weather resistant.
  - Smooth and damage proof.
  - 9 inches thickness

- **Roof**
  - The height of the roof should be less than 10 ft.
  - The roof should have a low heat transmittance.

- **Rooms**

  Persons per Room

1 room	2 persons
2 rooms	3 persons
3 rooms	5 persons
4 rooms	7 persons
5 rooms	10 persons
More than 5	2 additional persons for each further room

- **Floor Area**

110 sq. ft.	2 persons
90-100 sq. ft.	1 ½ persons
70-90 sq. ft.	1 person
50-70 sq. ft.	½ person
<50 sq. ft.	Nil

  A baby under 12 months is not counted; children between 1-10 years are counted as half a unit.

- **Cubic Space**

  Air space = min. 500-1000 c. ft. / capita

- **Windows**

  - 2 windows for every living room with opening to external atmosphere.
  - Windows should be placed at the height of 3 ft. above the floor.
  - Window area should be 20% of floor area.

- **Lighting**

  The daylight factor should exceed 1% over half the floor area.

- **Kitchen**

  Separate kitchen with adequate light, proper water supply, protected against dust & smoke, sufficient storage area, a sink for washing dishes and with proper drainage.

❖ Rural Housing

In rural areas, the approved standards may be lower than in towns.

Minimum standards:

- At least two living rooms
- Built up area should not exceed 1/3 of the total area
- Sufficient balcony / gallery area
- Separate kitchen with sink
- Window area is 10% as that of floor area
- Cattle shed should be at least 25 ft. away from human dwellings
- Sanitary well / Tube well within 250 m
- Arrangements for proper disposal of refuse, garbage and waste water

❖ Housing & Health

Housing is a part of the total environment of man and is to some extent responsible for the status of man's health and wellbeing.

Poor housing may cause various health hazards such as:

- Respiratory infections; common cold, tuberculosis, influenza, diphtheria, bronchitis, measles, whooping cough, etc.
- Skin infections; scabies, ringworm, impetigo, leprosy, etc.
- Rat infestation; plague
- Arthropods; houseflies, mosquitoes, fleas, bugs, etc.
- Accidents
- Psychosocial effect; the sense of isolation felt by persons living in the upper floor of high buildings is now well known to have harmful effects. Often also people living in densely populated urban areas feel a similar sense of isolation which may lead to neurosis and behavioural disorders.

❖ Overcrowding

Overcrowding refers to the situation in which more people are living within a single dwelling than there is space for, so that movement is restricted. In such a situation privacy is secluded, hygiene is less, proper rest and sleep is difficult to attain. Infectious disease spread rapidly under conditions of overcrowding. Psychologically, overcrowding may lead to irritability, frustration, anxiety, mental stress, unhappiness and psychosomatic & mental disorders.

High morbidity and mortality rates are observed where housing conditions are substandard.
The accepted standards with respect to overcrowding are as below:

A) Persons per Room

1 room	2 persons
2 rooms	3 persons
3 rooms	5 persons
4 rooms	7 persons
5 rooms	10 persons
More than 5	2 additional persons for each further room

B) Floor Space

A baby under 12 months is not counted; children between 1-10 years are counted as half a unit.

110 sq. ft.	2 persons
90-100 sq. ft.	1 ½ persons
70-90 sq. ft.	1 person
50-70 sq. ft.	½ person
<50 sq. ft.	Nil

CHAPTER V: PRAKASHA / LIGHTING

Light is an essential subject to see and understand everything. Requirement of good lighting is possible by arranging various factors.
If lighting is not in a good pattern, it leads to headache, stress, fatigue, impairment of vision, and other complications.

Some requirements of good lighting are:

1) Sufficient illumination
Illumination like that from 15-20 candles is considered as sufficient lighting.
Insufficient lighting causes straining of eyes.

2) Uniform distribution
Light distribution for efficient vision is done by establishing the source of light without the production of shadows.

3) Absence of glare
Glare is high contrast of light. There should be excessive light and high intensity of light to cause glare. Glare may be direct from a light source or reflected glare from a source such as a polished surface. Glare causes annoyance. The eye cannot tolerate glare because it causes acute discomfort and recuses critical vision.

4) Absence of sharp shadows
Slight shadows are inevitable, but sharp and contrasting shadows are disturbing. Like glare, shadows cause confusion to the mind and inhibit vision.

5) Steadiness of source of light
Light must be constant with constant contrast and constant intensity. Flickering lights are creating eyestrain and headache.

6) White colour of light
The colour of light has various effects on the person's mentality and physiology. For regular working, reading, etc. processes, the colour of daylight or artificial light resembling the daylight are the most suitable.

7) Contrast surroundings
The term refers to the background field of vision. The walls and ceiling of a room create reflection and is essential for proper lighting.

8) Angle of light
The light source should be established in a proper angle that lead to effective lighting by reflection. For effective reading, the light source should be established on the left side rather than on the ceiling or other sides.

❖ Natural Lighting

Natural lighting is derived partly from the visible sky and partly from reflection. Light comes to the rooms by reflection from light colour objects. Efficient utilization of natural light calls for careful design, location and orientation of building and relationship between buildings. Natural lighting also depends upon the time of the day, season, weather and atmospheric pollution.

Improving daylight illumination:

i) Orientation

The brightness of the sky is not constant on the east and west and therefore the illumination is subject to variation in buildings facing east and west. The direct penetration of sunlight from east or west may heat up the rooms, especially during summer.

ii) Removal of obstructions

Removal of obstructing objects either wholly or partially is likely to give the most effective single improvement in lighting.

iii) Windows

Windows should be properly planned as the natural lighting within any room is influenced by the amount of visible sky, the size, shape and arrangement of window openings. Generally, the window area should not be less than 10% of the floor area.

iv) Interior of the rooms

To get the full benefits of the natural illumination, the ceiling should be white, the upper portion of the walls light-tinted, and lower portions somewhat darker so as to give comfortable contrast to the eyes.

❖ Artificial Lighting

Daylight may not meet the requirements of illumination during all hours, and especially during cloudy days. It should be supplemented by artificial illumination which should be as close as possible to daylight in composition.

There are five general systems of artificial lighting:

i) Direct lighting

In direct lighting, 99-100% of the light is projected directly towards the working area. Direct lighting is efficient & economical, but tends to cast sharp shadows. It should not fall into the eyes.

ii) Semi-direct lighting

In semi-direct lighting, 10-40% of the light is projected upward and light is reflected back on the working area or object.

iii) Indirect lighting

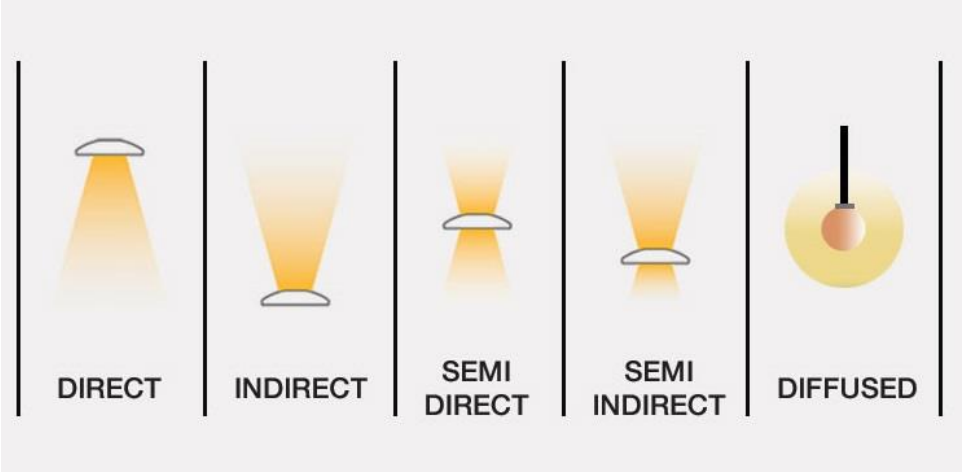
In indirect lighting, the light does not strike a surface directly because 90-100% of the light is projected toward the ceiling and walls. It illuminates the whole room.

iv) Semi-indirect lighting

In semi-indirect lighting, 60-90% of the light is directed upwards, the rest downwards.

v) Direct & Indirect lighting / Diffused lighting

In direct & indirect lighting, the light is distributed equally.



❖ Biological Effects of Lighting

The observation of daylight could cause the in vitro degradation of bilirubin is now being used as a therapeutic measure in premature infants with hyperbilirubinemia. Other biologic effects of light include effects on the biological rhythm of body temperature, physical activity, and the stimulation of melanin synthesis, the activation of precursors of Vitamin D, adrenocortical secretion and food consumption.

CHAPTER VI: DHVANI PRADOOSHANA / NOISE POLLUTION

Noise is an unwanted sound causing disturbance or annoyance to the hearer. Many people are used to exposure of loud sounds in daily life, such as loud music, television, traffic, etc. If such noises influence the health of a person or disturb the normal rhythm (e.g. sleep pattern), then it can be termed as noise pollution. Noise pollution also effect the environment and disturbs animals or even plants.

By definition, noise pollution takes place when there is either excessive amount of noise or an unpleasant sound that causes a disruption in the natural balance.

❖ Causes of Noise Pollution

- **Industrialization**
  Most of the industries use large machines which produce loud noise. Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills, etc. also may contribute to noise pollution. Due to this reason, workers in such areas should wear ear plugs or other kind of protection to minimize the effect of the noise.

- **Poor Urban Planning**
  In most of the developing countries, poor urban planning also plays a vital role regarding noise pollution. Congested houses, large families sharing small space, fight over parking, frequent fights over basic amenities leads to noise pollution.

- **Social Events**
  Noise is at its peak in most of the social events, such as marriages, parties, pubs, place of worship, etc.
  In markets, people are selling various items via making loud noise to attract the attention of potential customers.

- **Transportation**
  Large number of vehicles on the roads, aero planes, trains, underground trains, etc.

- **Construction Activities**
  Mining, construction of bridges, dams, buildings, stations, roads, etc.

- **Household Chores**
  Household noises are generally a minor contribution to noise pollution.
  Blender, vacuum cleaner, washing machine, dryer, air conditioner, etc.

❖ Effects of Noise Pollution

1) Auditory Effects

a) Auditory fatigue - may be associated with side effects such as whistling and buzzing in the ears.

b) Deafness - most serious effect of extreme acute or continuous noise pollution; may be temporary or permanent.

2) Non-auditory Effects

a) Interference with speech & sleep

b) Mental disturbance - annoyance, stress, low concentration, etc.

c) Less efficiency - reduction of noise has been found to increase work output

d) Physiological changes - temporary; rise of BP, HR, RR, intracranial pressure, general symptoms such as giddiness, nausea, fatigue, etc.

e) Noise pollution has been shown to impact the movement of sea mammals, such as dolphins and whales and also impacts the nesting success of birds.

❖ Control of Noise Pollution

- **Careful planning of cities**
  Division of the city zones with separation of areas concerned with industry & transport; separation of residential areas from the main streets by means of wide green belts.

- **Control of vehicles**
  Heavy vehicles should not be routed into narrow streets. Vehicular traffic on residential streets should be reduced. Indiscriminate blowing of horns and use of pressure horn should be prohibited.

- **Improve acoustic insulation of buildings**
  From the acoustic standpoint, the best arrangement is construction of detached buildings rather than a single large building or one that is continuous.

- **Protection of exposed persons**
  Hearing protection is recommended for all workers who are consistently exposed to noise louder than 85 decibels in the frequency bands above 150 Hz.

- **Education**
  No noise abatement program can succeed without people's participation. Education through all available media is needed to highlight the importance of noise as a community hazard.

CHAPTER VII: VIKIRANA / RADIATION

Radiation is the process by which radiant energy is transferred from one place to another in the form of electro-magnetic waves.
The various types of radiation differ from one another by their frequency or wavelength. The higher the frequency or lower the wavelength of a radiation, the higher will be its energy. The higher the energy of the radiation, the higher the damage to the living organism.

Radioactive pollution is defined as the physical pollution of living organisms and their environment as a result of release of radioactive substances into the environment due to factors such as nuclear explosions, testing of nuclear weapons, handling and disposal of radioactive waste.

❖ Sources of Radiation

1) Natural Sources

a) Cosmic rays

b) Environmental - Terrestrial (thorium, uranium, radium, etc.)
- Atmospheric (radioactive gases like randon & thoron)

c) Internal radiation - minutes quantities of uranium, thorium and related substances, and isotopes of potassium, strontium and carbon, are stored in the body tissues.

2) Man-made Sources

a) Medical X-ray, Radioisotopes
b) Nuclear / Radioactive fallout
c) Miscellaneous - Television sets, radio-active dial, watches, isotope tagged products, luminous marker

❖ Types of Radiation

Ionizing radiation is referred to radiation which has the ability to penetrate tissues and deposit its energy within them. Ionizing radiation may be classified into 2 main groups:
1) Electromagnetic radiation - X-ray, Gamma rays
2) Corpuscular radiation - Alpha particles, Beta particles, Photons

❖ Biological Effects of Ionizing Radiation

1) Somatic effects

A dose of 400-500 roentgens on the whole body is fatal in about 50% cases and 600-700 in practically every case. A dose of 25-50 roentgens to the whole body was found to affect the white blood corpuscles and to produce mild lassitude and softening of the muscles. The delayed effects take time to develop; the latent period may vary from a few weeks to one year. Delayed effects are mainly of three kinds: Leukemia, Malignant tumors and shortening of life.

2) Genetic effects

While somatic effects appear in the irradiated person, genetic effects manifest in the more or less remote offspring. Genetic effects of radiation include chromosome mutations and point mutations. Chromosome mutation is associated with sterility. Point mutation affects the genes.

❖ Radiation Protection & Control

The amount of radiation received from outer space and background radiation has been estimated to be 0.1 rad a year. Apparently, this does not at present constitute a hazard. The additional permissible dose from man-made sources should not exceed 5 rad a year. Of the man-made sources, X-rays constitute the greatest hazard.

Preventive measures should be followed to control radioactive pollution:

- Leakage of radioactive materials from nuclear reactors, industries and laboratories using them should be completely stopped.
- Radioactive wastes disposal must be safe. They should be changed into harmless form or stored in safe places so that they can decay in a harmless manner.
- Appropriate steps should be taken against occupational exposure.
- Safety measures should be taken against accidents in nuclear power plants.

CHAPTER VIII: APADRAVYA NIRMULANA / DISPOSAL OF SOLID WASTE

Solid waste includes garbage (food waste), rubbish (paper, plastics, wood, metal throw away containers, glasses), demolition products (bricks, masonry, pipes), sewage treatment residue, dead animals, manure and other discarded material. It should not contain night soil. The output of daily waste depends upon the dietary habits, lifestyle, living standards and the degree of urbanization and industrialization.

❖ Types of Wastes

1) Dry refuse or solid waste:

It includes all unwanted or discarded waste material arising from houses & streets, and commercial, industrial & agricultural activities.

- Garbage, kitchen waste, leftover food
- Rubbish, waste paper, broken glass, bottles and tins, bits of metal, plastic, rags
- Ashes from burnt wood, charcoal, cow dung fuel
- Animal dung, Street sweepings, Fallen leaves, Dead animals

2) Wet refuse or liquid waste:

- Waste water from houses after bathing, washing clothes & utensils, etc.
- Waste from public wells & washing places
- Waste from cattle sheds & market places
- Waste from cottage industries such as dyeing and weaving

3) Excreta – Faecal material

❖ Sources of Refuse

1) Street refuse – from street cleaning service or scavenging; leaves, straw, paper, animal droppings, etc.

2) Market refuse – putrified vegetables, animal matter, etc.

3) Stable litter – refuse from stables; animal droppings, left over animal feeds

4) Industrial refuse – variety of wastes, ranging from inter materials to highly toxic and explosive compunds

5) Domestic refuse – ash, rubbish, garbage

❖ Storage & Collection

- **Storage**

  The first consideration should be given to proper storage of refuse while waiting for collection. A galvanized steel dustbin with closed fitting cover is suitable receptacle for storing refuse. The capacity of a bin depends upon the number of users and frequency of collection. A recent innovation in the western countries is the paper sack. Refuse store in the paper sack and the sack is removed with the contents for disposal on a concrete platform raised 2-3 inches above the ground level to prevent flood water entering the bins.

- **Collection**

  The method of collection depends on funds available. House to house collection is the best method of collecting the refuse.
  People are expected to dump the refuse in the nearest public bin in places where house to house collection is not available.

❖ Methods of Disposal

1) Dumping
2) Controlled tipping
3) Incineration
4) Composting
5) Manure pits
6) Burial

1) Dumping

Refuse is dumped in low lying areas partly as a method of reclamation of land but mainly as an easy method of disposal of dry refuse. As a result of bacterial action, refuse decreases in volume and is converted into humus.

<u>Disadvantages:</u>

- Refuse is exposed to flies and rodents.
- Source of nuisance from the smell and unsightly appearance
- Loose refuse is dispersed by the wind
- Drainage from dumps contributes to the pollution of surface and ground water

2) Controlled tipping

Controlled tipping or sanitary land field is the most satisfactory method of refuse disposal where suitable land is available. There are three methods are used in this operation:

i) Trench method
ii) Ramp method
iii) Area method

These are methods in which refuse is buried. Chemical, bacteriological and physical changes occur in buried refused. The temperature rises to over 60°C within 7 days and kills all pathogens and hastens the decomposition process. Then it takes 2-3 weeks to cool down. Normally, it takes 4-6 months for complete decomposition of organic matter into an innocuous mass.

3) Incineration

Refuse can be disposed hygienically by burning or incineration. It is the method of choice where suitable land is not available. Hospital refuse which is particularly dangerous is best disposed by incineration.

4) Composting

It is the method of combined disposal of refuse and night soil or sludge. It is a natural process in which organic matter breaks down under bacterial action resulting in the formation of relatively stable humus-like material called compost; it has a considerable manorial value for the soil. The byproducts are carbon dioxide, water and heat.

i) Bangalore method (anaerobic method)
ii) Mechanical method (aerobic method)

5) Manure pits

The garbage, cattle dung, straw and leaves should be dumped into the manure pits and covered with earth after each days dumping.
In 5-6 months, the refuse is converted into manure which can be returned to the field. This method of refuse disposal is effective and relatively simple.

6) Burial

This method is suitable for small camps. A trench is excavated; 1.5 m wide and 2 m deep. At the end of each day, the refuse is covered with 20-30 cm earth. When the level in the trench is 40 cm from ground level, the trench is filled with earth and compacted, and a new trench is dug out. The contents may be taken out after 4-6 months and used on the fields.

❖ Bio-Medical Waste Management

According to Bio-Medical Waste (Management & Handling) Rules, 1998 of India, Bio-Medical Waste means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals, or in research activities.

Bio-Medical Waste is highly potential for infection and injury compared to any other type of waste. It is essential to have safe and reliable method of its handling & disposal.

Category	Waste	Treatment / Disposal
1	Human anatomical waste (human tissues, organs, body parts)	Incineration burial
2	Animal waste (animal tissues, organs, body parts, carcasses, bleeding parts, fluids)	Incineration burial
3	Microbiology and biotechnology waste (waste from laboratory cultures, stocks or specimens of micro-organism, live or attenuated vaccines)	Local autoclaving microwaving incineration
4	Sharp waste (needles, syringes, scalpels, blades, glass, etc.)	Disinfection (chemical treatment / autoclaving / microwaving and mutilation shredding)
5	Discarded medicines and cytotoxic drugs (out of date, contaminated and discarded medicines)	Incineration / Drug disposal in secured landfills
6	Solid waste (items contaminated with blood, fluids including cotton, solid plaster casts, linens, beddings)	Incineration / Autoclaving / Microwaving
7	Solid waste (waste generated from disposable items other than the sharp wastes such as tubing, catheters, intra-venous sets, etc.)	Disinfection (chemical treatment / autoclaving / microwaving and mutilation shredding)
8	Liquid waste (waste generated from laboratory and washing, cleaning, housekeeping and disinfecting activities)	Disinfection by chemical treatment (discharge into drains)
9	Incineration ash (ash from incineration of any bio-medical waste)	Disposal in municipal landfill
10	Chemicals used in disinfection, as insecticides, etc.	Chemical treatment / Discharge into drains for liquid and secure landfills for solids

- **Sources of health care waste:**
  Government hospitals, Private hospitals, Nursing homes, Physician's clinic, Dentist's clinic, Dispensaries, PHC, Medical research centers, Mortuaries, Blood banks and collection centers, Animal house, Slaughter house, Laboratories, Research organization, Vaccinating centers, Bio-technology institutions

CHAPTER IX: MALANISHKASANA / EXCRETA DISPOSAL

Safe disposal of excreta, so that it does not contaminate the environment, water, food or hands, is essential for ensuring a healthy environment and for protecting personal health. This can be accomplished in many ways, some requiring water, others requiring little or none. Regardless of method, the safe disposal of human faeces is one of the principal ways of breaking the faecal-oral disease transmission cycle. Sanitation is therefore a critical barrier to disease transmission.

Plans for locating sanitation facilities, and for treating and removing waste, must consider cultural issues, particularly as sanitation is usually focused on the household. Excreta disposal may be a difficult subject for a community to discuss: it may be taboo, or people may not like to discuss issues they regard as personal and unclean. In some cases, people may feel that sanitation facilities are not appropriate for children, or that children's faeces are not harmful. In others, separate facilities may be required for men and women, and it may be necessary to locate the facilities so that no one can be seen entering the latrine building. If the disposal facilities smell and are a breeding ground for flies, people may not use them. Health improvement comes from the proper use of sanitation facilities, not simply their physical presence, and they may be abandoned if the level of service does not meet the social and cultural needs of community members at an affordable cost.

Within a community, several different sanitation options may be required, with varying levels of convenience and cost (sometimes called a sanitation ladder).

Cartage

Cartage is the most basic form of excreta disposal - faeces are collected in a container and disposed of daily. An example is the bucket latrine, in which household wastes are collected in buckets under a hole in the floor of a specific room. Each day, the bucket is emptied into a larger container and the contents disposed of. Bucket latrines should not be promoted because they pose health risks to both users and collectors and may spread disease.

If cartage is considered for a community, a vault latrine (a latrine where wastes are stored in a sealed container) that is mechanically emptied on a regular basis is a better choice.

Pit latrines

In most pit latrine systems, faecal matter is stored in a pit and left to decompose. Unless specifically designed, pit latrines do not require periodic emptying; once a pit is full it is sealed and a new pit dug. If faecal matter is left to decompose in dry conditions for at least two years, the contents can be safely emptied manually and the pit reused. Indeed, some pit latrines are designed to allow faecal matter to compost and be reused in agriculture. Other designs use two alternating pits, reducing the need for new pits. Some pit designs are meant to be completely dry, while some use small quantities of water. Ventilation to remove odours and flies is incorporated into certain designs, while others are very basic and use traditional materials and approaches.

Septic tanks

A septic tank is a form of on-site sanitation that provides the convenience of a sewerage system. It is usually linked to flush toilets and can receive domestic wastewater. Since flush toilets tend to use large amounts of water, septic tanks are usually appropriate only for households with water piped into the home. The tank is offset from the house and linked to the toilet and domestic wastewater by a short drain. It is designed to hold solids and is linked to a soak away to dispose of liquid waste (effluent). Septic tanks generally require relatively large amounts of land and periodic emptying by vacuum tankers. This is often expensive and the trucks will need easy access to the tank. Septic tanks thus tend to be high-cost solutions for improving sanitation. They are commonly used only by communities whose members have access to water supply within the home, have land available and who can afford the cost of emptying the tanks. Communal septic tanks may be feasible if a large number of households close to the tank can be connected with very short lengths of sewer pipe.

Aqua-privies

An aqua-privy is similar to a septic tank; it can be connected to flush toilets and take most household wastewater. It consists of a large tank with a water seal formed by a simple down pipe into the tank to prevent odour and fly problems. Its drawback is that water must be added each day to maintain the water seal, and this is often difficult to do unless water is piped into the home. The tank is connected to a soak away to dispose of effluent. Unlike a septic tank, the aqua-privy tank is located directly below the house, but it, too, requires periodic emptying and must be accessible to a vacuum tanker.

Sewerage systems

Sewerage systems are designed to collect excreta and domestic wastewater and transport them away from homes to a treatment and/or disposal point. All sewerage systems require water for flushing waste away. Conventional sewerage is a high-cost sanitation option; it is usually deep-laid and must be maintained by professional staff. Such a system is thus appropriate only where funds are available for operation and maintenance by trained staff. All sewerage systems should be linked to a treatment plant, as the raw faeces they carry represent a public health risk.

Modified sewerage systems are also designed to transport waste away from the home, but work on different principles from conventional sewerage systems. They do not require high-volume flush toilets, but do need significant amounts of water for flushing. At least one tap on each plot or property is therefore essential.

Small-bore sewers are designed to carry only effluent, and each home requires an interceptor tank to collect and store solid material, which must be regularly emptied by mechanical means.

Shallow sewers are larger diameter sewers that carry both solid and liquid wastes. They differ from conventional sewers in that solids deposited in the pipes are re-suspended when water builds up behind the blockage. To ensure that enough water is available to move the solids, all household wastewater should be disposed of into the sewer. While both of these modified sewerage systems have problems, they have been successfully managed by communities and have far lower water requirements than conventional sewers.

CHAPTER X: DISPOSAL OF DEAD BODY

Disposal of dead body is the practice and process of dealing with the remains of a deceased human being. Several methods for disposal are practiced. In many cases, the manner of disposal is dominated by spiritual concerns and a desire to show respect for the dead. Many religions as well as legal jurisdictions have set rules regarding the disposal of corpses.

Methods of disposal of dead body:

1) Burial
2) Cremation
3) Water submersion
4) Cannibalism
5) Body donation
6) Body world display
7) Ariel burial
8) Hydrolysis / Dissolution
9) Freezing with liquid nitrogen

Most common methods of disposal of dead body:

1) Burial
2) Cremation

1) Burial

Burial usually involves interring the dead body in soil within a grave in cemetery or churchyard. The term can also refer to any method used to remove the dead body from sight. In earlier times, this may have involved placing the body in a cave or underground burial barrow designed for the purpose.

In ancient societies, bodies, especially those of important member of society, may have been buried in flamboyant tombs – the most famous of which are the pyramids of ancient Egypt. Other notable forms of burial are bodies interred in catacombs – found particularly in Italy, but also in other countries in Europe and South-America. Catacombs are narrow underground tunnels with built in niches or shelves where the bodies are placed. The most famous catacombs are located in Rome.

2) Cremation / Burning

Cremation is the burning of the human body. It burns the soft tissues and renders most of the skeleton to ash. The remains, known as 'cremains' may contain larger pieces of bone which are ground in a machine to the consistency of ash. The ashes may be stored in an urn or scattered on land or water.

Cremation is an ancient form of dead body disposal that has been used across the world for the last 20,000 years. In some cultures and religious traditions, cremation is done by placing the body on a heap of wood and other flammable material, and setting it on fire.
In western societies, cremation is done with the help of technology to burn the body in a furnace powered by gas or electricity. This process takes place in a building designed specifically for that purpose – crematorium.

-> Electric Cremation

The concept of electric cremation was commissioned in January 1989 as part of the Ganga Action Plan. The basic idea was to serve the purpose of river friendly cremation. In order to tackle environmental pollution, electric crematoriums are set up in various parts of the country, especially in the metro cities and are promoted by the Government, private NGOs and environmentalists. The electric system of cremation is used by certain sections of the society only.

Advantages of Electric Cremation: The traditional funeral pyre requires around 500-600 kg of firewood, 3 litres of kerosene or ghee, and 300-400 cow dung cakes per dead body. The total costs are around 2,000-3,000 RS in total. Mortal remains can be taken only after 24 hours. On the other hand, electric cremation is comparatively less expensive. Relatives can take the mortal remains within a few hours of cremation. In electric cremation, wood is not burned and there are no gas emissions. It is no doubt an unconventional way of cremation, but it helps in saving resources. It is the most economical option for disposal of dead bodies.

CHAPTER XI: METEOROLOGY (RITU EVAM VATAVARANA JNANAM)

Meteorology is the interdisciplinary scientific study of the atmosphere. The elements of Meteorological environments are atmospheric pressure, air temperature, humidity, rainfall, direction & speed of wind & movement of clouds and character of the weather.

Weather is the state or condition of atmosphere at any particular time in relation to its temperature, precipitation or any other meteorological phenomena.

Climate is the average condition of weather at any particular place over a considerable period of time.

Weather and climate are influenced by:
Altitude, Distance from the equator, Distance from the sea, Winds, Nature of soil, Rainfall
The weather and air temperature changes during the day are also strongly influenced by the ongoing season.

Air temperature varies in different parts of the day and in different seasons. Other factors which influence the air temperature are latitude, altitude, direction of the wind and proximity to the sea. The temperature of the ground surface is higher than that of the air.

Thermometers are instruments used for measuring temperature. Mercury thermometers are widely used, as mercury boils at a high temperature, has a regular expansion and its level can be easily seen.
The essential conditions for the use of the thermometers are that the air should have free access to the bulb and the thermometer should be protected against radiant heat.

CHAPTER XII: DISASTER MANAGEMENT

WHO (World Health Organization) defined disaster as "any occurrence that causes damage, ecological disruption, loss of human life or deterioration of health & health services on a scale sufficient to warrant an extraordinary response from outside the effected community or area."

ARC (American Red Cross) defined disaster as "an occurrence either natural or man-made that causes human suffering and creates human needs that victims cannot alleviate without assistance."

Hazard is defined as the phenomenon which has the potential to cause disruption or damage to people and environment.

Classification of Disaster:

A) Based on causes:

i) Natural

ii) Man-made

B) Based on onset:

i) Sudden

ii) Slow

-> Natural Disaster:

It is a disaster which occurs naturally by geological, seismic, hydrological, meteorological or any kind of environmental derangement.

a) Meteorological disaster: floods, earthquake, land slide, volcanic eruption, cyclone, hurricane, typhoon, tsunami, snowstorm, tidal waves, heat waves, etc.

b) Biological disaster: Epidemic, Pandemic, etc.

-> Man-made Disaster:

It is a disaster which is caused by human activities; accidental or intentional.

E.g.: Warfare, Civil strike, Conflicts, Airplane crash, Oil spill, Epidemic, Terrorism, etc.

-> Sudden Onset:

Disaster occurs with little or no warning; minimal time to prepare.

E.g.: Earthquake, Tsunami, Cyclone, Volcanic disruption, etc.

-> Slow Onset:

Disaster develops slowly. First the situation develops, the second level is an emergency, the third level is disaster.

E.g.: Drought, Civil strife, Epidemic, etc.

Phases of Disaster Management:

1) Mitigation
All actions taken before a disaster to reduce its impacts, including Preparedness and long-term risk reduction measures are categorized under Mitigation.
E.g.: Building codes and zoning, vulnerability analyses, public education, disaster drill

2) Preparedness
Preparedness is a program of long-term development activities whose goals are to strengthen the overall capacity of a country to manage all types of disasters. It should bring about an orderly transition from relief through recovery, and back to sustained development.

Objectives:
- To provide updated record of vulnerable population
- Coordination and response mechanisms
- Coordination with media
- Development of public education program
- National & international relations
- Keeping stock of foods, drugs, and other essentials

3) Response
Response is the action taken in case of occurrence of a disaster.
It includes:
Search, Rescue, First aid, Triage, Tagging, Identification of the dead, Procurement of supplies, transportation, storage and distribution of food, clothes, blankets, shelter, sanitary equipment, construction materials, medical supply, etc.

Triage:
Triage is defined as sorting and prioritizing patients for medical attention according to the degree of injury or illness and expectations for survival.
Triage is carried out to reduce the burden on health facilities and it is normally done by the most experienced health worker assisted by competent staff on the triage team.
Triage is a long-term process that begins when patients arrive at the medical post and continuous as their condition evolves until they are evacuated to the hospital.

Tagging:
All patients should be identified with tags stating their name, age, place of origin, triage category, diagnosis, and initial treatment.

4) Recovery

Recovery phase includes rehabilitation and disaster recovery.

Rehabilitation: Safe water supply, hygienic food supply, basic sanitation, personal hygiene, vector control to prevent vector borne diseases

Disaster recovery:

Returning the community to normal. Ideally, the affected area should be put in a condition equal to or better than it was before the disaster took place.

It includes: Referrals to hospital as needed, Psychological support of victims, Alertness for environmental health, Health teaching, Temporary housing, Medical care

CHAPTER XIII: OCCUPATIONAL HEALTH

Occupational Health is the promotion and maintenance of highest degree of physical, mental and social wellbeing of the workers in all occupations.

❖ Occupational Hazards & Occupational Diseases

1) **Physical Hazards**
   - Heat: Heat hyperpyrexia, heat exhaustion, heat syncope, heat cramps, burns
   - Cold: Trench foot, frostbite, chilblains
   - Light: Occupational cataract, miner's nystagmus
   - Pressure: Caisson disease, air embolism, blast / explosion
   - Noise: Occupational deafness
   - Radiation: Cancer, leukemia, aplastic anemia, pancytopenia
   - Mechanical factors: Injuries, accidents
   - Electricity: Burns

2) **Chemical Hazards**
   - Gases: Gas poisoning
   - Dust:
      A) Inorganic dusts
         a) Coal dust – Anthracnosis
         b) Silica – Silicosis
         c) Asbestos – Asbestosis, Lung cancer
         d) Iron – Siderosis

      B) Organic dusts
         a) Cane dust – Bagassosis
         b) Cotton dust – Byssinosis
         c) Tobacco – Tobaccosis
         d) Hay / Grain dust – Farmer's lung

   - Metal and compounds: Lead, mercury, cadmium, manganese, etc.
   - Chemicals: Acids, alkalis, pesticides
   - Solvents: Carbon bisulphide, benzene, trichloroethylene, chloroform, etc.

3) **Biological Hazards**
   Brucellosis, Leptospirosis, Anthrax, Actinomycosis, Hydatidosis, Tetanus, Encephalitis, Fungal infections

4) **Mechanical Hazards:** Accidents

5) **Psychosocial Hazards**
   - Psychological and behavioural changes: Hostility, aggressiveness, anxiety, depression, tiredness, alcoholism, drug abuse, sickness absenteeism.
   - Psychosomatic diseases: Fatigue, headache, peptic ulcer, hypertension, cardiac diseases, rapid aging

❖ Prevention of Occupational Diseases, Health & Precautionary Measures

1) Medical measures
2) Engineering measures
3) Legislation

1) Medical measures

- Pre-placement examination to place the right man in the right job.
- Investigations: Routine blood & urine examination, X-ray. USG, ECG, etc.
- Periodical examination: Ordinarily workers – examined once / year
  Occupations related with lead, toxic dyes, radium – monthly
  Occupations related with irritant chemicals – daily

- Periodical examinations may be supplemented with biological & radiological examinations wherever necessary.
- Medical and health services
- Immunization
- First-aid facility
- Supervision of work area
- Maintenance and analysis of records
- Health education and counselling

2) Engineering measures

- Design of building can be changed as per requirements.
- Good housekeeping, proper ventilation, lighting, washing, cleaning, food arrangements
- Substitution: replacement of harmful materials / machines with new assets.
- Dusts: regular water spraying to reduce dust in the working area
- Isolation: offensive processes are isolated in separate areas
- Protective devices: apron, mask, goggles, boots, gloves, etc.
- Environmental monitoring

3) Legislation

Laws are framed to govern the industries and safeguard the health and welfare of the workers.

- Employees State Insurance (ESI) Act, 1948
- Indian Factories Act, 1948

❖ Employees State Insurance (ESI) Act, 1948

Amended in 1975, 1984 & 1989.
It is an important measure of social security & health insurance in India.
It provides certain cash & medical benefits to industrial employees in case of sickness, maternity, disablement, injury & rehabilitation.

- It covers all power-using factories other than seasonal factories where 20 or more persons are employed.
- It covers small power-using factories where 10-19 persons are employed.
- It covers non-power using factories where 20 or more persons are employed.
- It includes shops, hotels, restaurants, cinemas, theaters, road-motor transport establishments, newspaper establishments.
- It excludes mines, railways & defense establishments.
- The act covers all employees earning up to Rs 7,500 / month.

Benefits to employees:
Insured persons get following benefits –
Medical benefit, Sickness benefit, Maternity benefit, Disablement benefit, Dependent's benefit, Funeral expanse and Rehabilitation allowance.

❖ Indian Factories Act, 1948

It dates back to 1881 with latest amendment done in 1987.

1) Scope
   a) 10 or more workers working in a place where power is used is called as factory.
   b) 20 or more workers working in a place where no power is used is called as factory.

2) Health, Safety & Welfare
   a) Cleanliness, lighting, ventilation are considered.
   b) One safety officer is appointed for every 1000 or more worker.
   c) Canteen should be present where 250 or more workers are working.

3) Age factor
   a) Children below 14 years are prohibited to work in factories.
   b) Adolescents; 15-18 years can work in factories if a medical certificate is provided.

4) Work hours
   a) Adults – 9h / day; 48h / week; 30 min rest after 5h work.
   b) Adolescents – 4 ½ - 5h / day

5) Occupational diseases should be notified.
6) Employment hazard should be considered.

❖ Offensive Trades

- Offensive trade is an official designation used in some countries to describe an industry or trade that damages the health and/or economic interests of significant numbers of people in the neighborhood or environment of that industry. The term is usually applied to an industry that produces unpleasant odours, environmental pollution and in general causes public health risk.

- The occupation and trade which are injurious to the health of the worker and other people and is offensive to sight, smell or hearing, is categorized under Offensive Trades.

The Health Act, 1956 lists the following activities as Offensive Trades:

- Blood or offal treating
- Bone boiling or crushing
- Collection and storage of used bottles for sale
- Dag crushing
- Fellmongering
- Fish cleaning
- Fish curing
- Flax pulping
- Flock manufacturing, or teasing of textile material for any purpose
- Gut scraping and treating
- Nightsoil collection and disposal
- Refuse collection and disposal
- Septic tank desludging and disposal of sludge
- Slaughtering of animals for any purpose other than human consumption
- Storage, drying or preserving of bones, hides, hooves or skins
- Tallow melting
- Tanning
- Wood pulping
- Wool scouring

Health Effects of Offensive Trades:

The Public Health Act defines a public health risk as 'a risk of harm to public health'. Harm is defined in this Act to mean 'physical or psychological harm to individuals, whether of long-term or immediate impact or effect'.

This definition covers a range of potential public health risks including:

♣ Physical risk e.g. noise, mechanical hazards, radiation and vibration

♣ Chemical risk from either naturally occurring or synthetic substances

♣ Biological risk e.g. viruses, bacteria and vermin.

Offensive trades may pose a number of public health risks depending on the trade. Traditionally, offensive trades involved malodorous industries associated with biological processes (e.g. animal and vegetable processing, human waste), however they are not restricted to these. Other industries such as laundries, dye works and brick works are considered or have been considered potential offensive trades under the Health (MP) Act. Public health risks can arise from noise, odour, dust, disposal of animal carcasses, release of pathogens, chemicals, effluent or solid wastes, or emissions of gases, dusts and fumes that can pollute the water, land and air. Furthermore, disease can be spread by flies, rodents and other vermin. Public health issues can range from nuisance to the spread of infectious disease.

The release of pathogenic microorganisms can be a major concern for public health as these can be released into the environment in solid, liquid and gaseous wastes and spread by vermin or pests attracted to the environment. A public health risk would only be present if there was external contamination of the environment.
Dust, noise and nuisance odour pollution from these trades can affect the amenity of the public surrounding these businesses, causing distress and in the extreme case, possible psychological impacts.

Precautionary Measures:
No person may conduct an offensive trade in or any premises unless:
- The floors of the premises are constructed of cement concrete or a similar impervious material, brought to a smooth finish.
- The floors of the premises are adequately grade and drained for the disposal of effluent to an approved disposal system.
- The inside walls, except where glazed or glass brick or glazed tiles are used, are plastered, brought to a smooth finish and painted with a light-coloured, washable paint.
- The surface of any backyard or open space is paved with concrete or similar impervious material, brought to a smooth finish.
- The premises are provided with adequate light and ventilation as prescribed in the National Building Regulations and Building Standards Act.
- An adequate supply of running potable water is provided.
- An adequate number of portable containers constructed of iron or another non-absorbent material, equipped with closely fitting lids, are provided for the removal of all waste and waste water from the premises.
- Adequate means are provided for the disposal of all effluent arising from the manufacturing or other process performed on the premises.
- Adequate accommodation is provided for the storage of all finished products, articles or material which are used in the manufacturing or other process and which may discharge offensive or injurious effluent or liquid; or decompose in the course of the work or trade.
- Adequate means are provided to control the discharge in the open air of any noxious, injurious or offensive gas, fume, vapour or dust produced during any handling, preparation, drying, melting, rendering, boiling or grinding process or storage of material.

CHAPTER XIV: SCHOOL HEALTH SERVICES

School health is an important branch of community health. School Health Services can be considered as a continuation of MCH service.

Objectives of School Health Services:
- Promotion of positive health
- Prevention of diseases
- Early diagnosis, treatment and follow-up of defects
- Increasing health awareness in children, Health education
- Provision of healthy environment

❖ Components of School Health Program

1) Health Education
2) Healthy Environment
3) Health Services

1) Health Education

The objective of health education is to bring about changes in regard to knowledge, attitude and practice about hygiene and health aspects to promote effective healthful living at home and in the community.
Health education should be directed at the health needs and interest of the children.

Some areas included under health education are:
- Personal hygiene
- Prevention of diseases
- First-aid
- Safety education
- Nutritional education
- Physical health
- Mental health
- Improvement of environmental sanitation
- Adult health education
- Family life education

2) Healthy Environment

The school children spend a lot of their time in the school. Therefore, the environment must be healthy both inside and outside the school, so that the children remain healthy; physically, mentally, socially, emotionally and culturally.

The elements of healthy school environment are:
- School building with a playground and clean sanitation
- Healthful teaching
- Mid-day meal
- Physical education procedures
- Good relation between teachers and students
- Good relation among students and among teachers

3) Health Services

Duties of School Medical Officers

The principal objective of the school medical officers is early detection and treatment of defects in children.

Other duties include:
- To guide about the site of school building, its ventilation, lighting, and hygienic cleanliness and sanitary upkeep; including regular inspection of the same.
- To guide the teachers in principles of healthful living of children, importance of hygiene, and first-aid training.
- Medical checkup of school children and upkeep of their medical records; height, weight, nutrition, vision, hearing, dental condition, immunization, etc.
- To arrange for periodic immunization of children.
- To organize preventive and supportive measures in case of epidemic.
- To isolate and recommend quarantine for the children who are suffering from contagious diseases.

❖ School Building

- **Location**
  School should be centrally located with proper approach roads and away from busy places, heavy traffic, factories, cinemas, market and railway tracks. It should have a compound. Preferably, it should have ample space, good ventilation and a playground for games and physical education.

- **Classrooms**
  The classrooms should have verandas outside and be spacious inside. The minimum floor space per student should be 10-15 sq. ft. The height should be 12 ft. All classrooms should open into corridors 6-8 ft. wide. The laboratories, if any, should have a separate wing. There should be sufficient natural lighting, ventilation and sitting arrangements in the classrooms.
- **Sitting arrangement**
  A good seat should be so adjusted in height that while sitting the child's feet should touch the ground with legs being vertical and thigh horizontal; abut 2/3 of thigh resting on the seat.

  If the desk-chair arrangements are improper, it results not only in the development of orthopaedic, postural and myopic defects, but also in the loss of interest in writing and reading, thus interfering with the learning process.

- **Maintenance of healthy environment**
  It should include not only the sanitation of the school premises, but also the surroundings, which has moral, physical and mental effects on the school children. The site should be dry, on a raised ground, situated at a distance from the road to minimize the nuisance of dust and noise.

- **Water supply**
  There must be provision to supply clean and safe water, preferably from an independent source like tube well; and the supply should be continuous through taps. There must be a minimum of one drinking fountain for every 100 students.

- **Latrines and Urinals**
  There must be one urinal for every 50 students and one latrine for every 100 students, separate for boys and girls. Wash basins must be available also.

- **Mid-day meal**
  It is a supplement and not a substitute for the home diet.
  It should provide at least 1/3 of daily caloric requirement and about ½ of daily protein requirement.
  The cost of the meal should be reasonably low.
  The preparation of meal should not involve complicated cooking processes.
  The menu should be changed frequently to avoid monotony.

CHAPTER XV: EPIDEMIOLOGY

❖ Concept of Epidemiology

Epidemiology is a scientific study of factors and conditions related to disease as they occur in people.

The word epidemiology is derived from:

- Epi = in, on, upon
- Demos = people
- Logos = science

Formerly, epidemiology was considered to be a science of epidemics, and its application was limited to prevention and control of a few communicable diseases such as cholera, smallpox, plague, etc. which occurred in epidemic form.

Gradually, the epidemiological method of studying a disease was extended to communicable diseases in general. Distribution, etiology, prevention and control are the main factors which were focused on.

During the last few decades, the epidemiological approach has been used in the study of non-communicable diseases also, such as hypertension, coronary artery disease, diabetes, cancer, mental disorders and even accidents and burns.

As a result, diseases are now broadly classified into two groups for the purpose of epidemiological study.

i) Communicable

ii) Non-communicable

Definitions:

- Epidemiology is an orderly study of incidence in human society of any morbid state (communicable and non-communicable disease, accidents, injuries and abnormalities of medical importance).
- It is the study of relationship among various factors and conditions in the agent, host and environment that determine the frequency of occurrence and distribution of an infectious process; a disease or physiological state in a population.
- Epidemiology is the study of the distribution of a disease or a physiological condition in human populations and of the factors that influence this distribution.
- Epidemiology is the branch of medical science which deals with treats epidemics.

Uses of Epidemiology:

- To study historically the rise and fall of diseases in population.
- To monitor continuously over the change of health in a community.
- To monitor vaccination programs, health education, nutritional supplementation.
- To make a community diagnosis.
- Planning and evaluation, Syndrome identification, Searching for causes and risk factors

Terminology:

Infection = The entry and development or multiplication of an infectious agent in the body of man or animals.

Contamination = The presence of infectious agent on a body surface, also on or in clothes, beddings, toys, surgical instruments or dressings or other inanimate articles or substances including water, milk and food.

Infestation = For persons or animals, the lodgment, development and reproduction of arthropods on the surface of the body or in the clothing.

Host = A person or other animal including birds and arthropods that affords subsistence or lodgment to an infectious agent under natural condition.

Communicable diseases = An illness due to specific infectious agent or its toxic products capable of being directly or indirectly transmitted from man to man, animal to animal, animal to man or from the environment to man or animal.

Epidemic = The unusual occurrence or sudden outbreak of a disease in a community or region.

Endemic = It refers to the constant presence of a disease or infectious agent within a given geographic area or population group.

Pandemic = An epidemic usually affecting a large proportion of the population, occurring over a wide geographic area such several countries or even worldwide.

Zoonosis = An infection or infectious disease transmissible under natural conditions from vertebrate animals to man.

Eradication = Termination of all transmission of infection by extermination of infectious agent through surveillance and containment.

Carrier = An infected person or animal that harbours a specific infectious agent in the absence of clinical manifestation but is a potential source of infection for others.

❖ Dynamics of Disease Transmission

Communicable diseases are transmitted from the reservoir / source of infection to a susceptible host.

Basically, there are three links in the chain of transmission.

i) Reservoir / Source of infection

ii) Modes of transmission

iii) Susceptible host

i) Reservoir / Source of infection

A reservoir is defined as any person, animal, arthropod, plant, soil or substance on which the infectious agent primarily depends for survival, and where it reproduces itself in such manner that it can be transmitted to a susceptible host.

The source of infection is defined as the person, animal, object or substance from which an infectious agent passes or is disseminated to the host.

Types of reservoir of infection:

a) Human reservoir

b) Animal reservoir

c) Reservoir of infection in non-living things

Human reservoir

A) Case = A person in the population identified as having the particular disease, health disorder or condition under investigation.

B) Carrier = An infected person or animal that harbours a specific infectious agent in the absence of clinical manifestation but is a potential source of infection for others.

Types of carrier:

I) Incubatory carrier – usually occurs during the last few days of the incubation periods. E.g.: Measles, mumps, polio, etc.

II) Convalescent carrier – who continues to shed the disease agent during the period of convalescence. E.g.: Typhoid, cholera, diphtheria, etc.

III) Healthy carrier – victims of subclinical infection who have developed carrier state without suffering from avert disease, but shed the causative agent. E.g.: Poliomyelitis, cholera, diphtheria, etc.

ii) Modes of transmission

A) Direct transmission

B) Indirect transmission

A) Direct transmission

a) Direct contact: Infection is transmitted by direct contact from skin to skin, mucosa to mucosa, mucosa to skin of the same or another person.
E.g.: Touching, kissing, sexual intercourse – STD, AIDS, Leprosy, etc.

b) Droplet infection: Infection is transmitted by direct projection of a spray of droplet, saliva and naso-pharyngeal secretion.
E.g.: Coughing, sneezing, speaking, spitting – Common cold, diphtheria, TB

c) Contact with soil: Infection is transmitted by direct contact with soil.
In epidemiological terminology, the human host Is referred to as 'soil' and the disease agent as 'seed'.

d) Inoculation into skin or mucosa: Infection is transmitted directly into skin or mucosa.
E.g.: Dog bite - rabies, hepatitis B - contaminated needle and syringes

e) Trans-placental (vertical): Infection is transmitted through placenta of the mother to the foetus.
E.g.: Rubella, syphilis, hepatitis B, HIV, etc.

B) Indirect transmission

The spread mainly takes place through 5 F's = Flies, Fingers, Fomites, Food, Fluid

a) Vehicle borne: Infection is transmitted through a vehicle like water, food, ice, blood, serum, plasma or other biological products such as tissues and organs.
E.g.: Diarrhoea, typhoid fever, cholera, polio, hepatitis A

b) Vector borne: A vector is defined as an arthropod or any living carrier of the infectious organism.
E.g.: Malaria, filarial, dengue, etc.

c) Air borne: Droplet infection; larger droplets may settle down on floor and become a part of the environment.
E.g.: TB, pneumonia, etc.

d) Fomite borne: Fomites are non-living articles or substances, other than water and food, contaminated by the infectious discharges from a patient and transfer the infectious agent.
E.g.: Clothes, towels, handkerchiefs, cups, spoons, pencils, books, etc.

e) Unclean hands and fingers: Hands are the most common medium by which pathogenic agents are transferred to the food from the skin, nose, etc.
E.g.: Staphylococcal, streptococcal infections

iii) Susceptible Host = A person who is vulnerable to develop infection when the body is invaded by germs.

❖ Concept of Diseases

Definition:

Disease is a condition in which the body health is impaired, a departure from a state of health, an alteration of the human body interrupting the performance of vital or normal functions.

Illness is a subjective state of the person who feels aware of not being well.

Sickness is a state of social dysfunction.

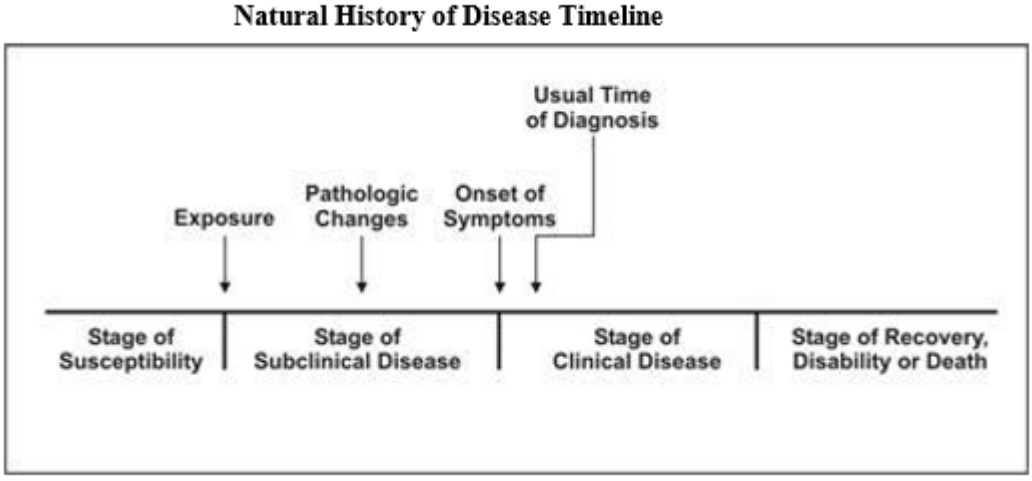
Types:

A) i) Infectious disease
ii) Deficiency disease
iii) Hereditary disease
iv) Psychological disease

B) i) Acute
ii) Chronic

C) i) Congenital
ii) Acquired – a) Communicable
b) Non-communicable

Natural History of Disease:



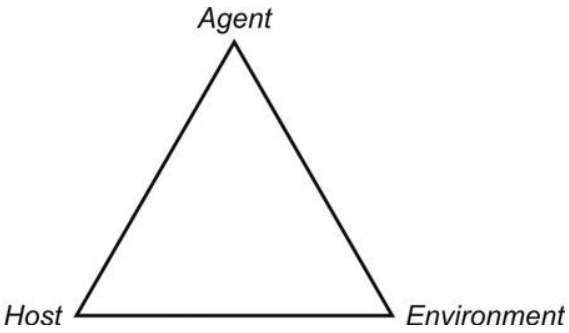
❖ Concept of Causation

- **Supernatural Theory of Disease**
  In the early past, the disease was thought mainly due to either the curse of Gods or due to the evil force of demons. Accordingly, people used to please the Gods by prayers and offerings or used to resort to witchcraft to tame the demons.

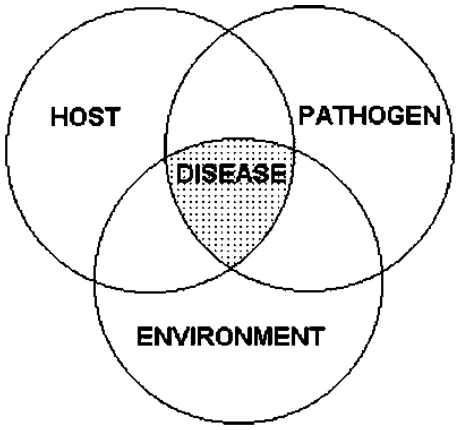
- **Germ Theory**
  Microbes (germs) were found to be the cause for many known diseases. Pasteur, Henle & Koch were strong proponents of the microbial theory after they discovered the microorganisms in the patients' secretions or excretions.

- **Ecological Theory**
  Around 463 BC, Hippocrates, was the first epidemiologist who advised to search the environment for the cause of diseases.
  Environmental influence: Interactions among humans, animals, plants, microorganisms, ecosystems, climate, geography and topography.

- **Epidemiological Triad**
  The causative factor of disease may be classified as Agent / Pathogen, Host and Environment.
  These three factors are referred to as the Epidemiological Triad. The presence of agent, host and environmental factors in the pre-pathogenesis period is not sufficient to start a disease.
  Only through an interaction of these three factors, the disease will develop.
  The combination of the Epidemiological Triad denotes the distribution of disease, cause of disease, and nature of disease.



Agent factor:
The pathogenic agent is defined as a substance, living or non-living, or a force, tangible or intangible, the excessive presence or relative lack of which may initiate or perpetuate a disease process.



<u>Classification of agents:</u>
i) Biological agents
ii) Nutrient agents
iii) Physical agents
iv) Chemical agents
v) Mechanical agents
vi) Social agents
vii) Absence or insufficiency or excess of an agent factor

Host factor:
The human host is referred to as 'soil' and the disease agent as 'seed'.
Host = A person or other animal including birds and arthropods that affords subsistence or lodgment to an infectious agent under natural condition.

Host factors = Intrinsic factors that influence an individual's exposure, susceptibility or response to a causative agent.
These include -
- Demographic characteristics such as age, sex & ethnicity.
- Biological characteristics such as genetic factors, biochemical levels of the blood, blood groups, enzymes, etc.
- Social and economic characteristics such as education, status, occupation, stress, mental status, housing, etc.

Environment factor:
i) Physical environment – non-living objects and physical factors (air, water, soil, housing, heat, light, etc.)

ii) Biological environment – microbial agents, insects, animals, plants, man

iii) Psychosocial environment – lifestyle, poverty, urbanization, community life, income, education, stress, etc.

- **The 'Beings' Model of Disease Causation**
  This concept postulates that human disease and its consequences are caused by a complex interplay of nine different factors:
  i) Biological factors innate in a human being
  ii) Behavioural factors concerned with individual lifestyles
  iii) Environmental factors such as physical, chemical and biological aspects
  iv) Immunological factors
  v) Nutritional factors
  vi) Genetic factors
  vii) Social factors
  viii) Spiritual factors
  ix) Services factors, related to the various aspects of health care services

❖ Concept of Prevention

Successful prevention depends upon knowledge of causation, dynamics of transmission, identification of risk factors & risk groups, availability of prophylactic or early detection and treatment measures, an organization for applying these measure to appropriate persons or groups

The Concept of Prevention is best described in the context of Levels, traditionally called Primary, Secondary and Tertiary Prevention. A fourth level, called Primordial Prevention, was later added as the first level prior to Primary Prevention.

1) Primordial Prevention

Primordial Prevention consists of actions and measures that inhibit the emergence of risk factors in the form of environmental, economic, social & behavioural conditions and cultural patterns of living.

It is the prevention of the emergence or development of risk factors in countries or population groups in which they have not yet appeared.

In primordial prevention, efforts are directed towards discouraging children from adopting harmful lifestyles.

The main intervention in primordial prevention is through individual and mass education.

2) Primary Prevention

Primary Prevention can be defined as the action taken prior to the onset of disease, which removes the possibility that the disease will ever occur. It signifies intervention in the pre-pathogenesis phase of a disease or health problem.

Primary prevention may be accomplished by measures of health promotion, improving the wellbeing & quality of life of people and specific protection.

3) Secondary Prevention

Secondary Prevention is defined as the action which halts the progress of a disease at its incipient stage and prevents complications.

The specific interventions are early diagnosis and adequate treatment.

Secondary prevention attempts to arrest the disease process, restore health, treating the disease before irreversible pathological changes take place, and reverse communicability of infectious diseases.

It thus prevents other in the community from acquiring the infection. So, it is a secondary prevention for the infected ones and primary prevention for the potential contacts.

4) Tertiary Prevention

Tertiary Prevention is used when the disease process has advanced beyond its early stages. It is the use of all the measures available to reduce or limit impairments and disabilities, and to promote the patients' adjustment to irremediable conditions.

Intervention that should be accomplished in the stage of tertiary prevention is disability limitation and rehabilitation.

❖ Risk Factors

A risk factor is a characteristic, condition, or behaviour that increases the likelihood of getting a disease or injury. Risk factors are often presented individually, however in practice they do not occur alone. They often coexist and interact with one another.
In general, risk factors can be categorized into the following groups:
i) Behavioural
ii) Physiological
iii) Demographic
iv) Environmental
v) Genetic

i) Behavioural risk factors

Behavioural risk factors usually relate to 'actions' that the individual has chosen to take. They can therefore be eliminated or reduced through lifestyle or behavioural choices.
Examples include:
- Smoking tobacco
- Drinking too much alcohol
- Nutritional choices
- Physical inactivity
- Spending too much time in the sun without proper protection
- Unprotected sex

ii) Physiological risk factors

Physiological risk factors are those relating to an individual's body or biology. They may be influenced by a combination of genetic, lifestyle and other broad factors.
Examples include:
- Being overweight or obese
- High blood pressure
- High blood cholesterol
- High blood sugar

iii) Demographic risk factors

Demographic risk factors are those that relate to the overall population.
Examples include:
- Age
- Gender
- Population subgroups, such as occupation, religion, or income

iv) Environmental risk factors

Environmental risk factors cover a wide range of topics such as social, economic, cultural and political factors as well as physical, chemical and biological factors.
Examples include:
- Access to clean water and sanitation
- Risks in the workplace
- Air pollution

v) Genetic risk factors

Genetic risk factors are based on an individual's genes. Some diseases, such as cystic fibrosis and muscular dystrophy, come entirely from an individual's 'genetic make-up'. Many other diseases, such as asthma or diabetes, reflect the interaction between the genes of the individual and environmental factors. Other diseases, like sickle cell anemia, are more prevalent in certain population subgroups.

❖ Modes of Intervention

Intervention can be defined as any attempt to intervene or interrupt the usual sequence in the development of disease in man.

Intervention may be done through the following methods:

i) Health promotion
ii) Specific promotion
iii) Early diagnosis and prompt treatment
iv) Disability limitation
v) Rehabilitation

i) Health promotion

It is the process of enabling people to increase control over and to improve health.

It is not directed against any particular disease, but is intended to strengthen the host through a variety of approaches.

In health promotion, the interventions include:

a) Health education
b) Environmental modification
c) Nutritional interventions
d) Lifestyle and behavioural changes

ii) Specific promotion

It is the intervention done to avoid development of the disease in the first place.

Specific promotion interventions include:

a) Immunization
b) Use of specific nutrients
c) Chemoprophylaxis
d) Protection against occupational hazards
e) Protection against accidents
f) Protection from carcinogens
g) Avoidance of allergens
h) Better environmental conditions
i) Control of consumer product quality and safety of foods, drugs, cosmetics, etc.

iii) Early diagnosis and prompt treatment

Early diagnosis is the detection of disturbances of homeostatic and compensatory mechanism while biochemical, morphological and functional changes are still reversible.

iv) Disability limitation

When a patient reports late in the pathogenesis phase, the mode of intervention is disability limitation.

The objective is to halt the transition of the disease process from impairment to handicap.

Disease -> Impairment -> Disability -> Handicap

Impairment is any loss or abnormality of psychological, physiological or anatomical structure or function.

Disability is any restriction or lack of ability to perform an activity in the manner or within the range considered normal for the human being.

Handicap is a disadvantage for a given individual, resulting from an impairment or disability that limits or prevents the fulfilment of a role in the community that is normal for that individual.

v) Rehabilitation

Rehabilitation is the combined and coordinated use of medical, social, educational and vocational measures for training and retraining the individual to the highest possible level of functional ability.

It includes all measures aimed at reducing the impact of disabling and handicapping conditions and at enabling the disabled and handicapped to achieve social integration.

❖ Incidence & Prevalence

Incidence rate is defined as the number of new cases occurring in a defined population during a specific period of time.

Prevalence is defined as the total number of all individuals who have an attribute or disease at a particular time divided by the population at risk of having the attribute or disease at point in time or midway through the period.

❖ Host Defenses

Host defenses against infection are local & systemic, non-specific & specific, and humoral & cellular. It is difficult to identify any infectious agent that fails to stimulate multiple host defense mechanisms.

❖ Immunizing Agents

1) Vaccine
2) Immunoglobulin
3) Antisera / Antitoxin

1) Vaccine

Vaccine is an immuno-biological substance designed to produce specific protection against a specific disease.

Types:

i) Live Vaccine

E.g.: BCG and typhoid, measles, oral polio, yellow fever, rubella, mumps, chicken pox
Live vaccines are prepared from live organisms. These organisms have been passed repeatedly in the laboratory in tissue culture or chick embryos and have lost their capacity to induce the full blown disease, but potent their immunogenicity.
Live vaccines should not be administered to a person with immune-deficiency diseases or to a person whose immune response may be suppressed or in pregnancy.

ii) Inactivated or Killed Vaccine

E.g.: Cholera, pertussis, rabies, hepatitis B, Japanese encephalitis, etc.
Organisms killed by heat or chemicals, when infected into the body, stimulate active immunity.

iii) Toxoids

E.g.: Diphtheria, tetanus bacilli
Certain organisms produce exotoxins. These toxins are detoxified and used in the preparation of vaccines.

iv) Cellular fractions

E.g.: Hepatitis B meningococcal
Vaccines prepared from extracted cellular fractions.

v) Combinations

E.g.: DPT, DP, DT, MMR, etc.
If more than one kind of immunizing agents is included in the vaccine, it is called a mixed or combined vaccine.

2) Immunoglobulin

The human immunoglobulin system is composed of major classes (IgG, IgM, IgA, IgD, IgE) and sub-classes.

Types:

i) Normal human immunoglobulin

Normal human Ig is an antibody rich fraction, obtained from a pool of at least 1,000 donors. It is used to prevent measles in highly susceptible individuals & to provide temporary protection up to 12 weeks.

ii) Specific human immunoglobulin

Specific human Ig should contain at least 5 times the antibody potential of standard preparation per unit volume. The preparations are made from the plasma of patients who have recently recovered from an infection, or are obtained from individuals who have been immunized against a specific infection.

E.g.: Chickenpox, rabies, tetanus I/M injection

3) Antiserum / Antitoxin

The term antiserum is applied to materials prepared in animals. They are specific immunoglobulins prepared from plasma of immunized animals (e.g. horses).

It is cheap but less effective. Immunity lasts for 2-3 weeks.

E.g.: ATS, ADS, ERIg, Anti-snake venom

❖ Disease Prevention & Control

Three main measures are adopted for prevention of infectious diseases:

1) Controlling the reservoir
2) Interruption of transmission
3) Immunizing the susceptible host

1) Controlling the reservoir

The general measures of reservoir control comprise:

Early diagnosis, Notification, Epidemiological investigations, Isolation, Treatment, Quarantine, Surveillance and Disinfection.

Types of isolation:

i) Standard isolation
ii) Strict isolation
iii) Protective isolation
iv) High security isolation
v) Hospital isolation
vi) Home isolation

2) Interruption of transmission

This may include change in some components of man's environment to prevent the infective agent from a patient or carrier from entering the body of susceptible person. Clean practices such as hand washing, adequate cooking, prompt refrigeration of prepared foods and withdrawal of contaminated foods will prevent most food borne illnesses. Vector control also includes removal of stray dogs, control of cattle, pets and other animals to minimize spread of infection among them, and from them to man. Personal hygiene and proper handling of secretions and excretions.

3) Immunizing the susceptible host

i) Active immunization
ii) Passive immunization
iii) Combined (Active & Passive immunization)
iv) Chemoprophylaxis
v) Non-specific measures; improvement in quality of life, sanitation, education, etc.

❖ Investigation of Epidemic

Importance of outbreak investigation:

- Stop the current outbreak from spreading
- Prevent future similar outbreaks
- Provide scientific explanation of the event
- Provide knowledge for the understanding of the disease process
- To calm the public
- Train epidemiologists
- Define **what** will be studied.
- Find out **where** the problem is, **who** gets it, **when** it is occurring.
- Try to explain **why** the problem has such a distribution.
- Find out **how** the problem is occurring.

Common steps in the epidemiologic approach:

1) Perform an initial observation to confirm the outbreak.
2) Define the disease.
3) Describe the disease by time, place and person.
4) Create a hypothesis about the possible etiologic factors.
5) Conduct analytic studies.
6) Summarize the findings.
7) Recommend and communicate the interventions or preventative programs.

❖ Disinfection

Disinfection is the process of elimination of most pathogenic microorganisms (excluding bacterial spores) on inanimate objects. Disinfection can be achieved by physical or chemical methods. Chemicals used in disinfection are called disinfectants. Different disinfectants have different target ranges, not all disinfectants can kill all microorganisms. Some methods of disinfection, such as filtration, do not kill bacteria, they separate them out.

Sterilization is defined as the process where all the living microorganisms, including bacterial spores are killed. Sterilization can be achieved by physical, chemical and physiochemical means.
Sterilization is an absolute condition while disinfection is not.

Decontamination is the process of removal of contaminating pathogenic microorganisms from the articles by either sterilization or disinfection. It is the use of physical or chemical means to remove, inactivate or destroy living organisms on a surface.

Sanitization is the process of chemical or mechanical cleansing, applicable in public health systems.

Asepsis is the employment of techniques (such as gloves, air filters, UV rays, etc.) to achieve a microbe-free environment.

Antisepsis is the use of chemicals (antiseptics) to make skin or mucus membranes devoid of pathogenic microorganisms.

Bacteriostasis is a condition where the multiplication of the bacteria is inhibited without killing them.

Bactericidal is a chemical which kills or inactivate bacteria.

Antibiotics are substances that inhibit the growth of or destroy microorganisms.

- **Types of Disinfection:**
    1) Concurrent disinfection
    2) Terminal disinfection
    3) Pre-current disinfection

1) **Concurrent disinfection**
   It is the application of disincentive measure as soon as possible after the discharge of infectious material from the body of an infected person or after the soiling of articles with such infectious discharges.

2) **Terminal disinfection**
   It is the application of disincentive measures after the patient has died or been removed to a hospital or has ceased to be a source of infection or after other hospital isolation practices have been discontinued.

3) **Pre-current disinfection**
   Disinfection of water by chlorine, pasteurization of milk and hand washing are categorized under pre-current disinfection.

- **Types of Disinfectants:**
  1) Natural agents
  2) Physical agents
  3) Chemical agents

1) **Natural agents**
   a) Sunlight: microbicidal activity is due to UV rays and heat; no sterilization.

   b) Heat: most reliable method of sterilization of articles that can withstand high heat temperature. Heat acts by oxidative effects as well as denaturation and coagulation of proteins. Those articles which cannot withstand high temperatures, can still be sterilized at lower temperature by prolonging the duration of exposure.

   c) Air: exposure to open air acts by drying or evaporation of moisture which is lethal to most bacteria.

2) **Physical agents**
   a) Burning: burning or incineration is an excellent method of sterilization. Inexpensive articles such as contaminated dresses, rags and swabs can be disposed by burning. It is done in an incinerator.

   b) Hot air: hot air is useful for sterilizing articles such as glassware, syringes, swabs, dresses, oils, sharp instruments, etc. It is usually done in a hot air oven. The temperature should be maintained at 160-180°C for at least one hour to kill spores.

c) Boiling: provides an atmosphere of boiling and steam. Boiling for 5-10 minutes will kill bacteria, but not spores or viruses. It is suitable for disinfection of small instruments or tools which are not used for subcutaneous insertion, lien and rubber goods such as gloves.

d) Autoclaving: sterilizers which operate at high temperature and high pressure are called autoclaves. They generate steam under pressure. It destroys all forms of life, including spores. Steam attains a higher temperature under pressure and has greater power of penetration.

e) Radiation: ionizing radiation is increasingly used for sterilization of bandages, dresses and surgical instruments. The objects to be sterilized are placed in plastic bags before radiation, so they will remain sterile until opened. This method is most effective, but very costly. Commercial methods of sterilization are normally carried out by gamma radiation. This technique requires special packing and equipment. It is one of the most viable, economic and safest methods.

3) Chemical agents

a) Pehnol and related compounds:

Phenol – pure phenol or carbolic acid is not an effective disinfectant. It is used as a standard to compare the germicidal activity of disinfectants.
Crude phenol – commonly used for disinfection; it is a mixture of phenol and cresol. It is a dark oily liquid.
Cresol – it is 3-10 times as powerful as phenol. Best used in 5-10% strength for disinfection of faeces and urine.
Chlorhexidine – one of the most useful skin antiseptics. Soluble in water and alcohol. It is inactivated by soaps and detergents. 0.5% alcoholic solutions can be used as effective hand lotions. Creams and lotions containing 1% chlorhexidine are recommended for burns and hand disinfections.
Dettol – it is a relatively non-toxic antiseptic and can be used safely in high concentrations. It is active against streptococci. Dettol 5% is suitable for disinfection of instruments and plastic equipment. Contact of 15 minutes is required for disinfection.

b) Halogens and their compounds: bleaching powder, sodium hypochlorite, halazone tablets, iodine, iodophors
Iodine – it is an alcoholic solution of 1-2%; most effective skin antiseptic, but it stains the skin and may produce sensitivity reaction in some people. Iodine is cheap, available and quick in action.

c) Alcohols: ethyl and isopropyl alcohols are commonly used as antiseptic and disinfectants.

d) Formaldehyde: it is a highly toxic and irritant gas which precipitates and destroys protein. It is effective against vegetative bacteria, fungi and many viruses. The gas may be used for disinfection of blankets, beds, books, and other articles which cannot be boiled.

e) Miscellaneous:
Lime – it is the cheapest of all disinfectants. It is used in the form of fresh quick lime or 10-20% aqueous suspension known as 'milk of lime'.
Ethylene oxide – heat sensitive articles may be sterilized at 55-60° C by ethylene oxide which kills bacteria, spores and viruses.

❖ Vyadhikshamatva

-> Refer to **Kaumarabhritya, Part A, Chapter XII**

❖ Sankramaka Roga

Certain group of diseases spread from one person to another by direct or indirect contact, these are termed as Sankramaka Roga.
Acharya Sushruta has clearly mentioned that diseases like Kustha, Jvara, Shosha, Netrabhishyanda, etc. may be infectious diseases and spread from one person to another. The exposure or contact can be a simple association, touch, inhalation of the infected person's expired air, eating from the same plate, sleeping or lying together and wearing clothes of an infected person, etc.
Also sexual intercourse with an infected person gives rise to various diseases.

CHAPTER XVI: EPIDEMIOLOGY OF COMMUNICABLE DISEASES

- **Chicken Pox, Measles, Diphtheria, Pertussis / Whooping Cough, Mumps, Tuberculosis, Typhoid Fever, Dengue Fever, Malaria, Hepatitis, Tetanus, AIDS**

  -> Refer to **Kaumarabhritya, Part B, Chapter X**

- **SARS**

  Severe acute respiratory syndrome (SARS) is a contagious and sometimes fatal respiratory illness. SARS first appeared in China in November 2002. Within a few months, SARS spread worldwide.
  SARS showed how quickly infection can spread in a highly mobile and interconnected world. On the other hand, a collaborative international effort allowed health experts to quickly contain the spread of the disease. There has been no known transmission of SARS anywhere in the world since 2004.

  Causes:
  SARS is caused by a strain of coronavirus, the same family of viruses that causes the common cold. Previously, these viruses had never been particularly dangerous to humans.
  Coronaviruses can, however, cause severe disease in animals, and that's why scientists suspected that the SARS virus might have crossed from animals to humans. It now seems likely that that the virus evolved from one or more animal viruses into a new strain.

  Spreading:
  Most respiratory illnesses, including SARS, spread through droplets that enter the air when someone with the disease coughs, sneezes or talks. Most experts think SARS spreads mainly through close personal contact, such as caring for someone with SARS. The virus may also be spread on contaminated objects - such as doorknobs, telephones and elevator buttons.

  Risk factors:
  In general, people at greatest risk of SARS are those who have had direct, close contact with someone who's infected, such as family members and health care workers.

Symptoms:
SARS usually begins with flu-like signs and symptoms - fever, chills, muscle aches, headache and occasionally diarrhoea.
After about a week, signs and symptoms include:
- Fever of 38° C or higher
- Dry cough
- Shortness of breath

Complications:
Many people with SARS develop pneumonia, and breathing problems can become so severe that a mechanical respirator is needed. SARS is fatal in some cases, often due to respiratory failure. Other possible complications include heart and liver failure.
People older than 60 - especially those with underlying conditions such as diabetes or hepatitis - are at the highest risk of serious complications.

Prevention:
Researchers are working on several types of vaccines for SARS, but none has been tested in humans. If SARS infections reappear, or similar viruses spread, follow these safety instructions:
Wash your hands. Clean your hands frequently with soap and hot water or use an alcohol-based hand rub containing at least 60% alcohol.
Wear disposable gloves. If you have contact with the person's body fluids or feces, wear disposable gloves. Throw the gloves away immediately after use and wash your hands thoroughly.
Wear a surgical mask. When you're in the same room as a person with SARS, cover your mouth and nose with a surgical mask. Wearing eyeglasses also may offer some protection.
Wash personal items. Use soap and hot water to wash the utensils, towels, bedding and clothing of someone with SARS.
Disinfect surfaces. Use a household disinfectant to clean any surfaces that may have been contaminated with sweat, saliva, mucus, vomit, stool or urine. Wear disposable gloves while you clean and throw the gloves away when you're done.

Follow all precautions for at least 10 days after the person's signs and symptoms have disappeared. Keep children home from school if they develop a fever or respiratory symptoms within 10 days of being exposed to someone with SARS.

❖ Influenza

Influenza is a viral infection that attacks the respiratory system.
Influenza is commonly called the flu.

Causes:

Flu viruses travel through the air in droplets when someone with the infection coughs, sneezes or talks. You can inhale the droplets directly, or you can pick up the germs from an object and then transfer them to your eyes, nose or mouth.
People with the virus are likely contagious from the day before symptoms first appear until about five days after symptoms begin. Children and people with weakened immune systems may be contagious for a slightly longer time.
Influenza viruses are constantly changing, with new strains appearing regularly. If you have had influenza in the past, your body has already made antibodies to fight that particular strain of the virus. If future influenza viruses are similar to those you have encountered before, either by having the disease or by getting vaccinated, those antibodies may prevent infection or lessen its severity.
But antibodies against flu viruses you have encountered in the past cannot protect you from new influenza strains that can be very different immunologically from what you had before.

Risk factors:

Factors that may increase your risk of developing influenza or its complications include:
Age. Seasonal influenza tends to target children younger than 12 months of age and adults 65 years old or older.
Living or working conditions. People who live or work in facilities with many other residents, such as nursing homes or military barracks, are more likely to develop influenza. People who are hospitalized are also at higher risk.
Weakened immune system. Cancer treatments, anti-rejection drugs, long-term use of steroids, organ transplant, blood cancer or HIV/AIDS can weaken your immune system. This can make it easier for you to catch influenza and may also increase your risk of developing complications.
Chronic illnesses. Chronic conditions, including lung diseases such as asthma, diabetes, heart disease, neurological or neurodevelopmental disease, an airway abnormality, and kidney, liver or blood disease, may increase your risk of influenza complications.
Aspirin use under age 19. People who are younger than 19 years of age and receiving long-term aspirin therapy are at risk of developing Reye's syndrome if infected with influenza.
Pregnancy. Pregnant women are more likely to develop influenza complications, particularly in the second and third trimesters. Women who are up to two weeks postpartum also are more likely to develop influenza-related complications.
Obesity. People with a body mass index (BMI) of 40 or more have an increased risk of complications from the flu.

Symptoms:
Initially, the flu may seem like a common cold with a runny nose, sneezing and sore throat. But colds usually develop slowly, whereas the flu tends to come on suddenly. And although a cold can be a nuisance, you usually feel much worse with the flu.

Common signs and symptoms of the flu include:
- Fever over 38°C
- Aching muscles
- Chills and sweats
- Headache
- Dry, persistent cough
- Fatigue and weakness
- Nasal congestion
- Sore throat

Complications:
If you're young and healthy, seasonal influenza usually is not serious. Although you may feel miserable while you have it, the flu usually goes away in a week or two with no lasting effects. But children and adults at high risk may develop complications such as: Pneumonia, Bronchitis, Asthma flare-ups, Heart problems, Ear infections
Pneumonia is the most serious complication. For older adults and people with a chronic illness, pneumonia can be deadly.

Prevention:
The Centers for Disease Control and Prevention (CDC) recommends annual flu vaccination for everyone age 6 months or older.
Each year's seasonal flu vaccine contains protection from the three or four influenza viruses that are expected to be the most common during that year's flu season.

In recent years, there was concern that the nasal spray vaccine wasn't effective enough against certain types of flu. However, the nasal spray vaccine is expected to be effective in the 2019-2020 season. The nasal spray still isn't recommended for some groups, such as pregnant women, children between 2 and 4 years old with asthma or wheezing, and people who have compromised immune systems.

Most types of flu vaccines contain a small amount of egg protein. If you have a mild egg allergy, you can receive the flu shot without any additional precautions. If you have a severe egg allergy, you should be vaccinated in a medical setting and be supervised by a doctor who is able to recognize and manage severe allergic conditions.

❖ Pneumonia

- It is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus (purulent material).
- Pneumonia can range in seriousness from mild to life-threatening. It is most serious for infants and young children, people older than age 65, and people with health problems or weakened immune systems.
- Children who are 2 years old or younger & people who are age 65 or older are at higher risk to develop pneumonia.

Causes:

- Bacteria, Viruses, Fungi
- Hospital-acquired pneumonia

Some people catch pneumonia during a hospital stay for another illness. Hospital-acquired pneumonia can be serious because the bacteria causing it may be more resistant to antibiotics and because the people who get it are already sick.

- Health care-acquired pneumonia

Health care-acquired pneumonia is a bacterial infection that occurs in people who live in long-term care facilities or who receive care in outpatient clinics.

- Aspiration pneumonia

Aspiration pneumonia occurs by inhalation of food, drink, vomit or saliva into the lungs.

Symptoms:

- Shortness of breath
- Cough, which may produce phlegm
- Chest pain while breathing & coughing
- Confusion or changes in mental awareness (in adults age 65 and older)
- Fever, sweating & shaking chills
- Lower than normal body temperature (in adults older than age 65 and people with weak immune systems)
- Nausea, Vomiting, Diarrhea, Fatigue
- Newborns and infants may not show any sign of the infection. Or they may vomit, have a fever and cough, appear restless or tired and without energy, or have difficulty breathing and eating.

Complications:

- Bacteremia; bacteria that enter the bloodstream from the lungs can spread the infection to other organs, potentially causing organ failure.
- Fluid accumulation around the lungs (pleural effusion)
- Lung abscess

Prevention:

Vaccination, Good hygiene, Avoid smoking or secondhand smoking, Maintenance of the immune system

❖ Cholera

Cholera is a bacterial disease usually spread through contaminated water. Cholera causes severe diarrhoea and dehydration. Left untreated, cholera can be fatal within hours, even in previously healthy people.

Modern sewage and water treatment have virtually eliminated cholera in industrialized countries. But cholera still exists in Africa, Southeast Asia and Haiti. The risk of a cholera epidemic is highest when poverty, war or natural disasters force people to live in crowded conditions without adequate sanitation.

Causes:

A bacterium called Vibrio cholerae causes cholera infection. The deadly effects of the disease are the result of a toxin the bacteria produces in the small intestine. The toxin causes the body to secrete enormous amounts of water, leading to diarrhoea and a rapid loss of fluids and salts (electrolytes).

Cholera bacteria might not cause illness in all people who are exposed to them, but they still pass the bacteria in their stool, which can contaminate food and water supplies. Contaminated water supplies are the main source of cholera infection. The bacterium can be found in surface or well water, seafood, raw fruits and vegetables, grains.

Symptoms:

Most people exposed to the cholera bacterium (Vibrio cholerae) do not become ill and do not know they have been infected. But because they shed cholera bacteria in their stool for seven to 14 days, they can still infect others through contaminated water.

Most cases of cholera that cause symptoms, cause mild or moderate diarrhoea which is often hard to tell apart from diarrhoea caused by other problems. Others develop more-serious signs and symptoms of cholera, usually within a few days of infection.

Symptoms of cholera infection can include:

- Diarrhea
- Nausea and vomiting
- Dehydration

Signs and symptoms of dehydration include irritability, fatigue, sunken eyes, dry mouth, extreme thirst, dry and shriveled skin, little or no urinating, low blood pressure, and irregular heartbeat.

Dehydration can lead to a rapid loss of minerals in your blood that maintain the balance of fluids in your body. This is known as electrolyte imbalance.

Complications:
Cholera can quickly become fatal. In the most severe cases, the rapid loss of large amounts of fluids and electrolytes can lead to death within hours. In less extreme situations, people who do not receive treatment can die of dehydration and shock within hours to days after cholera symptoms first appear.
Although shock and severe dehydration are the worst complications of cholera, other problems can occur, such as:
- Low blood sugar (hypoglycemia)
- Low potassium levels
- Kidney failure

Diagnosis:
Although signs and symptoms of severe cholera can be unmistakable in areas where it's common, the only way to confirm a diagnosis is to identify the bacteria in a stool sample. Rapid cholera dipstick tests enable doctors in remote areas to quickly confirm a cholera diagnosis. Quick confirmation helps to decrease death rates at the start of cholera outbreaks and leads to earlier public health interventions for outbreak control.

Treatment:
Cholera requires immediate treatment because the disease can cause death within hours.
Rehydration. The goal is to replace lost fluids and electrolytes using a simple rehydration solution, oral rehydration salts (ORS). The ORS solution is available as a powder that can be made with boiled or bottled water.
Without rehydration, approximately half the people with cholera die. With treatment, fatalities drop to less than 1%.
Intravenous fluids. Most people with cholera can be helped by oral rehydration alone, but severely dehydrated people might also need intravenous fluids.
Antibiotics. While not a necessary part of cholera treatment, some antibiotics can reduce cholera-related diarrhea and shorten how long it lasts in severely ill people.
Zinc supplements. Research has shown that zinc might decrease diarrhea and shorten how long it lasts in children with cholera.

❖ Polio

Polio is a contagious viral illness that in its most severe form causes nerve injury leading to paralysis, difficulty breathing and sometimes death.

Causes:

Poliovirus can be transmitted through direct contact with someone infected with the virus or, less commonly, through contaminated food and water. People carrying the poliovirus can spread the virus for weeks in their feces. People who have the virus but do not have symptoms act as carrier and can pass the virus to others.

Risk factors:

Polio mainly affects children younger than 5. However, anyone who has not been vaccinated is at risk of developing the disease.

Symptoms:

Although polio can cause paralysis and death, the majority of people who are infected with the virus do not get sick and are not aware they have been infected.

Non-paralytic polio

Some people who develop symptoms from the poliovirus contract a type of polio that does not lead to paralysis (abortive polio). This usually causes the same mild, flu-like signs and symptoms typical of other viral illnesses.

Signs and symptoms, which can last up to 10 days, include:

Fever, Sore throat, Headache, Vomiting, Fatigue, Back pain or stiffness, Neck pain or stiffness, Pain or stiffness in the arms or legs, Muscle weakness or tenderness

Paralytic polio

This most serious form of the disease is rare. Initial signs and symptoms of paralytic polio, such as fever and headache, often mimic those of non-paralytic polio. Within a week, however, other signs and symptoms appear, including:

Loss of reflexes, Severe muscle aches or weakness, Loose and floppy limbs (flaccid paralysis)

Post-polio syndrome

Post-polio syndrome is a cluster of disabling signs and symptoms that affect some people years after having polio.

Common signs and symptoms include:

Progressive muscle or joint weakness and pain, Fatigue, Muscle wasting (atrophy), Breathing or swallowing problems, Sleep-related breathing disorders, such as sleep apnea, Decreased tolerance of cold temperatures

Complications:
Paralytic polio can lead to temporary or permanent muscle paralysis, disability, bone deformities and death.

Prevention:
The most effective way to prevent polio is vaccination.

Diagnosis:
Doctors often recognize polio by symptoms, such as neck and back stiffness, abnormal reflexes, and difficulty swallowing and breathing. To confirm the diagnosis, a sample of throat secretions, stool or cerebrospinal fluid is checked for poliovirus.

Treatment:
Because no cure for polio exists, the focus is on increasing comfort, speeding recovery and preventing complications. Supportive treatments include:
Analgesics, Portable ventilators to assist breathing, Moderate exercise (physical therapy) to prevent deformity and loss of muscle function.

❖ Leptospirosis

Leptospirosis is a rare bacterial infection obtained from animals. It is spread through urine, especially from dogs, rodents, and farm animals. They may not have any symptoms, but they can be carriers.
In most cases, leptospirosis is unpleasant but not life-threatening. It rarely lasts more than a week. But about 10% of the time, in case of a severe form of leptospirosis, the patient will improve, but then get sick again. This is called Weil's disease and it can cause much more serious issues, like chest pain and swollen arms and legs. It often requires hospitalization.

Causes:
Leptospirosis is caused by a bacterium called *Leptospira interrogans*. The organism is carried by many animals and lives in their kidneys. It ends up in soil and water through their urine.
If you are around soil or water where an infected animal has urinated, the germ can invade the body through breaks in your skin, like scratches, open wounds, or dry areas. It can also enter through the nose, mouth, or genitals. It is generally no received from another human, though it can be transmitted through sexual intercourse or breastfeeding.

You're at risk if you spend a lot of time around animals or in the outdoors. You're more likely to be exposed to it if you have one of these jobs:

Risk factors:
Farmer, Veterinarian, Underground worker, Slaughterhouse worker, Military personnel

Symptoms:
Usually symptoms start appearing within 2 weeks, though in some cases, symptoms may not show up for a month or not at all.
Symptoms include:
Fever, Headache, Muscle ache, Jaundice, Vomiting, Diarrhoea, Skin rash

Treatment:
Antibiotics, including penicillin and doxycycline. Ibuprofen for fever and muscle pain.
The disease should run its course in about a week.
Hospitalization may be necessary if the infection is more severe. Symptoms may include kidney failure, meningitis, and lung problems.

❖ Chikungunya

Chikungunya is a mosquito-borne viral disease first described during an outbreak in southern Tanzania in 1952. It is an RNA virus that belongs to the alphavirus genus of the family Togaviridae. The name “chikungunya” derives from a word in the Kimakonde language, meaning “to become contorted”, and describes the stooped appearance of sufferers with joint pain (arthralgia).
The disease mostly occurs in Africa, Asia and the Indian subcontinent.

Transmission:
Chikungunya has been identified in over 60 countries in Asia, Africa, Europe and the Americas.
The virus is transmitted from human to human by the bites of infected female mosquitoes. Most commonly, the mosquitoes involved are *Aedes aegypti* and *Aedes albopictus*, two species which can also transmit other mosquito-borne viruses, including dengue. These mosquitoes can be found biting throughout daylight hours, though there may be peaks of activity in the early morning and late afternoon. Both species are found biting outdoors, but *Ae. aegypti* will also readily feed indoors.
After the bite of an infected mosquito, onset of illness occurs usually between 4 and 8 days but can range from 2 to 12 days.

Symptoms:
Chikungunya is characterized by an abrupt onset of fever frequently accompanied by joint pain. Other common signs and symptoms include muscle pain, headache, nausea, fatigue and rash. The joint pain is often very debilitating, but usually lasts for a few days or may be prolonged to weeks. Hence the virus can cause acute, subacute or chronic disease.
Often symptoms in infected individuals are mild and the infection may go unrecognized, or be misdiagnosed in areas where dengue occurs.

Complications:
Most patients recover fully, but in some cases joint pain may persist for several months, or even years. Occasional cases of eye, neurological and heart complications have been reported, as well as gastrointestinal complaints. Serious complications are not common, but in older people, the disease can contribute to the cause of death.

Treatment:
There is no specific antiviral drug treatment for chikungunya. Treatment is directed primarily at relieving the symptoms, including the joint pain using anti-pyretics, optimal analgesics and fluids. There is no commercial chikungunya vaccine.

❖ Filariasis

Lymphatic filariasis, commonly known as elephantiasis, is a neglected tropical disease. Infection occurs when filarial parasites are transmitted to humans through mosquitoes. Infection is usually acquired in childhood causing hidden damage to the lymphatic system.

Cause & Transmission:

Lymphatic filariasis is caused by infection with parasites classified as nematodes (roundworms) of the family Filariodidea. There are 3 types of these thread-like filarial worms:

i) Wuchereria bancrofti, which is responsible for 90% of the cases
ii) Brugia malayi, which causes most of the remainder of the cases
iii) Brugia timori, which also causes the disease.

Adult worms nest in the lymphatic vessels and disrupt the normal function of the lymphatic system. The worms can live for approximately 6-8 years and, during their life time, produce millions of microfilariae (immature larvae) that circulate in the blood. Mosquitoes are infected with microfilariae by ingesting blood when biting an infected host. Microfilariae mature into infective larvae within the mosquito. When infected mosquitoes bite people, mature parasite larvae are deposited on the skin from where they can enter the body. The larvae then migrate to the lymphatic vessels where they develop into adult worms, thus continuing a cycle of transmission.

Lymphatic filariasis is transmitted by different types of mosquitoes for example by the Culex mosquito, widespread across urban and semi-urban areas, Anopheles, mainly found in rural areas, and *Aedes*, mainly in endemic islands in the Pacific.

Symptoms:

Lymphatic filariasis infection involves asymptomatic, acute, and chronic conditions. The majority of infections are asymptomatic, showing no external signs of infection while contributing to transmission of the parasite. These asymptomatic infections still cause damage to the lymphatic system and the kidneys, and alter the body's immune system. When lymphatic filariasis develops into chronic conditions it leads to lymphoedema (tissue swelling) or elephantiasis (skin/tissue thickening) of limbs and hydrocele (scrotal swelling). Involvement of breasts and genital organs is common. Such body deformities often lead to social stigma and sub-optimal mental health, loss of income-earning opportunities and increased medical expenses for patients and their caretakers.

Acute episodes of local inflammation involving skin, lymph nodes and lymphatic vessels often accompany chronic lymphoedema or elephantiasis. Some of these episodes are caused by the body's immune response to the parasite. Most are the result of secondary bacterial skin infection where normal defenses have been partially lost due to underlying lymphatic damage. These acute attacks are debilitating, may last for weeks and are the primary cause of lost wages among people suffering with lymphatic filariasis.

Large-scale treatment:

Elimination of lymphatic filariasis is possible by stopping the spread of the infection through preventive chemotherapy. The WHO recommended preventive chemotherapy strategy for lymphatic filariasis elimination is mass drug administration (MDA). MDA involves administering an annual dose of medicines to the entire at-risk population. The medicines used have a limited effect on adult parasites but effectively reduce the density of microfilariae in the bloodstream and prevent the spread of parasites to mosquitoes.

Vector control:

Mosquito control is a supplemental strategy supported by WHO. It is used to reduce transmission of lymphatic filariasis and other mosquito-borne infections. Depending on the parasite-vector species, measures such as insecticide-treated nets, indoor residual spraying or personal protection measures may help protect people from infection. The use of insecticide-treated nets in areas where *Anopheles* is the primary vector for filariasis enhances the impact on transmission during and after MDA. Historically, vector control has in select settings contributed to the elimination of lymphatic filariasis in the absence of large-scale preventive chemotherapy.

❖ Leprosy

Leprosy is an infectious disease caused by a bacillus, Mycobacterium leprae.

Leprosy is likely transmitted via droplets, from the nose and mouth, during close and frequent contact with untreated cases.

M. leprae multiplies slowly and the incubation period of the disease, on average, is 5 years. Symptoms may occur within 1 year but can also take as long as 20 years or even more to occur.

The disease mainly affects the skin, the peripheral nerves, mucosa of the upper respiratory tract, and the eyes.

Leprosy is curable with multidrug therapy (MDT).

Untreated, leprosy can cause progressive and permanent damage to the skin, nerves, limbs, and eyes.

❖ Rabies / Lyssa

- Rabies is a viral disease that causes acute inflammation of the brain in humans and other warm-blooded animals.
- Rabies also known as Hydrophobia is an acute, highly fatal viral disease of the Central Nervous System caused by Rabid Animal Bite that is transmitted by infected secretions. Most commonly, transmission to humans takes place through exposure to saliva during a bite by an infected animal.
- World rabies day = 28th September

- **Causes:** Bacteria found in the mouths of rodents:
  Streptobacillus moniliformis, Spirillum minus

- **Incubation period:** Generally: 20-30 days
  Fulminant cases: 5-6 days
  1-3% of cases: 6 months or more

- **Transmission:** Saliva of infected animals

- **Signs & Symptoms:** Flu-like symptoms, Anxiety, Insomnia, Mental confusion, Agitation, Altered behaviour, Paranoia, Hallucinations, Delirium, Hydrophobia

- **Hydrophobia:** It is fear of water. It includes a set of symptoms that manifest in the later stages of rabies infection:
  Dysphagia, Panic when given liquids, Failure to quench thirst

- **Treatment:** Washing of the bite site with soap and water
  Human rabies immunoglobulin (HRIG) injections

- **Personal Safety Against Rabies:**
  - Do not touch animal bite wounds with bare hands.
  - Do not touch the fomites viz. chain, food plate, etc. of an animal suspected or proven of rabies.
  - Do not touch stray or sick animal.
  - Take pre-exposure vaccination if you are in constant touch with animals.
  - Avoid contact with saliva, urine, tears, semen and vaginal secretions of a rabies patient.
  - Provide pre-exposure prophylaxis to medical, nursing and ancillary staff who regularly attends to hydrophobia patients and to public health personnel removing rabid and stray animals.
  - Veterinarians shall always be on pre-exposure prophylaxis, wear gloves, glasses, masks and long sleeved overall while examining rabid animals.

❖ Emerging & Re-emerging Diseases

Emerging Infectious Diseases: Newly identified & previously unknown infectious agents that cause public health problem either locally or internationally.
Some of such diseases were previously documented, but without known etiology.

Re-emerging Infectious Diseases: Infectious agents that have been known for some time, had fallen to such low levels that they were no longer considered public health problems & are now showing upward trends in incidence or prevalence worldwide.

Emerging & Re-emerging Infectious Diseases:
AIDS, SARS, Tuberculosis, Cholera, Malaria, Kala-azar, Dengue, Hepatitis (B, C & E), Schistosomiasis, Japanese encephalitis, Ebola hemorrhagic fever, Rabies, Influenza

❖ Kuprasangaja Vyadhi (STDs)

The word Kuprasangaja is comprised of Ku (bad), Prasanga (physical contact) & Ja (born or produced).
Kuprasangaja Vyadhi are Sexually Transmitted Diseases (STDs).
STDs are a group of communicable diseases that are transmitted by sexual contact and are caused by a wide range of bacterial, viral, protozoal and fungal agents and ecto-parasites.
Among STDs, Gonorrhoea, Cancroid and Syphilis have strong incidence rate.

❖ Gonorrhoea

Gonorrhoea is an acute condition characterized by inflammation of urethra in male and of urethra, cervix and vagina in females. There is acute burning sensation with pain and pus discharge while passing urine. Later the pus becomes thin and persists lifelong.
Causative Organism: Neisseria gonorrhoea
Incubation period: 2-10 days
Complications: Acute prostatitis, Bartholin's gland abscess, infertility, ectopic pregnancy, Pelvic Inflammatory Diseases (PID)
Treatment:
- Ceftriaxone – 250 mg I/M for 7 days
- Ciprofloxacin – 500 mg orally for 7 days
- Ofloxacin – 400 mg orally for 7 days
- Ampicillin – 3 gm orally for 7 days

❖ Cancroid

Causative Organism: Haemophilus ducreyl
Symptoms: Normally after 2-3 days of infection, a small papule develops at the site of inoculation. Lesions are deep, extremely painful ulcerations.
Treatment: Ciprofloxacin, erythromycin, azithromycin

❖ Syphilis

Causative Organism: Treponema pallidum
Mode of transmission: Abrasion in skin, mucous membrane, blood transfusion, tattooing, kissing, etc.
Incubation period: 14-28 days

Classification:

i) Primary Syphilis

Incubation period: 9-10 days
The primary lesion begins with single small pink macule, later on it ulcerates at the site of infection, usually on genitalia. The ulcer is painless and does not bleed easily on touch.
The regional lymph nodes are enlarged and are painless.
The usual sites of ulcer in males are cornal sulcus of penis and the glans penis.
In females, the labia majora, labia minora, cervix, urethral orifice and clitoris.
Extra genital ulcers are seen in 10% cases. It may be found on fingers, tongue, lips, nipples, rectum, anus.

ii) Secondary Syphilis

After 6-8 weeks of appearance of primary syphilis, secondary syphilis develops. It starts with mild fever, headache and vomiting.
Four important signs in secondary syphilis:

a) Skin rashes
b) Generalized lymphadenopathy
c) Condylomata lata
d) Mucus patches

iii) Late Syphilis

Late syphilis is the Tertiary stage. It affects the skin, mucosa and bones. The characteristic feature is granulomatous lesions called gumma. This takes more than 10 years to appear.

iv) Quaternary Stage

Cardiovascular syphilis and neuro syphilis are included in this stage.

-> Congenital Syphilis

Transmission of syphilis to foetus from mother through placenta may occur at any stage of pregnancy; usually 16^{th} week of pregnancy.

Treatment:

Primary Stage: Penicillin – 600-1200 mg I/M once daily for 12 days.
Doxycycline – 100 mg orally every 8 hours for 15 days.

CHAPTER XVII: EPIDEMIOLOGY OF NON-COMMUNICABLE DISEASES

Non-communicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression.
NCDs can mainly be categorized into four:
i) Cardiovascular diseases
ii) Cancers
iii) Chronic respiratory diseases
iv) Diabetes

❖ Diabetes

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Hyperglycemia (increased blood sugar level) is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's system, especially the nerves and blood vessels.

- **Type 1 Diabetes**
  Type 1 diabetes (previously known as insulin-dependent, juvenile or childhood-onset diabetes) is characterized by deficient insulin production and requires daily administration of insulin. The exact cause of type 1 diabetes is not known.
  Symptoms: Polyuria, Polydipsia, Constant hunger, weight loss, impaired vision, fatigue

- **Type 2 Diabetes**
  Type 2 diabetes (previously known as non-insulin-dependent or adult-onset diabetes) results from the body's ineffective use of insulin. Type 2 diabetes comprises 90% of people with diabetes around the world, and is largely the result of excess body weight and physical inactivity.
  Symptoms may be similar to those of type 1 diabetes, but are often less marked. As a result, the disease may only be diagnosed several years after onset, once complications have already arisen.

- **Gestational Diabetes:**
  Gestational diabetes is hyperglycemia occurring during pregnancy; glucose level is above normal but below those of diagnostic diabetes.
  Women with gestational diabetes are at an increased risk of having complications during pregnancy and at delivery. They are also at increased risk of developing type 2 diabetes in the future. Gestational diabetes is diagnosed through prenatal screening, rather than reported symptoms.

- **Impaired Glucose Tolerance (IGT) & Impaired Fasting Glycaemia (IFG)**
  IGT & IFG are intermediate conditions in the transition between normality and diabetes. People with IGT or IFG are at high risk of progressing to type 2 diabetes.

- **Common Consequences of Diabetes:**
  - Over time, diabetes can damage the heart, blood vessels, eyes, kidneys and nerves.
  - Diabetes increases the risk of heart diseases and stroke.
  - Combined with reduced blood flow, neuropathy in the feet increases the chance of foot ulcers, infection and eventual need for limb amputation.
  - Diabetic retinopathy is an important cause of blindness, and occurs as a result of long-term accumulated damage to the small blood vessels in the retina.
  - Diabetes is among the leading causes of kidney failure.

- **Prevention:**
  Simple lifestyle measures have been shown to be effective in preventing or delaying the onset of type 2 diabetes.
  - Achieve and maintain healthy body weight.
  - Physical activity – at least 30 minutes or regular, moderate-intensity activity on most days.
  - Eating healthy diet of between 3-5 serving of fruit and vegetables a day and reduction of sugar and saturated fat intake.
  - Avoid use of tobacco; smoking increases the risk of cardiovascular diseases also.

- **Diagnosis & Treatment:**
  Early diagnosis can be accomplished through relatively inexpensive blood testing. Treatment of diabetes involves lowering blood glucose level and other risk factor that damage the blood vessels. Cessation of tobacco smoking is also an important factor to avoid complications.

Type 1 diabetes is managed with insulin as well as dietary changes and exercise.
There are four types of insulin that are most commonly used. They are differentiated by how quickly they start to work, and how long their effects last:
i) Rapid-acting insulin starts to work within 15 minutes and its effects last for 3 to 4 hours.
ii) Short-acting insulin starts to work within 30 minutes and lasts 6 to 8 hours.
iii) Intermediate-acting insulin starts to work within 1 to 2 hours and lasts 12 to 18 hours.
iv) Long-acting insulin starts to work a few hours after injection and lasts 24 hours or longer.

Type 2 diabetes may be managed with non-insulin medications, insulin, weight reduction, or dietary changes.
The choice of medications for type 2 diabetes is individualized, taking into account:
- the effectiveness and side effect profile of each medication.
- the patient's underlying health status.
- any medication compliance issues.
- cost to the patient or health-care system.

Medications for type 2 diabetes can work in different ways to reduce blood glucose levels. They may:
- increase insulin sensitivity.
- increase glucose excretion.
- decrease absorption of carbohydrates from the digestive tract.
- work through other mechanisms.

Medications for type 2 diabetes are often used in combination.
Different methods of delivering insulin include:
- syringes
- pre-filled pens
- insulin pump

Proper nutrition is a part of any diabetes care plan. There is no one specific ‘diabetic diet’ that is recommended for all individuals.

Pancreas transplantation is an area of active study for the treatment of diabetes.

❖ Obesity

Overweight and obesity are defined as abnormal or excessive fat accumulation which may impair the health of the individual.

Body Mass Index (BMI) is a simple index which considers the relation between weight and height of the individual and is commonly used to classify overweight and obesity in adults.
BMI is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m^2).

Definition according to WHO:
- A BMI greater than or equal to 25 is overweight.
- A BMI greater than or equal to 30 is obesity.

Obesity is frequently subdivided into categories:
a) Class 1: BMI of 30-35
b) Class 2: BMI of 35-40
c) Class 3: BMI of 40 or higher.
Class 3 obesity is sometimes categorized as "extreme" or "severe" obesity.

Causative Factors:
The fundamental cause of obesity and overweight is an energy imbalance between consumed calories and used calories.
Globally, there has been –
- An increased intake of energy-dense foods that are high in fat.
- A decrease in physical activity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization.

Changes in dietary and physical activity patterns are often the result of environmental and societal changed associated with development and lack of supportive policies in sectors such as health, agriculture, transport, urban planning, environment, food processing, distribution, marketing and education.

Complications:
Overweight or obesity is a major risk factor for non-communicable diseases such as:
- Diabetes
- Cardiovascular diseases
- Musculoskeletal disorders
- Cancers (such as endometrial, breast, colon cancer)
- Difficulty in breathing and movements
- Increased risk of fractures
- Psychological effects

Prevention & Control:

A) At the individual level:

- Limited caloric intake, reduced intake of fat and sugar
- Increased consumption of fruits, vegetables, legumes, whole grains and nuts
- Regular physical activity

B) At the societal level:

- Support of the individuals to follow the above recommendations through sustained political commitment and the collaboration of many public and private stakeholders.
- Areas for regular physical activity and healthier dietary choices should be made available, affordable and easily accessible to all.
- Ensuring the availability of healthy food choices and supporting regular physical activity practice in the workplace.

C) Food industry:

- Reducing fat, sugar and salt content of processed foods.
- Ensuring that healthy and nutritious choices are available and affordable to all.
- Practicing responsible marketing, especially those aimed at children and teenagers.

❖ Hypertension

Hypertension, also known as high or raised blood pressure, is a condition in which the blood vessels have persistently raised pressure. Blood is carried from the heart to all parts of the body through the blood vessels. Each time the heart beats, it pumps blood into the vessels. Blood pressure is created by the lateral force of blood pushing against the walls of blood vessels as it is pumped by the heart. The higher the pressure the harder the heart has to pump.

High blood pressure increases the risk of heart attacks, strokes and kidney failure. Uncontrolled hypertension can also cause blindness, irregularities of the heartbeat and heart failure. The risk of developing these complications is higher in the presence of other cardiovascular risk factors such as diabetes.

However, hypertension is treatable and preventable.

The risk of developing hypertension can be reduced by:

- Reduced salt intake
- Eating of balanced diet
- Regular physical activity
- Maintaining a healthy body weight
- Avoiding harmful use of alcohol
- Avoiding use of tobacco

❖ Coronary Heart Diseases

Also known as Coronary Artery Disease, Coronary Microvascular Disease, Coronary Syndrome X, Ischemic Heart Disease, Nonobstructive Coronary Artery Disease, Obstructive Coronary Artery Disease.

Heart disease is a catch-all phrase for a variety of conditions that affect the heart's structure and function. Coronary heart disease is a type of heart disease that develops when the arteries of the heart cannot deliver enough oxygen-rich blood to the heart. It is the leading cause of death in the United States.

Types:

i) Obstructive coronary artery disease
ii) Non-obstructive coronary artery disease
iii) Coronary microvascular disease

Coronary artery disease affects the large arteries on the surface of the heart. Many people have both obstructive and non-obstructive forms of this disease. Coronary microvascular disease affects the tiny arteries in the heart muscle.

Cause:

The cause depends on the type of coronary heart disease. The condition may also have more than one cause, including plaque buildup or problems that affect how the heart's blood vessels work.

Plaque buildup in the arteries is called atherosclerosis. When this buildup happens in the heart's arteries over many years, the arteries become narrower and harden, reducing oxygen-rich blood flow to the heart. The result is coronary artery disease.

Obstructive coronary artery disease means the heart's arteries are more than 50% blocked. The blood flow may eventually be completely blocked in one or more of the three large coronary arteries. In nonobstructive coronary artery disease, the large arteries may be narrowed by plaque, but not as much as they are in obstructive disease.

Small plaques can also develop in the small blood vessels in the heart, causing coronary microvascular disease.

Risk factors:

There are many risk factors for coronary heart disease. Some risk factors - such as high blood pressure and high blood cholesterol - can be changed through heart-healthy lifestyle changes. Other risk factors, such as sex, older age, family history and genetics, and race and ethnicity, cannot be changed.

Air pollution in the environment can put you at higher risk of coronary heart disease. The increase in risk may be higher in older adults, women, and people who have diabetes or obesity. Air pollution may cause or worsen other conditions, such as atherosclerosis and high blood pressure, which are known to increase your risk for coronary heart disease.

Work life can also raise the risk if one:
- Comes into contact with toxins, radiation, or other hazards.
- Has a lot of stress at work.
- Sits for long periods.
- Works more than 55 hours a week, or works long, irregular, or night shifts that affect sleep patterns.

Over time, unhealthy lifestyle habits increase the risk of coronary heart disease because they can lead to plaque buildup in the heart's blood vessels. Unhealthy lifestyle habits that are risk factors include the following:
Being physically inactive, which can worsen other heart disease risk factors, such as high blood cholesterol and triglyceride levels, high blood pressure, diabetes and prediabetes, and overweight and obesity.
Not getting enough good quality sleep, including waking up often throughout the night, which may raise the risk of coronary heart disease. While one sleeps, blood pressure and heart rate fall. The heart does not work as hard as it does when one is awake. As one begins to wake up, the blood pressure and heart rate increase to the usual levels when one is awake and relaxed. Waking up suddenly can cause a sharp increase in blood pressure and heart rate, which has been linked to angina and heart attacks.
Smoking tobacco or long-term exposure to secondhand smoke, which can damage the blood vessels.
Stress, which can trigger the tightening of arteries, which increases the risk of coronary heart disease, especially coronary microvascular disease. Stress may also indirectly raise the risk of coronary heart disease if it makes the individual more likely to smoke or overeat foods high in fat and added sugars.
Unhealthy eating patterns, such as consuming high amounts of saturated fats or trans-fats and refined carbohydrates (white bread, pasta, and white rice). This can lead to overweight and obesity, high blood cholesterol, atherosclerosis, and plaque buildup in the heart's arteries.

Signs, Symptoms & Complications:
Some people have severe symptoms of coronary heart disease. Others have no symptoms at all. If you have "silent" coronary heart disease, you may not have any symptoms until you have a heart attack or other complication.

An acute coronary event, such as a heart attack, may cause the following symptoms:
- Angina, which can feel like pressure, squeezing, burning, or tightness during physical activity. The pain or discomfort usually starts behind the breastbone, but it can also occur in the arms, shoulders, jaw, throat, or back. The pain may feel like indigestion.
- Cold sweats, Dizziness, Light-headedness
- Nausea or a feeling of indigestion
- Neck pain, Sleep disturbances, Weakness
- Shortness of breath, especially with activity

Women are somewhat less likely than men to experience chest pain. Instead, they are more likely to experience:
- Dizziness
- Fatigue
- Nausea
- Pressure or tightness in the chest
- Stomach pain

Women are also more likely than men to have no symptoms of coronary heart disease.

Chronic (long-term) coronary heart disease can cause symptoms such as the following:
- Angina
- Shortness of breath with physical activity
- Fatigue
- Neck pain

The symptoms may get worse as the buildup of plaque continues to narrow the coronary arteries. Chest pain or discomfort that does not go away or happens more often or while you are resting might be a sign of a heart attack.

Coronary heart disease can cause serious complications, including the following:
- Acute coronary syndrome, including angina or heart attack
- Arrhythmia
- Heart failure
- Cardiogenic shock
- Sudden cardiac arrest

Complications of coronary heart disease can be life-threatening and may lead to disability.

Treatment:
i) Heart-healthy lifestyle changes such as aiming for a healthy weight, being physically active, heart-healthy eating, managing stress, quitting smoking, enough good-quality sleep.

ii) Medicines such as ACE inhibitors and beta blockers & Calcium channel blockers.

iii) Procedures such as coronary artery bypass grafting or percutaneous coronary intervention.

❖ Rheumatic Heart Disease

Rheumatic heart disease is a condition in which the heart valves have been permanently damaged by rheumatic fever. The heart valve damage may start shortly after untreated or under-treated streptococcal infection such as strep throat or scarlet fever. An immune response causes an inflammatory condition in the body which can result in on-going valve damage.

Cause:

Rheumatic heart disease is caused by rheumatic fever, an inflammatory disease that can affect many connective tissues, especially in the heart, joints, skin, or brain. The heart valves can be inflamed and become scarred over time. This can result in narrowing or leaking of the heart valve making it harder for the heart to function normally. This may take years to develop and can result in heart failure.

Risk factors:

Rheumatic fever can occur at any age, but usually occurs in children ages 5 to 15 years old. It's rare in developed countries like the United States.
Untreated or under-treated strep infections can increase the risk for rheumatic heart disease. Children who get repeated strep throat infections are at the most risk for rheumatic fever and rheumatic heart disease.

Symptoms:

- Fever, Weakness
- Swollen, tender, red and extremely painful joints — particularly the knees and ankles
- Nodules
- Red, raised, lattice-like rash, usually on the chest, back, and abdomen
- Shortness of breath and chest discomfort
- Uncontrolled movements of arms, legs, or facial muscles

Complications:

Heart failure. This can occur from either a severely narrowed or leaking heart valve.
Bacterial endocarditis. This is an infection of the inner lining of the heart, and may occur when rheumatic fever has damaged the heart valves.
Complications of pregnancy and delivery due to heart damage. Women with rheumatic heart disease should discuss their condition with their healthcare provider before getting pregnant.
Ruptured heart valve. This is a medical emergency that must be treated with surgery to replace or repair the heart valve.

Diagnosis:
People with rheumatic heart disease will have or recently had a strep infection. A throat culture or blood test may be used to check for strep.
They may have a murmur or rub that may be heard during a routine physical exam. The murmur is caused by the blood leaking around the damages valve. The rub is caused when the inflamed heart tissues move or rub against each other.
Along with a complete medical history and physical exam, tests used to diagnose rheumatic heart disease may include:
Echocardiogram, Electrocardiogram (ECG), Chest X-ray, Cardiac MRI, Blood tests

Treatment:
Treatment depends in large part on how much damage has been done to the heart valves. In severe cases, treatment may include surgery to replace or repair a badly damaged valve.

The best treatment is to prevent rheumatic fever. Antibiotics can usually treat strep infections and keep rheumatic fever from developing. Anti-inflammatory drugs may be used to reduce inflammation and lower the risk of heart damage. Other medicines may be needed to manage heart failure.

People who have had rheumatic fever are often given daily or monthly antibiotic treatments, possibly for life, to prevent recurrent infections and lower the risk of further heart damage. To reduce inflammation, aspirin, steroids, or non-steroidal medicines may be given.

❖ Cancer

Cancer is a generic term for a large group of diseases that can affect any part of the body. Other terms used are malignant tumours and neoplasms.

Properties of a malignant tumor are:
i) It grows in an unlimited, aggressive manner.
ii) It invades surrounding tissues.
iii) It does metastasis.

Metastasis is the spread of a disease from one organ / part to another non-adjacent organ / part. The new tumour is called secondary or metastatic tumour. Its cells are like those of the original tumour, so it is also named after the original type.
E.g.: Breast cancer -> Metastasis to lung -> Metastatic breast cancer in lung

Cancer is a leading cause of death worldwide. The most common causes of cancer death are cancers of lung, liver, stomach, colon, rectum, breast & oesophagus.

Causes:
Cancers are caused by abnormalities in the genetic material of the transformed cells.

i) Mutation: Chemical carcinogen
ii) Mutation: Ionizing radiation
iii) Viral or Bacterial Infection
iv) Hormonal imbalances
v) Immune system dysfunction
vi) Hereditary
vii) Other causes, such as trans-placental from mother to foetus, unhealthy diet

Risk factors:
Tobacco, Overweight, Obesity, Unhealthy diet, Lack of physical activity, Alcohol, Sexually transmitted infection, Ionizing and non-ionizing radiation, Urban air pollution, Exposure to indoor smoke from household use of solid fuels

Mode of spread:
- Blood stream
- Lymphatic drainage
- Both
- Direct spread

Signs & Symptoms:

A) Local symptoms

Unusual lump / swelling, haemorrhage, pain, ulceration, compression of surrounding tissues

B) Metastatic symptoms

Enlarged lymph nodes, cough, haemoptysis, hepatomegaly, bone pain, fracture of affected bone, neurological defects

C) Systemic symptoms

Weight loss, poor appetite, fatigue, night sweats, anemia, etc.

Pathogenesis:

Causes -> Cell proliferation: uncontrolled & uncoordinated cell division or replication -> Angiogenesis: new vascular tree grows to supply oxygen & nutrients to neoplastic cells -> Growth: continuous cell proliferation leads to formation of lump / mass -> Metastasis -> Growth: cell proliferation of secondary tumour

Prevention:

- Avoidance of risk factors listed above
- Vaccination against human papilloma virus (HPV) and hepatitis B virus (HBV)
- Control occupational hazards

Diagnosis:

- Clinical observation
- Histopathological study or biopsy
- Radiological investigation

Treatment:

Primary treatment. The goal of a primary treatment is to completely remove the cancer from your body or kill all the cancer cells.

Any cancer treatment can be used as a primary treatment, but the most common primary cancer treatment for the most common types of cancer is surgery. If your cancer is particularly sensitive to radiation therapy or chemotherapy, you may receive one of those therapies as your primary treatment.

Adjuvant treatment. The goal of adjuvant therapy is to kill any cancer cells that may remain after primary treatment in order to reduce the chance that the cancer will recur. Any cancer treatment can be used as an adjuvant therapy. Common adjuvant therapies include chemotherapy, radiation therapy and hormone therapy.

Palliative treatment. Palliative treatments may help relieve side effects of treatment or signs and symptoms caused by cancer itself. Surgery, radiation, chemotherapy and hormone therapy can all be used to relieve symptoms. Other medications may relieve symptoms such as pain and shortness of breath.
Palliative treatment can be used at the same time as other treatments intended to cure the cancer.

Cancer treatment options include:

Surgery. The goal of surgery is to remove the cancer or as much of the cancer as possible.
Chemotherapy. Chemotherapy uses drugs to kill cancer cells.
Radiation therapy. Radiation therapy uses high-powered energy beams, such as X-rays or protons, to kill cancer cells. Radiation treatment can come from a machine outside the body (external beam radiation), or it can be placed inside the body (brachytherapy).
Bone marrow transplant. Bone marrow is the material inside your bones that makes blood cells from blood stem cells. A bone marrow transplant, also knowns as a stem cell transplant, can use one's own bone marrow stem cells or those from a donor.
A bone marrow transplant allows the udoctor to use higher doses of chemotherapy to treat cancer. It may also be used to replace diseased bone marrow.
Immunotherapy. Immunotherapy, also known as biological therapy, uses the body's immune system to fight cancer. Cancer can survive unchecked in the body because the immune system does not recognize it as an intruder. Immunotherapy can help the immune system "see" the cancer and attack it.
Hormone therapy. Some types of cancer are fueled by the body's hormones. Examples include breast cancer and prostate cancer. Removing those hormones from the body or blocking their effects may cause the cancer cells to stop growing.
Targeted drug therapy. Targeted drug treatment focuses on specific abnormalities within cancer cells that allow them to survive.
Cryoablation. This treatment kills cancer cells with cold. During cryoablation, a thin, wand-like needle (cryoprobe) is inserted through the skin and directly into the cancerous tumor. A gas is pumped into the cryoprobe in order to freeze the tissue. Then the tissue is allowed to thaw. The freezing and thawing process is repeated several times during the same treatment session in order to kill the cancer cells.
Radiofrequency ablation. This treatment uses electrical energy to heat cancer cells, causing them to die. During radiofrequency ablation, a doctor guides a thin needle through the skin or through an incision and into the cancer tissue. High-frequency energy passes through the needle and causes the surrounding tissue to heat up, killing the nearby cells.
Clinical trials. Clinical trials are studies to investigate new ways of treating cancer. Thousands of cancer clinical trials are underway.

CHAPTER XVIII: CHIKITSALAYA BHAVANA / HOSPITAL BUILDING

❖ Charaka Samhita, Sutra Sthana, Adhyaya 15

Architect should construct a building which has the following features:
Drudha (strong), Nivata (not exposed to excessive wind), Pravata Eka Desha (entry of wind from one direction only), Sukha Pravichara (comfortable space to move), Anupatyaka (not situated near mountain or large buildings), Anabhigamaniya (should not be exposed to) Dhuma, Atapa, Jala, Rajas (dust) & undesirable Shabda, Sparsha, Roopa, Rasa, Gandha.

The building should have following arrangements:
Upadana (water reservoir), Udukhala (mortar), Musala (pestle), Varcha Sthana (latrine), Snana Bhumi (bath room), Mahanasa (kitchen)

❖ General Structural Standards for Ayurvedic Hospitals

No. of treatment rooms – (No. of treatments depends on type of treatment; e.g.: Basti takes less time than Vamana)	Max. 15 treatments / Day / Treatment room
No. of consultation rooms	Max. 25 consultations / Day / Consultation room
Consultation & Examination room	Min. 10 ft. x 10 ft.
Pharmacy / Dispensary Specialty	Min. 10 ft. x 10 ft.
Medical Stores Specialty	Min. 100 sq. ft.
Medicine preparation area	Min. 100 sq. ft.
Kitchen	Sufficient size to prepare food for inpatients as per diet advised by the physician or dietician
Waiting area	Min. 100 sq. ft. per 10 beds
Office area with enquiry counter, cash counter and record area	Min. 100 sq. ft. per 10 beds

Circulation areas	Corridors / Stairs / Lifts / Ramp etc. Min. 200 sq. ft. per 25 beds
Water supply	Around the clock availability for patients Min. 200 litres / Day / Bed
Electricity	At least 3 hours backup or generator for critical areas
RMO (Resident Medical Officer)	To be present
RMO Quarters	Min. 1 room with attached bathroom Approx. 200 sq. ft.
Nursing station / Duty room	One nursing station / Room / 10 Beds Approx. 200 sq. ft.
For out-patient department: - No. of wash basins - No. of water closets	 - 1 for every 50 persons - 1 for every 40 beds
For in-patient department: - No. of wash basins - No. of water closets - No. of bathrooms	 - 1 for every 12 persons - 1 for every 6 persons - Min. 1 bathroom / 6 Beds
Average size of toilet	Each therapy room – 3.5 sq. m.
Space between 2 rows of beds in a ward	Min. 5 ft.
Distance between 2 beds	Min. 3.5 ft.
Size of hospital bed	Min. 6 x 3 ft.
Area per bed	Min. 50 sq. ft. / Bed
Nurses to beds ratio	1 for every 10 Beds
Panchakarma Technician / Assistant / Therapist	Min. 2 per treatment room; male and female separate; the technician / assistant / therapist should have passed min. 3 months course training in Panchakarma.
Panchakarma Attendant	Min. 1 per treatment room; male and female separate