

Diseases and First Aid

Diseases and their Causes

Solved Examples

Medium

Example 1:

Can you explain the difference between a healthy and a disease-free state of the human body?

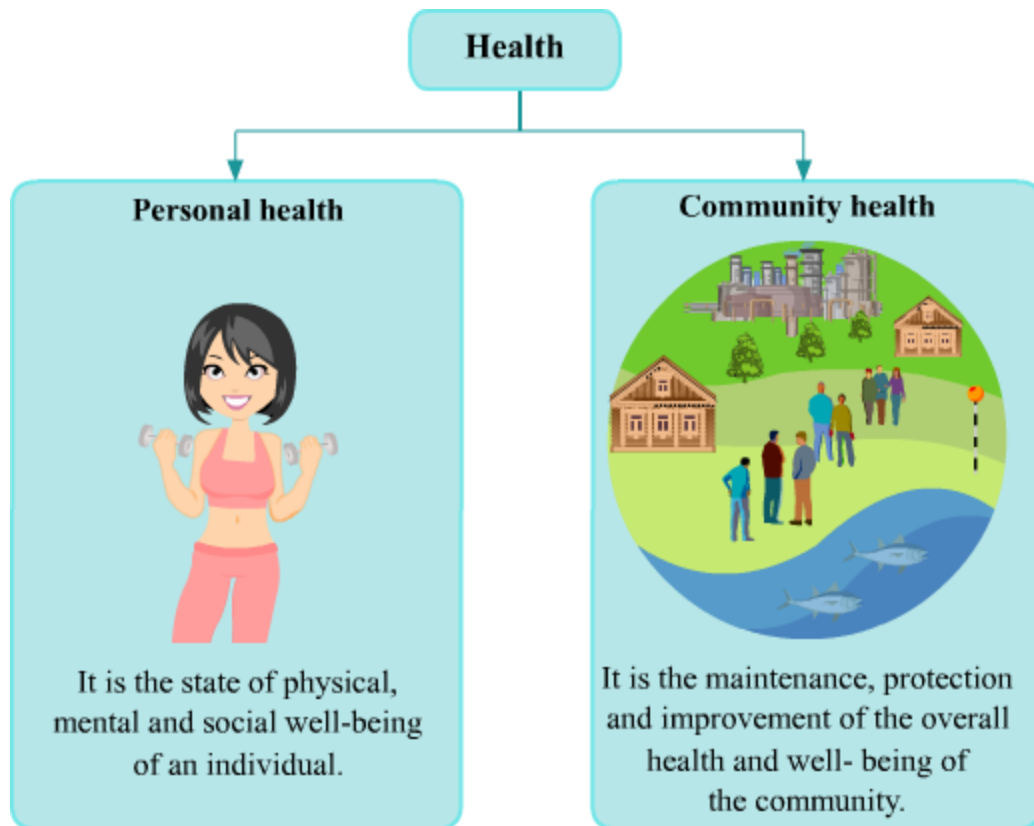
Solution:

The state of not having any **disease** is not the same as being healthy. Good **health** is the ability of an individual to realize his or her full potential. Consider, for example, an athlete who is tired after running about hundred metres. The athlete cannot be called a diseased person. However, he is not healthy either. Therefore, one can have poor health without having any identifiable disease.

Types of Health



Personal Health and Community Health



Did You Know?

- The word 'hygiene' is derived from the Greek word 'Hygieia'. In Greek mythology, Hygieia is the goddess of health, cleanliness and sanitation.

Concept Builder

Personal hygiene

Here are certain healthy habits that we all must follow to maintain personal hygiene.

- Bathing regularly to remove sweat and dirt
- Washing hands before eating
- Keeping our nails clean
- Brushing teeth after every meal

Community or social hygiene

Here are some of the steps that need to be taken to ensure effective social hygiene.

- Making provisions for clean drinking water
- Making provisions for family welfare education
- Establishing healthcare services

- Making provisions for proper waste disposal and sanitation facilities
- Controlling diseases by providing vaccination, medical aid and medicines

Solved Examples

Medium

Example 2:

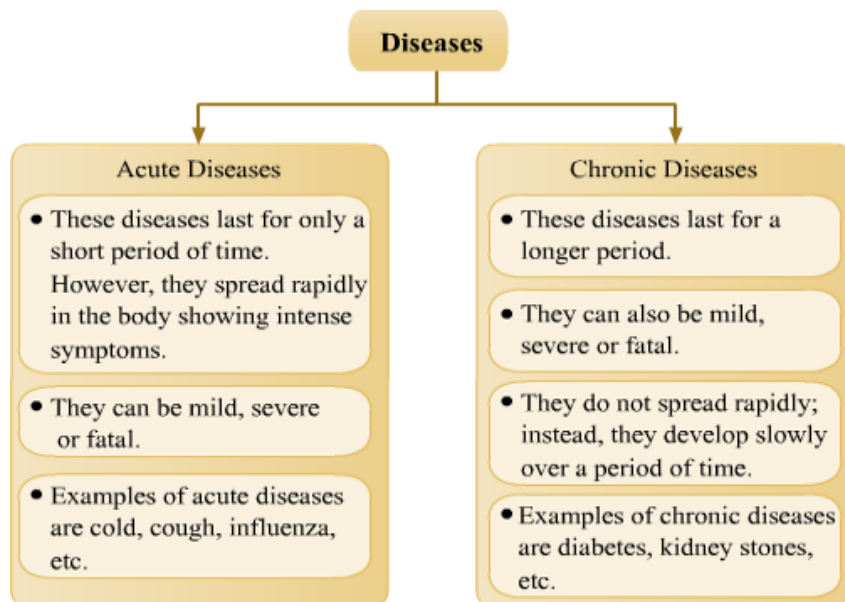
Why are social equality and harmony necessary for good personal health?

Solution:

Social equality and harmony are important for good personal health. Social equality means equal access to education, hygienic environment, health facilities, etc. Social harmony refers to the peaceful interactions between the various individuals and groups constituting the society. Individual health prospers when conditions for social equality and harmony are present. This in turn adds to the overall health and well-being of the community.

Disease

Disease refers to any disorder of structure or structural function in an organism. Such disorders produce specific signs and symptoms. Diseases are basically characterized by disturbance in normal body functions. On the basis of time duration, diseases can be classified as **acute** disease and **chronic** disease.



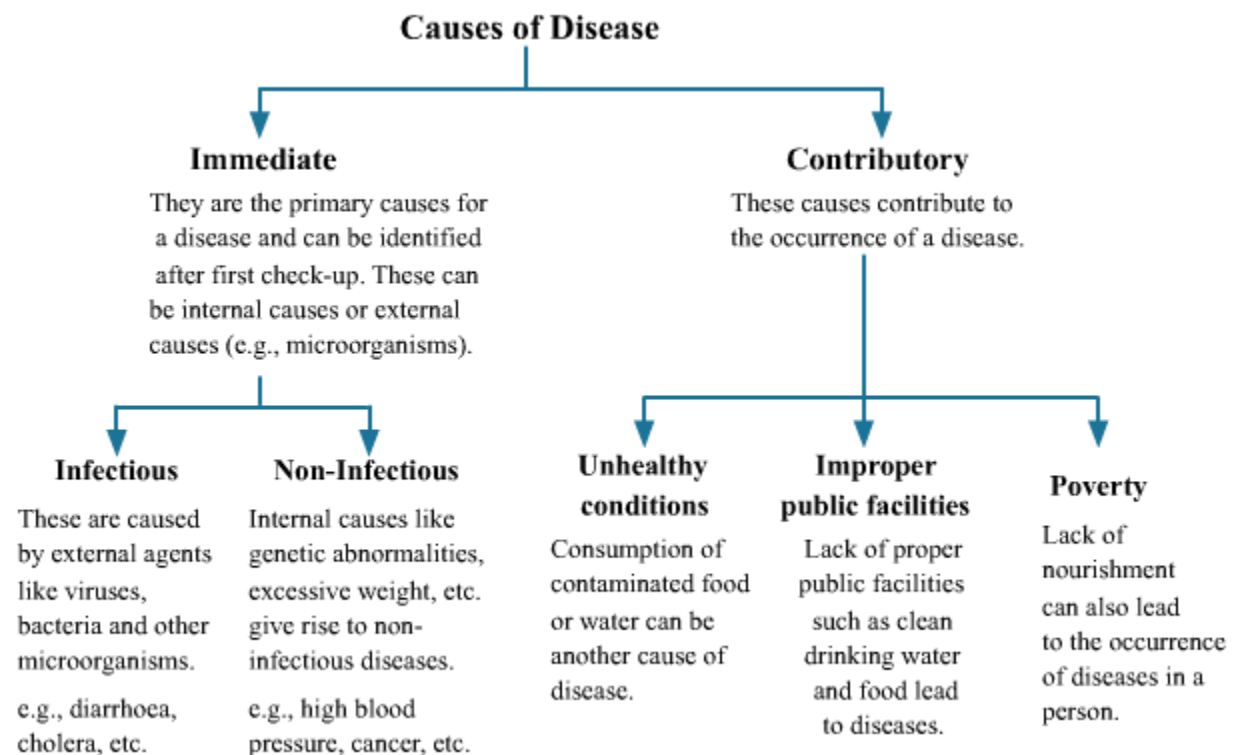
This is the reason why some people get diseases only for a short period and some people suffer from a particular disease throughout their lifetime.

Did You Know?

According to WHO, chronic diseases are responsible for 60% of all deaths worldwide.

Causes of Disease

There can be a number of causes for disease. These are broadly divided into **immediate** causes and **contributory** causes (as is shown in the figure).



Solved Examples

Medium

Example 3:

A number of children consume contaminated food and water. Yet, only some get diarrhoea while the others remain disease-free. Why is this so?

Solution:

This happens because of the difference in the levels of **immunity**. A **healthy body** or a well-nourished body is less likely to catch a disease when exposed to disease-causing agents. This is because it has a strong **immune system**. On the other hand, a poorly nourished body will easily become diseased due to its weak immune system.

Diseases and Their Causes

Infectious and Non-Infectious Diseases

Health and Diseases

We often describe 'health' as a state of a person who is free from any kind of disease. However, it is an incomplete definition of health. A person need not only to be free from any physical disease, but he must also have a sound mind to be called a healthy individual. So we can define health as a state of complete physical, mental and social well-being.

The word disease is derived from two words 'disturbed ease'. It may be defined as any condition that can lead to discomfort, distress, health problems, and even death of the affected person. In this condition, a part of body is no longer healthy or it is malfunctioning.

Acquired and Congenital Diseases

Acquired diseases

Diseases acquired by individuals during their lifetime are called acquired diseases. Such diseases are mostly non-inheritable. They can be classified as follows:

1. Infectious diseases
2. Non-infectious diseases

Non-infectious diseases are of the following types.

- **Degenerative diseases:** These are caused by the malfunctioning of vital organs. Examples include diabetes and cancer.
- **Deficiency diseases:** These are caused by the deficiency of one or more nutrients. Examples include night blindness, marasmus and anaemia.
- **Allergy:** These are caused due to hypersensitivity towards certain substances, e.g. dust, pollen, etc. Asthma and hay fever are two such diseases.

Congenital diseases

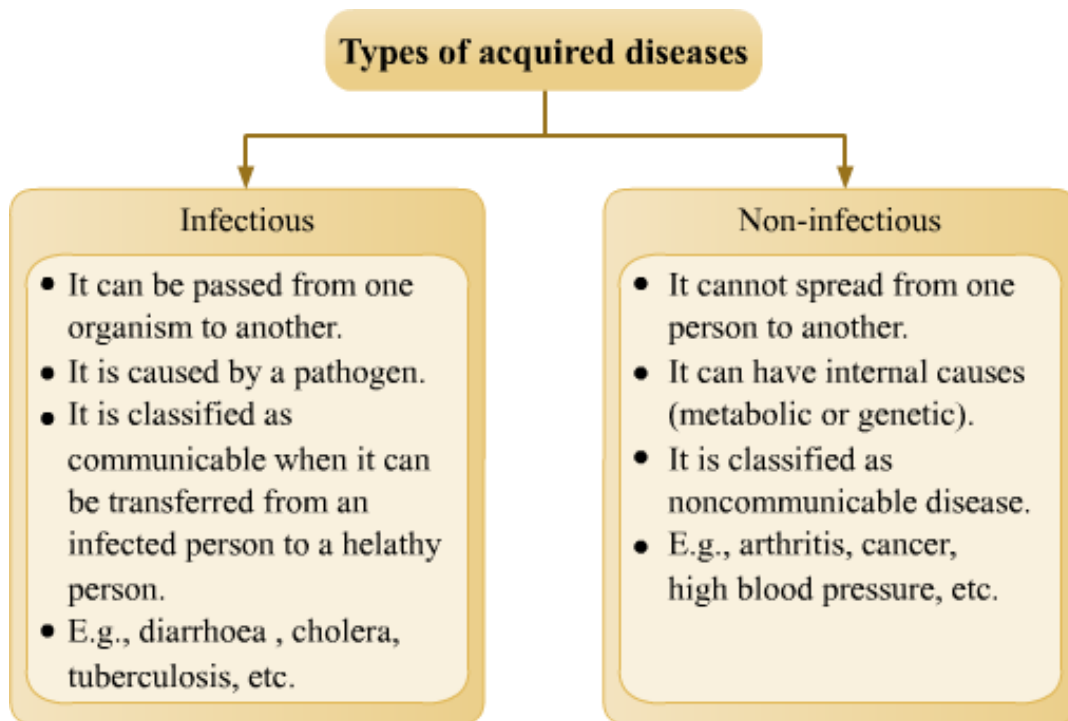
Diseases that are present in individuals from birth are called congenital diseases. They may be caused due to some mutations or metabolic disorders. They are often inheritable. Examples of such diseases include various genetic diseases such as **haemophilia**, autism, sickle-cell anaemia, Klinefelter's syndrome and Turner's syndrome.

Know More

On the basis of spread of disease, diseases are classified in the following manner.

- **Endemic diseases:** An endemic disease is one that is constantly present in a particular region and affects some people in that region. Goitre, for example, is endemic to the north-eastern hills of India, mainly because the water present there lacks iodine.
- **Epidemic diseases:** An epidemic disease infects a large proportion of a country's population, irrespective of the regions. Plague, for example, affected a large proportion of India's population in 1994.
- **Sporadic diseases:** Such diseases occur occasionally. Malaria is a sporadic disease.
- **Pandemic diseases:** Such diseases occur worldwide. AIDS is a pandemic disease.

Types of Acquired Diseases



All communicable diseases are infectious, but all infectious diseases are not communicable.

Types of Diseases

Non-infectious Diseases

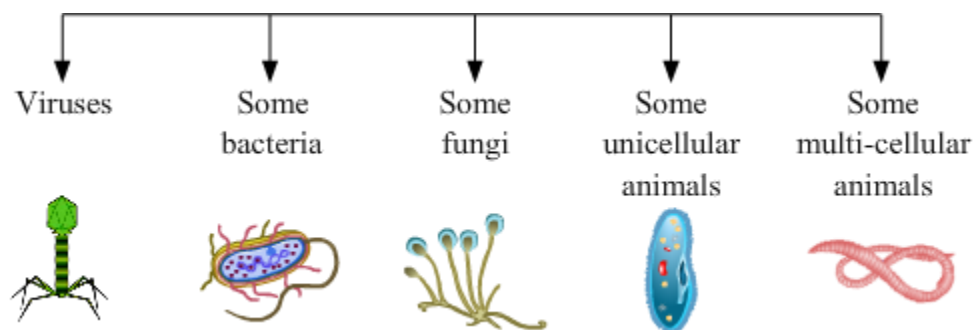
Non-infectious or non-communicable diseases can occur due to a number of reasons.

- **Genetic disorders:** Diseases that are caused by changes in the genetic makeup, or DNA of an individual. These diseases may get passed on from parents to their children. Examples include haemophilia and thalassaemia.
- **Dietary deficiency diseases:** These diseases are caused due to deficiency of some important dietary components in our body. These nutrients are highly important for normal growth and development of our body, and thus their lack can result in diseases.
- **Allergy:** Allergy refers to a sudden, unpredictable reaction of body to any particular substance, or **allergen**. Some common allergens include dust, pollens, spores, certain medicines, cosmetics, etc. These allergens most commonly affect the skin, respiratory system, digestive tract, eyes, etc.
- **Diseases caused by physical and chemical agents:** Heat stroke or sunburn can be caused by the physical agents. Some diseases may also be caused by chemical agents, such as mercury, lead, potassium cyanide, etc.

Infectious Agents

Infection: It may be defined as the entry and multiplication of disease-causing microorganisms inside the body. It may or may not lead to a disease. Diseases caused due to such disease-causing microorganisms are known as infectious diseases.

Infectious agents/ Pathogens: They are the disease-causing microorganisms which show **virulence**. They belong to different categories.



Infectious Agents: Viruses

Viruses: They are very tiny organisms and are visible only with the help of an **electron microscope**. They cannot grow, multiply or reproduce on their own. They need to infect a host cell to get the required machinery to perform these functions. The genetic component of a virus may be made of **DNA** or **RNA**. RNA-containing viruses are called retroviruses.

- Examples of RNA viruses include SARS virus (Severe Acute Respiratory Syndrome-causing virus), polio virus, influenza virus, hepatitis C virus, retrovirus (example, HIV).
- Examples of DNA viruses include bacteriophage (virus that infects bacteria) and herpes virus.

Viron: A virion is a single viral particle consisting of an outer protein shell (called capsid) and an inner core of genetic material (either DNA or RNA).

The smallest known virus is *Circovirus* and the biggest known virus is *Megavirus*.

Infectious Agents: Bacteria and Fungi

Bacteria: Bacteria are unicellular **prokaryotic** organisms. They reproduce very quickly. They are larger than viruses. Only some bacteria cause diseases; others are useful in nature.

- Examples of diseases caused by bacteria include whooping cough, typhoid, cholera, anthrax, tuberculosis, diarrhoea, diphtheria, tetanus, syphilis, **gonorrhoea**, dysentery, plague and acne.

Fungi: They are **eukaryotic** organisms and are **heterotrophic** in nature, i.e., they lack chlorophyll. They are mostly multicellular and have thread-like bodies.

- Examples of diseases caused by fungi include athlete's foot, **candidiasis** and ringworm.

Not all bacteria are harmful for humans. In fact, the disease causing bacteria are less than 1%. Some bacteria that live in our body are actually good for us. For example, *Lactobacillus acidophilus* is a harmless bacterium that resides in our intestines. It helps us digest food, destroys some disease-causing organisms and provides nutrients to our body.

Infectious Agents: Other Unicellular and Multicellular Organisms

Protozoa: They are simple, eukaryotic, unicellular organisms. *Amoeba*, *Trypanosoma* and *Leishmania* are examples of protozoa. They often spend part of their life cycle outside of humans or other hosts. Most of them are

found in water as they require moisture for survival. Some live in other sources like food and soil.

- Examples of diseases caused by protozoa include amoebiasis, kala azar, malaria and African sleeping sickness.

Multicellular animals (e.g., worms): Worms are parasites that infect the intestines of human beings and animals. Roundworms, pinworms, hookworms and tapeworms are some examples of disease-causing worms.

- Examples of diseases caused by worms include diarrhoea, taeniasis (by tapeworms) ascariasis (by roundworms), elephantiasis (end stage of filariasis), anaemia and liver rot.

Know More

Why do we have to identify the causal agent of a particular disease? Is there any advantage in having information about the disease-causing organism?

The type of causal agent of a disease determines the type of treatment that can be used for curing the disease. Since all microorganisms are different in structure, a medicine or drug manufactured to disrupt the structure/function of one microorganism may not have any effect on another microorganism.

For example, the common **antibiotic** penicillin blocks the synthesis of the cell wall in bacteria. Therefore, this antibiotic can be used effectively against a large number of bacteria. However, it cannot be used on other microorganisms like viruses.

Pathogens and Infectious Diseases

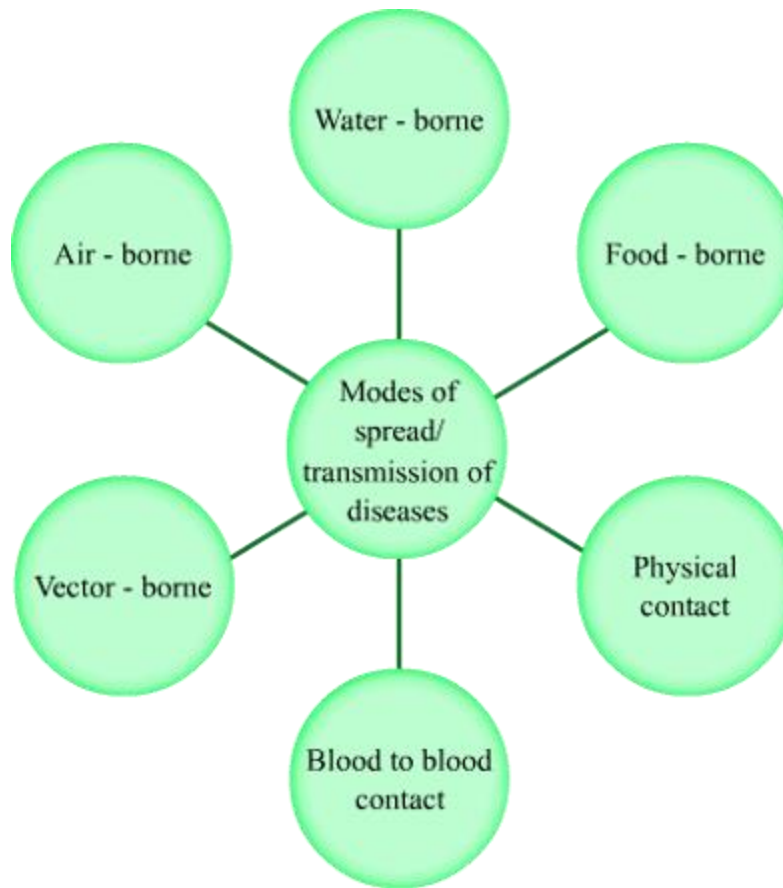
Life Cycle of Plasmodium

Modes of Transmission of Diseases

Transmission of Diseases

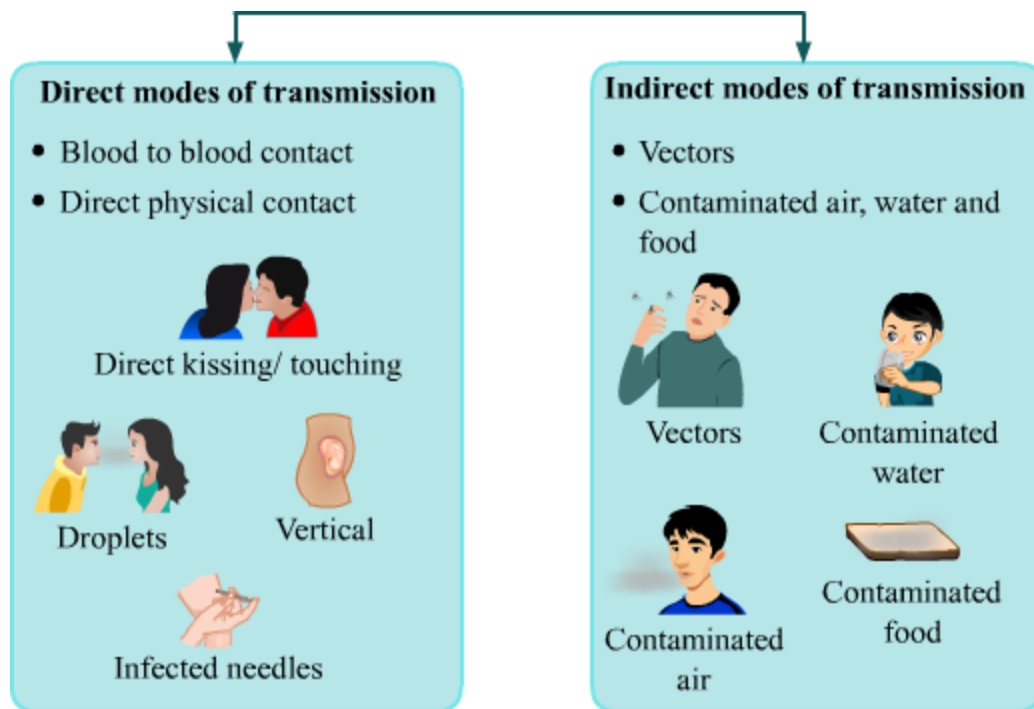
We use various means of transport to travel from one place to another. In the same way, pathogens causing infectious diseases also use certain means of transport (or to be more specific, modes of transmission) such as air, food and water to enter the bodies of living organisms.

Infectious diseases are caused by microorganisms such as bacteria, viruses, etc. that get into the body and cause problems. Some — but not all — infectious diseases spread directly from one person to another. Such diseases are called communicable diseases.



Diseases: Modes of Transmission

The modes of transmission of diseases are categorized as:



Pathways to Pathogens: Direct ways

Blood to blood contact: This type of contact is established –

- through blood transfusion
- by the use of contaminated needles
- during pregnancy (between the mother and the foetus)

Note: AIDS is a disease that spreads through sexual contact and also via blood to blood contact.

Sexual contact: The sexual act involves close contact between two people. This may lead to the transfer of diseases such as syphilis, gonorrhoea and AIDS. These diseases are known as *sexually transmitted diseases*. Note that casual physical contact such as handshaking, hugging and kissing do not lead to the transfer of these diseases.

Direct contact: Certain diseases spread when one comes in contact with the diseased person or on using the articles used by him. Swine flu, athlete's foot, ringworm, conjunctivitis and German measles are diseases that spread in this manner.

Whiz Kid

Do you know why most newborn babies suffer from jaundice?

While in the womb, the foetus relies on RBCs for oxygen supply. After birth, these extra RBCs get broken down and the liver changes the wastes into water-soluble products.

However, when this does not happen, the waste products (yellow in colour) attach to the fatty tissues of the skin and brain of the baby. This is one of the reasons why most newborn babies suffer from jaundice.

Pathways to Pathogens: Indirect ways

- **Air:** Disease-causing microorganisms can be expelled into air when a diseased individual coughs, sneezes, talks, etc. The dust particles or water droplets present in air carry these microorganisms to other people. Diseases caused in this way are called *airborne diseases*. Common cold, chicken pox, small pox, pneumonia, influenza and tuberculosis are examples of such diseases.
- **Water and food:** When the excretions from an infected person get mixed with drinking water, the water becomes contaminated with disease-causing microorganisms. Diseases are caused when this contaminated water is consumed by other individuals. Such diseases are called *waterborne diseases*.

Any food prepared using this same water can also cause diseases when consumed. These diseases are known as *food-borne diseases*. Food and water can also be contaminated by various insects like mosquitoes, houseflies, cockroaches, etc. Examples of such diseases include cholera, typhoid and hepatitis A.

- **Vectors:** These are organisms that carry disease-causing microorganisms from an infected person to others. Though a vector carries pathogens, it itself is not infected by them. Diseases spread through vectors are known as *vector-borne diseases*. Examples of such diseases include malaria, filariasis, dengue, rabies and plague.

Malnutrition and Deficiency Diseases

Malnutrition is defined as the lack of sufficient food or the non availability of proper nutrients in the food we consume or the physical inability to absorb and metabolize the nutrients.

It can be classified into-

Under nutrition: this condition results when there is insufficient amount of food consumed over a period of several days. It is also known as starvation. It affects the physical and mental abilities of the person.

Over nutrition: it is caused by the over consumption of food over extended period of time. It may lead to a condition called obesity.

Deficiency Diseases

Diseases that occur due to the lack of nutrients are called **deficiency diseases**. Deficiency diseases can be of various types:

Vitamin Deficiency

Vitamins are needed by the body in small amounts yet their deficiency leads to various deficiency diseases. Vitamins are of two types – fat soluble (vitamins A, D and K) and water soluble (Vitamin B and C).

If taken in excess, the water soluble vitamins are excreted with the urine but if fat soluble vitamins are taken in excess, they are not excreted easily and harm the body and cause restlessness and nausea.

The sources, uses and associated deficiency diseases for various vitamins are given the following table

	Vitamin	Sources	Essential for	Deficiency disease
1.	Vitamin A	Milk, butter, cheese, tomatoes, carrots, cod liver oil, yellow fruits	Good eyesight	Night-blindness (poor night vision)
2.	Vitamin B complex (mixture of several vitamins)	Milk, eggs, cheese, meat, liver, husk of cereals and pulses	Digestion, growth	Beri-beri (nervousness, loss of appetite, paralysis)
3.	Vitamin C (ascorbic acid)	Citrus fruits (orange, lemon, lime), green vegetables, tomatoes	Muscles and teeth	Scurvy (bleeding of gums and swelling of joints)
4.	Vitamin D (produced by sun in skin)	Milk, yellow of egg, liver, fish liver oil, especially sunlight, cod liver oil.	Strong bones and teeth	Rickets (decaying teeth, weak bones) in children and osteomalacia in adults
5.	Vitamin K (made by bacteria in large intestine)	Leafy green vegetables (spinach, cabbage)	Blood clotting	Haemorrhage (bleeding)

Mineral Deficiency

Some important sources of minerals are vegetables, spices, and fruits. Though they are needed in small quantities, they are indispensable for proper growth of the body and to protect the body from various diseases.

The detail information on various vitamins is given in the following table

	Chemical element	Sources	Functions	Deficiency effect/disease
1.	Calcium	Cheese, milk, green leafy vegetables, pulses, eggs, meat	Bone and teeth formation, blood clotting, Muscle activity	Rickets , Brittle bones, excessive bleeding, bad muscle movement
2.	Phosphorus	Fish, eggs, meat, milk, cheese, potatoes	Bone and teeth formation, nucleic acid formation, energy transfer, ATP	Bad bones and teeth body weakness
3.	Potassium	Beef, eggs, milk, cheese, potatoes	Osmocontrol-blood and tissue fluid, nerve impulse conduction	Muscle weakness and paralysis
4.	Sodium	Salt, cheese, bread, butter	Osmocontrol-blood and tissue fluid, nerve impulse conduction, Gastric juice, HCl acid	Dehydration, extreme weakness
5.	Magnesium	Cheese and green vegetables	Energy transfer, bone and teeth formation	Activity of muscles and nerves, weakness
6.	Iron	meat, liver, eggs, green leafy vegetables	Blood haemoglobin formation, Muscle myoglobin formation, Enzyme activity	Anaemia
7.	Iodine	Sea fish, iodised salt	Thyroid gland function	Goitre (enlarged thyroid), abnormal metabolism
8.	Fluorine	Sea fish, tea, and some drinking water	Bone and teeth formation	Dental cavities

Protein and Carbohydrates/Energy (Calorie) Deficiency

There are certain diseases which are caused due to the deficiency of proteins or proteins and energy (calories). These are termed as Protein Energy Malnutrition (PEM). Deficiency of proteins leads to Kwashiorkor whereas deficiency of proteins and carbohydrates/calories/energy leads to marasmus.

The diet that is poor in proteins lead to a disease called **kwashiorkor** in which the growth of the infant is retarded. This disease affects the children in age group of 1 to 5 years. The symptoms of this disease are

- Stick like thin legs
- Protruding belly
- Water retention
- Bulging eyes
- Discolouration of hair
- Mental retardation

The deficiency of both proteins and carbohydrates in the diet leads to a condition called **marasmus**. It occurs when the child under the age of one year does not get sufficient food. The symptoms of marasmus are as follows

- Lean and weak body
- Prominent ribs
- Dry, thin, wrinkled skin with folds of loose skin.
- Mental retardation

Do you know that improper cooking methods such as cooking in iron vessels, overcooking, and boiling can lead to the loss of taste and nutrients from vegetables?

This happens because during cooking, some volatile acids and gases are released from the vegetables. These acids and gases spoil the taste and look of the food.

Hence, cooking should be fast to prevent the loss of taste and look of the food.

- Repeated washing of rice, pulses, and some fruits should be avoided as the vitamins and minerals present in them may also get washed away.
- The skins of many fruits and vegetables contain vitamins and minerals. Hence, they should not be peeled before eating.
- Vegetables and fruits should not be washed after they have been cut or peeled.
- Water (in which grains are soaked) should not be thrown away as it contains many useful proteins and minerals.

Therefore, the loss of nutrients while preparing food can be minimized by keeping the above mentioned points in mind.

Degenerative Disease

Some non-communicable diseases are caused by degeneration or malfunctioning of certain body parts such as heart, pancreas, eye lens, etc.

Diabetes

In our body, hormone insulin is secreted by special cells called Islets of Langerhans present in the pancreas. When these cells do not manufacture enough insulin, the level of glucose rises in the blood.

The blood has excess of glucose, but other tissues lack glucose. The level of sugar becomes so high in the blood that sugar is passed out along with urine and sugar can be detected in urine test. Diabetes can be caused by reasons like obesity, lack of physical exercise, mental stress. It can also be hereditary i.e. it can be passed on through generations.

Symptoms of diabetes are excessive urination, excessive thirst, fatigue, and weight loss.

Diabetes can be controlled by proper treatment in the form of insulin injections, anti-diabetic pills, and by controlling diet.

Arthritis

Arthritis is a disease associated with joints. It occurs mainly in elderly age, but sometimes even people below the age of 25 years suffer from it. Arthritis is of two types.

Rheumatoid Arthritis: In this, swelling pain and stiffness occur in the joints, especially the middle joints of finger, and the joints twist into various shapes. The patients do not recover entirely from the disease, but further deformation can be prevented by proper rest, physiotherapy, and diet control.

Osteoarthritis: It leads to knob-like enlargements of the end and middle joints of the fingers. It normally occurs beyond middle age.

Cancer

Cancer is the uncontrolled growth of cells in the body. The growing mass of cancerous cells is called a **benign tumour**. Cells from a tumour break off from the site and travel to other regions of the body and develop a cancer there also. Such tumour is called **malignant tumour** and leads to cancer.

The cause of cancer may be various, ranging from genetic predisposition, radiation, and smoking to exposure to certain carcinogenic chemicals.

Symptoms of cancer depends on the type of cancer. For example, chronic cough, hoarse voice, difficulty in swallowing are symptoms of mouth or throat cancer, lump in breasts is a symptom of breast cancer.

Kidney Malfunction

The main function of kidneys is to remove waste and toxic products from the body through urine formation. If the kidneys do not work properly, then the waste products are not removed from the body. Once the wastes pile up, they prevent the removal of other wastes also.

This condition is called uremic poisoning or uremia. In uremia fever, chills and extreme fatigue occurs. Finally brain cells are affected and the person falls into coma.

Allergy

Allergy is the unusual hypersensitivity of body tissues to certain substances. The substances that bring about this hypersensitivity are called **allergens**. Allergens may be certain foods, drugs, cosmetics, dust, pollens, etc.

Reactions to allergies range from mild to severe. Mild allergic reactions result in itching, swelling of skin, and redness while in a severe allergic reaction, there could be collapse of circulatory system, heart failure, or even death.

Examples of allergic reactions:

- Feeling of nausea and vomiting on eating certain foods
- Asthma in which a person becomes allergic to pollens, dust, certain eatables, and changing season

Heart Diseases

Diseases in which heart and blood vessels are affected are referred to as heart diseases. There are various reasons which can lead to heart diseases like smoking, alcoholism, diabetes, hypertension, obesity, lack of physical exercise, mental stress, anxiety etc.

Coronary Heart Disease

In this, the supply of blood to heart muscles is reduced. The blood vessels that supply blood to heart muscles are coronary arteries. When they harden due to deposition of

cholesterol, the blood supply to heart muscles is stopped and the heart does not get enough oxygen.

Atherosclerosis

In this disorder, the inner lining of arteries becomes hard, thick, and rough due to deposition of cholesterol on them. This reduces the flow of blood and raises the blood pressure.

Heart Attack

Heart attack is the term used to describe a situation in which the blood supply to a certain part of the heart is greatly reduced. The changes in coronary arteries over a long period of time lead to a sudden heart attack.

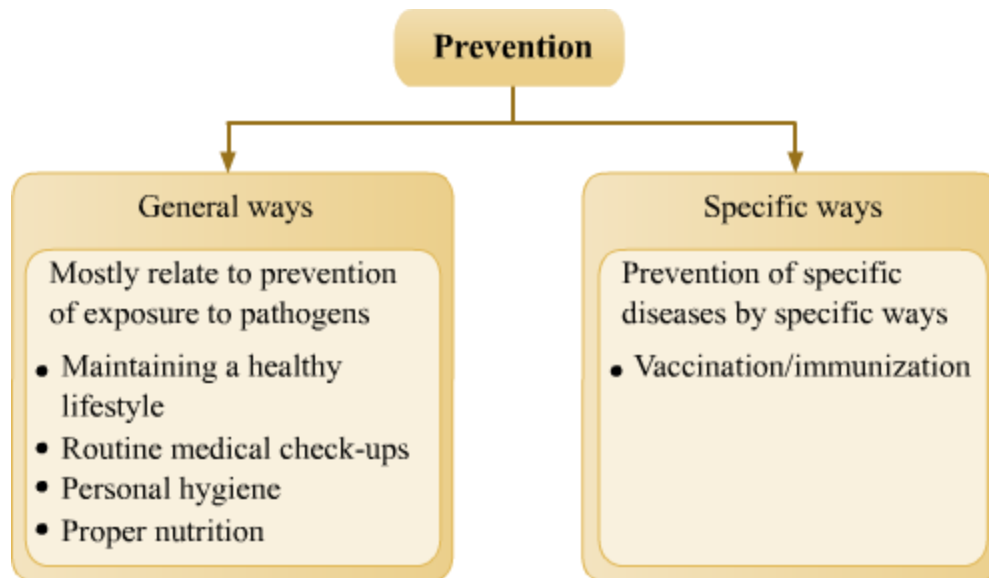
Pain under the breast bone extending to arms, throat, or back and feeling of great pressure in the chest are the symptoms of heart attack.

Always remember that the initial few minutes after a heart attack are extremely crucial to save the life of a patient. Appropriate first aid may save the life of the person. You can perform C.O.L.S (Compression Only Life Support) on the patient. In this method, you have to press the thorax for at least 30 times at the rate of 100 to 120 strokes per minute.

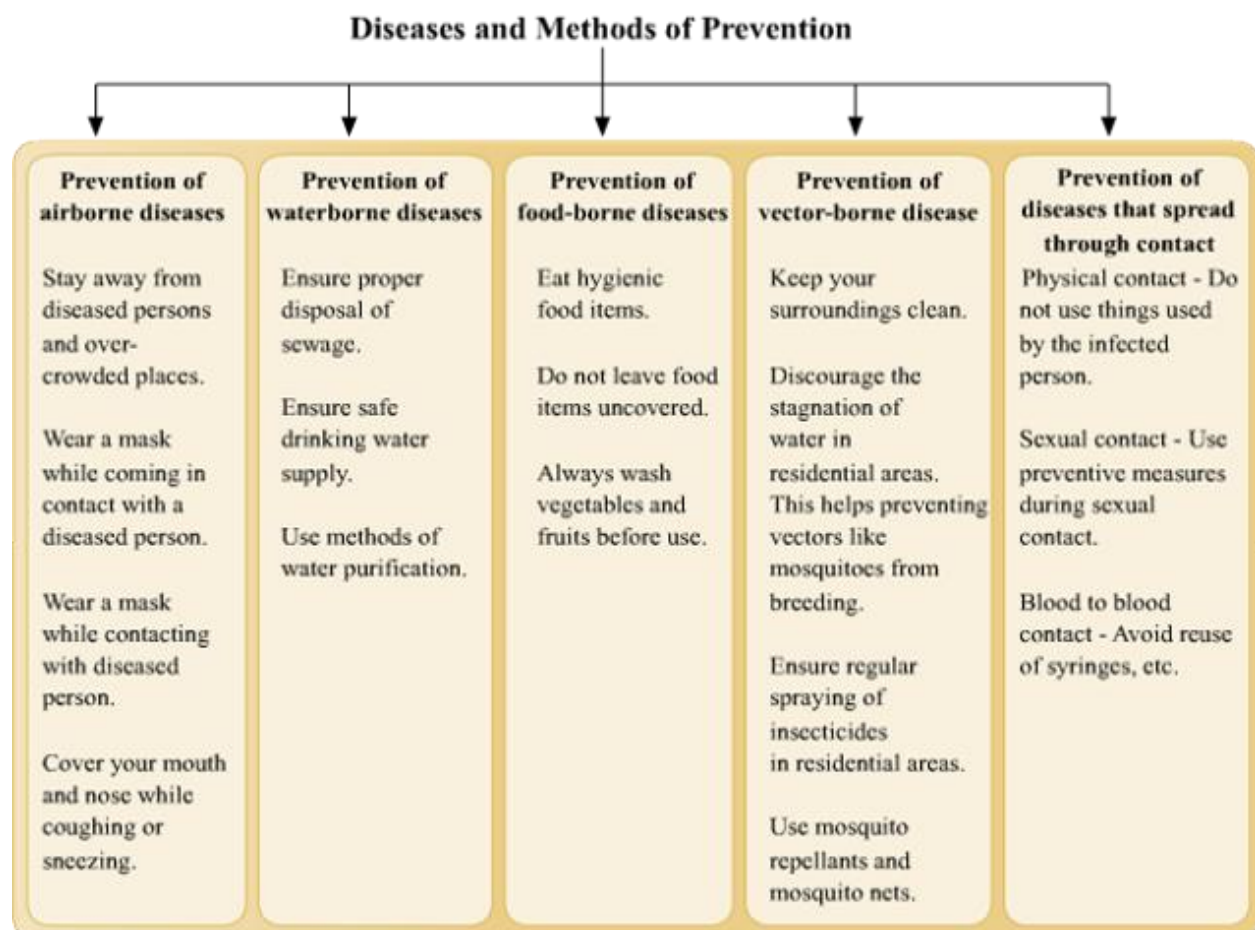
Treatment and Prevention of Diseases

Disease Prevention

Disease prevention refers to certain measures which should be taken so as to lower our chances of getting diseased. Broadly speaking, there are two ways of preventing diseases.



General Methods of Disease Prevention



Disease Prevention Through Vaccination

Certain diseases need specific methods of prevention, i.e., vaccination. You must have seen on television or read in the newspapers about the Pulse Polio day, when children in the age group of 0–5 years are given the polio vaccine. **What is a vaccine? What is meant by the term vaccination? And what is the difference between vaccination and immunisation?**

Vaccination is defined as the protection of the body from infectious diseases by the administration of some agents that **mimic** disease-causing microbes. The agents can be **suspension** of killed or **attenuated** microbes, or substances that mimic the disease-causing germs.

These agents are known as **vaccines**. They make the body produce antibodies. The antibodies remain in the blood for a long duration. When the disease-causing germs enter the body a second time, the antibodies destroy them.

Immunisation is the process whereby an individual's immune system is **fortified** against an infectious agent. This immunity can be achieved through artificial means such as vaccination.

Did You Know?

Passive immunisation is the immunity provided by the direct administration of ready-made antibodies to protect the body against foreign agents. The transfer of antibodies during pregnancy, from the mother to the foetus through the placenta, is an example of passive immunisation. Feeding a baby with mother's milk is another example of the same.

Mother's milk is considered very essential for infants. The yellowish fluid **colostrum**, secreted by a mother during the initial days of lactation, has abundant antibodies to protect an infant.

Principle of Vaccination

Vaccination is based on the specific way in which the immune system defends the body. When the immune system encounters a pathogen for the first time, it reacts against it and remembers it.

Consequently, if the same pathogen strikes again, the immune system reacts strongly to prevent the body from becoming diseased by the infection again. For example, if a child has suffered from measles once, then there is almost no chance of the child suffering from it again.

It logically follows that if we infect the body with something that mimics a pathogen, then the immune system will remember it and prevent the actual pathogen from causing any disease. This forms the basis of vaccination.

Vaccines are available against many diseases; for example, tetanus, polio, measles, hepatitis A and B, whooping cough and yellow fever.

Solved Examples

Medium

Example 1:

A person shows certain symptoms like loss of appetite, severe coughing with bloody sputum, chest pain, fever.

1. **Name the disease the person is suffering from and its causative agent.**
2. **How does this disease spread?**
3. **What treatment should be followed?**
4. **What precautions should be taken to avoid the disease?**

Solution:

1. The person is suffering from tuberculosis. The causative agent of tuberculosis is a bacterium called *Mycobacterium tuberculosis*.
2. Tuberculosis (TB) is a communicable disease that spreads through inhaling the infected air during close contact with the person suffering from TB.
3. Person suffering from tuberculosis should be vaccinated with BCG (Bacillus - Calmette-Guerin) vaccine.
4. Person should avoid the company of people suffering from tuberculosis. Person should use protective measures such as face mask in the company of untreated TB people. Person should practise the healthy lifestyle to strengthen his/ her immune system to minimise the chances of getting this disease.

Hard

Example 2:

Both chicken pox and the common cold are viral infections. Yet why is that the former occurs only once during one's lifetime while the latter occurs several times?

Solution:

Chickenpox is caused by the varicella- zoster virus. It spreads through direct physical contact with the infected person as well as through droplet infection. If a person has

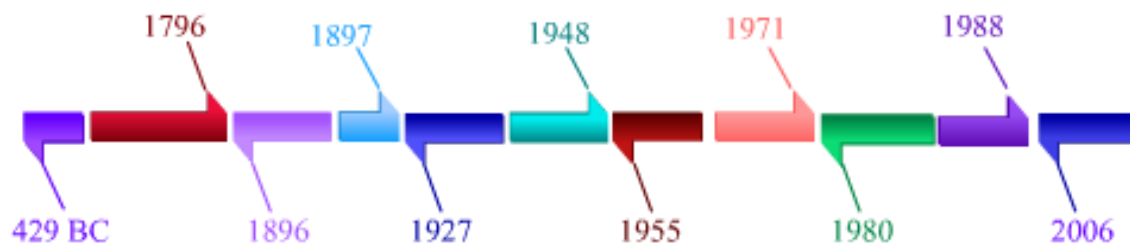
suffered from chicken pox once, then there is almost no chance of him suffering from it again. This happens because of the specific way in which the immune system defends the body.

When a pathogen (in this case, the chickenpox virus) attacks the body for the first time, the immune system reacts against it and remembers it. When the same pathogen strikes again, the immune system reacts strongly to prevent the body from becoming diseased by the infection again.

Common cold is also a viral disease. It is caused by rhinovirus. However, unlike the chickenpox virus, the virus causing common cold mutates at a very fast rate. This makes it difficult for the immune system to remember the common-cold-causing virus.

As a result, the immune system fails to prevent the virus when it infects the body next time. This is why the common cold occurs several times during one's lifetime.

History of Vaccination



429 BC: Thucydides, a Greek historian, notices that smallpox survivors do not get re-infected.

1796: Edward Jenner, an English doctor, invents the vaccination for smallpox.

1896: The vaccines for cholera and typhoid are developed using killed versions of bacteria.

1897: A killed vaccine for the plague is developed.

1927: The tetanus vaccine is developed.

1948: The diphtheria, tetanus and pertussis vaccines are combined into a single **DPT vaccine**.

1955: Polio vaccination begins.

1971: MMR vaccine becomes available.

1980: Smallpox is eradicated from the world.

1988: WHO targets for polio eradication.

2006: The hepatitis-A vaccine is added to the routine childhood immunization schedule.

Types of Vaccines

Vaccines can be prepared using any of the following four methods:

(1) Using killed germs: Vaccines can be prepared from dead causal germs, for example, Salk's vaccine for polio, TAB vaccine for typhoid, etc

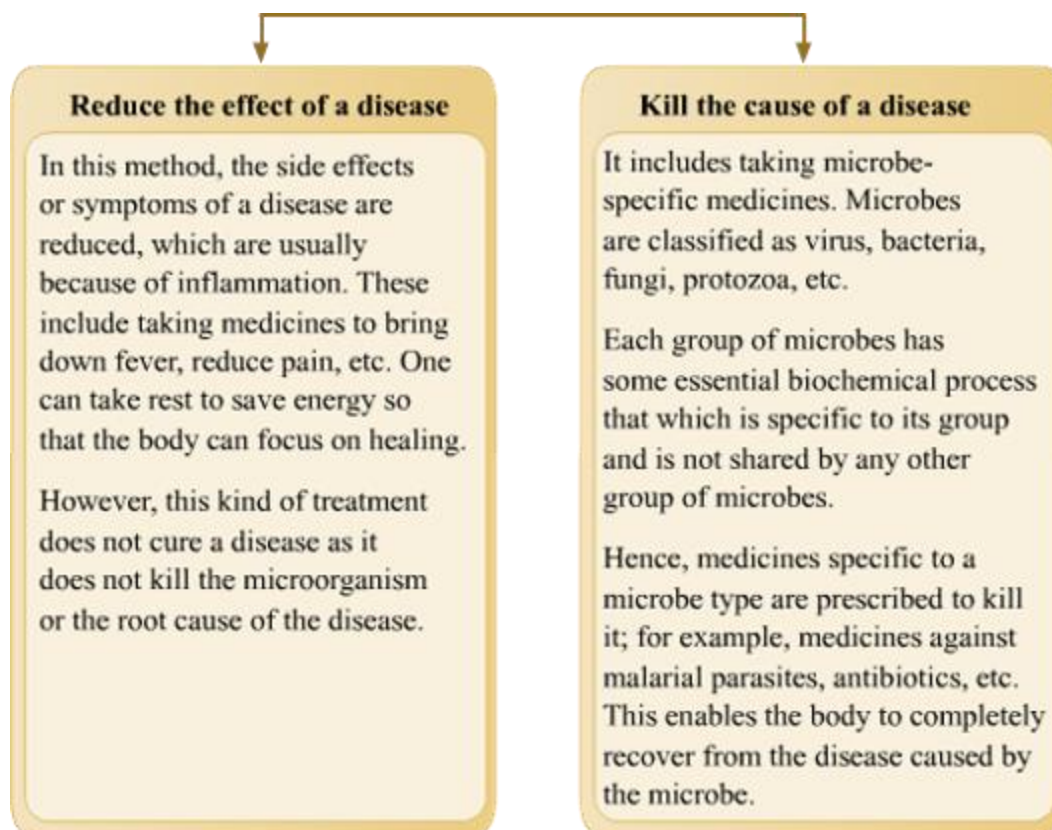
(2) Using living weakened germs: Vaccines can be prepared from living causal germs, but these germs are first treated to become very weak, so that they cannot cause any disease. Such vaccines can however induce antibody generation when entered into the body. Examples include vaccines for measles, and BCG vaccine for tuberculosis.

(3) Using living, virulent germs: In some cases, live and fully active (or pathogenic) germs are introduced into the body to induce antibody generation. For example, cowpox virus is inoculated as vaccine to induce antibodies against smallpox virus.

(4) Using toxoids: Toxoids are modified, inactive form of harmful toxins produced by bacteria. Although non-toxic in nature, these toxoids are capable of inducing antibody generation in body, and thus can be used as vaccines. Toxoid vaccines are used for diphtheria and tetanus.

Treatment of Diseases

Diseases might occur even after following different preventive measures. In such cases, the diseases need to be treated. A disease can be treated either by reducing its effect or by killing its cause.



Did You Know?

- About 90% of antibiotics are extracted from bacteria, fungi and moulds. The remaining 10% are produced synthetically.
- Antibiotics should not be taken unless prescribed otherwise bacteria can become resistant to them.

Concept Builder

Antibiotics and Their Working

An antibiotic is a drug that kills or slows the growth of bacteria. Antibiotics are a class of antimicrobials that also include antiviral, anti-fungal and anti-parasitic drugs. These are basically the chemicals produced by or derived from microorganisms. Certain antibiotics may be described as broad-spectrum, implying that they can get rid of infections caused by a wide range of bacteria.

Antibiotics work by killing the disease-causing agents (i.e., bacteria). They do this by interrupting the chemical processes used by bacteria to make their cell walls. For example, the antibiotic penicillin blocks the cell-wall formation in bacteria. Some antibiotics stop bacteria from growing and multiplying.

Solved Examples

Medium

Example 3:

Why can antibiotics be used effectively against a wide range of bacteria, but not against other microorganisms such as viruses?

Solution:

Antibiotics are drugs that kill or slow the growth of bacteria. In their action, they are selective only toward bacterial cells as they are produced by certain bacteria which limit the growth of other bacterial cells.

Further, they do not affect the host cells. Viruses become integrated with the host cells; so, antibiotics cannot target them. This explains why the use of antibiotics during the common cold does not help much.

If there is a bacterial infection along with the common cold, then the antibiotic will be effective only against the bacterial infection.

Do you know what are generic medicines?

Generic medicines/general medicines are manufactured and distributed without any patent. These medicines have lower prices as compared to the branded medicines but are at par in quality with them.

Their cost of production is low as their formula are readily available and fewer expenses are spent on their research.

Misuse of medicines:

Medicines are used in the treatment of diseases and they should only be consumed on the prescription of a doctor.

Overdose of medicines can harm our body. For example, overdose of painkillers may damage the nervous system, excretory system and liver whereas overdose of antibiotics may lead to stomach ache, nausea, dysentery, rashes etc.

Know Your Scientist



Edward Jenner (1749–1823) was an English doctor who invented the vaccination for smallpox. He is also known as ‘the father of immunology’. He was the first to develop vaccines, using living **virulent** organisms for smallpox.

In 1788, a smallpox epidemic occurred in Gloucestershire, England. Jenner observed that people who had previously suffered from cowpox (generally the milkmaids) were not affected by smallpox during the epidemic. In 1796, he carried out an experiment on an eight-year-old boy named James Phipps.

He deliberately infected the child with the cowpox virus. The boy recovered soon after a slight fever. Then, after a few weeks, Jenner infected the child with the smallpox virus and found that the boy remained healthy. This happened because the cowpox virus is closely related to the smallpox virus. Hence, the boy was provided immunity by the cowpox virus administered before.



Sir Alexander Fleming (1881–1955) was a Scottish bacteriologist who discovered a drug called penicillin in 1928. This drug was extracted from the fungus *Penicillium chrysogenum*.

Prevention Is Better Than Cure

You must have heard the old saying, ‘prevention is better than cure’. It is surely better to prevent a disease from occurring, rather than to cure it afterward. This is because it is

easier to stop something bad from happening in the first place, rather than to fix the damage later on.

Additionally, treatment measures can be difficult to deal with for the following reasons.

1. Diseases damage the functions of the body, which then takes a long time to become fully functional again.
2. Sometimes a prolonged treatment may be necessary. Consequently, the affected individual has to remain bedridden for a long time.
3. Even while being treated, diseased persons may spread the pathogens to others coming in contact with them.

Alcohol and Drug Abuse

The practice of intake of alcohol, drugs and tobacco is becoming very common among the youth. However, these products have very serious and deleterious health concerns.

- Tobacco: Smoking and chewing tobacco products have very harmful effects on our body. A person consuming these products is at a very high risk of various ailments, such as lung cancer, mouth cancer, heart attack, high pressure, etc. Non-smokers that regularly sit around a active smoker person and inhale tobacco smoke may also suffer from these diseases. Such phenomena is known as passive smoking.
- Alcohol: Alcohol consumption affects both physical and mental health. It causes damage to nervous system, kidneys, stomach and blood vessels. It also reduces self-control and impairs judgement. Excessive alcohol consumption causes liver damage.
- Drugs: Narcotic or psychotropic drugs are those that causes insensible conditions in human beings, for example, morphine, cocaine, opium, etc. These drugs adversely affect nervous system and other organs of the body. They may also cause heart and respiratory diseases. Most of them are highly addictive in nature and thus are hard to leave.

Bacterial Diseases

Diseases	Causative organisms	Symptoms	Transmission	Control and prevention
Tuberculosis	<i>Mycobacterium tuberculosis</i>	Weight loss, cough, fever, chest pain, breathlessness,	Droplet infection	BCG vaccine, antibiotics such as streptomycin;

		blood-containing sputum		quarantining the patient
Diphtheria	<i>Corynebacterium diphtheriae</i>	Sore throat, skin ulcers	Droplet infection	DPT vaccine; quarantining the patient; antitoxins, antibiotic prophylaxis
Whooping cough (pertussis)	<i>Bordetella pertussis</i>	Severe cough with whooping sound, vomiting	Droplet infection	DPT vaccine
Tetanus	<i>Clostridium tetani</i>	Muscular spasms of the mouth and neck regions, convulsions, death due to lack of oxygen	Cuts and open wounds in the skin	DPT vaccine, Tetanus Toxoid injection
Cholera	<i>Vibrio cholerae</i>	Inflammation of the gut, severe diarrhoea, abdominal pain characterised by rice-water stools	Faecal contamination of water and food	Antibiotics such as tetracycline and chloramphenicol; clean water supply, properly disposing wastes
Typhoid	<i>Salmonella typhi</i>	Fever, abdominal pain, diarrhoea, vomiting, headache	Faecal contamination of food and water	Antibiotics such as ampicillin and chloramphenicol
Syphilis	<i>Treponema pallidum</i>	Pinhead or pea-sized sores with red centre around the sex organs	Sexual contact with infected person	Penicillin injection; avoiding sexual contact with infected person
Gonorrhoea	<i>Neisseria gonorrhoeae</i>	Burning sensation during urination, feeling of ill health, fever, headache	Sexual contact with infected person	Antibiotics such as penicillin and streptomycin; avoiding sexual contact with infected person

Fungal Diseases

Diseases	Causative organisms	Symptoms	Transmission	Control and prevention
Ringworm	<i>Microsporum</i> , <i>Trichophyton</i> , <i>Epidermophyton</i>	Appearance of dry, scaly lesions on various parts of the body like the scalp, the skin and the skin folds such as those in the groin or between the toes, intense itching	Generally acquired from soil or by using towels, clothes and combs of infected individuals	Maintaining personal and public hygiene
Athlete's foot	<i>Trichophyton</i>	Scaling, flaking and itching of affected areas of the feet	Generally spread by using contaminated socks and clothes	Try to keep the affected area dry

Viral Diseases

Diseases and incubation periods	Causative organisms	Symptoms	Transmission	Control and prevention
Poliomyelitis (polio); 9–14 days	Poliovirus	Fever, headache, stiffness or paralysis of limbs	Droplet infection, faeces and nasal secretion	Administering oral polio vaccine to children in the age group of 18–24 months
Mumps; 12–26 days	Mumps virus (Paramyxovirus)	Swelling of parotid salivary glands, mainly in children	Droplet infection	MMR vaccine; quarantining the patient
Rabies; 14 days to several months	Rabies virus	Headache, nervousness, fever, painful spasms, fear of water (hydrophobia)	Bite of infected animal	Rabies vaccine, cleaning bite wound, checking if animal was rabid; immunization of pets and humans with anti-rabies vaccine

Influenza (flu); 48 hours	Myxovirus (3 strains)	Fever, headache, sore throat, muscular aches	Droplet infection	Influenza vaccine; keeping the mouth and nose covered while sneezing, staying away from infected persons
Measles; 10–12 days	Paramyxoviruses	Sore throat, cough, fever, skin rashes	Droplet infection	Administering MMR vaccine to children in the age group of 9–15 months
Chickenpox; 14–20 days	<i>Varicella zoster</i>	Fever, headache, rashes (which later form crusts on the skin)	Droplet infection	Vaccination; single attack gives lifelong immunity
Common cold; 1–3 days	Rhinovirus	Sneezing, coughing, sore throat, infection of the upper respiratory tract, fever, chills, headache, nasal secretion	Droplet infection	Taking adequate rest; covering the mouth and nose while sneezing
Jaundice 2-3 weeks	Hepatitis virus	High fever, headache, nausea, vomiting, loss of appetite, dark yellow urine	Contaminated food and water	Maintaining good hygiene and sanitary conditions, avoiding stale food
Hepatitis B; 6 weeks to 6 months	Hepatitis virus	Flu-like symptoms, jaundice, nausea, loss of appetite	Blood to blood and through sexual contact	Hepatitis-B vaccine, 3 doses of the vaccine and one booster dose for children in the age group of 1–3 months, control-injection of interferon on the advice of the doctor, using chlorinated and boiled water, avoiding fatty and protein-rich food

AIDS; 28 months	HIV (human immunodeficiency virus)	Fatigue, loss of weight, dry cough, oral rashes, headache, occurrence of cancers and lung infections	Blood to blood and through sexual contact	No cure; avoiding sexual contact with unknown persons, screening blood before transfusion, avoiding sharing of needles
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Protozoan and Helminth Diseases

Diseases and incubation periods	Causative organisms	Symptoms	Transmission	Control and prevention
Malaria; 3 weeks	<i>Plasmodium spp.</i>	Fever, chills, vomiting, headache	<i>Anopheles spp.</i> (mosquito bite)	Drugs such as chloroquine, primaquine, daraprim and mepacrine; not allowing mosquitoes to breed in your surroundings, using mosquito nets and repellents
Amoebic dysentery (amoebiasis); 1–4 weeks	<i>Entamoeba histolytica</i>	Diarrhoea, abdominal pain, stools with blood, nausea, vomiting	Contaminated food	Drugs such as metronidazole; preparing food hygienically, keeping food away from flies
Ascariasis; 10– 40 days	<i>Ascaris spp.</i>	Loss of appetite, insufficiency of nutrients, jaundice	Contamination of food and water by soil and faecal matter	Drugs such as mebendazole, pyrantel pamoate and piperazine citrate; cleaning vegetables and fruits before consumption
Taeniasis;	<i>Taenia solium</i> and <i>Taenia saginata</i>	Diarrhoea, abdominal pain, indigestion,	Eating raw or undercooked beef and pork	Drugs such as praziquantel and niclosamide; properly cooking beef and

7– 12 weeks		nutritional deficiency		pork, personal hygiene
Filariasis or elephantiasis; 1 year or more	<i>Wuchereria bancrofti</i>	Enlargement of lymph nodes, swelling of limbs, pain, oedema, fever, headache	Bite of <i>Culex</i> mosquito	Diethylcarbamazine; control vector by using insecticides, maintaining proper hygiene

First Aid

Sometimes mistakenly we get injured or have minor accidents. If this happens, then we rely on first aid. First aid helps us in case of emergencies.

First aid is the immediate, temporary care given to a patient in case of accident or sudden illness before the doctor arrives.

Let us learn about some common first aids given to the patient in case of some common emergencies.

First aid for cuts and bruises

- Wash the cut with clean water and antiseptic lotion. Then apply the antiseptic cream and cover the cut with a bandage. The bandage prevents the cut from infections.
- In case of bleeding, press the cut with a bandage.
- Bruises refer to the injuries that occur beneath the skin to the tissues. In this, blood vessels beneath the skins are broken resulting in oozing of blood, which causes the spot to turn dark and we develop blue marks on our skin. In case of bruises, ice pack must be applied to the site.

First aid for burns

- If the burn is minor and results in the burned area becoming dark, then apply cold water.
- If burn results in the formation of blisters, then do not puncture the blister.
- If the blister gets punctured accidentally, then wash the area with cold water and cover it with bandage.

First aid for fractures

- Lay the victim on the floor.
- Loosen and remove the clothes from affected part.
- Do not move the affected part.

First aid for unconsciousness

- Lay the person on bed in an uncrowded, airy room, and loosen the clothes.

First aid for Heart attack

- Lay the person horizontally straight.
- Get immediate medical help.

First aid for swallowing poison

- Make the victim drink salt water as much as possible.
- Try to induce vomiting.
- Get the medical help.

First aid for snake bite

- Squeeze out blood from the wound immediately.
- Tie a tourniquet above the wound to prevent venom from spreading.
- Get the medical help.

Artificial Breathing

When a person stops breathing in cases of drowning, accidents, head injuries etc. **artificial breathing** is provided immediately to restore breathing and save his life.

Procedure of artificial breathing:

- Lay the victim flat on their back and put a pillow beneath his shoulder such that the chest is raised.
- Sit near the victim's head.
- Hold his arms and draw them upwards and backwards; this will expand his chest to draw air.
- Fold the victim's arms and press them against the ribs to expel the air.
- Repeat the above steps 15-16 times per minute till the victim starts breathing.